



NILE BASIN INITIATIVE
NILE EQUATORIAL LAKES SUBSIDIARY ACTION PROGRAM

Consulting Services for

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)
AND DEVELOPMENT OF A RESETTLEMENT POLICY
FRAMEWORK (RPF) FOR THE PROPOSED SMALL
MULTIPURPOSE MAIRA DAM IN THE SIO-MALABA-MALAKISI
SUB-BASIN – KENYA**

NBI/NELSAP/ Sio-Malaba-Malakisi /RFP02/2011

MAIRA DAM FINAL ESIA REPORT

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List of Acronyms

ADB	African development bank
AECOM	Consultant formerly known as RSW International Inc.
AIDS	Acquired Immune Deficiency Syndrome
AM	Annual maximum
BOD	Biological Oxygen Demand
BP	Bank Procedures
CAAC	Catchment Area Advisory Committee
CBD	Convention of Biological Diversity
CBO	Community Based Organizations
CFC	Chlorofluocarbon
CFP	Centre for Deformation Professional
CGV	Chief Government Valuer
CH4	Methane
CITES	Convention on International Trade in Endangered Species of wild flora and fauna
CLO	Community Liaison Officer
CMS	Convention of Migratory Species
CNHS	Critical Natural Habitat
COD	Chemical Oxygen Demand
DIZ	Direct Impact Zone
DLB	District Land Board
DSG	District Steering Group
EA	Environmental Assessment
EAC	East African Community
EALA	East African Legislation Assembly
EC	Electrical Conductivity
ECOSAN	Ecological Sanitation
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Authority
ESMP	Environmental and Social Management Plan
ENSAP	Equatorial Nile Subsidiary Action Programme
ENTRO	Eastern Nile Technical Regional Office
ESIA	Environmental Social Impact Assessment
ESMO	Environmental Social Management Officer
FDC	Flow Duration Curve
GIS	Geographical Information System
GoK	Government of Kenya
GPS	Geographical Positioning System
Ha	Hectares
HCFCs	Hydrochlorofluocarbon
HIV	Human Immunodeficiency Virus
IDEH	Integrated Development Alliance for Health

IDIZ	Indirect Impact Zone
IFR	In stream Flow Releases
ILO	International Labour Organization
IPCC	Integrated Panel on Climatic Change
IPM	Integrated Pest Management
ITCZ	Inter Tropical Convergence Zone
ITN	Insecticide Treated Nets
IUCN	International Union for the Conservation of Nature and Natural Resources
IVM	Integrated Vector Management
KARI	Kenya Agricultural Research Institute
KeRRA	Kenya Rural Roads Authority
KMD	Kenya Meteorological Department
KNEAP	Kenya National Environmental Action Plan
KSH	Kenya Shillings
LC	Local Council
LVBC	Lake Victoria Basic
LVNCA	Lake Victoria North Catchment Area
MAF	Mean Annual Flow
MASL	Meter Above Sea Level
MDGs	Millennium Development Goals
MINLOC	Ministry of Local Government
MLHUD	Ministry of Lands, Housing and Urban Development
MWI	Ministry of Water and Irrigation
MWL	Maximum Water Level
NBI	Nile Basin Initiative
NEL	Nile Equatorial Lakes
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NELSAP- CU	Nile Equatorial Lakes Subsidiary Action Program – Coordination Unit
NEMA	National Environmental Management Authority
NEWPLA	Consultancy Firm formerly known as NORPLAN
N	
NGOs	Non-Governmental Organizations
NMK	National Museum of Kenya
NTU	Nephelometric Turbidity Units
NWCPC	National Water Conservation and Pipeline Cooperation
OP	Operational Procedures
OD	Operation Directive
OHS	Occupational Health Safety
OM	Operation Manual
PAPs	Project Affected Persons
PAPs	Project Affected Persons
PMP	Pest Management Plan
POP	Persistent Organic Pollutants
PRAP	Preliminary Resettlement Action Plan
PRSP	Poverty Reduction Strategy Paper

PWDs	People with Disabilities
RAP	Resettlement Action Plan
REEP	Rural Economic Empowerment Programme
RSTF	The Rural Settlement Task Force
RTI	Respiratory Tract Infections
RUSL	Revised Universal Soil Loss
SAPs	Subsidiary Action Program
SMM	Sio- Malaba- Malakisi
SMMRBMP	Sio- Malaba- Malakisi- River Basin Management Programme
SPSS	Statistical Package For Scientists
SRES	Special Report on Emissions Scenarios
STD	Sexually Transmitted Diseases
SVP	Shared Vision Program
TA	Total Alkalinity
TAC	Technical Advisory Committee
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
TH	Total Hardness
TV	Television
UN	United Nations
UNCCD	United Nations Convention To Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climatic Change
USD	United States Dollars
VIP	Ventilated Improved Pit Latrine
VOCs	Volatile Organic Compounds
WB	World Bank
WB NBTF	World Bank Nile Basin Trust Fund
WHO	World Health Organization
WREM	Water Resources Engineering Management
WRMA	Water Resource Management Authority
WRUAS	Water Resource User Associations
WS	Whether Station
WSRP	Water Services Regulatory Board

EXECUTIVE SUMMARY

Project Background

This is an Environmental and Social Impact Assessment (ESIA) report for the proposed multipurpose dam. The proposed Maira dam is part of the Sio-Malaba –Malakisi River Basin Management project (SMMRBMP); trans-boundary integrated water resources management and development project whose main objectives are to establish a sustainable framework for the joint management of the water resources of the Nile Basin and prepare for sustainable development intended to improve the socio-economic conditions of the people and to protect the environment.

This dam site was selected by SMM management unit in collaboration the riparian countries and aligned for feasibility studies. In order for this development to take place and as per general policy of the two governments (Kenya and Uganda), it is mandatory that for this kind of development which is likely to or will have significant impacts on the Environment, an Environmental and Social Impact Assessment (ESIA) be conducted so that adverse impacts can be foreseen, eliminated or mitigated.

The purpose of the ESIA study was to assess the technical, social, economic, financial and environmental viability of the multipurpose dam project; evaluate the environmental and social aspects of the multipurpose dam site and prepare a Preliminary Resettlement Policy Frameworks for the dam site. The study involved consultations and data gathering activities at regional, district and community levels. The Outcome of the study were reports which included **Inception Report** which was submitted two months after the start of the study. The second outcome of this study was the **Interim Report** which was also submitted 4 months after start of the study. The Interim Report was submitted in three volumes namely, the **Scoping Report** which provided information on environmental and social impact scoping results with the relevant annexes. The Scoping Report further analyzed possible project alternatives and identified any other past, existing or planned projects in the area; the **Baseline Report** which provided key findings of the baseline environmental and social findings in the dam site. These included data on fauna and flora; fish and invertebrates; hydrology and water quality; community livelihoods; settlements and infrastructure; archaeology and culture; dam safety. The consultation and public participation process invoked was also described. The third volume was the **Preliminary Resettlement Action Plan (RAP)** for the Maira dam site.

This is the third report (**The Final ESIA together with the Dam safety and RAP Reports**) submitted 10 months after start of the study in accordance with the Terms of Reference. The proposed Maira multipurpose dam will be sited on Rivers Namanderema and Nangeni, tributaries of River Sio. The proposed earth dam and the associated reservoir are mainly located in Nambale and Butula districts (formally Busia District. – in Buhayo Central Location Malanga and Sinende Sub-locations with a small part located in Butula district - Elugulu Location in Buhweso sub-location and Marachi East location in Elukongo sub-location.

The project will have a catchment area for the reservoir at 126 km² with the surface area of Sio River catchment at the confluence with the Nangeni River estimated at 754 km². It will have an average capacity of 4.6 Mm³ at full supply Level and the height and 11 m with a throwback of about 2.5 Km expected to inundate a surface area of 1.26 km². The dam wall length will be 637m with reservoir fetch of about 2381m and dam crest width of about 6m. However, being aware of the effects of a dam project regardless of its size, NELSAP engaged NEWPLAN to undertake an environmental and Social Impact assessment for the proposed dam project. The Environmental and Social Impact Assessment (ESIA) was undertaken to determine, analyze and present the environmental impacts of proposed multipurpose dam project, formulate remedial measures to mitigate the negative impacts and plan in such a way that a rational decision can be made about its implementation. The ESIA multi-disciplinary team assessed the project site conditions taking into account the adjusted dam design.

The methodology used involved six basic steps:

- a) Review of the literature on environmental baseline conditions of the project area and its immediate environs.
- b) Scoping exercise aimed establishing issues of relevance to the study
- c) Consultative meetings with stakeholders at various levels in order to determine the potentially significant issues of the project and to exclude any issues unlikely to be of significance;
- d) Identification and analysis of the magnitude and significance of the principal impacts;
- e) Determination of appropriate mitigation measures and/or design changes to eliminate or reduce the identified impacts
- f) Formulation of an environmental and social management plan and monitoring plan, the emergency response Plan as well as dam decommissioning plan.

Project justification and objective

The Maira project area is characterized by seasonal changes (plenty during the rainy season and scarce during the dry season). Either way it makes the project area water stressed hence affecting the people in the area who depend on agriculture as a source of their livelihood. The situation is expected to get worse as the population increases and as demand by the different water use sectors out-matches the existing supply making rain fed farming unsustainable. With water related conflicts imminent in the area, a proposed dam at Maira will certainly address these challenges. This dam is expected to improve water resource storage in the catchment, and enhance its availability for improved livelihoods and to minimize its wastage.

Project alternatives

With regard to the overall project development, three options were considered namely;

- a) Do nothing and avoid construction of the earth dam at the proposed site and continue to depend on rains with the view of increasing agricultural productivity without irrigation

- b) Construct a single large dam on River Namanderema with a reservoir capacity of 12Mm³
- c) Construction of a smaller Dam on the same river and site but with a reservoir capacity of 4.6Mm³

Choosing the first option would lead to perpetual low farm yields and further undermine the championing of agriculture as an engine for economic growth in the project area and the country at large. On the hand, option two would have far reaching Environmental effects that will lead to destruction of infrastructure such as Maira –Mukemo irrigation scheme being implemented by the National Irrigation Board, about 521 structures including settlements, schools and churches, 2 concrete bridges and 5 foot bridges and finally this option will be complex and expensive as the dam required should be very strong to hold the volume of water and difficult to maintain. Option 3 is the most preferred, as this will affect about 30 structures including settlements, churches and schools and only 2 foot bridges and one concrete bridge. This design would guarantee availability of adequate water throughout to meet current and future water demand for meaningful irrigation in the project area. Besides the cost of construction is expected to be much less than in option 2.

Identified Impacts

The findings for each step are documented in this report but more emphasis is given to the identified potential positive and negative environmental and social impacts of the project on the social and biophysical environment prior to, during and after infrastructure construction. It also covers the proposed measures that will enhance positive impacts of the project and those that will mitigate, minimize, reduce or eliminate negative impacts of the project are given.

a) Positive Impacts of the action during planning and construction phase

Creation of employment opportunities and increase in income

Positive impacts associated with the Preparations/Planning and Construction Phase of the project will include; Workers including both skilled and unskilled are expected to be employed directly by the project which will in turn contribute to an increase in their income. The local communities will further benefit from this project whereby a big numbers of workers with increased demand for services and goods may provide the market food stuffs and workers renting house in the project area. This is likely to enhance the livelihoods for some households and the general community in the project area. Since not every member of the community is expected to benefit, magnitude of this impact is expected to be **Medium positive**.

Skills development

Those who will have the opportunity to work with the project during the construction phase, particularly the unskilled and semi-skilled, will get have their skill enhanced. Improved skills are always beneficial as they result into more income opportunities for the holder. The impact is **Medium positive** since very few people would be exposed

Improvement of vulnerable groups' livelihoods and welfare

The project may help to improve livelihoods and welfare of vulnerable people especially those who benefit from direct and indirect employment opportunities. Through livelihood restoration program for PAPs women and other vulnerable people will be targeted. The magnitude of this impact is expected to be **Medium positive** because a small number of the may benefit from the project.

Improved access roads

The improvement of the access roads will mean improved the transportation of hence the incentive for households to grow a variety of food crops and easy to get access to markets hence further development of the area. This impact will be **medium positive** because it covers very few roads but would be beneficial to many people use them on regular basis.

a) Positive impacts during Operation phase

Flood control

The project can help to mitigate climate change impacts such as floods on downstream communities. The reservoir will also improve in recharge of ground water. This impact is long-term, and it covers only the Sio River downstream thus the extent of impact confined thus it will be **Medium positive**.

Creation of conducive ecosystem

The creation of a reservoir will change habitats significantly and sustainable water supply will lead to the creation of conducive environment for water loving animals such as birds, reptiles, fish, insects and other aquatic organisms. This impact is expected to be localized but long term, thus will be **Medium positive**. The enhancement measures will include sensitizing the community about the need to conserve the wildlife particularly the globally threatened near /threatened or vulnerable species.

Improved water supply

With the Maira dam constructed, the communities will have access to improved water supply throughout t the year to meet both domestic and animal use. The area has water deficit especially in the dry season and the fact that many people will benefit from water supply, the impact is expected to be **Medium positive**. In order for this impact to be enhanced continuous sensitization of the communities in regard to use and maintenance of the facilities will be required at all levels and measures to ensure water maintenance will be put in place

Boost to Tourism and Recreation

With the reservoir in place and area surrounding used for several recreational activities tourists may be attracted to the area hence helping in changing the face of the area. Other secondary socio-economic impact on people living in the area is job opportunities as well other Income generation ventures for the local people in the project area .The magnitude of this impact is expected to be **Medium positive** as it will be long term and will uplift the low tourism in the area. To enhance this, the developer will ensure that all activities are done in a regulated manner without compromising the environment.

Provision of employment

During the operation/ maintenance phase, a few employment opportunities will be available such as clearing of bushes around the dam site, maintenance of the fence and provision of security for the dam among others. The project however will have multiplier effects with a substantial number of people engaged in crop farming, aquaculture farming and tourism. The benefits accruing are long term and therefore described as **Medium positive**.

Generation of Hydropower

One of the benefits likely to accrue from proposed Maira Multipurpose Dam Project is generation of hydropower. The generated electricity will improve the power supply in the region and could be used for domestic lighting, water supply through pumping and small scale industries which would create job opportunities for the local people. Although Electricity generation from this dam can be long term, it may not generate enough to meet peoples demand hence evaluated as **Medium positive**. In order for this benefit to be enhanced, it is suggested that power tariffs and connection fees be subsidized to enable many people to access it.

Improved agricultural productivity

The creation of the reservoir will be a source of water to enable farmers grows their crops throughout the year hence helping to improve food insecurity and people's incomes. Currently, crop farming is mainly rain fed and there are mainly two seasons for farming. The magnitude of this impact is expected to be **High positive** as it is long term, and it will benefit quite a number of people. This benefit will be enhanced by GoK putting in place infrastructure to facilitate irrigation and by building farmers capacity to use proper irrigation methods.

Increased potential for fisheries and fish farming

The reservoir at Maira is expected to be used in the promotion of Apiculture in the area. Rudimentary fishing activity would turn into a commercial activity that will help in the improvement of people's income and nutrition hence **Medium positive**. This impact will be enhanced by GoK actively supporting the initiative and building farmers capacity to undertake fish farming and fisheries in the reservoir.

b) Negative Impacts during preparations and construction phase

Negative impacts associated with this phase of the project will include the following:

Social expectations generated by disclosure of information to the Community

This stage gives higher social expectations in anticipation for jobs from the project considering the high levels of unemployment in the project area. Secondly, the fear generated in the mind of the public with regard to land acquisition and loss of crops. This is a **High negative impact** as it affects all the people in the community and will continue until completion of the project. This impact can be mitigated through dissemination of all information regarding the project including aspects compensation of lost property compensation.

Increased Risk to Soil Erosion

The use of heavy machinery and clearing of vegetation may destabilize the soil cover triggering soil erosion as some areas hence resulting into siltation and sedimentation of rivers if not controlled. This impact is however expected to be **Medium negative** due to gentility of the landscape and the fact that construction will be limited to the project area will last for a short time. The impact will be mitigated through rehabilitation of the cleared areas, catchment area management and ensuring that construction takes place in the dry season.

Impact on Aesthetics

During the construction phase, aesthetic quality of landscape in compatibility with the surrounding areas will be negatively impacted due loss of vegetation and landscaping activities compounded by the soil spoil and waste generated. This impact will be **Medium negative** and easily mitigable by re-vegetating the cleared areas and managing any debris produced.

Waste generated

The wastes generated from different activities (spillage of contaminants such as hydrocarbons, oils, concrete admixture, solvents and other chemicals, solid and domestic waste from the workers' camps may be a source environmental pollution and health risk in the area. Although the waste produced is expected to be high, this will stop after construction hence expected to have short term impacts and mitigable thus its magnitude is expected to be **medium negative**. This impact can be minimized or controlled by implementing procedures and strategies for managing wastes in order to guarantee the safety of the environment, community members and project workers.

Impacts of noise and vibrations

The noise sources during this phase will be from excavations, blasting, and clearance of vegetation within the project area, access roads, burrow pits and noise from camp. This impact will be experienced by project workers and community members as well as wild animals in the vicinity of the project. Although the noise impacts associated with this phase are significant, none of its sources are spread over a large area, relatively restricted within the project area and more site specific affecting or experienced by only a small number of individuals. This impact will be temporary in that after construction phase, noise intensity from transport vehicles, blasting, excavations and camps will disappear and therefore considered **Medium Negative**. This impact can be mitigated by adhering to construction work schedule, proper management of construction equipment and machinery and following guideline on noise and vibration management

Negative Impacts of Air pollution

The project activities particularly from vehicular movement and excavation works may generate aerial dust particulate matter and toxic gases which will affect workers and communities neighbouring these sites. However, it will be temporary in that after construction phase intensity of air pollution will disappear or be minimal hence evaluated as **Medium Negative**. This impact can be mitigated by ensuring machinery and vehicles are properly serviced, putting in place vehicle speed control, gas emission and dust control mechanisms and providing respirators to project workers

Disturbance of natural water flow and River sedimentation

The dam created on river Namanderema will necessitate impoundment of river there by disturbing the river's natural water flows as the river will have to be diverted to allow for construction of the embankment. However, this will be short-term (*only during construction of the embankment*) and therefore the magnitude of this impact is considered to be **Medium Negative**.

Loss of Vegetation and plant species of conservation concern

During construction this vegetation will be cleared hence interfering directly with these existing natural wetland plant species including a rare and endangered tree species. *Hallea stipulosa* that was encountered upstream of the proposed dam (*Hallea stipulosa* is listed as an endangered species on the IUCN (2007) red list). This impact is rated as **Medium negative** and will be mitigated by re-vegetating the clearing sites and planting the threatened tree around the reservoir.

Introduction and spreading of non-native invasive plant species.

A number of potential invasive species are already present in the vicinity of the project, in particular the aggressive invasive herbs such as *Lantana camara*, *Mimosa pigra* and *Tithonia diversifolia* may proliferate during construction. The impact is **Medium negative** and this can be mitigated by quickly removing any species sited and ensuring that any bare space is planted with appropriate and recommended plant species.

Impact on Faunal Species

The project activities will have profound impacts on the breeding /feeding, species migration patterns and decimation. The direct interruptions in the breeding cycle and decrease in the breeding success of some animals, destruction species migration patterns together with kills of some animals during construction could lead to disappearance of some animal species with the endangered species of conservation concern the most affected e.g. globally threatened Grey-crowned Crane. The impact on faunal species **medium negative** and can be mitigated ensuring that areas of such species are minimally disturbed

Influx of people

The temporary population increase in the project area during the construction phase due to people looking for jobs will be associated negative consequences like pressure on sanitation facilities, health facilities, increased conflicts, struggle for the limited resources, and increase in diseases like HIV/AIDS, insecurity, and increase in the price of commodities. However, population influx into the project area is temporary and the impact can be considered **Medium negative**. This impact can be mitigated by putting in place a mechanism for workers recruitment, additional sanitation facilities and strengthening local leaders to deal with problems associated with this impact.

Theft of project materials

There is likely development of vices such as stealing of project materials and equipment. Theft of materials will lead high project cost and delays. Although the impact is reversible and short term as it is likely to occur in the construction phase only thus qualifying it to be **Medium negative**. This impact can be mitigated by putting in place mechanism for security of project assets including collaboration with the community leaders to be involved in curbing the crime.

Conflicts between the local people and the new comers

With new people coming into the area, it is likely that there will be an increase in conflicts in the area arising from differences in culture norms and backgrounds and these come along with clashes and conflicts between the local people and the new comers. The magnitude of the impact is expected to be **low negative** due to the fact that it will be short term in nature since most people will go back to where they came from after construction work is complete. However, this impact can be mitigated through deliberate effort to recruit most of the worker from the project area , sensitize the workers about cultural norms and values of the project area and to work with local leaders and build their capacity to deal with any act of indiscipline.

Impact on vulnerable groups

Vulnerable groups in the area are likely to be affected by a reduction in farm land, unequal consideration during the recruitment process and exploitation by men thereby making their situation worse. Although the impact is expected to be long term and irreversible, the fact that strategies can be put in place to make the lives of vulnerable groups better as compared to the pre-project status qualifies the impact to be **Medium Negative**. This impact can be mitigated by putting in place livelihood restoration strategies that should be extended to vulnerable people and recruitment for jobs that specifically targets the vulnerable people.

Increase in STDs including HIV/AIDS

During construction, malaria, sexually transmitted diseases (STDs) and HIV/AIDS prevalence are likely to increase due to population influx. This impact is likely to be long term as HIV impacts may be noticed after several years and will continue even during the construction phase. This impact can be qualified **High Negative for (HIV/AIDS)**. This impact can be mitigated by putting in place strategies to control the spread of (STDs) and HIV/AIDS and supporting the existing health centres.

Occupational Health and Safety

The project employing many unskilled people with minimal or no experience of operating construction equipment or machinery may increase the likely occupational hazards. Although, the impact has far reaching consequences if not properly handled, it can be mitigated and will be short term mainly during construction thus it is regarded as **Medium Negative**. The suggested mitigation measures include training of all project staff, Training of workers in safe operating procedures, provision of appropriate Personal Protective Equipment (eg helmets, overalls, nose masks, ear muffs, etc.), labeling of danger zones and hazardous materials and restrictions/control of access to potential danger zones or usage of hazardous chemicals.

Community Health and Safety.

During construction phase some community members may be attracted to the construction sites curious to see the different activities going on. Furthermore transportation of materials may result into accidents to the local people, noise and air pollution. There is also a likelihood of increased traffic in terms of humans and vehicles. The magnitude of the impact is estimated to be **Medium negative** and will be mitigated by communities following proper

guidelines and warning signs as well as project contractor ensuring all safety measures are implemented.

Destruction of sites and Artifacts mishandling

During construction there will be likelihood that some of archaeological sites in the project area may be destroyed in the process of dam site construct and material excavation. This impact is evaluated as low negative as the sites and value of the assets is currently not known. However, there will be need to mitigate for this impact the contractor using professional archaeologists so that any chance findings may be rescued and taken to the National Museum of Kenya, surveying any excavated soil/ rock to check artifacts and avoiding any sensitive cultural sites.

Destruction of graves and exposure of human remains.

It is expected that in an area where people have for a long time there are some graves likely to be affected by the project. This impact is short term, localized and is mitigable but may lead to desecration culture values and dishonor the affected households. The overall impact of the project on burials burial grounds can be evaluated as **Medium negative** and could be mitigated through sensitization and implementation of the RAP.

c) Negative Impacts during Operation and Maintenance

Consequence of Inundated ecosystem and Greenhouse Gases

The inundation will submerge vegetation material in the reservoir site leading the materials to decompose, consume all the oxygen and produce gases like carbon dioxide, methane and other acidic gases such as sulphides and nitrous oxides hence affecting other aquatic biota. However, this will last for short time as water will eventually clear with ample algal growth thereby oxygenating the water column to support the survival of biota. The impact of the project on the ecosystem of will therefore be **Low negative**.

Disruption of aquatic ecological functions downstream

Disruption of the Namanderema River flow may reduce/increase volumes of water reaching the downstream aquatic systems leading to indirect negative impacts on fish and other aquatic life. The overall impact on aquatic ecology is considered to be **Medium negative**. This impact will be mitigated by implementing the recommended minimum by flow environmental of **0.15m³/s** to ensure sustainability of the river bank ecosystem.

Impacts of noise and vibrations

The only noise source of the Project foreseen in operation phase will be the generator and turbines located in the powerhouse for electricity production. However, this will not be considerable noise nuisance since this will be located in closed buildings. In addition, it will be somewhat an isolated facility since it will be located at more than 500 m from the nearest settlement. This would render noise pollution to be evaluated as **low negative** and considered negligible.

Reservoir Sedimentation

Agricultural activities taking place along the river banks and within the catchment often lead to erosion in the catchment resulting into sedimentation into the reservoir. The presence of the dam will further block the flow of sediment downstream, leading to reduce downstream sediment deposits and with increased sediment build-up in the reservoir leading to reduced water-storage capacity due to the exchange of storage space for sediment. This will result in decreased ability of the dam from serving its. This impact is considered **High Negative**. This impact will be mitigated by integrating catchment area management and putting in place river bank management practices and involving the local environmental committee to play a key role.

Impacts on river hydrology

The implementation of the the proposed dam will result in changes in the flow regime downstream. The storage of excess water during the rainy season will reduce time base of for the inflow and the outflow hydrographs. The reduced sediment load downstream in turn will lead to the decrease in the rate of deposition allowing river to erode the river banks between the dam and the confluence of Namanderema with the Sio River which will threaten the river bank ecosystems, river morphology and groundwater table hence reducing water availability. The magnitude of this impact although long term is considered **Medium Negative**.

Impacts on water quality in downstream reaches of the River

The change in the annual flow and sedimentary regime downstream and upstream of the dam will affect water quality to some extent. Impoundment may increase or decrease (dilution) the pollutant load of receiving waters while withdraws may indirectly lead to an increase of pollutant loads. Accumulation of sediments in the reservoir will increase the concentration of organic matter thereby affecting its quality. The magnitude of this impact is considered **Medium negative**.

Impact on downstream water uses

The baseline on current water use indicates that approximately 11% of the population in the project draws their water directly from the river. Impoundment of the water in the dam will reduce the amount of water in the river. Given the importance of the river, a source of water for various purposes by the communities, this impact is considered to be **High Negative**. This will be mitigated by providing water supply systems for provision of water to the surrounding communities.

Dam safety related impacts and Flooding

Poor dam design and maintenance may lead to dam breakage and therefore flooding that may lead to deaths and destruction of property. In case of dam break, it can have far reaching impacts on the downstream communities. However, emergency plans and procedures have been developed to handle such an incidence. Although its occurrence may have far reaching consequences, the impact is mitigable and the probability of its occurrence will be minimized through dam safety plans, inspection procedures and disaster management procedures and thus the magnitude of this impact is expected to be **Medium negative**. This will be mitigated by putting in place emergency plans and procedures and coordination committee to oversee implementation of such plans.

Increase in Groundwater Level

Impoundment of the rivers may lead to increased percolation of water to deeper levels resulting in localized increase in groundwater level and consequently overall quantity. If this is not checked this may lead to water logging and salinization of soils. However, this is mainly the case where the water table is too near to the surface and Maira area has water table near the surface. Much as this may be good for recharge to groundwater, it may not be desired as it may impact on the quality of the river downstream, degrade the soil nutrient downstream and make pit latrine construction for settlements closer to the reservoir impossible. Although this impact is long term it is mitigable and reversible hence described as **Medium negative**

Disruption of aquatic ecological functions downstream

The impounding of Namanderema River will reduce the flow to downstream aquatic ecosystem affecting the fish and other aquatic life. Since the dam operation will last for a long period about (about 25years) and there are few endangered species impacted and the fact that the minimum ecological flow is maintained the magnitude is considered to be **Medium negative**.

Mitigation

- Maintain the recommended environmental flow of 0.15m³/s to ensure sustainability of the ecosystem has been computed and should be maintained at all stages of the project.
- A staff gauge should be installed downstream of the embankment to ensure the river flow rate does not go below the minimum river flow rate (environmental flow) at any one time.

Introduction and spreading of invasive plant species.

The presence of the reservoir would be potential habitat for the of infestation and proliferation of four invasive aquatic plants that are already in the region (Water Lettuce (*Pistia stratiotes*), Water Hyacinth (*Eichhornia crassipes*), Red Water Fern (*Azolla filiculoides*) and Kariba Weed (*Salvinia molesta*). These water plants spread rapidly and can be a nuisance if not controlled and hence their impact on the reservoir may be significant although they can be controlled and therefore the magnitude will be **Low -Medium Negative**. This impact will be dealt with by using a combination of measures to combat invasive species.

Impacts on faunal species

Impact of the project is insignificant for most animal species except for the common Hippopotamus and Crocodile suspected in the project area may eventually find the created reservoir conducive habitat for their survival. If crocodiles and Hippos become established in the reservoir this may have human implications in terms of danger associated with these animals. Since the number of these animals may be low and the impact mitigable it is

considered to be a **low negative**. To prevent any animal disturbing humans and humans disturbing animals it is proposed that a fence is constructed all around reservoir.

Risk of increased water and insect-borne diseases

There will be a risk of increased water and insect-borne diseases as a result of the reservoir. The water in the reservoir will be stagnant and will act as a breeding ground for mosquitoes and this will increase the prevalence of malaria in the area. The water in the reservoir may also be contaminated by human activities in the vicinity of the dam, thereby leading to water borne diseases. Although this impact is longer term and has multiplier effects to the livelihoods of the people, it is reversible and can easily be mitigated hence **medium negative**. This impact will be mitigated through measures that help in controlling the proliferation of these diseases.

Loss of Land and change in land use

Implementation of the project will lead to loss of agricultural, loss of crops and loss of medicinal plants. The current land use will change permanently to become a reservoir area. The impact of loss of land will be permanent, irreversible, and direct and will affect people's livelihoods. The impact of the magnitude is thus **High negative** but can be mitigated by effectively compensating all PAPs ,providing alternative land for PAPs who have lost more than 20% of their land and putting in place livelihood restoration programs for PAPs.

Loss of residential and other structures

Inundation will lead to displacement of about 25 households and these are likely to be psychologically impacted in addition to losing their social networks livelihoods. Some structures such as churches, schools and water supply sources and irrigation canals etc. will be disrupted. This impact is long term and irreversible but will not affect many people hence qualified as **Medium negative**. It can be mitigated through adequate compensation and in accordance with the national laws and the World Bank guidelines.

Destruction of access roads, bridges and footpaths

The project may lead to inundation of some access roads, bridges and footpaths currently used by the local community will be destroyed leading to social network/communication breakdown and restricting people's movements to different areas such as schools, health centers. The magnitude of the impact is expected to be **Medium negative** as this is long term and many people not only from the project area will be affected. With the alternatives routes provided and all destroyed infrastructure replaced the impacts will be minimized.

Risk of drowning

There is a risk of drowning by both children and adults in the reservoir. Furthermore, domestic animals may also drown in the reservoir while trying to drink from it. Although this risk leads to loss of lives, it can be avoided and mitigated thus the magnitude of the impact is considered to be **medium negative** and can be mitigated by planting trees and other vegetation to reduce accessibility, carry out surveillance and off the dam area and sensitization of the community of emergency plans of action in case of disasters.

Environmental Social Monitoring and Management Plan

A monitoring and Social Environmental management Plan (ESMP) has been developed for purposes of addressing identified adverse negative /positive impacts of the project on the social economic as well as on the environment. Under the ESMP, various mitigation measures have been organized into well formulated plan, which will serve as a guide for construction and operation phases of the proposed project. The ESMP further aims to ensure implementation of mitigation measures whilst identifying the necessary resources and budgets required for its implementation as well as identifying responsibility schedules of various stakeholders who will be involved in its implementation.

The implementation of the Maira dam ESMP will require the full participation of key players including

- Ministry of Water and Irrigation (MWI) with the overall responsibility of overseeing ESMP implementation and particularly ensure proper dam construction as well as repairs in case of serious linkages and flooding. MWI will also ensure water allocation/ distribution and conflict resolutions through CAACs and WRUAs.
- Water Resources Users Associations (WRUAs) with the mandate to manage water resources in their area of jurisdiction and handle water use conflict and grievances as stipulated in the law
- The contractor has the primary role of delivering measures set out in the ESMP and will ensure that there is cordial working relationship between the project's Environmental Management Specialist (EMS) and Community liaison Officer (CLO) with specialists in MWI on one hand and the Water Resource user Associations on the other. The contractor is obliged to ensure compliance of project implementation in accordance with the relevant legislation as well as adhering to all environmental and socio-economic mitigation measures specified the ESMP.
- Other stakeholders involved will include; different government departments both at national and local levels, NGOs and the communities. These are NEMA, Water Resources Management Authority (WRMA), Directorate of Irrigation, Drainage and Storage, National Water Conservation and Pipeline Cooperation
- National Water Conservation and Pipeline Corporation will ensure proper Dam Construction, Dam Repair and flood control
- President's Office (District Commissioners), Community Mobilization and mobilization of relevant institutions including chairing the District Disaster management Committee. Enforcement of law and order through chiefs and other security agencies
- Ministry of Roads and Public Works; Repair and construction of bridges in case of flooding or dam overflows
- Health (public Health Management of disease outbreaks and occupation safety as well as enforcement of sanitation and hygiene rules.
- Ministry of Lands oversee all matters related to land acquisition under its semi-autonomous bodies of the Land Arbitration Tribunal, Valuers Registration Board and Land
Ministry of Special Programs; Early warning signals to the community through radio programs.

NEMA; Monitoring compliance, Water bank conservation and management

The total budget for implementing ESMP will consist of the budget for Mitigation plan and that of Environment Monitoring Plan. Mitigation plan cost was estimated at 114,500 while that of monitoring plan has been estimated at **USD 205,600**. Therefore a budget of **USD 320,100** has been estimated for the ESMP for Maira Multipurpose Project excluding RAP costs which are detailed in Preliminary RAP report. However the other proportion will be met under the contractor's budget during construction of the dam and later to be covered in the annual budgets of the Nambale District

Conclusion

A number of positive impacts will come along with this project especially those related improved incomes through improved agriculture and irrigation as well as employment and, improved water supply. The project will also have negative impacts however, once the proposed mitigation measures are implemented, most of the negative impacts will either be eliminated or minimized except those related to loss of land , loss of structures and displacement, influx of people which is related to HIV/AIDs as well as social expectations. Mitigation and monitoring of the residual impacts will therefore be long term impacts. However the main conclusion of this Environment Impact Assessment is that there is no environmental obstacle to implementation of the project, if environmental and social management plan (ESMP) is properly implemented. For the implementation to be carried out smoothly, recommendations have also been included in chapter 9.

1 INTRODUCTION

1.1 Project background

The Nile Basin Initiative (NBI) is a collaborative effort of the Nile riparian countries (Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda) aiming at developing the River Nile and its resources in an equitable and sustainable way for the benefit of the people of the Nile Basin.

NBI has a Strategic Action Program composed of two complementary programs the first being the Shared Vision Program (SVP), whose mandate is to build confidence and capacity throughout the basin. The second program is the Subsidiary Action Program (SAP), whose objective is to initiate concrete investments in the Eastern Nile (ENSAP) and in the Nile Equatorial Lakes sub-basin (NELSAP). The Sio-Malaba-Malakisi River Basin Project is one of the three Trans boundary integrated water resources management and development projects being implemented within the framework of the Nile Equatorial Lakes Subsidiary Action Program (NELSAP) of the Nile Basin Initiative (NBI). The others include the Kagera and the Mara River Integrated Water Resources Management and Development Projects.

The objective of the Sio-Malaba-Malakisi River Basin Management Project is to establish a sustainable framework for the joint management of the water resources of the Sio-Malaba-Malakisi catchments and prepare for sustainable development oriented investments that will improve the living conditions of the people as well as protecting the environment.

The project targets economic growth opportunities from cooperative management of the shared water resources and aims at contributing towards eradication of poverty, economic growth, and reversal of environmental degradation. It also aims at contributing towards the wider NBI goal of achieving sustainable socio-economic development through equitable utilization of, and benefit from, the common Nile Basin water resources. The Project is consistent with the national development strategies - Vision 2030, Kenya and National Development Plan, Uganda. These strategies emphasize healthy ecosystems, poverty reduction, sustainable economic growth, and identify degradation of natural resources as a key constraint to attainment of results. The project is funded by the Royal Swedish Government, Royal Norwegian Government and World Bank through the Nile Basin Trust Fund (NBTF).

The project is designed to develop trans-boundary water resources planning and management framework to allow large-scale investment projects to proceed with the participation of stakeholders close to the project site.

The initiative to commence this project has been undertaken with the aim of improving the planning, management and utilization of the natural resources in the basin. These initiatives include the feasibility studies and project preparation for an Integrated Watershed Management Project and feasibility study for Maira and Bulusambu Small Multipurpose Use Dams. This support is consistent with the vision of the Nile Basin Initiative of promoting “sustainable socio-economic development through equitable utilization of, and benefit from, the shared common Nile Basin water resources”.

The Sio-Malalaba-Malakisi River Basin Management Project (SMMRBP) has therefore completed a study for identification and rapid assessment of potential small dams for the multipurpose uses of agricultural development, hydropower generation, water supply, fisheries, and other ecosystem functions. The SMMRBP study identified and assessed Twenty Seven dam sites in Kenya and Uganda from which only two sites were selected based on criteria including those defined by World Bank OP4.37 such as;

- Equity (targeting one site per country),
- Dam height (targeting small dams),
- Reservoir storage capacity and reservoir yield
- Site foundation conditions,
- Material availability,
- Access to proposed sites,
- Potential water uses,
- Environmental and social considerations, and
- Priority of each participating governments

From the above criteria, SMMRBP together with Kenya and Uganda governments selected two dam sites for feasibility study and these are Maira dam site in Kenya and Bulusambu dam site in Uganda.

In December 2011, SMMRBP identified Newplan Consulting Engineers and Planners to undertake an Independent Environmental and Social Impact Assessment (ESIA) for the two selected multipurpose dam sites. Subsequently Newplan subcontracted ERMIS Africa a company registered with NEMA Kenya to be able to complete the assignment in the stipulated time.

This ESIA report is for the Maira project based in Western Kenya.

The ESIA study was conducted concurrently with the Feasibility study. Consultants from New plan conducted a reconnaissance survey in January 2012 to identify key issues to be investigated further. The reconnaissance survey covered general environment assessment, hydrology, ecology, fisheries, archaeology, socio-economy, and water demand and dam safety. The survey results were used to prepare an Inception Report. The Inception Report

was presented to key stakeholders in a regional workshop held in Tororo Uganda on 7th March 2012.

Following the Client's acceptance of the Inception Report, the Consultant proceeded to prepare a scoping report which provides information on environmental and social impact scoping results with the relevant annexes and is in a separate report. The Scoping Report particularly provides information on relevant, policies, laws and institutional framework in the riparian countries, East African Community Frame work, Financial Institutions, Multilateral Environmental Agreements and gives a preliminary identification of impacts. The Scoping Report further analyses possible project alternatives and identify any other past, existing or planned projects in the area that may impact or may be impacted by the project.

The Survey to collect baseline information for the production of draft ESIA for Maira dam site commenced on 17th April 2012 and ended on 25th April 2012. The study involved consultations and data gathering at regional and district level as well as at dam site. At the dam site the following activities were undertaken;

- i) Carrying out stakeholder consultations through meetings with regional leaders, district leaders, community leaders and grass root village groups;
- ii) Carrying out household and community social surveys;
- iii) Conducting field assessment on various environmental aspects;

The data collected was compiled into a baseline report, reflecting the findings about The biophysical, socio-economic and physical cultural environment of the study area.

A separate reports was also prepared on **Preliminary Resettlement Action Plan (PRAP)**. The TOR originally required the Consultant to prepare **Resettlement Policy Framework (RPF)**. However, later on the Client suggested a change where the Consultant was asked to proceed to prepare **Preliminary Resettlement Action Plans (PRAP)** instead of RPF. This has been prepared and is presented separately. Scoping report, report on existing environment and Preliminary RAP reports formed an Interim Report which was presented to the stakeholders in a workshop on 28th -29th August 2012. Their inputs were incorporated and a final Interim report submitted to the Client on 18th September 2012. The present report therefore is an Environmental and Social Impact Assessment (ESIA) Report.

1.2 Objectives of Environmental and Social Impact Assessment (ESIA)

The aim of the study was to assess the potential environmental and social impacts of the proposed development of a small reservoir/dam at Maira in Kenya, prepare an Environmental and Social Management Plan and assess the capacity of the institutions responsible for management and mitigation of those impacts. The study was carried out to

establish modalities of implementing the project in line with Kenya environmental policies and laws. The objectives of the proposed study are as follows:

1. To conduct an Environmental and Social Impact Assessment of the planned developments in order to identify and assess their potential environmental and social impacts;
2. To carry out consultations with relevant stakeholders, including potentially project affected persons, to obtain their views and suggestions regarding the environmental and social impacts of the proposed project. The outcome of the consultations will be reflected in the ESA report and incorporated into the project design as appropriate.
3. To prepare and cost an Environmental and Social Management Plan (ESMP) detailing mitigation measures as well as institutional roles and responsibilities in the operationalization of the ESMP.

1.3 Environmental Assessment

1.3.1 Scoping

The Environmental and Social Impact Assessment (ESIA) process in Kenya is regulated under the Environmental Management and Coordination Act (EMCA), 1999. The procedural requirements for ESIA in which scoping stage is included are set out in the Environmental (Impact Assessment and Audit) Regulations of 2003. Any project being proposed will thus follow the recommended ESIA stages including submission of scoping report and Terms of Reference (TORs) as provided for in regulation (14).

NELSAP' is fully aware of these requirement and has subsequently drafted guidelines and procedures for ESIA (2010) as a framework for mainstreaming environmental and social concerns within its Environmental and Social Assessment Procedures (ESAP). This has been proposed to ensure that any development project undertaken by NELSAP and in the category of projects that require ESIA are prepared in considerations of all environmental and social concerns to determine the extent of the ESIA studies required. The scoping of the environmental and social assessments followed this process.

Article 14 and 15 of the Operational Policies (OP 4.01) Environment Management, requires public scoping for Category A & B projects. The proposed project at Maira is expected to displace some households, inundate land of about 103Ha (according to the Arial map by the Feasibility Study), affect about 3 roads 1 concrete bridge and 2 foot bridges thus has been

categorized as Category A project (see section on International Financial Institutions-under World Bank Social Safeguard OP 4.01) .Borrowers are required to first consult the affected public immediately after screening and before ‘Terms of Reference’ for the environmental assessment are finalized. A summary of the proposed project’s objectives, functions and potential impacts are expected to be provided at this stage. Therefore a scoping for this site has been carried out, **Terms of Reference were also developed, submitted to NEMA, approved and are attached in Annex 1.**

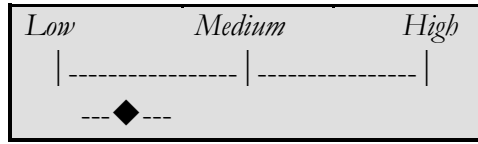
1.3.2 Impact Assessment Methodology

The method for assessment of impacts was adapted from the methods recommended by Hydro-Québec (1990), the World Bank (1991) and by the Canadian Environmental Assessment Agency (2000). These methods assess the Intensity, Extent, and Duration of the anticipated positive or negative impacts of the project and determine the environmental and social value of the components. The three components are then grouped together under one indicator, the Significance of the impact. This indicator provides an overall assessment of the anticipated impacts on a given environmental or social component. The assessment of impacts was based on a three step procedure which makes impact assessment conclusive and its recommendations objective and easier to conceptualize, follow and trace back if desired. The core of the procedure was to combine the ‘value’ (step 1) of the affected environment and the ‘magnitude of impacts’ (step 2) to obtain the ‘overall impact assessment’ (step 3).

Step 1: Base line data was collected using different methodologies as follows:

- i) Review of existing information;
- ii) Onsite assessments –this involved site visits to` observe what exists in the area covering physical, biological and social –cultural issues;
- iii) Focus group discussions;
- iv) Public /stakeholder consultations – process is highlighted in this report;
- v) Social surveys by use of questionnaires.

Baseline environmental and social conditions was described in detail and valued on a continuous scale from ‘low value’ to ‘high value’, which was assigned to the impact zones and the characteristics thereof. This value is related to international, national or local guidelines, standards and evaluations. Values were assigned to elements of the biological environment such as flora and vegetation, aquatic ecosystem etc. The human environment aspects will be taken to have “high value” due to their intrinsic value in addition to others. These are presented below diagrammatically.



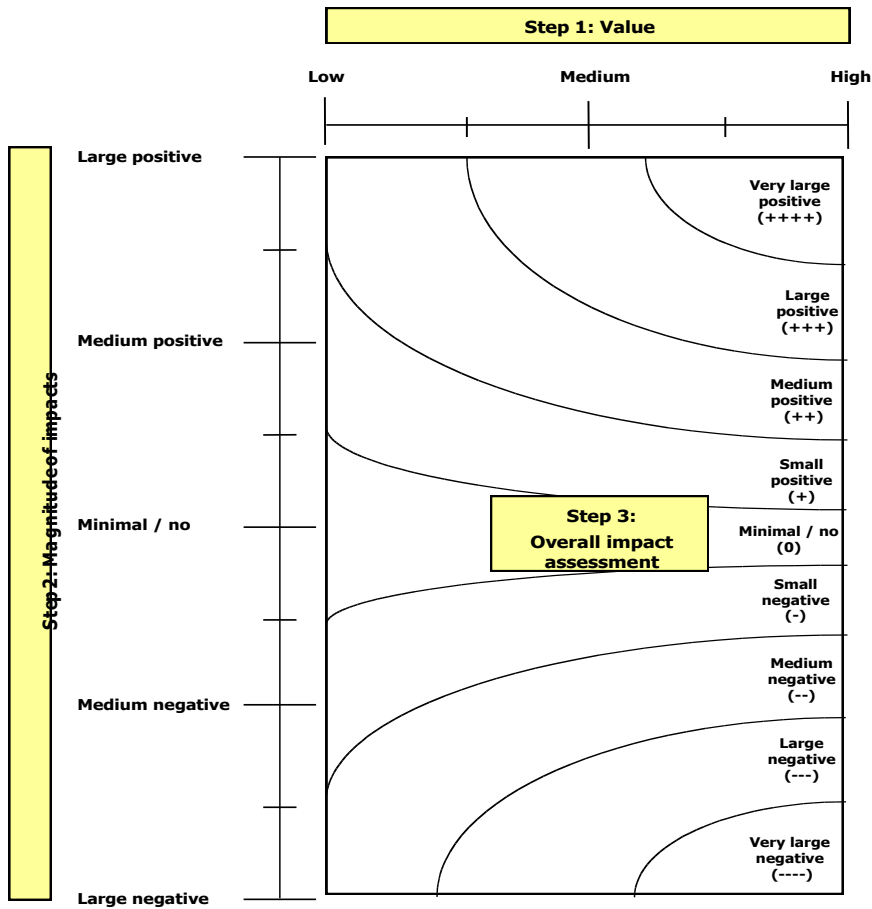
Step 2:

The second step was to describe and evaluate the magnitude of potential project impacts, measured in terms of their **extent in time and space (long term/short-term)**, the **vulnerability of the environments affected**, the **reversibility (permanent or temporary) of the impacts** and the **probability that the impacts will occur**. The magnitude of impacts was evaluated on a scale from ‘high negative’ to ‘high positive’ as shown below.

Phase	Magnitude of Impacts
	<i>High neg. Medium neg. Low/ Low pos. Medium pos. High pos.</i> ----- ----- ----- ----- -----
Planning	-----▲-----
Construction	-----▲-----
Operation	

Step 3:

The third and final step was combining ‘value’ (Step 1) and ‘magnitude of impacts’ (Step 2) to obtain the ‘overall impact assessment’ (Step 3). This assessment evaluated the importance of an impact on a scale ranging from ‘very large negative’; ‘medium negative’; ‘low negative’ to ‘very large positive’; ‘medium positive’ or ‘little positive or no impact’.



1.3.3 Specific Methodology

1.3.3.1 Socio-Economic Studies

Review of Available Documentation

The Consultant reviewed several documents vital for the project. These included among others; Busia District Environment Action Plan (2009-2013), Busia District Development Plan (2002-2008), Busia District Development Plan (2008-2012), Kenya Population and Housing Census Report (2009) and Geographic Dimension of Well Being in Kenya (2006).

Stakeholder Consultation

Stakeholder consultation will be a continuous activity during the duration of the study. The Consultant used both snow-ball and purposive methods in identifying the relevant stakeholders. Stakeholders consulted included officers at national level and local authorities, CBOs in the project area and potential project affected populations among others. The methods for consultation, information sharing and gathering were highly participatory in nature. Stakeholder consultations were carried out through in-depth interviews (key informants' discussions), focus group discussions and community meetings.

Household Surveys

An interviewer-administered questionnaire was developed with both open ended and close ended questions for gathering information on socio-economic conditions of the people in the area (**Annex 2**). Research Assistants with the knowledge of the local language were deployed and trained.

Maps showing the administrative units in the project area were obtained and the GIS Specialist superimposed the dam site to the given administrative and topographic maps. These maps guided the Consultant in choosing the villages to be included in the household survey. A 7% sample of the households in both the directly and indirectly affected villages was randomly selected for inclusion in the interviews. The sample size was determined based on the number of households in the Sub Locations as given by the 2009 Kenya Housing and Census Report. Consequently a total of 464 households were included in the household survey. The number of respondents was further guided by Glenn Israel's Published Tables (1992). According to Glenn's Tables with a survey population of 8,000, a sample size of 381 with precision levels of ± 5 and 95% confidence levels is a representative sample. The survey population for this study was about 8,000 thus 7% (464) was considered a representative sample for the study.

Observation

Observation was applied for purposes of identifying apparent contradictions or confirming stated responses.

Data Analysis

The data collected was analyzed using the Statistical Package for Social Scientists (SPSS) and MS-Excel packages.

Analysis of quantitative data generated through questionnaires was done using a computer analytical package known as SPSS. With the SPSS package, it was possible to cross-tabulate variables and to generate the relevant tables and graphs and also generate information like average incomes. Analysis of qualitative data generated through key informants' interviews was done using thematic procedure and content analysis. Using the thematic procedure, data was summarized into merging themes. The themes were analyzed and interpreted according

to survey variables. Content analysis was used to analyze data that was not frequently reported but had profound implications for the survey variables.

Data Quality Control

All Enumerators for the household interviews were trained on the survey methodology, use of the data collection instruments and question interpretation. The purpose was to ensure that all enumerators use the same methods of questioning and recording of responses. In addition, the Consultant edited a sample of the questionnaires during fieldwork after which feedback was given to the enumerators and necessary corrections and clarifications made.

Methodology for analyzing issues of gender and vulnerable groups

Like any other society in Africa, there are vulnerable and marginalized groups in the project area. These include the elderly, female headed households, widows, people with disabilities and the very poor among others. These groups normally face a number of problems such as heavy workload, oppression, low participation in decision making, lack of ownership of resources, social discrimination, low incomes and high levels of illiteracy among others.

The Consultant analyzed the issues of gender and vulnerable groups based on a number of methods and these included analysis of data disaggregated by gender and group type from Kenya Housing and Census Report, Busia District Development Plan and data from household interviews.

1.3.3.2 Plants (Flora)

The study was aimed at characterizing the different vegetation/ habitat types within the project area; ascertain species richness and diversity; identify species of conservation concern (i.e. endangered and threatened) and examine the ecosystem services within the project area and its surrounding with geo-referenced data.

To study the vegetation structure and composition in the Maira project area, the assignment was executed using a combined methodology comprising GIS and remote sensing techniques, literature review and field observations. A GPS unit was used to take coordinates of plots sampled within project area during the study. Three transects were laid along the three rivers, Namudoda, Namanderema and Nangeni within the wetland area. A total of 22 plots established within the landscapes 200m apart using the GPS to locate them.

Inventory: Inventories of demarcated plots have been widely used in floristic sampling and ecological studies in the recent years (Poulsen 1997). However, the results of species richness depended on the size, shape and number of the plots being used, and the choice of the parameters depends on the scope of the study. Circular plots of 20m radii were used in this survey. Plots were laid at every 200m and data of trees recorded. Within the plot, Herbs and

shrubs were enumerated in a radius of 2 meters with all individuals counted and recorded. Trees were enumerated in 10m radius from the center of the plots and numbers recorded. Opportunistic sampling was done to record other species that were not captured within the plots to come up with a total species list of the area. The GPS position, altitude and vegetation type were taken at each point and the extent of that type recorded

Specimen collection and identification: For identification to be complete, a voucher specimen of the encountered plants that could not be identified was taken in form of a picture and later identified at the Makerere University Herbarium.

Data analysis and presentation: A species list was compiled to show the diversity to a lesser extent with abundances using the encounter rate. Plants of any conservation status or importance,

1.3.3.3 Animals (Fauna).

The study aimed at assessing the extent to which the dam development will affect the living things in their natural environment as an avenue of establishing mechanisms for ensuring natural resource sustainability and ecosystem functioning. This study focuses specifically on those living organisms that will serve as indicators of project impact that will help in determining the extent of impacts of the project on the environment. In this particular study, the impact of the project on butterflies and dragonflies, birds, amphibians, mammals and aquatic biodiversity which act as indicators of all the other biodiversity were assessed.

Butterflies respond quickly to environmental changes and there is now considerable data on how particular species contend with alterations in land-use, and thus may play a valuable role in ecological monitoring (Daily and Ehrlich, 1995). The compilation of species lists may be used both qualitatively and quantitatively, to comment on a habitat (its condition and vegetation) and to identify conservation and monitoring needs. Increasingly, therefore, butterflies are being used as tools in ecological monitoring strategies (Pollard and Yates, 1993; Sparrow *et al.*, 1994). Dragonflies spend most of their lives as larvae in water and therefore depend on availability of pure water. Different species have varied habitat preferences, making them very useful indicator species. Birds are very important in conservation and environmental impact assessments because they are good indicators of general biodiversity. Areas rich in birds have been found to also be rich in other biodiversity. Birds can be categorised according to habitat. The habitat categories include forest specialists (FF), forest edge species (F), forest visitors (f), species restricted to wetlands/open waters (water bird specialists) (W), water bird non-specialist-often found near water (w) and grassland species

(G) (Caswell, *et al* 2005, Bennun *et al* 1996). Ecologically, amphibians are important; they are mostly predators, acting as primary and secondary carnivores. Their prey consists mostly of

insects, some of which are pests to crops or disease vectors. They are also inter-linked in food chains, often acting as food for other vertebrates, such as birds, snakes and sometimes man. Amphibians are known to be an easily recognizable taxon in given habitats; and populations are sometimes specialized within a narrow habitat. Factors that have made amphibians to be recognized, nowadays, as good indicators of habitat change.

Many mammal species are specialised in their habitat requirements. Specialised habitats include forest, woodlands, grassland and swamps. Many mammal species are hunted for meat by the local community; others are pests to crops and livestock while others are important in ecotourism.

The survey was carried out using a number of methods as follows;

- i) Transect count: Transect count method was used to survey birds present in the project area. All birds seen or heard were recorded. Transect count was employed because it is suited for:
 - extensive, open, and uniform habitats
 - mobile, large or conspicuous species
 - covering the study area very quickly and efficiently
 - recording many species with least interference by the observer
 - Situations where access is good.

- ii) Trapping: 30 Snap traps were used to trap rodents around the project area. Amphibians were trapped by hand, A Sweep net was used to trap butterflies and dragon flies while Fish species were recorded using catches by the local people who use:
 - Passive bucket trapping (Error! Reference source not found.).
 - Angling (using baited hooks tied on a sapling or a reed)
 - ‘An embankment’ of Phragmites (Error! Reference source not found.) used when there is a lot of flowing water



- iii) *Informal interviews:* With the local people were conducted generate information on types of mammals and fish they know that occur in the area.

1.3.3.4 Hydrology and water resources

The specific objectives of the hydrological assessment are to:

- i) Determine water yield into the proposed dam
- ii) Determine the water quality at the dam site
- iii) Determine sediment yield into the dam
- iv) Determine peak flows
- v) Determine environmental flow downstream of the dams
- vi) Determine the hydrological impacts due to construction of the proposed dam

3.2.4.1 Approach to hydrological study

The approach to the hydrological study involved data collection of available data, literature review of existing reports on the SMM basin, field investigation to collect data on the ground, assessment of available water resources and hydrological impact assessment. The key tasks undertaken are described below:

i) Data Collection

The data required for the hydrological assessment includes daily rainfall records, daily stream flow, monthly evaporation and temperature, sediment concentrations, borehole yield and depth. All available historical hydrometric data on the Sio and Namanderema rivers, as well as meteorological data recorded at stations within the drainage basin and the surrounding area was gathered from the relevant national institutions and analysed for any

inconsistencies. Other data included water quality data, sediment load, water census data (principal water users downstream and upstream of the proposed dam), list of boreholes, springs, and shallow wells, wetlands, and surface water bodies.

ii) Literature Review

All available literature on regional studies in the basin relevant to the hydrological study were obtained from the Client and reviewed. This aimed at extracting the relevant data base and information to this current study and the list of reviewed studies is as follows;

- Pre-feasibility Report on Development of Multipurpose Reservoirs in the SMM basin (Newplan, 2010)
- Final Feasibility study Report to identify irrigation investments in the lower Sio basin, detailed design and Preparation of tender documents (Bhundia, 2009)
- Interim Report for Feasibility Study and Preparation of an Integrated Watershed Management Program and Investment proposal for Sio-Malaba-Malakisi Sub Basin
- Water Sector Strategic Plan 2009-2014 (MWI-Kenya)

iii) Field Visit and Consultations

A field visit to the project area was carried out to crosscheck information obtained during the desk study and obtain any additional field information where necessary. Part of this visit involved consultations with the relevant authorities including the SMM Project Management Unit, the Water Resources Management Authority, Lake Victoria North Catchment Area, Busia District Water Office and Nambale District Water Office.

3.2.4.2 Hydrological Analyses

• Reservoir yield Estimation

The proposed Maira site is located on Namanderema river, a tributary of River Sio. River Sio is gauged downstream of the proposed dam site. The flows at the dam site were determined by applying the area reduction factor given that the Maira catchment is a sub-basin of the Sio basin and can therefore be considered to have similar hydrological characteristics.

To determine water loss from the reservoir, pan evaporation data from the neighbouring Kari Alupe climate station near Kakamega was used to estimate the potential evaporation from the water bodies to be impounded.

• Water Quality Assessment

Water quality determination is crucial for understanding the health of the streams where the proposed dam site is located. To establish the status of the water quality of the streams of interest to the study, water quality data for the Sio River was obtained from the Water Resources Management Authority in Kakamega. A rapid assessment of the water quality at

the proposed location of the dam was also done by taking spot water quality samples at five different locations on the Namanderema river and its tributaries.

The water quality parameters analysed included pH, Electrical Conductivity (EC), Colour, Turbidity, Total Dissolved Solids (TDS), Total Hardness (TH), Total Alkalinity (TA), Iron, Chloride, Fluorides, Biological Oxygen Demand (BOD5), Chemical Oxygen Demand (COD), Total Coliforms and Faecal Coliforms. The observed results of the laboratory analysis were then compared descriptively with the existing international standards, i.e., World Health Organisation (WHO) for drinking water purposes.

- Sediment Yield Estimation

The determination of sediment yield into any dam is important as it has bearing on the life period of the dam. Sites with high sedimentation rates result in filling up of the reservoir after just a few years of operation thereby decreasing the useful life of the dam. Sediment yield generated from the catchments upstream of the dam site was computed to ascertain the amount of sediments that will be deposited into the dam.

The estimation of sediment yield into the proposed dams was made using the Revised Universal Soil Loss Equation (RUSLE). This method requires information on catchment area, slope, altitude, rainfall and factors indicating vegetation cover and proneness to erosion. This information was compiled from maps that were derived from a Digital Elevation Model (DEM) and also from field investigations on land use and erosion.

- Peak Flow Estimation

Frequency analysis method was used estimate peak flows at the dam site using historical flow records generated from the gauging station on River Sio. Annual maximum discharges were then extracted to constitute the Annual Maximum (AM) discharge series. The AM series were modelled using the Gumbel/ Extreme value type I distribution. The model was then used to estimate peak flows for return periods, $T = 20, 50$ and 100 .

- Environmental Flows Assessment

The construction of the dam embankment across the stream valley will block the flow of water downstream which will impact on the livelihood of the ecosystem on the area downstream side of the embankment. As such, some water of specified quantity must be allowed to continue to flow on a continuous basis for purposes of maintaining the health of the ecosystem downstream of the dam.

The approach applied here was to establish the human and ecological environments based on the baseline studies carried out. The results of these surveys were then used to establish the minimum water requirements for both the human and environmental environments. To establish this environmental flow, a simple methodology referred to as 'Montana Method' proposed by Tennant (1976), where by an environmental flow regimes are prescribed on the basis of the average daily discharge or the mean annual flow (MAF) was applied. In general

cases, 10% of the MAF is recommended as a minimum instantaneous flow to enable most aquatic life to survive, 30% MAF is recommended to sustain good habitat. In this study, both indices, i.e., 10% of MAF and Q95, have been quantified. The Q95 flow values were derived from the constructed flow duration curves from available flow record.

1.3.3.5 Archeology and culture

The main objective of this study was to investigate the existence of any physical cultural resources in the project area and determine the likely impacts on these resources by the proposed Maira multipurpose dam project. The main focus of the survey was to investigate the magnitude and value of the key physical cultural resources in the project area. In order to complete these studies the following methodologies were employed;

- i) Desktop survey: Literature review of the project and other similar development in the country as well as studies on archaeology, palaeontology, and socio-cultural aspect of the region in question.
- ii) Site Survey: Field personnel applied spot checks across the study area and guided surveys based on information gathered from the local leaders. The method of data collection included; observations, recording, photographing, and documenting all identified cultural materials, and other environmental features likely to be impacted on either positively or negatively by the project.
- iii) Ethno-archaeological study: Meetings and interviews with stakeholders and the local people will be a major source of information about the impact of the project on the current socio-cultural lives of the people living in and around the area.
- iv) Pottery analysis: Pottery is very important and has been used in categorizing sites in timeframe and identifying the people who occupied the area in question in terms of activities or tribal. Like farming communities always make pots in different shapes from cattle keepers.
- v) Interviews and focus group discussions: Local leaders and elders were talked to about the historical and cultural practices of the people in the project area. Such consultative meetings took place at offices and people met at the fields.
- vi) Surface collection: Some finds were collected during the foot survey. Most of the finds were briefly analysed and photographed.

1.3.3.6 Health and Safety

In carrying out assessment for this report, qualitative methods of data collection and analysis were adopted. The methods of data collection included interviews and document review and inspection.

Document reviews: - Documents and literature review were undertaken. The purpose of this was to identify gaps, areas of weaknesses and strengths to build upon. Relevant policy

documents, action plans, and other materials were reviewed. These include Government policies, laws and institutional set ups in subjects of population, health and environment management.

The range of the documents reviewed included international documents and conventions. The purpose of this was to obtain reference point with which to judge Kenya's effort in developing the Maira dam.

Furthermore, a literature survey was undertaken. This included in particular, ILO, UNEP and WHO materials on safety, health and the environment. The purpose of this review was to obtain international experience on the subject with which to assess the impacts and threats facing the project, the workers and the communities.

Field Survey: - In order to get a deeper understanding of the people's experiences and thoughts, in-depth interviews were carried out in all the accessible selected test population. The following aspects were considered among others:

- Experience with materials that may be used during the project;
- General health and other social services accessed;
- Common beliefs;
- Health demoting behaviours and habits;
- Awareness of laws and dangers of chemicals consumed or used; and
- Level of inspection and contact with competent authorities.

The method of data collection was unstructured discussions, not longer than one and a half hours, with a probing question at the beginning. The venue was in the interviewee's respective place of work or home where necessary. The in-depth interviews were undertaken with individuals.

Premises visits: Inspection type field visits to the premises of stakeholders were carried out supported with administration of an in-depth questionnaire described above.

Site Examinations: The general areas of the project were examined by a walk-through tour with a view to assess the values that are being affected and to estimate the extent of damage in the event of further commercial development activities. Consultations and interviews with the community members, entrepreneurs and officials were then carried out in order to expand the observations and make inferences.

Approach: A multi-sectorial, multidisciplinary multi-agency team of persons with detailed terms of reference for their tasks carried out the survey. The objectives were to assess the sound management of various aspects of the project. For this assignment, this included

population, health and safety aspects. This progressed to proposals to put in place a plan to begin addressing gaps and potential impacts.

1.4 Public Disclosure

Environmental Management and Coordination Act (EMCA), 1999 of the republic of Kenya requires public scoping and disclosure of the project. A draft scoping report for the project was prepared, presented and discussed with the stakeholders on the 28th of August 2012 in Busia Kenya. The views of the stakeholders were incorporated and the final scoping report is prepared and submitted to NELSAP for subsequent submission to NEMA. Once the Environment Impact Assessment Study Report is ready the proponent (NELSAP /Ministry of Water and Irrigation) submits 10 copies and an electronic copy of EIA Study report to NEMA in Form 1B set out in the Schedule to Environmental (Impact Assessment and Audit) regulations 2003 (section 19). Section 20 of these regulations stipulates that NEMA is expected to submit the report to relevant lead agencies for their comments within fourteen days. If the lead agencies do not submit their comments within thirty days or specified extended period, the Authority may proceed with the determination for application for the implementation of the project.

The Authority is also to invite written or oral comments from the public within fourteen days of receipt of the report. At the expense of the proponent the Authority shall also publish for two weeks in the Gazette and in a newspaper with country wide circulation and in particular with wide circulation in the project area. It will also make public announcement on radio in official and local language at least once a week for two consecutive weeks.

Upon receipt of public comments the Authority may hold a public hearing (section 22). The public hearing shall be conducted according to section 22 (2-6) of the regulations. On conclusion of the public hearing, the presiding officer shall compile a report and submit to Director General within fourteen days from date of public hearing. All this information shall form part of the EIA process.

The Authority shall give its decision on the Environment Impact Assessment Study Report within three months of receiving the EIA Study Report (section 23) after which it will be a public document.

Furthermore, according to World Bank Environmental Assessment (OP/BP 4.01), January 1999, revised in 2011, Maira dam project has been categorized as A project (see Chapter 3, Requirements of International Financial Institutions). The disclosure requirements for EA reports are that they have to be disclosed at the World Bank Info shop (English) and will have to be accessible to local affected groups (in the local language) in their country

1.5 Structure of the Report

This report has the following chapters as outlined below:

Chapter 1- INTRODUCTION - provides a description of the background of the project, The objectives, the methodologies used in the assessment, public disclosure and report structure.

Chapter 2 – PROJECT DESCRIPTION - describes the project location, the area of influence, the project design and activities.

Chapter3 – POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK- presents an overview of the legal and institutional framework under which this ESIA has been conducted including national, regional, requirements of financial institutions and Multilateral Agreements.

Chapter 4 - CONSIDERATION OF ALTERNATIVES - presentation of the project alternatives that have been considered in the ESIA taking into account technical, economic, environmental and social considerations.

Chapter 5 – PUBLIC CONSULTATIONS - provides an overview of public disclosure and consultation activities undertaken in connection with the EIA study process. The major concerns raised are dealt with in the Environmental and Social Management Plan.

Chapter 6 – DESCRIPTION OF THE EXISTING ENVIRONMENT - describes physical and chemical environments including geology and soils, hydrology, water quality and climate of the proposed project site; presents the current flora and fauna in the project area and provides an overview of socio economic characteristics of the project area.

Chapter 7 – EVALUATION OF POTENTIAL IMPACTS AND MITIGATION MEASURES –and describes the potential positive and negative environmental and social impacts according to their magnitude and presents the anticipated overall of impacts of the project. It also lists the measures to be taken to mitigate or compensate the environmental impacts during the various stages of the project phases.

Chapter 8 – ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMP) - Guidelines to be adopted in environmental monitoring and management of the project are presented in this chapter.

Chapter 9– CONCLUSION AND RECOMMENDATIONS – gives concluding remarks, recommendations on the way forward of the project.

2 PROJECT DESCRIPTION

2.1 Location

Maira Multipurpose dam project is located in the Sio-Malaba –Malakisi in Kenya in the Districts of Nambale and Butula which was part of formally Busia District. **Figure 2-1** shows the location of Busia in Kenya. The dam was identified with the objective of building small dam to store and manage water to protect the population against droughts and floods and to meet other socio economic pertinent needs of the people in the river basin by providing water for irrigation and domestic use and to a lesser extent, hydro electricity production, fisheries and supply to industries.



Figure. 2-1 Location of Nambale and Butula Districts (formally part of Busia District)

According to the Interim report for the Feasibility study, Maira Dam site is located at coordinates; E 0645179 and N 0047701, on Rivers Namanderema and Nangeni, tributaries of River Sio (Fig 2-1). The proposed dam and the associated reservoir are mainly located in Nambale District, Nambale Division- Buhayo Central Location in Sub-locations of Malanga and Sidende (Figure 2-3). A small part is located in Butula District, Butula Division -Elugulu Location in Buhweso sub-location and Marachi East location in Elukongo sub-location all in Kenya. The village in which most of the dam is located is Maira in Malanga sub-location. Busia District is a downstream district that may be affected through dam operation and risks.

The locations of the associated developments like irrigation areas, water supply infrastructure, and hydropower and fish ponds were not yet clearly defined at the time of preparation of this report. However according to the feasibility report, it is expected that the water for irrigation will exit from the power plant, and then be directed to the irrigation areas. The water supply will only benefit those communities very close to the reservoir as no water supply network has been planned. The hydropower structures are also very close to the dam. In general therefore, the present assessment concentrates on the dam and reservoir but lightly discusses other components of the project.

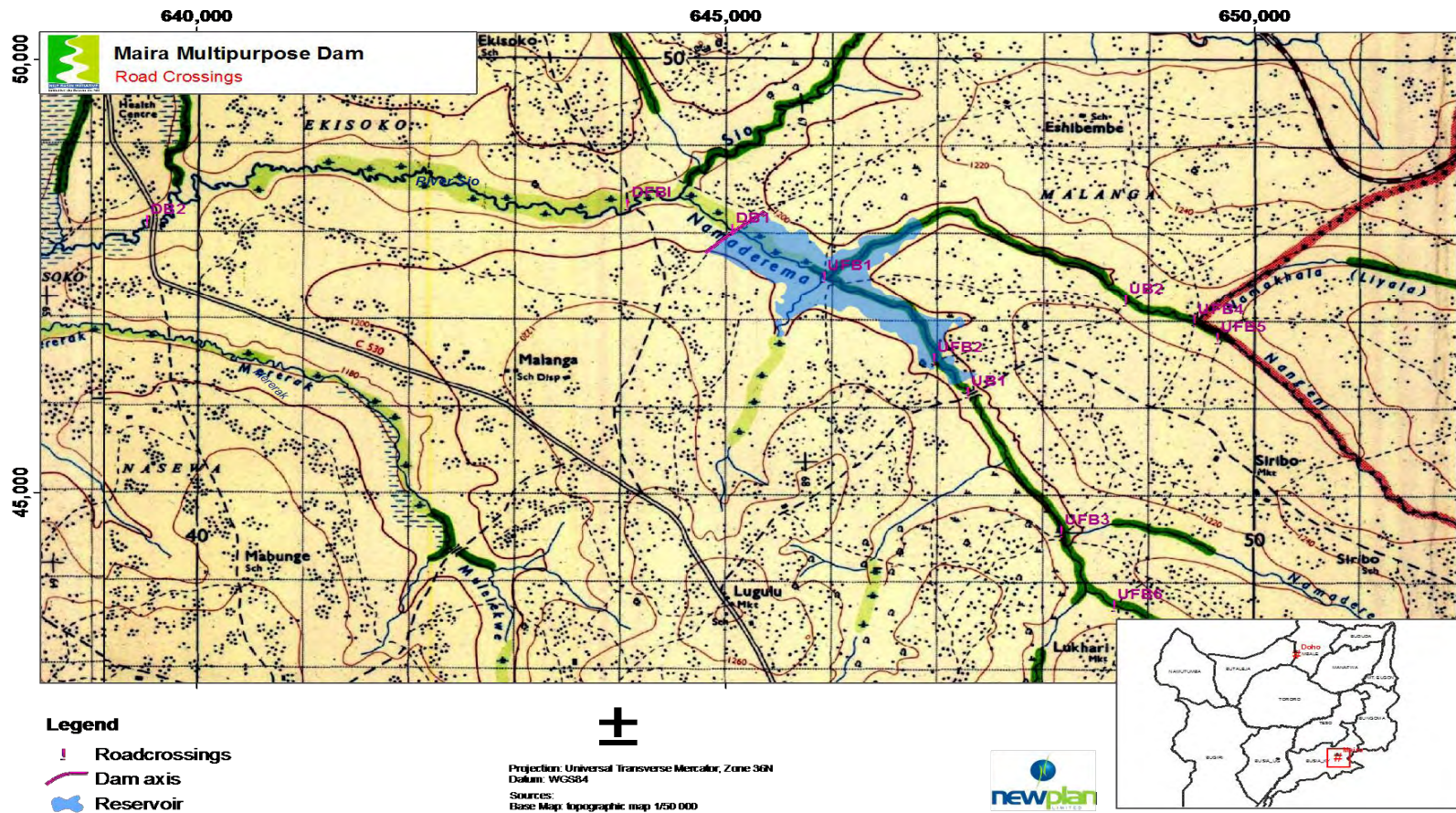


Figure 2-2 Maira Project location

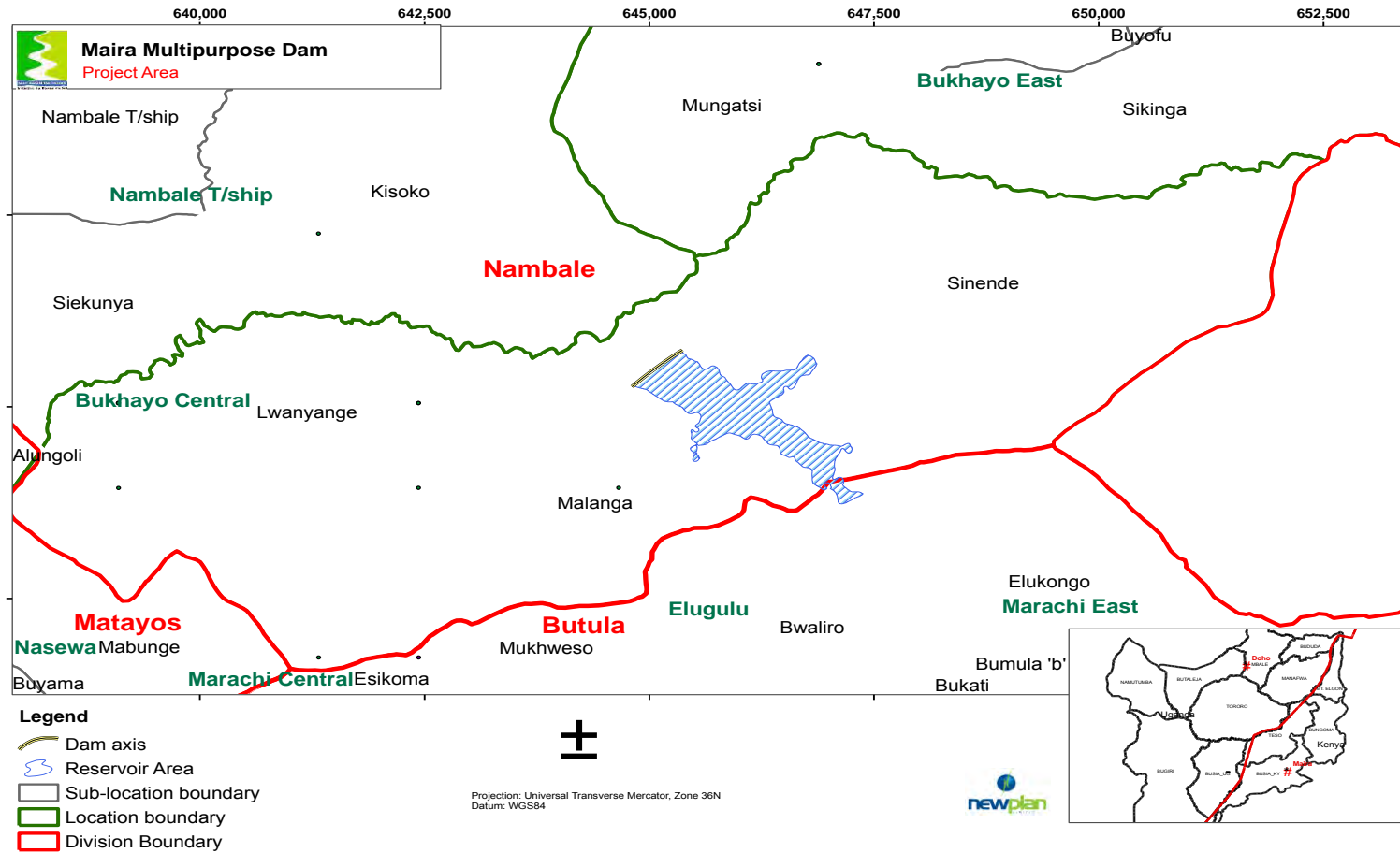


Figure 2-3 Maira Dam Project Location

2.1.1 Maira Dam Characteristics

Principal characteristics of the dam and the future reservoir (table 2-1) as proposed in the Interim report of the feasibility Study for Maira dam are highlighted below

Table 2-1: Dam and Reservoir Characteristics

Description of Component	Size
Site Location	E 0645179 and N 0047701
Reservoir Capacity	4.6 Mm ³
Height of Dam	11.0 M
Reservoir Fetch	2381m
Length of Dam	637 M
Dam Crest Width	6m
Maximum Water Level	
• Maximum water level + 6 m	1198.8 masl
• Maximum water level	Elev. of banks + 14 m
• Minimum water level	Elev. of banks + 6 m
Dam Crest elevation	
Reservoir surface area at MWL (km ²)	1.26 km ²
Reservoir fetch/reach (km)	
Contributing catchment area (km ²)	
Surface area of managed Catchment for the reservoir	126 km ²
Surface area of Sio River catchment at the confluence with the Nangeni River	754 km ²
Mean annual flow at the dam site	1,16 m ³ /s
Flood flow	1 :2 : 4,94 m ³ /s;
Water residence time in the reservoir	20 days
Dam crest	1201 m
Maximum depth	9 m
□ Average depth	2.61 m

2.2 Area of Influence

This is defined as the area that will be affected by the project development. The zones in this area have been defined based on the intensity of the impacts. These were identified under the Direct

Impact Zone (DIZ) and Indirect Impact Area (INDIZ.)The DIZ is an area that will have a direct impact from the project activities. The key DIZ areas include : the dam location, the reservoir area, areas that will be affected by the creation of access road, material sources like burrow pits and quarry (where necessary), the camp sites (temporary), the irrigation areas and the downstream areas that normally receive storm water in the wet season and soil disposal sites. The DIZ is mostly in the sub-locations of Malanga and Sidende (Bukhayo Location), Buhweso (Elugulu) and Elukongo (in Maracha East).

The INDIZ refers to areas that are surrounding the project area that may not be directly affected by the project, but may be influenced by human activities anticipated after the project has commenced. These areas include: the surrounding sub-locations of Bwaliro, Kisoko, Lwanyange and other sub-locations downstream that are not directly affected.

2.3 Technical Design/Dam features

2.3.1 Civil works

Designs are still at preliminary stage so civil works activities will be defined at a later stage.

2.3.2 Camp sites and Workshops

The camps and workshops are expected to be constructed. The proposed campsite location(s) are yet to be identified. The campsites will consist of, water supply structures, housing for workers, sanitation facilities and access roads. The Contractor will provide their own water either by constructing bore holes or getting water from the nearby sources.

Significant amounts of wastes are expected to be generated from the areas that are designated as workshops. More solid waste will be generated from the campsite together with the workshop area and this will include; plastic containers and bags, medical waste, domestic waste like food remains, peelings etc. , metal cuttings, wood, metallic tins and containers.

From the workshop area waste like; Liquid waste- fuels and oils used for machines in the workshop area, waste water and Sewage from sanitation areas will be produced.

2.4 Planned activities

The project activities include those during the pre-construction, construction and operational phases of the proposed Maira dam project

Each activity has potential impacts on the environment.

2.4.1 Pre - Construction Stage

Setting out (Demarcation of project area) and Site clearing (including dam axis and access roads)

- i) Surveying: The proposed project area (dam site and reservoir) have been surveyed using aerial survey and detail surveys to mark off the project area on ground shall also be carried out.
- ii) Clearing: the removal of all vegetation from dam axis
- iii) Access road construction: this will involve the construction of the various roads required to access the area, construction camps, material sources etc.

Transport of Material to Site

Road transport: materials sourced outside of the project area will be transported to the construction site by road. The existing Malanga -Sidende and Elugulu-Namisi and other access roads will be utilized as a means of delivering these materials to site, with potential impacts on the transport infrastructure and road users in the area.

Establishment of Construction Camps

Construction of temporary camp: this will be established by the contractor, and involve clearing of the vegetation, fencing of the camps and the construction of houses, workshops, store-rooms and vehicle parking areas. The camp will be electrified and ablution and potable water provided. The exact location of the camp has not been determined yet. An Environmental Management Plan (EMP) will be compiled as part of the EIA, which will describe parameters to be considered.

2.4.2 Construction Phase

Borrow pit and Quarry Establishment???

Designated borrow pit areas are not yet identified but will be identified once detailed design work has been carried out on the proposed project. The establishment of borrow pits will be done in consultation with the District Environment Officer, land owner and the Community.

Dam Construction

Site Cleaning and Rehabilitation

Site cleaning and rehabilitation involves removal of structures of the camp site, waste material generated during construction, regressing and replanting of the exposed areas. All waste material must be removed from site and disposed appropriately once construction is complete. If the location of some of the structures was agreed upon with the local authorities and the communities, some structures can be left to benefit the farmers or be used as community school etc.

2.4.3 Operation and Maintenance

This activity includes de-silting of the reservoir, clearing around the reservoir and maintenance of access roads to the reservoir. More details to be provided by the Design Team.

3 REVIEW OF EXISTING POLICIES, LAWS AND INSTITUTIONAL FRAMEWORK

The Kenyan Government in accordance with the Kenya National Environment Action Plan (NEAP, 1994) recognizes the negative impacts on ecosystems emanating from economic and social development programmes. Appropriate policies and legal guidelines are in place to projects of this magnitude in order to minimize negative environmental impacts. The Kenyan law has provisions for the establishment of the National Environment Management Authority (NEMA), which has the statutory mandate to supervise and coordinate all environmental activities in the country. Policies and legislation highlighting the legal and administrative requirements pertinent to this study are presented below.

3.1 Policy I frame work

Kenya Government's environmental policies aim at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy and laws include;

- Optimal use of natural land and water resources in improving the quality of human environment
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations
- Conservation and management of the natural resources of Kenya including air, water, land, flora and fauna
- Promotion of environmental conservation through the sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

Some of these policies that are relevant to the project are listed below

3.1.1 Kenya Vision 2030

The future development of Kenya is pegged on its Vision 2030 (“***A globally competitive and prosperous nation with a high quality of life by 2030***”), which has three pillars namely; the economic, the social and the political. This Vision’s aspiration is for Kenya to be a just and cohesive society enjoying equitable social development in a clean, secure and sustainable environment attained through good environmental and natural resources management principles that sustain economic development.

3.1.2 The Equal Opportunities Bill, 2007

Kenya has drafted a bill Equal opportunities Bill, 2007 that promotes equal opportunities for all persons, to prohibit discrimination and provide for remedies for victims of discrimination and for connected purposes. The act provides for public bodies, employers and providers of public services shall make active, targeted and systematic efforts to promote gender equality in all sectors of society, enterprise and organization. Since the project intends to provide services for development it must ensure that all tenets of society benefits either short term through employment during construction or long term through the benefits accruing

3.2 Legal frame work

3.2.1 The Constitution of Kenya, 2010

The Constitution of Kenya 2010 has a number of articles that allude to the right by all Kenyans to have a clean and healthy environment including the right to have the environment protected for the benefit of present and future generations through legislative and other measures; and to have the obligations relating to the environment fulfilled. This right is a public interest enforceable in article 70 of this constitution with the court given power to grant any relief it deems fit including an order to prevent or discontinue harm to the environment; and an order to provide for the compensation of any victim of a violation of the right to a clean and healthy environment.

Article 69 stipulates various obligations and in respect of the environment and orders the state to ensure sustainable management of the environment and natural resources and as well as equitable sharing of the accruing benefits.

The constitution encourages public participation in the management, protection and conservation of the environment and instructs the State to establish systems for environment impact assessment, environment audit and monitoring of the environment.

3.2.2 The Environment Management and Co-ordination Act, 1999

The Act provides for the establishment of appropriate legal and institutional framework for the management of the environment and related matters. Part III of the Act highlights the administrative structures (National, Provincial and district levels) for environment management with National Environmental Management Authority (NEMA) established as the principal

instrument for Government in the implementation of all policies relating to the environment and powers to supervise and coordinate all matters relating to the environment.

The Act states that everyone is entitled to a safe clean and healthy environment and has the duty to safeguard and enhance the environment. This therefore directs that any new programme activity or operation undertaken as specified in the second schedule of this Act which may cause major changes on the environment undertakes must be preceded by an Environmental Impact Assessment (EIA). Part VI and VII of this Act therefore require that the developer conducts an Environmental Impact Assessment (EIA) and prepares a report to the National Environmental Management Authority (NEMA) who may in turn issue EIA license.

Under the Environment Management Co-ordination Act are various regulations including;

The Environmental (Impact Assessment and Audit) Regulations, 2003, regulations on water quality; wetlands, river banks and sea shore management; controlled substances; waste management; conservation of biological diversity, access to genetic resources & benefit sharing; noise /excessive vibration pollution. The Act is emphatic on these regulations and further states that only these must be taken into consideration during the EIA process. This Act in addition establishes an EIA Practitioner’s Association with members mandated to observe the Code of Conduct for EIA Practitioners.

i) The Environmental (Impact Assessment and Audit) Regulations, 2003

Under this regulation, there are provisions on guidelines that have been established to govern the conduct of environmental assessments and audits in Kenya. The regulation dictates that EIA studies be done in accordance with the guidelines spelt out in the Second and Third schedules. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures). The regulations stipulates that any project likely to have negative effects on the environment or one for which an EIA is required under the Act or regulations cannot commence until an EIA has been concluded and approved the Authority.

This regulation provides guidance and all the processes and stages to be followed right from the onset of EIA study up to the Approval of the final report. It prescribes that EIA study shall be undertaken in accordance with terms of reference developed during the scoping exercise by the developer and approved by the Authority.

ii) Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009.

This Act applies to all wetlands in Kenya whether occurring on private or public land. It contains provisions for the utilization of wetland resources in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological, social and economic functions and services.

The proposed Maira project will be located in the three valleys which are part of the Sio River basin with wetlands ecosystem in some parts still intact while in others it has been altered. Despite the current status, the regulation will be vital in guiding the project management to be compliant and protect the wetlands and preventing and controlling pollution and Siltation in the rivers.

iii) Air Quality Regulations, 2008

The objective of these Regulations is to provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air. As regulations everyone is prohibited from causing emission of air pollutants listed under 1st Schedule (Priority air pollutants) to exceed the ambient air quality levels stipulated under the provisions of the 7th Schedule (Emission limits for controlled and non-controlled facilities) and 2nd Schedule (Ambient air quality tolerance limits).

The Project shall therefore observe policy and regulatory requirements and implement the possible mitigation measures in an effort to comply with the provisions of these Regulations on abatement of air pollution.

iv) Environ Noise and Excessive Vibration Pollution Control) Regulations, 2009.

This regulation is aimed at controlling noise pollution to ensure a healthy environment for all people Kenya as well as making serenity of their surroundings and psychological well-being Under this regulation, it is stipulates that no person shall make or cause any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered: (i) time of the day; (ii) proximity to residential area; (iii) whether the noise is recurrent, intermittent or constant; (iv) the level and intensity of the noise; (v) whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and, (vi) whether the noise is subject to be controlled without unreasonable effort or expense to the person making the noise.

These regulations also relate noise to its vibrational effects and seek to ensure project activities likely to generate injurious noise and vibrations apply to NEMA for a license and comply with the conditions. The activities of this project

v) Waste Management Regulations (2006)

This regulation is meant to streamline the handling, transportation and disposal of various types of waste. The regulations aim is to protect human health and the environment. Emphasis has therefore been put on waste minimization, cleaner production and segregation of waste at source. This regulation will be applicable TO the project at Maira especially during construction when litter and any other waste will be generated. The regulation clearly spells how this will be collected and disposed of at designated disposal sites.

vi) Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006

The Act states that no person shall engage in any activity that may have an adverse impact on any ecosystem, lead to the introduction of any exotic species, or lead to unsustainable use of natural resources, without an Environmental Impact Assessment License issued by the Authority under the Act. Since this project involves the transfer of materials, there is likely to be introduction of alien plants species which may be evasive. The project management is aware of this and has therefore commissioned an environmental assessment and obtain a license from the Authority (NEMA) in compliance with the Act. The Management it its ESIA report shall provide guidelines on mitigation of potentially adverse impacts on natural resources.

vii) Controlled Substances regulation, 2007, Legal Notice No. 73

The Controlled Substances Regulations defines controlled substances and provides guidance on how to handle them. The regulations stipulates that controlled substances must be clearly labeled with among other words, “Controlled Substance-Not ozone friendly”) to indicate that the substance or product is harmful to the ozone layer. Advertisement of such substances must carry the words, “Warning: Contains chemical materials or substances that deplete or have the potential to deplete the ozone layer. “Persons handling controlled substances are required to apply for a permit from NEMA. Should the project use any of the controlled then this regulation shall apply. However, there are indications that this project will not use any of the *controlled substances in the operation or construction of the dam.*

viii) National Climate Change Response Strategy, 2010

Kenya has put in place a National Climate Change Response Strategy, 2010 which recognizes that climate change is a threat to national development and has had an adverse impact on Kenya’s socio-economic sectors. The strategy is divided into ten chapters that outline the evidence of climate change, its impacts and make recommendations for action to reduce these impacts. The primary

focus of the Strategy is ensuring that adaptation and mitigation measures are integrated in all government planning, budgeting and development objectives. Joint action and collaboration with all stakeholders-private sector, non-governmental organizations, civil society and others-is called upon in addressing the impacts of climate change. The proposed project at Maira will consider activities likely to impact on climate changes and devise means to mitigate these as per national strategy.

3.2.3 *The Water Act 2002*

According to this Act, ownership of all surface and groundwater resources rests in the hands of the state which is responsible for the management of water resources in recognition its economic value and ensuring that there is equitable allocation of water for all Kenyans. This Act Provides for protection of the quality of water resources and puts in place mechanisms for stakeholder involvement in the management of water resources. Enshrined in this Act, are the institutional changes in water resources management at national, regional and local levels and provision of the main legislation governing the use of water. These institutions include among others;

- Water Resources Management Authority (WRMA) with regional offices as well as being responsible for water resources; regulates water resource management issues that include water allocation, irrigation water, source protection and conservation, water quality management, pollution control, flood control, drainage, abstraction and international. Under WRMA are decentralized water resources management that include the establishment of
 - a) Catchment Area Advisory Committees (CAAC) to provide advisory services on conservation and allocation including granting and cancellation of permits
 - b) Water Resource Users Associations (WRUA) for management of water resources and conflict resolution at sub-catchment level.
 - Water Services Regulatory Board (WSRB) - responsible water and sewerage services.
- Furthermore, the Water Act 2002 also requires an environmental flow to be maintained.

It anticipated that this project will have some impacts on the water supply due the greatest amount being trapped in the reservoir. However, the proponent is expected to observe the requirements to ensure no adverse effects on the local water supply during operations and constructions.

This Act therefore will be applicable to the proposed reservoir at Maira that will be created after dam construction.

3.2.4 *Draft Water Rules*

Section 110 of the Water Act 2002 calls for rules to be prescribed for carrying out or give effect to the provisions of the Act. To enable Water Resources Management Authority carry out its

mandates, it was necessary to put in place the draft rules to govern various activities that affect water resources in the country.

The draft rules aim at addressing persistent problems in the water sector such as

- Poor regulatory environment
- Poor water quality
- Low water reliability
- Destruction of catchment areas

The rules have been designed to benefit all water users depending or have an interest in water resources. The draft rules provide for a reserve (environmental flow) that aims at benefiting downstream water users.

3.2.5 The Lakes and Rivers Act Chapter 409 Laws of Kenya

This Act provides for protection of river, lakes and associated flora and fauna. The proposed project is based on the three tributaries hence need protection including flora and fauna as per the Act.

3.2.6 The Wildlife Conservation Act, 2009

This Act provides for the protection, conservation, management and sustainable utilization of wildlife resources in Kenya. Since this project is likely to affect the wetland ecosystems specifically inhabited by different animal and plant species some of which could be of ecological significance, the Act applies and commands protection of such resources as Wildlife habitats. Therefore the Act permits the Minister in consultation for Wildlife in consultation with the Minister responsible for the Environment to cause the making of regulations and guidelines prescribing the sustainable management of wetland reserves and wetland areas.

The dam being proposed has significant physical development for which an ESIA will be undertaken as per ESIA laws and regulations. This Act will be applied by the developer in the implementation of the project towards protection and conservation of wildlife within in the project areas.

3.2.7 ACT NO. 14 of 2006 - HIV and AIDS Prevention and Control Act

Under this Act, there are provisional measures for the prevention, management and control of HIV and AIDS as well as promotion of public health and for the appropriate treatment, counseling, support and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes. The object and purpose of this Act is to:

- Promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS;

- Extend to every person suspected or known to be infected with HIV and AIDS full protection of his human rights and civil liberties by:
- Prohibiting compulsory HIV testing save as provided in this Act;
- Guaranteeing the right to privacy of the individual;
- Outlawing discrimination in all its forms and subtleties against persons with or persons perceived or suspected of having HIV and AIDS;
- Ensuring the provision of basic health care and social services for persons infected with HIV and AIDS;
- Promote utmost safety and universal precautions in practices and procedures that carry the risk of HIV transmission; and
- Positively address and seek to eradicate conditions that aggravate the spread of HIV infection.

3.2.8 The Public Health Act (Cap. 242)

The Act states that no person/institution shall cause nuisance or conditions liable to be injurious or dangerous to human health. It provides for the securing of public health and recognizes the important role of water thus the need for prevention of water pollution. The Proponent shall thus observe policy and regulatory requirements and implement measures to safeguard public health and safety.

3.2.9 The Occupational Health and Safety Act, 2007

This is an Act of Parliament enacted to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces but also its immediate environment to provide for the establishment of the National Council for Occupational Safety and Health. Part VI deals with Health and general provisions. This touches on issues of overcrowding, ventilation, lighting, and sanitary provisions. Part VII deals with machinery safety. Part VIII deals with safety issues and general provisions including fire prevention, safety provisions in case of fire, evacuation procedures, and safe means of access and safe place of employment. The Act requires employers to take all reasonably practicable measures to protect the health and safety of workers and public exposed to risks from workplace. The Act promotes creation of a safety culture at workplaces through education and training in occupational safety and health.

The dam construction activities will involve use of heavy vehicles and blasting and the reservoir created may be a source of accidents and health hazards to the workers and the immediate project area. This act is therefore applicable and the proponent advised to ensure the project activities follow the provision of health safety and welfare plans and procedures to workers on site.

3.2.10 Employment Act (Cap 226, Laws of Kenya): ACT NO. 14 of 2007 - Labour Relations Act

The Act outlines the laws governing employment and protecting employees in Kenya. The Act protects all children under the age of 16 years from employment in industrial undertaking except for internship or training. Further, the Act outlines Children's Employment Rules, which provide for Protection of children at work. The act provided consolidate the law relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratization of trade unions and employers organizations or federations, to promote sound labour relations through the protection and promotion of freedom of association, the encouragement of effective collective bargaining and promotion of orderly and expeditions dispute settlement, conducive to social justice and economic development and for connected purposes. The project management will employ a number of people most of whom shall be casual labors who need protection from exploitation hence this law will be applicable to this project.

3.2.11 The Work Injury Benefit Act, Chapter 236

The Work Injury Benefit Act, came into operation in June 2008 but was revised in 2010. This is an Act of Parliament to provide for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes.

Part II of the Act, provides for the obligation of the employer. Section 7 (1) stipulates that every employer shall obtain and maintain an insurance policy, with an insurer approved by the Minister in respect of any liability that the employer may incur under this Act to any of his employees. The subsections that follow explain the conditions under which the Minister can be exempt the employer and the penalty in case of contravention.

Part III provides for the right to compensation, accident out site Kenya, compensation ordered by Director, employee requiring constant assistance, substitution of compensation for other legal remedies and claims against third party. Part IV provides for reporting of accidents; it discusses issues like notice of accident from employee to employer, notice of injury or accident by employer to Director, inquiry by Director, particulars in support of claim , employee to submit to medical examination, claim for compensation and lapse of right to benefits.

Part V provides for compensation; Compensation for temporary total or partial disablement, Expiry of compensation for temporary total or partial disablement, Compensation for permanent disablement, payment of compensation, and manner of calculating earnings.

Part VI discusses occupational diseases while medical Aid and Appeal are handled in part VII & VIII respectively.

3.2.12 The Children Act (Cap. 586, Laws of Kenya)

This Act of Parliament that provides for the rights of children and seeks to enhance the welfare of children in Kenya. The Children's Act (CA) was enacted for the following main reasons make provision for parental responsibility, fostering, adoption, custody, maintenance, guardianship, care and protection of children; to make provision for the administration of children's institutions; to give effect to the principles of the Convention on the Rights of the Child and the African Charter on the Rights and Welfare of the Child and for connected purposes. The act provide for the safeguards for the protection of the rights and welfare of children. It will be incumbent for the project management to apply this law and to avoid child labor and employment.

3.2.13 Physical Planning Act (Cap286)

The Act provides for the preparation and implementation of physical development plans and for related purposes. It gives provisions for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land. This Act will be vital to the management as it plans, designs, implements the project at Maira basing on the development plans of the area.

3.2.14 Land Act Chapter 288 of the Laws of Kenya

The Trust Land Act makes provision for Trust land (under customary land tenure) Section 115 of the Constitution is vested in the county council within whose area of jurisdiction it is situated. As per constitution there are provision for each county council to hold the Trust land vested in it for the benefit of the persons ordinarily resident on that land and gives rights, interests or other benefits in respect of the land as may, under the African customary law for the time being in force and applicable thereto, be vested in any tribe, group, family or individual. Section 118 of the Constitution empowers the Government to cause the county councils to set apart Trust land for public purposes.

Section 8 of the Act states that where land is set apart, full compensation shall be promptly paid by the Government to any person who has any right to occupy any part thereof under African customary law for the time being in force and applicable to the land, or who is, otherwise prejudicially affected by the setting apart.

Section 9 gives mandate to the District Commissioner after consultation with the Divisional Board, to assess the compensation to be awarded. Such compensation shall be assessed in respect of the

loss of the right of occupation or in respect of the applicant having been otherwise prejudicially affected.

Section 10 provides for the right of and process of appeal. An appeal from the decision of the District Commissioner lies with the Provincial Agricultural Board in the province in which the land is situated. Any party to an appeal to the Provincial Agricultural Board who is dissatisfied with the decision of that Board may appeal to the Resident Magistrate's Court and any party to an appeal to the Resident Magistrate's Court who is dissatisfied with the decision may appeal to the High Court whose decision shall be final.

Section 38 further provides that license may be granted to any person empowering him/her and his/her servants and agents to enter upon Trust land vested in the council and to lay pipes, make canals, aqueducts, weirs and dams and execute any other works required for the supply and use of water, to set up electric power or telephone lines, cables or aerial ropeways and erect poles and pylons therefore, and to make such excavations as may be necessary for the carrying out of any such purposes, and to maintain any such works as aforesaid. Where a license has been applied for and the lessee or the holder of the mining right will suffer loss by reason of disturbance or damage to his interest, he shall be entitled to compensation therefore in such sum as may be agreed upon between the licensee and the lessee or holder, as the case may be, or, in default of such agreement, such sum as may be determined by the Minister.

3.2.15 Land Acquisition Act (Cap. 295)

This Act makes provision for the procedures and methods of compulsory acquisition of land from private ownership for the benefit of the general public. Non-titled land occupied by communities is addressed in the Trust Land Act, Cap 288. Matters related to community land are handled by the Provincial Administration and if there is need to gazette any area, the Commissioner for Lands is involved.

The Minister responsible for land may authorize any person to enter the land, survey the land, dig or bore the subsoil or any other thing necessary for ascertaining whether the land is suitable for a public purpose. The Government or developer is to compensate any person who suffers damage as a result. The Act requires that adequate, fair and prompt compensation is paid before taking possession of land and property. Any disputes regarding the adequacy of the award and/or the persons to be compensated are determined by the Land Acquisition Compensation Tribunal established under the *Land Acquisition (Amendment) Act, 1990*. Should there be failure by Land Tribunal to handle the dispute arising from the compensation to be paid, the dispute should be referred to the court for final decision.

Since this project is likely to inundate about 103 Ha of land with some other land needed temporarily for access road and other infrastructure during construction, this Act will be triggered and therefore necessary for the Maira project.

3.2.16 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.

Once the proponent has established land occupancy status through survey and a Resettlement Action Plan (RAP) for those who will be affected by the proposed project would be handled as stipulated under this Act. Therefore the project management shall adhere to the requirements of the Act in dealing with any squatters that will be displaced by the proposed project.

3.2.17 The Registered Land Act Chapter 300 Laws of Kenya

This Act provides for the absolute proprietorship over land (exclusive rights). Such land can be acquired by the state under the Land Acquisition Act in the project area.

The project traverses some areas with Registered Land. The Proponent shall comply with the provisions of the Act in the acquisition of Registered Land.

3.2.18 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 connection with the dam construction. The construction of the dam and its accessories will use materials and equipment whose specifications are contained in this Act. It is therefore advisable that the project management ensures that use of equipment as well as codes of practice in the project adhere to the provisions of this Act.

3.2.19 The Antiquities and Monuments Act, 1983 Cap 215

The Act aims 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

(NMK) 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. Consultation with NMK will be necessary to identify physical cultural resources that may be impacted by the implementation of the proposed project as well as the appropriate mitigation measures to protect such resources.

3.2.20 The National Museums and Heritage Act, 2006 (Cap 216)

The Act provides for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya. The National Museums of Kenya (NMK) is established under the Act with the functions of serving as national repositories for things of scientific, cultural, technological and human interest. 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

The Act through NMK has protects these sites by having them gazette.

This Act is applicable to this project since the construction of the dam and the creation of the reservoir may impact on some of the archeological and cultures.NMK the lead agency in respect to matters of heritage in liaison with NEMA has the authority to undertake EIAs subject to the provisions of the Environment Management and Co-ordination Act.

3.2.21 Penal Code Act (Cap.63)

The Act states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution is dwelling or business premises in the neighbourhood or those passing along public way, commit an offence. The project considers this as a vital law which will be clearly set out in the guidelines of project the Environmental and Social; Management and the recommendations provided for mitigation/ minimization/ avoidance of adverse impacts arising from the project activities.

3.3 Institutional framework

The construction and management of Maira Multipurpose Dam will bring into play various ministries, departments and agencies. The main key institutions will include: ministry of Water and Irrigation; Ministry of Agriculture, ministry of Livestock Development; Ministry of Fisheries, Ministry of works (Kenya Rural Roads Authority (KeRRA); president's Office/provincial

Administration; Ministry of Health (Public Health); National Environment Management Authority (NEMA); Ministry of Special program.

3.3.1 National Environment Management Authority (NEMA)

The mandate of the National Environment Management Authority (NEMA) is a government parastatal established to exercise general supervision and co-ordination over all matters relating to the environment. The Authority is the principal instrument of Government in the implementation of all policies relating to the environment. Section 9(2) of EMCA details 17 statutory functions that NEMA shall undertake.

The major functions of NEMA include but not limited to:

Coordinating the various environmental management activities being undertaken by the lead agencies

- Promote the integration of environmental considerations into development policies, plans, programs and projects, with a view to ensuring the proper management and rational utilization of environmental resources, on sustainable yield basis, for the improvement of the quality of human life in Kenya.
- Monitor and assess activities, including activities being carried out by relevant lead agencies, in order to ensure that the environment is not degraded by such activities. Management objectives must be adhered to and adequate early warning on impending environmental emergencies is given.
- Undertake, in cooperation with relevant lead agencies, programs intended to enhance environmental education and public awareness, about the need for sound environmental management, as well as for enlisting public support and encouraging the effort made by other entities in that regard.
- Render advice and technical support, where possible, to entities engaged in natural resources management and environmental protection, so as to enable them to carry out their responsibilities satisfactorily.

NEMA will be expected to play active roles to the project during the construction and implementation phases especially with regard to; environment education and awareness, ensure that that the project maintain sound environment management and provide advice and technical support to dam management agency.

3.3.2 Ministry of Water and Irrigation (MWI)

The Ministry devolves from regulation and direct provision of services to focus on its core functions of policy formulation, overall coordination of the water sector, and supervision of public institutions under the Ministry, resources mobilization and guidance. The key organs of the ministry relevant for the project include but not limited to; Water Resources Management Authority (WRMA), The Directorate of Irrigation, Drainage and Water Storage and National Water Conservation and Pipeline Corporation (NWCP)

3.3.3 *Water Resources Management Authority (WRMA)*

In accordance with the Water Act 2002, the WRMA is responsible for the sustainable management of the country's water resources. WRMA is responsible for the regulation of the use and management of water resources. A key aspect of this mandate is the allocation of water resources through a permit system. In Kenya, management of water resources is undertaken on a catchment basis. The WRMA has designated six catchment areas. Lake Victoria North is one of the catchment areas and covers the area of the Sio-Malaba-Malakisi. WRMA established regional offices in or near each catchment area to manage water resources.

3.3.4 *The Catchment Area Advisory Committees (CAACs)*

The CAACs are established at catchment levels to advise the WRMA on conservation, use and allocation of water resources in their respective catchment areas. According to the Water Act 2002, the CAACs shall advise officers of the WRMA at the appropriate regional office concerning: Water resources conservation, use and apportionment; the grant, adjustment, cancellation or variation of any water permits and any other matter pertinent to the proper management of water resources

3.3.5 *Water Resources Users Association (WRUAs)*

The Act provides a role for user groups, organized as Water Resources Users Associations. The WRUAs provide fora for conflict resolution and cooperative management of water resources in designated sub-catchment areas. Under this process, the public and communities are enabled to participate in managing water resources within each catchment. The WRUAs will be represented on the Dams management committee.

3.3.6 *Directorate of Irrigation and Drainage*

The mandate of the Irrigation and Drainage Department is to promote the development of sustainable farmer-owned and managed irrigation and drainage projects, through participatory approach and coordination of stakeholders with the aim of contributing to poverty alleviation, food security and employment creation. The department has offices at the national, provincial and district levels. At the head office the functions focus on policy matters and collaboration and coordination of irrigation and drainage issues at the national, regional and international level.

At the district level is where the Strategic Business Units of the department are. These are concerned with the day-to-day provision of irrigation and drainage services to the farmers namely: investigations, survey, design, and supervision of civil works, irrigation water management and training activities. The goal of the directorate is to contribute to the realization of the overall national development goals of poverty alleviation, food security, economic growth and sustainable development by:

- Increasing area under irrigation and drainage for increased agricultural production
- Increasing productivity of irrigation schemes through provision of appropriate support services and training on efficient use of irrigation water.
 - Increasing sustainability of irrigation schemes through provision of effective technical support services in planning, implementation, operation and maintenance of schemes.
 - Training of farmers on operation, maintenance and management of irrigation infrastructure and on farm water management.

Both the head office and provincial offices provides administrative and technical backstopping to the field offices. It should be noted that the major Clients of the Directorate of Irrigation, Drainage and Storage are: individual smallholder irrigation/drainage farmers, smallholder group-based schemes, organizations/institutions with an interest in irrigation development. Bearing the above into consideration, the directorate may not be instrumental in managing a big project as envisaged in the case of Maira Multipurpose project because of its inability to manage big irrigation projects. Moreover, the current capacity of directorate especially at district level is very low. There is only one technical officer in the three project districts (Busia, Butula and Nambale) yet under normal circumstances, a district is supposed to be manned by four (4) technical staff in charge of; irrigation and drainage, irrigation water management, planning and design-including surveying .

3.3.7 The National Water Conservation and Pipeline Corporation (NWCPC)

National Water Conservation and Pipeline Corporation (NWCPC) is a State Corporation established under the State Corporations' Act Legal Notice No. 270 of 24th June, 1988 Cap 446 of the Laws of Kenya. The NWCPC is mandated to construct dams, drilling of boreholes, development of canals and flood control works. It is also mandated to supply water in bulk as advised by the Minister in charge of water affairs. Since Maira Multipurpose Dam is one of the state schemes, NWCPC may have to play significant roles especially in areas of dam construction and flood control. It has demonstrated experience in designing and implementing projects on water security and storage for multi-purpose uses.

3.3.8 Ministry of Agriculture

The mandate of the Ministry of Agriculture is to promote and facilitate production of food and agricultural raw materials for food security and incomes; advance agro based industries and agricultural exports; and enhance sustainable use of land resources as a basis for agricultural enterprises. This ministry is a potential beneficiary of the project especially through crop irrigation but is also a likely victim of the project through floods that could result into crop destruction.

Other water user ministries that have interest in the project are; Ministry of livestock Development and Ministry of Fisheries. There is a growing demand for fish farming which depend on water in the area. Since the project is likely to result into the creation of a reservoir fishing farming may be introduced alongside recreation sport fishing and angling. Livestock may also need water but care

must be undertaken to ensure that animals are protected against drowning and floods resulting from dam damage or over flow overflow.

3.3.9 Ministry of Health

The key department of the ministry of health which is critical to this project is the Environment Health and Sanitation Department. Its Mission is to provide comprehensive and effective environmental health services for the people of Kenya, ensuring that through appropriate interventions, monitoring, regulation and enforcement, all can enjoy services which are so far as possible safe and without risk to health or welfare. Water safety and quality, sanitation and hygiene issues occupation health/safety and outbreaks of epidemics such as malaria are some of the likely consequences of the project. The ministry should be prepared to respond to such emergencies

3.3.10 Ministry of Roads and Public Works

The Ministry of Roads and Public Works is charged with the responsibility of providing basic infrastructure facilities to the public. These infrastructure facilities include; development, rehabilitation and maintenance of the road network in the country and maintenance of buildings and other public works. The responsibility of rural roads is charged with Kenya Rural Roads Authority. KeRRA is a state corporation whose mandate is to offer guidance in the construction, maintenance and management of the rural road network in the country. KeRRA is responsible for the management, development, rehabilitation and maintenance of rural roads. KeRRA will be instrumental in the emergency situations especially with regard to dam damage that could result into floods-affecting roads and bridges

3.3.11 Provincial Administration

This department cascades from the Ministry's headquarters to grassroots level headed by the Provincial Commissioners, District Commissioners, District Officers, Chiefs and Assistant Chiefs. The core functions are: Co-ordination of development activities in the field; Dissemination of government policies; Identification of persons for registration; Conflict resolution between communities and peace building; Interpretation of government policies in the field; Maintenance of public security; Enforcement of law and order and Land matters. Given the multi-sectoral nature of the project, the office of the District Commissioner and the Chiefs will be instrumental in terms of coordinating line ministries/district departments and community mobilization. In case of mitigation of likely negative impacts of the project including disasters, the District Commissioner is the chairperson of the District Disaster Management Committee, a body which brings together relevant institutions at district level to address emergencies.

3.3.12 Ministry of Special Programme

The core functions of the ministry are: Coordinate the formulation and implementation of Policies and Institutional; Framework for Disaster Management; Coordinate the mobilization of resources

for Disaster Management; Coordinate all stakeholders in Disaster Risk Reduction and Management; Monitoring and Evaluation of the Disaster Management Program. Coordination between this ministry and the project will be crucial with regard to emergency situations where immediate community mobilization and mobilization of resources will be required. It is also instrumental in early warning and public announcements.

3.3.13 The Ministry of Lands

The Ministry of Lands will oversee all matters related to land acquisition under its semi-autonomous bodies of the Land Arbitration Tribunal, Valuers Registration Board and Land Control Boards. It will ensure that all policies and regulations related to land are enforced.

The ministry will also be instrumental in addressing matters arising in resettlement through Land Acquisition Compensation Tribunal. The key role of the Land Acquisition Compensation Tribunal will be to solve grievances that will be related land acquisition and compensation. The cases will be referred to court if the Tribunal fails to resolve the disputes.

3.3.14 District Land Office

In cases of land acquisition, resettlement and grievance management, the People Affected by the Project (PAP) shall make an appeal to the County Council, addressed to the District Lands Officer at the District Steering Group (DSG), assisted by the local Land Control Board

3.4 East African Institutions

The treaty unifying the three East African Countries of Kenya, Uganda and Tanzania (and now includes Rwanda and Burundi) was signed in November, 30th 1996 by the Presidents of the respective countries.

3.4.1 The East African Community

3.4.1.1 The EAC Treaty, 1999

The objectives of the Treaty include the sustainable utilization of natural resources; taking measures to protect the environment; sharing meteorological information; collaboration in the development of energy sources; and cooperation in environment & natural resources management. The need for joint efforts in environmental protection and conservation was realized right from the formulation of the revived East African Cooperation.

Cooperation in environment and natural resources management is stipulated in Chapter 19 of the treaty. The partner states recognize that development activities may have negative impacts on the environment leading to degradation of the environment and depletion of natural resources and are empathic on the notion that clean and healthy environment is a prerequisite for sustainable development.

The States agree to take measures to foster cooperation in the joint and efficient management and sustainable utilization of natural resources within the community; and shall provide prior and timely information to each other on activities that may have significant trans-boundary impacts and shall consult at an early stage. The development of a common environment management policy is encouraged including joint development and adoption of water resources conservation and management policies that ensure sustenance and preservation of ecosystems. The states undertake to adopt common environmental control regulations, incentives and standards; and develop capabilities and measures to undertake EIA of all development project activities and programmes.

3.4.1.2 The Protocol on Environment and Natural Resources, 2006

The Protocol is not yet in force pending the ratification of a member State. It governs cooperation between the Partner states in the management of the environment and natural resources over areas within their jurisdiction including trans-boundary environment and natural resources.

The Protocol provides for areas of cooperation between Partner States and specifically for cooperation in conducting EIA and environmental audits. Other areas of cooperation include; the management of trans-boundary resources; harmonization and adoption of common policies, laws & programmes requiring EIA; prior planning for trans-boundary activities & projects that may have adverse impacts. Common guidelines on EIA in shared ecosystems shall be adopted. Partner states undertake to ensure that the Regional Environment Assessment Guidelines for Shared Ecosystems of East Africa-Annex I to the protocol-are adhered to. The Annex is currently under review by the EAC. Maira dam is located in the Sio Malaba Malakisi transboundary river basin, thus this protocol will be applicable.

3.4.1.3 Draft EAC Climate Change Policy, 2011

A *Draft EAC Climate Change Policy, 2011* has been proposed and is in the approval process. The policy was developed as a result of lack of national policies on climate change and the effects of climate change in the East African region. The proposed EAC Climate Change Strategy and Climate Change Master Plan were referred by the Sectorial Council on Environment and Natural Resources to Partner States for further input.

3.4.1.4 Trans-boundary Ecosystems Management Bill, 2010

A *Trans-boundary Ecosystems Management Bill, 2010* was proposed in the East African Legislative Assembly (EALA) as a private members' Bill but was deferred because of its ramifications on the existing legal and institutional mechanisms in place in Partner States.

3.4.2 The Lake Victoria Basin Commission (LVBC)

3.4.2.1 The Protocol for the Sustainable Development of Lake Victoria Basin, 2003

LVBC is established under the Protocol for the Sustainable Development of Lake Victoria Basin. The Protocol looks to cooperation of Partner States in conservation and sustainable utilization on the basin resources. All LVBC programmes are aimed at promoting sustainable development in the Lake Victoria basin.

In implementing programmes particularly development projects, there may be need for EIA for those projects and environmental mitigation measures to restore degraded environments around the lake basin. Projects that require EIA are subjected to national processes. This applies to trans-boundary projects since there is no mechanism currently available for trans-boundary EIA.

Sio Malaba Malakisi River basin where the proposed Maira dam is to be located falls in a sub-basin of Lake Victoria Basin and therefore this dam project will be subjected to the EIA requirements of Kenya.

3.5 Requirements of International Financial Institutions

3.5.1 World Bank Safeguard Policies

The ‘Environmental and Social Safeguard Policies’ of the World Bank consist of Operational Policies (OP), Operational Directives (OD) and Bank Procedures (BP). Some of these policies likely to be triggered by the proposed dam construction at Maira are highlighted below.

3.5.1.1 Safety of Dams (OP 4.37)

Section 1 of these procedures clearly indicates that the responsibility of ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam lies with the owner irrespective of its funding sources or construction status.

Section 2 to 6 of OP 4.37 concerns the “New Dams”. When the project includes the construction of a new dam for example a water storage dam for multipurpose project, it requires that the dam be designed and its construction supervised by experienced and competent professionals. It also requires that the lender makes sure that the borrower adopts and implements certain dam safety measures for the design, bid tendering, construction, operation, and maintenance of the dam and associated works (section 2). Section 3 distinguishes between small and large dams. Section 3a stipulates that small dams are normally less than 15 meters in height. Section 3b indicates that large dams are 15 meters or more in height. However if they present special design complexities-for

example, an unusually large flood-handling requirement, location in a zone of high seismicity, foundations that are complex and difficult to prepare, or retention of toxic materials then if such dams are between 10-15meters in height are treated as large dams.

The proposed Maira dam has a height of 12 m which is less than the 15m and does not present special design complexities; therefore it is a small dam. .

According to section 4 OP 4.37, generic dam safety measures designed by qualified engineers are adequate for small dams.

3.5.1.2 Environmental Assessment (OP/BP 4.01)

This ESIA is also based on internationally respected procedures recommended by the World Bank, covering environmental guidelines. The purpose of OP 4.01 is to make sure that projects funded by the Bank are environmentally viable and possible, and that decision making has been improved through appropriate analysis of actions and their probable environmental impacts (OP 4.01, para 1). That policy is triggered if the project is likely to cause potential (negative) environmental risks and impacts in its area of influence. OP 4.01 covers impacts on physical environment (air, water and land); life environment, health and safety of populations; cultural and physical resources; and environmental concerns at the trans-boundary and world levels. Social aspects (involuntary resettlement, indigenous populations) as well as natural habitats, pest control, forestry and safety of dams are covered by separate policies with their own requirements and procedures.

Section 8 categories the project according to type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects.

This policy emphasizes consultation and public disclosure. Section 14 requires that developer of category A and B projects consults the project-affected groups and local nongovernmental organizations (NGOs) about the project. The policy also requires that relevant material be provided in a timely manner prior to consultation and in a form and language that is understandable by groups being consulted (section 15). Before the project can be upraised by the Bank, an EA report for such project (Category A and B) has to be disclosed to the affected persons and the public. Furthermore, the developer is required to report on compliance monitoring of the EMP.

Maira dam project will have impacts that are likely to be site specific, to cause relocation of some households, affect infrastructure like roads, water sources and institutions like schools and some churches. It will also affect agricultural land therefore Maira dam project has been categorized as a Category A project.

3.5.1.3 Cultural Property (OP/BP 4.11) Physical Cultural resources

This policy assists in preserving physical cultural resources and helps reduce chances of their destruction or damage. The policy considers Physical Cultural Resources (PCR) to be resources of archeological, paleontological, historical, architectural, and religious (including graveyards and burial sites), aesthetic or other cultural significance. The project area harbours several rural homes thus it shall stumble onto several burial sites within the affected homesteads; since the tradition of burying the deceased within the homesteads is practiced in the project area, consultations with individual home owners need to be made before project implementation to enable develop appropriate mitigation measures.

3.5.1.4 Natural Habitats (OP/BP 4.04)

The World Bank defines natural habitats as land or water zones where biological communities sheltered by ecosystems are in majority made of indigenous plant and animal species, and where human activity did not fundamentally modify the zone's main ecological functions.

OP 4.04 therefore aims at protecting natural habitats and their biodiversity and ensuring sustainability of services and products that natural habitats supply to human societies. The policy prohibits projects which would lead to significant loss or degradation of any Critical Natural Habitats (CNH). It seeks as much as possible to avoid financing projects that could lead to conversions or degradations of natural habitats and is emphatic on key stakeholders be engagement in project design, implementation, monitoring and evaluation including mitigation planning including strengthening of effective protection of CNHs when the project has been considered.

CNHs are defined as:

- Existing protected areas and areas officially proposed by governments to be classified among (Protected areas)
- Areas traditionally recognized as protected by traditional local communities;
- Sites maintaining vital conditions for the viability of such protected areas.

As per observation during the ESIA study, this policy may be triggered to some extent because there are critical habitats within the project area such as the river banks and wetlands ought to be protected and their functions enhanced to continue providing livelihoods to the communities

upstream and downstream of the proposed dam area. Thus this policy is required for use as precautionary approach to natural resources management for environmental sustainability by Project seeking alternative when working in fragile environment areas;

3.5.1.5 Pest Management (OP 4.09)

The objective of this policy is to promote the use of biological or environmental control and reduce reliance on synthetic chemical pesticides; strengthen the capacity of the country's regulatory framework and institutions to promote and support safe, effective and environmentally sound pest management as one way of minimizing potential adverse impacts on human health and the environment and to advance ecologically based IPM.

More specifically, the policy aims to (a) Establish that pest management activities in Bank-financed operations are based on integrated Approaches and seek to reduce reliance on synthetic chemical pesticides (Integrated Pest Management (IPM) in agricultural projects and Integrated Vector Management (IVM) in public health projects. (b) Ensure that health and environmental hazards associated with pest management, especially the use of pesticides are minimized and can be properly managed by the user. (c) As necessary, support policy reform and institutional capacity development to (i) enhance implementation of IPM-based pest management and (ii) regulate and monitor the distribution and use of pesticides.

As per observation during the ESIA study, this policy may be triggered to some extent because the project area is known for the growing of sugar cane where the farmers use fertilizers and pesticides. As water for irrigation is made available from the proposed dam many more farmers will be involved hence more fertilizers and pesticides needed hence leading to a substantial increase in pesticide use with a subsequent increase in health and environmental risks. Pesticides may be used in fight against vector-borne disease likely to be associated with the creation of the reservoir.

Thus this policy is required for use as an approach for best practices in pest management and to enhance the health and sustainability of the environment. The Pest Management Plan (PMP) will be included in ESMP as part of Environmental Assessment.

3.5.1.6 World Bank Resettlement Policy OP4.12

Resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. Under this policy, the Bank has the following objectives on resettlement;

- To avoid involuntary resettlement and where this is not feasible, resettlement activities should be conceived and executed as sustainable development programs through meaningful consultation.
- Providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

The World Bank Resettlement Policy Framework (OP 4.12 and BP 4.12) is usually applied for projects that require international financing. The World Bank OP 4.12, Annex A (Paragraphs 17-31), describe the scope (level of detail) and the elements that a resettlement plan should include. These include objectives, potential impacts, socio economic studies, legal and institutional framework, eligibility, valuation and compensation of losses, resettlement measures, relocation planning, community participation, and grievance redress procedures, implementation schedule, costs and budgets, and monitoring and evaluation. This report conforms to the WB policy requirement on contents and structure.

WB OP 4.12.(6a) demands that the resettlement plan includes measures to ensure that displaced persons are (i) informed about their options and rights, (ii) consulted on, offered choices among and provided with technically and economically feasible resettlement alternatives, and (iii) provided prompt and effective compensation at full replacement costs.

WB OP 4.12 (8) requires that particular attention should be paid to the needs of vulnerable groups among those displaced such as those below the poverty line, landless, elderly; women and children and indigenous peoples and ethnic minorities.

WB.OP 4.12 (13 a) stipulates that any displaced persons and their communities and any host communities receiving them should be provided with timely and relevant information, consulted on resettlement options and offered opportunities to participate in planning, implementing and monitoring resettlement.

WB OP4.12 (12a) states that payment of cash compensation for lost assets may be appropriate where livelihoods are land-based but the land taken for the project is a small fraction (less than 20%) of the affected asset and the residual is economically viable.

WB OP4.12 Para (6 b & c) state that in case of physical relocation, displaced persons should be (i) provided assistance (such as moving allowances) during relocation; and (ii) provided with residential housing, or housing sites, or, as required, agricultural sites for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the old site.

In addition displaced persons should be offered support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living; and provided with development assistance in addition to compensation measures such as land preparation, credit facilities, training, or job opportunities.

WB OP4.12 Para 13 (a) requires that appropriate and accessible grievance mechanisms are established to sort out any issues arising.

3.5.1.7 World Bank guidelines on vulnerable people

The World Bank resources and toolkits for vulnerable people are relevant to this project. They describe the vulnerable as those who are most likely to fall through the cracks of regular programs and need to be protected from negative outcomes and/or allowed participation. Vulnerable people need to be given special attention to remove the barriers that stand in the way of equal participation in projects, or through special project components and targeting strategies tailored to their needs.

WB OP 4.12 (8) requires that particular attention should be paid to the needs of vulnerable groups among those displaced such as those below the poverty line, landless, elderly; women and children and indigenous peoples and ethnic minorities. In this project, groups of vulnerable people have been identified and these include; the widows, orphans, the women etc which will trigger this safeguard during implementation of this project.

3.5.1.8 Public Disclosure

The policy requires that;

- Category A project EA reports be disclosed at the World Bank Infoshop (English) and should be accessible to local affected groups (local language) in their country.
- Category B project reports be accessible to local affected groups (local language) in their country
- Category FI should have their Framework disclosed at the World Bank Infoshop and appropriate in-country Web site (e.g. Ministry of Water and Environment). Individual subproject disclosure requirements defined in Framework (**OP 4.01, 1999 revised in 2011**).

Being a category **A** project disclosure will be as specified above for category A projects.

3.5.2 African Development Bank

The ‘Environmental and Social Safeguard Policies’ of the African Development Bank (ADB) consist of Environment Policy, Operations Manual and Guidelines, Policy on Involuntary Resettlement and Policy on Indigenous Peoples. Some of these policies are likely to be triggered by the proposed construction of Maira dam. Some of the Safeguards are presented below.

a) The Environment Policy

The policy is grounded in ADB's Poverty Reduction Strategy that recognizes that environmental sustainability is a prerequisite for pro-poor economic growth and efforts to reduce poverty. It is derived from ADB's Long Term Strategic Framework (2001-2015) that includes environmental sustainability as one of its crosscutting themes. The Environment Policy Addresses the following main challenges:

- i) Need for environmental intervention to reduce poverty
- ii) Need to mainstream environmental consideration into economic growth and development planning
- iii) Need to maintain regional and global life support systems
- iv) Need to work in partnership with others
- v) Need to further strengthen the processes and procedures for addressing environmental concerns in ADB's own operations.

The major ADB's environment policy and operational procedures to environmental considerations into ADB's business process are described in Operational Manual (OM) F1. The procedural and substantive elements of ADB's environmental assessment requirement are described in detail in Integrated Environmental Impact Assessment Guidelines, October 2003.

Furthermore, ADB has in place Environment policy (February, 2004) that brings out the need for a greater focus on pro-poor growth policies and programmes to counter unacceptable impoverishment rates; rapid progress in the inevitable integration of Africa in the globalization process; and the need for an improved governance with a clearer commitment of the majority of African governments to provide the necessary leadership for sustainable development.

The Environmental policy has the following key environmental issues:

- Reversing land degradation and desertification,
- Protecting the coastal zones,
- Protecting global public goods,
- Improving public health
- Enhancing disaster management capabilities
- Promoting Sustainable Industry, Mining and Energy Resources
- Improving urban environmental management,
- Environmental governance,
- Institutional and capacity building
- Increasing awareness and, stakeholder participation

b) Involuntary Resettlement

ADB's Policy on Involuntary Resettlement was adopted and became operational in January 1996. This policy was up dated in November 2003 after incorporating in lessons learnt.

The policy requires that involuntary resettlement be an integral part of project design, dealt with from the earliest stages of the project cycle. In general the policy has been developed to address involuntary physical displacement and/or loss of other economical assets of people caused by Bank-financed projects and programs. The policy is intended for the executing agencies in the borrower countries and for Bank staff involved in identifying, preparing, and appraising projects that involve involuntary resettlement.

The policy specifically aims to:

- Avoid involuntary resettlement wherever feasible
- Minimize resettlement where population displacement is unavoidable by exploring viable project options.

The policy also provides that individuals or communities in case of loss of land, means of livelihood, social support systems or way of life they should be;

- Compensated for lost assets and loss of income and livelihood
- Assisted for relocation
- Assisted so that their economic and social future will generally be at least as favourable with the project as without it
- Provided with appropriate land housing infrastructure, and other compensation, comparable to the without-project situation
- Fully informed and closely consulted on resettlement and compensation options.

The policy also specifies that lack of formal legal title to land should not stop any one from being compensated or given any other assistance.

It further stipulates that appropriate assistance should be provided to poorest affected persons such as female-headed households, and other vulnerable groups such as indigenous peoples.

For every project that involves physical displacement of people from homes, lands, other assets, resources or services or loss of income and livelihood, the policy requires that the government of the borrowing Country or private project sponsor (developer) submits a satisfactory Resettlement Plan with time-bound actions and budgets before loan appraisal.

A number of structures are located within the reservoir area in Maira which indicates that some households will need to be resettled. Thus this policy will be triggered.

3.6 Multilateral Environmental Agreements

The Kenya government recognizes the importance of International conventions and agreement and as result has signed and ratified several of these. The government has not only ratified this agreement but has domesticated them into national legislation. In accordance with the Constitution of Kenya 2010, the general rules of international law and treaty ratified shall form part of the law of

Kenya. This is an indicator of the country's commitment to environmental conservation in recognition that environmental issues are many times trans-boundary issues that require collaboration with other parties in order to adequately address them.

The international agreements and conventions Kenya has ratified which relate to the environment and of relevance to the Maira Dam project are as follows:

3.6.1 The Convention on Biological diversity 1992 (CBD)

The CBD was one of the major outcomes of the 1992 United Nations Conference on Environment and Development – termed the “Earth Summit” – in Rio de Janeiro. It was signed on 11th November 1992 and ratified on 26th July 1994. The three main goals of the Convention on Biological Diversity (CBD) are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from utilization of genetic resources. The CBD calls for a much more holistic approach to biodiversity, by recognizing its ecosystem, species and genetic levels. Since the dam will be constructed within the Sio river basin with some flora and fauna of ecological significance, this convention will be relevant for this project.

3.6.2 Convention on the International Trade in Endangered Species Wild Fauna and Flora (CITES)

Kenya is a party to CITES, which obliges member states to adhere to the recommendations of the Conference of Parties with respect to trade in endangered species. *Hallea stipulosa* is one of the endangered plant species that was observed in the study area as per the IUCN status and so is the Hippopotamus. This convention may not be applicable for the case of Maira project.

3.6.3 United Nations Framework Convention on Climate Change (UNFCCC)

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 convention encouraged industrialized countries to stabilize greenhouse gases while the Kyoto protocol commits them to do so.

Kenya signed the Kyoto Protocol in June 1992 and ratified the convention in March 2002 while entry into force was February 2005. As already discussed under Convention for the protection of Ozone layer and its Montreal Protocol), greenhouse gases are gases in an atmosphere that absorb and emit radiation within the thermal infrared range and greatly affect the temperature of the Earth. Carbon dioxide is one of the main greenhouse gases and is expected to be released from

construction vehicles and equipment during construction of Maira dam. Thus UNFCCC will be relevant to this project.

3.6.4 Rio Declaration (or Agenda 21)

The concept of public participation in development planning project is key aspect in this convention. From the most important conventions and declarations, one should note the Rio World Conference on Environment and Development in 1992 (in Brazil), followed by the Aarhus Convention in 1998 (in Denmark), public participation in environmental matters became like a human right. 'Free access to information for the public and active participation in development project Processes'. Moreover, the World Bank encourages a stakeholders 'involvement to be ensured by governments in all stages of the projects starting from early planning which is in conformity with Kenya government on disclosure.

3.6.5 The Ramsar Convention on Wetlands

This important Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) came into force in Kenya in October 1990 as 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 Ramsar Convention is the global environmental treaty that deals with a particular ecosystem but the Convention's member countries cover all geographic regions of the planet.

The convention has the mission of "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world. There no known nearby RAMSAR site therefore this convention is not likely to be triggered by the proposed project at Maira.

3.6.6 The Convention on the Conservation of Migratory Species of Wild Animals (CMS)

Realizing that animal migration is a global phenomenon in response to biological requirements, several countries have come together under the CMS, also known as the Bonn Convention, to cooperate in the conservation of animals that migrate across national boundaries and between areas of national jurisdiction and the sea. The Convention aims to improve the status of all threatened migratory species through national action and international Agreements between range states of particular groups of species. Agreements can range from legally binding multilateral treaties to less formal memoranda of understanding. The object of such agreements is to restore the migratory species to a favorable conservation status or to maintain it at that status. The Convention has two appendices: Appendix I lists endangered migratory species, Appendix II lists migratory species to be subject to agreements. It also establishes a scientific council to provide advice on scientific matters. This convention is applicable to the Maira project because Busia Grasslands at Mungatsi and

Malanga about 5-10 km from the project area have been designated Important Bird Area (IBA No. 57) for the Afro-tropical migratory globally Vulnerable Blue Swallow *Hirundo atrocaerulea* (Bennun).

3.6.7 *Convention for the Protection of the Ozone Layer*

Under this are several protocols and international [treaty](#) designed to protect the Ozone layer.

- i) *Vienna Convention for the Protection of the Ozone Layer*: Inter-governmental negotiations for an international agreement to phase out ozone depleting substances such Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs). The treaty was concluded in March 1985 with the adoption of this Convention to encourage Inter-governmental co-operation on research, systematic observation of the ozone layer, monitoring of CFC production and the exchange of Information and was adopted in 1987 with intention to allow the revision of phase out schedules on the basis of periodic scientific and technological assessments. It was last revised in 1999 at Beijing to Introduce other kinds of control measures and to add new controlled substances to the list. It has been ratified by 96 countries including Kenya. The ozone shield is important because it protects plant and animal life on land from the sun's ultraviolet rays, which can cause skin cancer, cataracts, and damage to the immune system. Thinning of the ozone layer also may alter the DNA of plants and animals. The signatory are required to;
 - Recognize that worldwide emissions of certain substances can significantly deplete and otherwise modify the ozone layer in a manner that is likely to result in adverse effects on human health and the environment.
 - Determine to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge.
 - Acknowledge that special provision is required to meet the needs of developing countries.
 - Accept a series of stepped limits on CFC use and production, including:
- ii) *The Basel Convention*: Sets an ultimate objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system.
- iii) *Kyoto Protocol*: Drawn up in 1997, pursuant to the objectives of the United Nations (UN) Framework Convention on Climate Change, in which the developed nations agreed to limit their greenhouse gas emissions, relative to the levels emitted in 1990.

3.6.8 *Other Conventions*

Other conventions ratified include; the Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal (Basel Convention); the United Nations Convention to Combat Desertification (UNCCD); the Bamako Convention on the Ban of the Import into Africa

and the Control of Trans-boundary Movement of Hazardous Wastes within Africa all of which have the Ministry of Environment and Mineral Resources and/or NEMA as focal points.

The Convention on the Protection of the World Cultural and Natural Heritage (Heritage Convention) is ratified, the focal point being the Ministry of Natural Heritage. The Convention on Persistent Organic Pollutants (POPs) was ratified and has the Ministry of Environment and Mineral Resources as the focal point. Matters of indigenous persons and vulnerable persons are within the mandate of the Ministry of Natural Heritage and the ministry responsible for special programmes. Kenya is a UN Millennium Project pilot country and the Millennium Development Goals (MDGs) play a particularly important role in Kenya. Kenya has endorsed the Paris Declaration on Aid Effectiveness.

4 ANALYSIS OF ALTERNATIVES

The Maira project area is characterized by seasonal changes (plenty during the rainy season and scarce during the dry season. Either way it makes the project area water stressed hence affecting the people in the area who depend on agriculture as a source of their livelihood. The situation is expected to get worse as the population increases and as demand by the different water use sectors out-matches the existing supply. Water related conflicts are on the increase and these cause security risks in the catchments. A dam at Maira has been proposed as one of the approaches to address these challenges. This dam is expected to improve water storage in the catchment, and enhancing demand management to minimize wastage of the scarce water resources. Three options have been considered in the analysis of alternatives.

4.1 Option I: Do nothing Scenario

Choosing the first option which is leaving the status quo would entail perpetual low farm productivity to farmers. This would further undermine the championing of agriculture as an engine for economic growth in the project area and the country at large. Furthermore no additional employment opportunities are envisaged under this option as the situation will remain as it is.

4.2 Option 2: Construction of a big dam at Maira

The second option is that which was provided in the Terms of Reference for this study which involves construction of a dam River Namanderema with a reservoir capacity of 12Mm³. This will entail far reaching Environmental effects. The irrigation system (Maira –Mukemo being implemented by the National Irrigation Board) will be totally submerged. The proposed irrigation schemes (Namanderema- Bulwana, Busina –Mundika, Luigebu-Nasimu and Nasewa) in the region covering Busia, Butula, Nambale and Samia will be negatively impacted by either the reservoir submerging the irrigation system upstream of the proposed dam or reducing the amount of water to these areas. Fish ponds in Namudoda and Nangeni tributaries of River Namanderema will be submerged; this will deny the population yet another livelihood source (income and food).

This option will directly affect 2 concrete bridges and 5 foot bridges, about 521 structures including settlements, schools and churches.

The design would be more complex and expensive as the dam will require being very strong to hold the volume of water. It is also expected that sediments will also accumulate in the reservoir and sediment yield is yet to be calculated but will be in the next draft ESIA. Sedimentation is a function of the catchment.

4.3 Option 3: Construction of a smaller Dam

The third option is that which has been provided in the 1st Interim Report for the Feasibility Study which involves construction of a smaller dam on River Namanderema but with a reservoir capacity of 4.6Mm³ covering an area of about 1.26km². This option will affect less land, will not affect the Maira-Mukemo irrigation scheme being implemented and will also avoid the proposed irrigation schemes in the region.

This option will affect about 30 structures including settlements, churches and schools. Also 2 foot bridges and one concrete bridge are likely to be affected.

The cost of construction is expected to be much less than in option 2 because the strength of the dam structure will be less than in option 2 and size is also likely to be smaller. However, less water will be available for irrigation.

Sediment yield is the same as in the above option and since the reservoir in this option is smaller, is likely to be filled faster and thus needs de-silting more regularly thus increasing the cost of maintenance.

4.3.1 Analysis

Analysis of alternatives has been carried out using the information provided under each option. Scores 1-4 have been used; score 1 refers to very high negative/not desirable while score 4 refers to the most desirable or very high positive. Option 1 which is the Do nothing scenario has not been included in the analysis as it leaves the situation as it is and is not desirable.

Results have been put in Table 4-1: Analysis of Results below.

General parameters used include but not limited:

- Displacement /relocation of households
- Storage capacity
- Cost of construction
- Environmental impacts including displacement, loss of land, sedimentation, loss of infrastructure etc
- Public preference

The scores have been assigned to the alternatives as shown in table below and the options with the highest scores being considered.

Table 4-1: Analysis of Results

Parameters	Scores for the Options			
	Option 2		Option 3	
Storage capacity	More storage (12 Mm ³) thus more economic activities likely to result	4	Storage lower (4.6Mm ³ thus less water available for economic activities	2
Cost of construction	More expensive as stronger structures are needed	1	Less expensive	2
Displacement /Relocation of Households	Very many structures affected (about 521) thus more people likely to be displaced	1	Less structures affected (30) and less people likely to be displaced	2
Other Environmental impacts	<ul style="list-style-type: none"> - More land inundated thus more people affected - De-silting less regular - infrastructure affected e.g. Maira-Mukemo irrigation schemes, fish ponds & IPA project 	1	<ul style="list-style-type: none"> - No structure affected, - Sediments are likely to fill the reservoir faster, needs more regular de-silting - less land inundated thus less people affected -Road infrastructure affected, IPA 	2
Public preference	Less preference	1	More preferred	2
Total scores		8		10

From the above results, option 3 seems to be the one that can be advanced and then proper mitigation measures worked out for the major environmental impacts identified. Thus further environment and social impact assessment shall be carried out.

5 PUBLIC CONSULTATIONS

This section describes the process of the public consultation, public participation and identification of the key issues related to the proposed project. Views from national stakeholders, the local residents and local leaders were sought through interviews and public meetings. The feedback from these consultations has been taken into account when preparing this report.

5.1 Stakeholders Identification

It is always important to identify stakeholders at an early stage in order to develop an effective stakeholder involvement programme. The stakeholders were identified based on the definition that a stakeholder is any individual or group who is potentially affected by a project or can they affect a project.

In this project, stakeholders are those who have an interest in the project development, and who will be involved in the consultative process. Stakeholders for this project were thus identified purposively.

Different categories of stakeholders were identified and these included directly and indirectly affected people by the project; stakeholders at different levels; that is at national level, local government level, NGOs, CBOs and communities in the project area. Their participation will make them understand and appreciate the likely impacts of the dam on their livelihood.

The four main groups of stakeholders are:

(i) Directly Affected people-

These are persons who reside or derive their living from areas where the project will have a direct impact, often referred to as the Direct Impact Zone (DIZ), consisting of all the project components.

Consultations were held with the directly affected communities in the sub-locations of Malanga, Sidende, Bukhweso and Elukongo where the reservoir will be located. These included communities from villages that will be directly affected by the reservoir. These were informed about the project including its location, purpose, features, objectives of the study and the consultation meetings, the team for the assignment the different stages of the project and the different activities to be carried out throughout this phase of the assignment. Their views and concerns in regard to the project were sought and suggestions to mitigate the negative impacts were recorded.

(ii) Indirectly Affected Persons-

These are persons who reside near project features or rely on resources in the project area and will have to change or adjust their livelihoods. For this project, these include communities living in the villages affected by the dam but they do not own property in the earmarked locations for the reservoir and communities downstream of the reservoir and the surrounding area

(iii) Government or public sector agencies and community based organizations:

These include;

- *National Stakeholders*

National Liaison Officer, TAC Members, Directorate of Water Resources officials (Director, Commissioner – Water Regulator), Directorate of Water Department, Ministry of Water and Environment, Commissioner Water for Production, Commissioner Water Regulator, National Environmental Management Authority Kenya (NEMA).

- *Local Government stakeholders*

These include Busia, Nambale, and Butula District staff; Busia District Commissioner, District Irrigation Officer (Busia, Nambale and Butula), District Community Development Officer (Busia, Nambale), Nambale District Education Officer, Administrative Officer in Charge of Busia District, Busia District Works Engineer, Busia Deputy District Water Officer, Location and Sub-location Chiefs, Area Councilors for Elugulu, Malanga, Elukongo, Marachi East

- *Village leaders*

These are leaders of both directly affected and indirectly affected villages. At this stage of the project village leaders of Mukemo, Esibembe, Elara, Nangeni and Esidende have been consulted.

- *Community members*

These are all community members in the four sub-locations locations of Malanga, Sidende in Buhayo location, Elukongo in Marachi East and Bukhweso in Elugulu location. At this stage communities in the villages of Mukemo, Esibembe, Elara, Nangeni, Esidende, Maira, and Elugulu? have been consulted.

- *NGOs and CBOs*

Rural Education and Economic empowerment Programme (REEP), a community based organization whose main focus is to provide assistance to people living with HIV AIDS and the vulnerable groups in the area, was consulted.

(iv) Other stakeholders

These include; The Client (Nile Basin Initiative), donors, companies with an indirect interest, external advisors and consultants and private sector. At this stage of the project, only NBI has been consulted.

Consultations were held with the above stakeholders. Information regarding aspects of the project was disseminated to them. The Consultant also sought from them information regarding policies, general socio-economic trends among others. Hard copies and soft copies of secondary information were provided to the Consultant by the different stakeholders. In addition, their views and concerns in regard to the project were sought and suggestions to mitigate the negative impacts were also sought.

5.2 Public Participation Process

Stakeholders for this project were identified purposively. Appointments for meetings with the different stakeholder were arranged a few days prior to the meetings. However, in some cases impromptu meetings were carried out. The meetings were carried out in the months of January and April 2012. At the national level meetings were carried out in the respective offices of the identified stakeholders. At the local government level meetings were carried out with the different officials in their respective offices. Sample pictures of meetings with local authorities are given in **Figure 5-1 & Figure 5-2**, while list of Consulted persons is attached at **Annex 6**. Furthermore, Inception Report was presented to key stakeholders in a regional workshop held in Tororo Uganda on 7th March 2012.

An interim report including Draft Scoping report, a report on existing environment and Preliminary RAP report was presented to regional stakeholders in a workshop on 28th -29th August 2012 in Busia Figure 5-5. Their inputs were incorporated and it forms this report.

For the local community representatives and community members, meetings were held in different places as indicated in the schedule of meetings in **Table 5-1** and sample pictures in **Figure 5-3 & Figure 5-4** for community meetings. The Sub-location Chiefs and Assistant Chiefs were instrumental in the selection of the appropriate venues and in mobilization of the participants. Minutes of the public meetings and attendance lists are attached to this report as **Annex 7**. The main materials/tools used for the meetings included, maps, interview guides/checklists, attendance lists and camera.

Table 5-1: Schedule of Community meeting and Focus Group Discussions

Date	Venue	Time	Participants	Nature of the meeting
20/04/2012	St. Peters Church Malanga	9.30 am	Community members from Malanga Sub-location - Mukemo, Malanga villages	Public meeting
20/04/2012	Nangeni village	11.30 am	Community members from Sidende Sub-location - Nangeni, Maira, Esibembe villages	Public meeting
20/04/2012	Esibembe Primary School	2.30 pm	Community members from Bwaliro Sub-location - Esibembe, Elara villages	Public meeting
21/04/2012	Bwaliro C, Office of the Location Chief	10:30 am	Women	Focus Group Discussion

A total of 138 participants turned up for the public meetings of which 27% were females. For the discussion with women, a total of 31 women turned up for the meeting as shown in the attendance lists.



Figure 5-1: Meeting with stakeholders in Nambale - 23/01/2012



Figure 5-2: Meeting the Busia District Commissioner - /18/04/20112



Figure 5-3: Meeting in Nangeni Village 20/04/2012



Figure 5-4: Meeting with Women at Bwaliro sub-location Chiefs Office 21/04/2012



Figure 5-5: Stakeholder Workshop for presentation of Interim Report in Busia Kenya, 28th – 29th September 2012.

5.3 Participation and Consultation Objectives

The objectives of stakeholder participation included the following:

- To disseminate and inform the stakeholders about the proposed project.
- To gather comments, suggestions and concerns of the interested and affected parties that will hence help in the formulation and refinement of the project design and the development of effective mitigation measures and management plans.
- To collect all relevant information about the existing social values, practices and norms and socioeconomic characteristics of the people in the project area within which the project will operate

5.4 Stakeholder briefings and consultation

A brief description of the proposed project was presented to the participants in the local language of Luhya, however English was used during consultations with the national and local government officials. The aim of the presentation was to provide a brief description of the proposed project including its features, location and purpose; the phases of project planning and development, the EIA process, the specialists involved in the study and to encourage the participants to be cooperative in all stages of the project and to air out their views and concerns.

After the presentation, a discussion then followed whereby the communities were asked to raise any issues and /or concerns. Below is a summary of the issues raised.

5.4.1 *Issues raised*

During the consultations, several issues/concerns were raised by the different stakeholders and these are highlighted in (Table Table 5-2, Table 5-3and Table 5-4)

Table 5-2: Issues Raised at National Level

Issues	Description
Displacement of people	The Ministry Of Lands Principle Physical Planer expressed concern the project will bring about displacement of the people and the displaced People could put pressure on the public amenities in the new location. The project needs to take this into account by beefing up social amenities in the proposed relocation area, or chose relocation areas that have a substantial presence of social amenities
Compensation Process	It was mentioned in the consultation meeting that Compensation of the PAPs should follow the due process with fair compensation in exchange for value lost to facilitate the development of the project It was also advised that Proponent should estimate property value thoroughly before prompt compensation is made to the PAPs
Water for Downstream Users	Advice from the Ministry of Water and Irrigation was that the dam should be designed in a manner that ensures that the people downstream have enough water for domestic use and agricultural use.

Table 5-3: Issues Raised by District Officials (Nambale, Butula and Busia)

Issues	Description
Negative Issues	
Submergence of an existing irrigation scheme	This issue was raised by the Nambale District officials. There was concern that there is an existing irrigation scheme planned to benefit about 100 farmers from the villages of Maira and Mukemo that might be submerged by the proposed reservoir. Nambale Irrigation Officer proposed that Maira dam could be scaled down, Ntake site could be scaled up or several small dams could be built instead of one big dam.
Displacement of people	Busia District Commissioner expressed concern the project will bring about displacement of the people and if the process is not handled well, it may bring about resistance from the people.

Issues	Description
Squandering of compensation money by the PAPs	There was fear that the PAPs may not utilize the compensation money profitably and may end up poorer and landless. A project implemented in 1994 by a Sugar Factory was cited and there was fear that people may relate to this project and this may affect the proposed project negatively.
Timing of the project	There was fear that the studies were undertaken during a political season which may cause to challenges to the project.
Ethnic conflicts	There was concern that ethnic conflicts between the Bahayo and the Malachi could occur due to the positioning of the dam. The officials advised that the people should be informed of the technical reasons for choosing the dam site.
Siltation of the dam	It was pointed out that land pressure has brought about land degradation in the area and therefore heavy siltation of River Sio. There was fear that with the current trend of cultivation up to the river bank, the proposed dam might silt very quickly.
Positive issues	
Development of the area	The stakeholders of Nambale district expect the district to be taken to another level in terms of development due to the presence of such a big project in the area
Improvement in food security	The district officials hope that with the proposed dam in place, there will be an improvement in food security in the area.
Other suggestions	
Sensitization of the communities in irrigation farming	It was noted that the communities in the area were used to rain fed agriculture and irrigation farming was new to them. The district officials pointed out that there will be need for sensitization of the people about irrigation practices

Table 5-4: Issues Raised by Area Councillors and Chiefs

Issues	Description
Positive issues	
Eradication of poverty	This would be attributed to the new methods of farming with irrigation facilities in place. It is thus envisaged by the stakeholders that there will be increased production of fish and agricultural products thereby increasing incomes of the local people.
Utilization of land currently considered infertile	It was pointed out that currently there was land that was not utilized as it was considered to be infertile. With irrigation in place, this land will be turned into fertile land and could therefore be used to increase production.
Empowerment of the youth	The stakeholders hope that the project will empower the youth through small scale farming which will in turn improve their incomes. They further hoped that this will steer the youth away

Issues	Description
	from bad behaviors like stealing and idling.
Employment opportunities	It is that the dam will provide employment opportunities to the local people in all stages of the project and this will lead to increased earning and self-sustenance of many families.
Development of the area in particular and the country in general	There is hope among the stakeholders that dam lead to development of the area and thus the area and the country in general will be marketed to other countries.
Increase in exports	The Councilors expect that with increased production of agricultural products, there will be increased market through exports to neighboring countries.
Retention of able bodied people in the area	It was pointed out that currently there was a high rate of unemployment in the area and many of the youths and able bodied people were migrating to other areas and towns in search of job opportunities. It is hoped that with the dam in place, there will be more job opportunities and thus retention of the able bodied people in the area.
Negative Issues	
Reduced water flow for people downstream	The Councilors feared that if proper measures were not put in place, runoff from Namanderema may be reduced and therefore farmers downstream may face a problem of reduced water flow.
Attraction of wild animals	There was concern that if the reservoir is not well protected, it could attract wild animals like hippos, crocodiles which could be dangerous to the local people.
Loss of land and other property	It was feared that there will be loss of land and other property for the people residing near the river banks.
Misuse of compensation money	This concern was raised by both the chiefs and the councilors. It was feared that some of the PAPs may not use the money to buy the lost land and instead may use it for other things like drinking etc. It was proposed that area councilors and chiefs should supervise the PAPs and ensure that they use the money to buy land.
Other suggestions	
Capacity building in fish farming methods	There should be intensive capacity building for the farmers in practical fish farming methods, proper fish feeds and fish species as this will reduce the rate failure of fish farming projects.
Intensify sensitization on catchment area management and enforce the NEMA regulations of river bank land use	It was proposed that farmers be sensitized about the dangers of farming up to the river banks. Farmers should be sensitized in proper catchment area management so as to protect the proposed project from siltation. It was also proposed that NEMA should enforce it laws and regulations on river bank land use.

Issues raised by the Communities

Benefits/ positive issues

Generation of electricity: The people hoped that there will be generation of electricity in the area and as a result many people will be able to access it.

Employment opportunities: The people expect employment opportunities especially for the local youth. They therefore suggested that local people should be given priority for local labour. They also suggested that the women should also be considered for employment. It was also suggested that available skilled labour should be considered for skilled jobs.

Improvement in food security: The people expect an improvement in the food security status as compared to today due to irrigation that many people will benefit from. The women especially said that they will be able to produce vegetables all year round for their families and for sale.

Development of the area: The stakeholders of Nambale district expect the district to be taken to another level in terms of development due to the presence of such a big project in the area.

Control of floods: The stakeholders were happy that the dam will be able to control floods and therefore people's crops will no longer be destroyed and swept away during heavy rains.

Pollution and contamination of the water source: There was concern that some people depended on the swamp for domestic water supply and this might be polluted or contaminated during the construction period.

Improvement in water supply: The people hoped that with the dam in place there will be an improvement in water supply especially during the dry season. They said that in the dry seasons, they sometimes walk long distances to get water.

Negative issues /Fears

Loss of Access roads:

The community members were worried that the reservoir will submerge the Lugulu-Maolo and Sidende-Maira roads, thereby making loss of access and communication between the two locations. They thus wanted to know whether the dam wall would be used as an alternative road from them to cross over to the other location.

Disruption of education for children: The people are worried that because of loss of access roads, some children may not be able to access their schools.

Loss of land: The issue of loss of land was a major concern for the communities and other

stakeholders consulted. They feared that because of the project people will lose their land and will be relocated to other places. They proposed that alternative land be given to the affected households or people.

Family conflict after compensation: The participants feared that there might be family conflicts due to compensation payments. The community thus suggested that local leaders be part of the compensation process to prevent the likelihood of such conflicts.

Drowning: The participants feared that they might drown in the water. They proposed that a fence be constructed around the dam to protect the people from drowning. They also suggested that a number of safety precautions should be undertaken for instance, putting in place signposts to show that the area was dangerous and employing security guards to guard the place.

Effect on fishing activities: The people expressed concern about loss of fishing in the river especially during construction.

Relocation to faraway places: There was concern that some people may be relocated to very far away from their traditional homes and relatives.

Conflict with people downstream: The people were concerned that conflicts with people downstream might erupt due to a reduction in water flow especially during the dry season.

Increase in diseases: The people were concerned that with the presence of the dam, there might be an increase in diseases especially malaria. They hoped that this problem will be addressed by the government.

Lack of compensation: There was concern that some affected people may not be compensated for their affected property.

Other suggestions

- Agricultural extension officers should be made available to advise farmers on better farming practices as irrigation will be new to them.
- As part of the compensation package to the community, a hospital for the community should be constructed in the area.
- Inform the people to be displaced in time so that they organize and plan for the relocation.
- Raw materials like sand and stones should be sourced from the local people.

Appreciation of the project: There was general support and appreciation of the project. Most of the stakeholders consulted appreciated and welcomed the project. Although some of them would lose property, they expect the project to be good generally.

6 DESCRIPTION OF THE BASELINE CONDITIONS

6.1 Physical Chemical Environment Catchment Characteristics

6.1.1 Climate

The SMM Climate is characterized by a wide range of climatic patterns influenced by Inter-Tropical Convergence Zone (ITCZ), the basin's topography, latitude and the presence of Lakes and swamps. The rainfall is typical tropical modulated by the ITCZ, Lake Victoria and varies from 900mm in the low laying land areas to over 1800mm in the elevated areas of Mt Elgon. The areas in the peripheral of Lake Victoria receive annual rainfall ranging from 1460mm to 1600mm. The upland reaches are endowed with ample rainfall and elevated slopes which leads to abrupt changes in discharge as the rivers fall and rise rapidly in response to rainfall.

6.1.2 Temperatures

The different altitudes in the project area contribute to variation in mean monthly temperatures. The presence of Mt Elgon project regulates the temperature in the project area and favours low temperature occurrence to the extent that higher areas at 3,050 m have temperature as low as 10°C. In low-lying areas, mean monthly minimum of 15°C is experienced. In addition to altitude, the basin is close to the equator just a few degrees north where the apparent movement of the sun influences the temperature regime of the area. In January–February and June–September, the dry East-West winds Nandi Hills increase the temperatures to a maximum of 27-30°C. However, during the period March–May and October–December, the wind pattern changes towards the south (WREM, 2008). Evaporation has limited variation and occurs in the dry months.

Climate change

SMM basin located is experiencing impacts of climatic change and the trends indicate an annual variations in temperature increasing by at least 1.0°C-1.3°C since 1960 and projected to 3.1°C by the 2060s and 4.9°C by the 2090s (source: UNDP, SRES: A2, A1B, B1). Daily temperature observations for Uganda and Kenya show significantly increasing trends in the frequency of hot days and much larger increasing trends in the frequency of hot nights. Between 1960 and 2003, the average number of 'hot' days per year increased by 57 (+15.6%) in Kenya and by 74 (+20.4%) in Uganda (Source: UNDP *Climate Change Countries Profiles*). The average number of 'hot' nights per year increased by 113 (+31%) in Kenya and by 136 (+37.4%) in Uganda. In terms of precipitation, rainfall has shown decreasing trends since 1960 over Uganda. Annual rainfall has decreased at an average rate of 3.4 mm per month per decade (3.5%), but this trend was strongly influenced by the high total rainfall in 1960-61. The NELSAP study on the Impact of Climate Change on Lake Victoria showed a clear tendency for a decrease in the net basin supply. Hence, programs promoted by NELSAP like the proposed 2 multipurpose dams at Maira in Kenya and Bulusambu in Uganda are likely to be affected by climate change impacts. The multipurpose dams and water resources will

be vulnerable to climate change and this will have wide ranging consequences for environment, natural resources, and the socio-economy of the local people. Therefore, if the dams are going to be sustainable, it will be necessary to mitigate and adapt to climate change implications.

In some cases, however, climate change might have positive impacts, such as increased growth rates and food conservation efficiencies, increased length of growing season and species range expansion. The communities in these areas therefore need to understand and maximize the benefits from these positive impacts that can support adaptation, for example by using a prolonged growing season to increase the number of annual harvests. Furthermore, it should be noted that dams can help mitigate climate change impacts like drought mitigation, flood control and make available the water resources needed for irrigation, hydro power generation and domestic water supply.

6.1.3 Geology and Soils

Much of the basin is underlain by decomposed tertiary volcanic phonolites and agglomerate tuff rocks of Mt Elgon at an elevation of about 2,000m a.s.l. There are also rocks of Kavirondian system fractured by granite intrusions. The lower zone consists of laterite deposits resulting from the weathering of volcanic rocks of the Kavirondian system. Along the Sio river mouth, the geology contains late Pleistocene and Holocene alluvial and swamp deposits. The soils in Sio valley are clay grey to dark grey in colour and soggy in the middle. Some limited parts of the project area (Uganda), are underlain with rocks of the basement complex predominated by a variety of granites, migmatites gneisses and schist overlain by laterites. In the flooded plain, there is thick overburden consisting of sediments eroded from River Manafwa catchments and banks. These deposits comprise of sandy clays which are dark grey in colour and soggy during the wet season and hardened during the dry season. In the adjoining areas are sandy clay-loams of colour ranging from yellow to brownish and in the elevated areas are red lateritic soils.

The proposed Maira dam site is located in an area underlain by rocks of Kavirondian System represented by the igneous and sedimentary rocks of the Nyanzian Supergroup (Nambale formation of Yale group), intrusive rocks (related to Mumias Granite) and Quaternary superficial deposits (**Kimomo et al., 2007**). On the other hand the catchment area is underlain by igneous (granite), sedimentary (sandstone, greywacke and arkose) and unconsolidated rocks (fluvial).

The geological formations around the Maira dam are shown in Figure 6-1

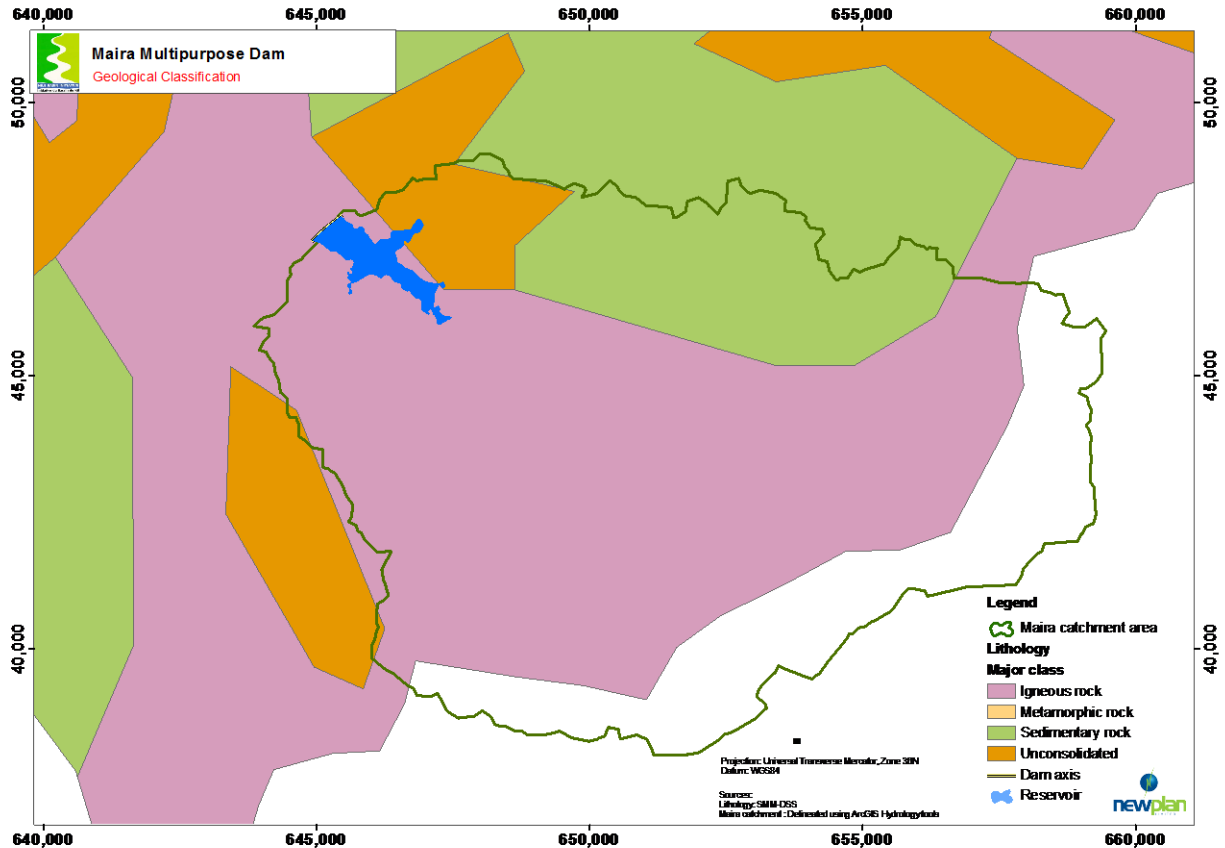


Figure 6-1: Geological Formation in the Maira Catchment

Granitic rocks allied with intrusive (comprising dolerites, and black felsites) and sediments comprised of conglomerate lenses, mudstone, sandstone, silt stone, shale and grit, predominate the area of study (AECOM, 2012).

The Nambale formation at the site is characterized by poorly exposed, weathered to highly weathered mudstones which are masked by laterite deposits (**Figure 6-2**)



Figure 6-2: Mudstone Formation

(Source AECOM report)

There are several rock outcrops encountered near the dam site. One such outcrop was encountered in River Namanderema at coordinates N00 25 53 .0 and E342018.0 (Figure 6-3)



Figure 6-3: Intrusive rock in river Namanderema

The soils in the project area have been formed as a result of different factors (Parent rock l, climate, vegetation and time). The formation of superficial deposits in the area is linked to both tectonic and climatic changes in the Lake Victoria basin and its margins. High temperature, high humidity in the equatorial region and old stable landforms combine to produce thick, weathered profiles of gently sloping, paleo-land surfaces Laterites (AECOM 2012). The predominant soil types identified at the dam site and the reservoir areas are friable clay, sandy with some section along the river banks dominated by sandy clay loam. The Alluvial clay soils are found in swampy areas along rivers where they are associated with deposits of silt clay and sand (Figure 6-4). These soils have moderate water holding capacity and where clay is predominant they become soggy during the wet season and very hard during the dry season hence difficult to plough.



Figure 6-4: Alluvial and Clay sandy soils near the dam

These soils support the growing of a variety of crops and the population in the area generally depends on intensive farming mainly done along the rivers.

6.1.4 Seismicity

The seismic zoning map of Kenya (Loupekine, 1973) as quoted by AECOM during the feasibility study, places the Maira site in Intensity Scale of Zone 5 of the Kenya seismic zoning map. According to this map, Zone 5 is described as follows: “Felt by nearly everyone, many awakened. Some dishes, windows broken; a few instances of cracked plaster; disturbances of trees, poles and other tall objects sometimes noticed,” (Equivalent to V-VI of Rossi-Forel scale). Impact of this on the reservoir will need to be assessed.

6.1.5 *The Sio-Malaba Catchment, Drainage, Hydrology water resources*

The Sio-Malaba-Malakisi river basin shares the Kenya–Uganda border and lies between latitudes of 1.1330N to 0.1930S and longitude 33.6730E to 34.5710E. These rivers drain two adjacent areas on the southern slopes of Mt. Elgon with Malaba and Malakisi Rivers originating from the slopes of Mt. Elgon. It flows southward through the high altitude and then westward to join and confluence with Lwakhakha River near Tororo to form the Malaba River which joins Mpologoma river before discharging into Lake Kyoga. On the other hand, the Sio River originates from the adjoining Mt Elgon catchment and flows through rolling plains mostly in Kenya. The River flows southwest to form the border with Uganda, passing through an extensive wetland in its middle reaches. It then flows southwards and discharges in Lake Victoria.

The Sio River catchment occupies an area of about 1450 km² and the Malaba-Malakisi catchment covers an area of about 1790km². Much of the project site lies between elevations 1100 to 1200 meters above sea level (m .a.s.l). The Elgon Mountains which form the catchment area of the two basins has an altitude range of 1439 to 4314 m a.s.l. Figure 6-5 shows Sio and Maira dam catchments respectively

The Maira dam site is located on the Namanderema River, less than a kilometer upstream of the confluence of Namanderema and Sio rivers.

The Sio River originates from Siritanyi, south Kanduyi, south Mateka, Namasanda and Sibembe areas of Bungoma District at a height of 1550 m.a.s.l. It drains Nalinda, Khasoko, Luanda, Lunganyiro, Sibembe and Mungatsi areas before it is joined by Namanderema near Mahuga area. The main tributaries of the river at this stage include: Namberereka, Namasara, Myanga, Mateka, Namulungu, Mirere and there is no gauging station in its upper stream (Bhundia, 2010).

The Namanderema sub catchment consists of the following tributaries, Namakhala, with its tributaries Sisare originates from Koyonzo area, Nangeni with its tributaries Itete and Koyonzo originates from Koyonzo area and Namanderema with its tributaries Akayo and Luduru originates from Buduma- Buhuyi area, it drains the upper eastern parts of the catchment, areas of Koyonzo, Munami, Buhuyi, Bwaliro, Lugulu and joins the Sio River upstream of Nambale bridge, and it is not gauged (Bhundia, 2010).

Figures 4-5 and 4-6 show the drainage area of the proposed site indicating the river network and corresponding catchments. The catchment area of River Namanderema at the proposed Maira Dam Project site (E 0645179, N 0047701) is estimated at 115.92 km². The catchment at Maira is a sub-catchment of the River Sio basin whose area is 981.172 km² as measured at a river gauging station (Station 1AH01). The station (34.14, 0.388), located at the bridge crossing of the Busia-Kisumu road and River Sio is presently fitted with a vertical staff gauge with an automatic water level recorder.

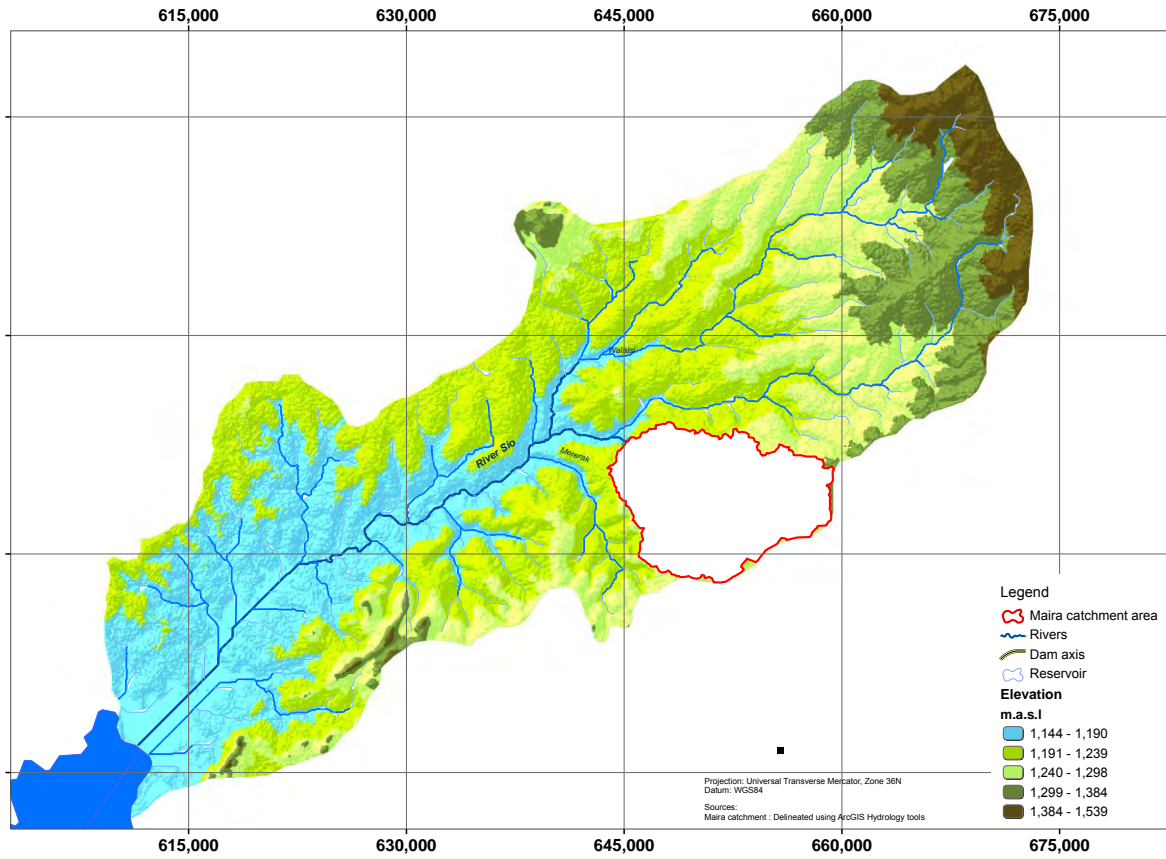


Figure 6-5: Drainage map of project area

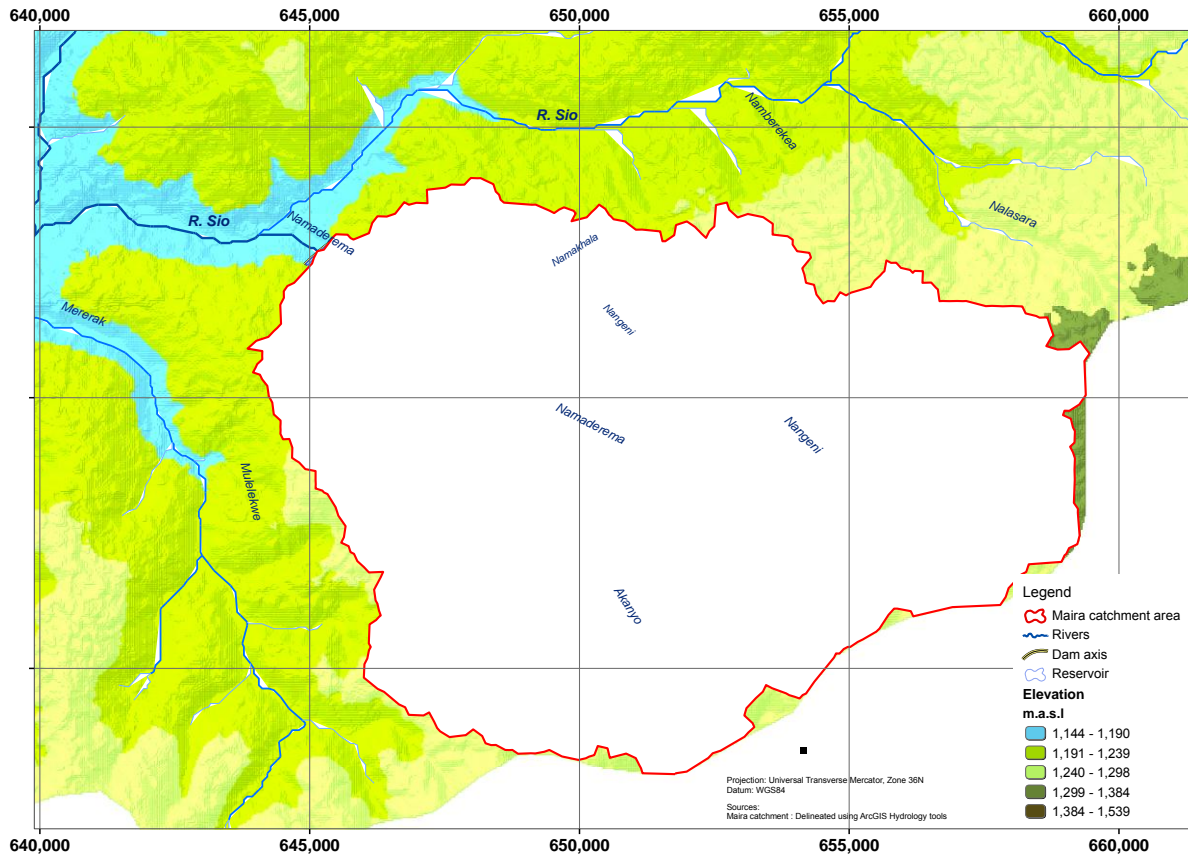


Figure 6-6: Maira Catchment

6.1.5.1 Catchment characteristics

The river network and corresponding catchments for both the entire Sio Basin and the proposed Maira dam were delineated from a 30m-resolution STRM (Shuttle Radar Topographic Mission) DEM (Digital Elevation Model) using ArcGIS software. The catchment characteristics are shown in

Table 6-1: Catchment characteristics

Country	Dam site	Catchment			
		Area (km ²)	Zmin (m)	Zmax (m)	Δz (m)
Kenya	Maira	115.92	1144	1539	395

6.1.5.2 Meteorological and River Discharge Monitoring Network

The climate in the western province of Kenya may be described as mainly tropical. The climate of Maira catchment was characterized by analyzing climatic data obtained from Bungoma meteorological station (rainfall), Busia station (temperature) and the Kari-Alupe station (evaporation). The Bungoma station is located in the south of the Maira catchment while the Kari Alupe station is located approximately 29km southwest of the catchment

The Kenya Meteorological Department (KMD) is responsible for climatological data collection, analysis and dissemination. The monitoring stations are equipped with standard rain gauges which are read daily. The Maira catchment and Sio basin in general has a number of weather stations (mainly rainfall stations) spread throughout the basin. Some stations are manned by the Provincial Administration through the Chiefs and District Officers offices. The Kenyan Ministry of Water and Irrigation through the Department of Water Resources also operates a network of rainfall stations. One river gauging station (Station 1AH01) has been established within the Sio basin to monitor water levels and discharges of the Sio River. The station, located at the bridge crossing of the Busia-Kisumu road and River Sio is presently fitted with a vertical staff gauge with an automatic water level recorder (Figure 6-7). Discharge measurements are carried out periodically to determine the stage-discharge relationship at a stable cross section of the water course.

The rating curve for River Sio is stable (*SMM Monograph*).



Figure 6-7: River Gauging Station on River Sio

The hydrometric data required for carrying out the hydrological assessment was collected from various institutions and offices including the Lake Victoria North Catchment Area (LVNCA) in Kakamega, Busia and Nambale District Water Offices and the SMM – PMU in Kakamega. Data was also obtained from the SMM – DSS. The data collected for the study is summarised below:

Rainfall Data

- i) Busia Water Office Climate Station - Daily rainfall data: 1994 - 2006
- ii) Nangina CM Climate Station - Daily rainfall data: 1957-2006
- iii) Kari Alupe Climate Station - Daily rainfall data: 1974-2008
- iv) Amagoro Climate Station - Daily rainfall data: 2003-2006
- v) Lukolis HC Climate Station - Daily rainfall data: 2004
- vi) Anguri HC Climate Station - Daily rainfall data: 2003-2005
- vii) Bungoma WS Climate Station - Daily rainfall data: 1994-2006
- viii) Kwangmor Climate Station - Daily rainfall data: 2004-2006
- ix) Kapsokwony Climate Station - Daily rainfall data: 1985-2000
- x) Cheptais Climate Station - Daily rainfall data: 2001

Evaporation Data

- i) Kari Alupe Climate Station - Daily pan evaporation data: 2001 - 2008

Discharge Data

- i) Record from 1HA01 gauging station located on River Sio
 - Daily water levels - 2005-2011
 - Daily water levels – 2009 - 2012
 - Measured discharge data – 1959 – 2008

Figure 6-8 below illustrates the distribution of climatological monitoring stations and river gauging stations within and around the Maira catchment.

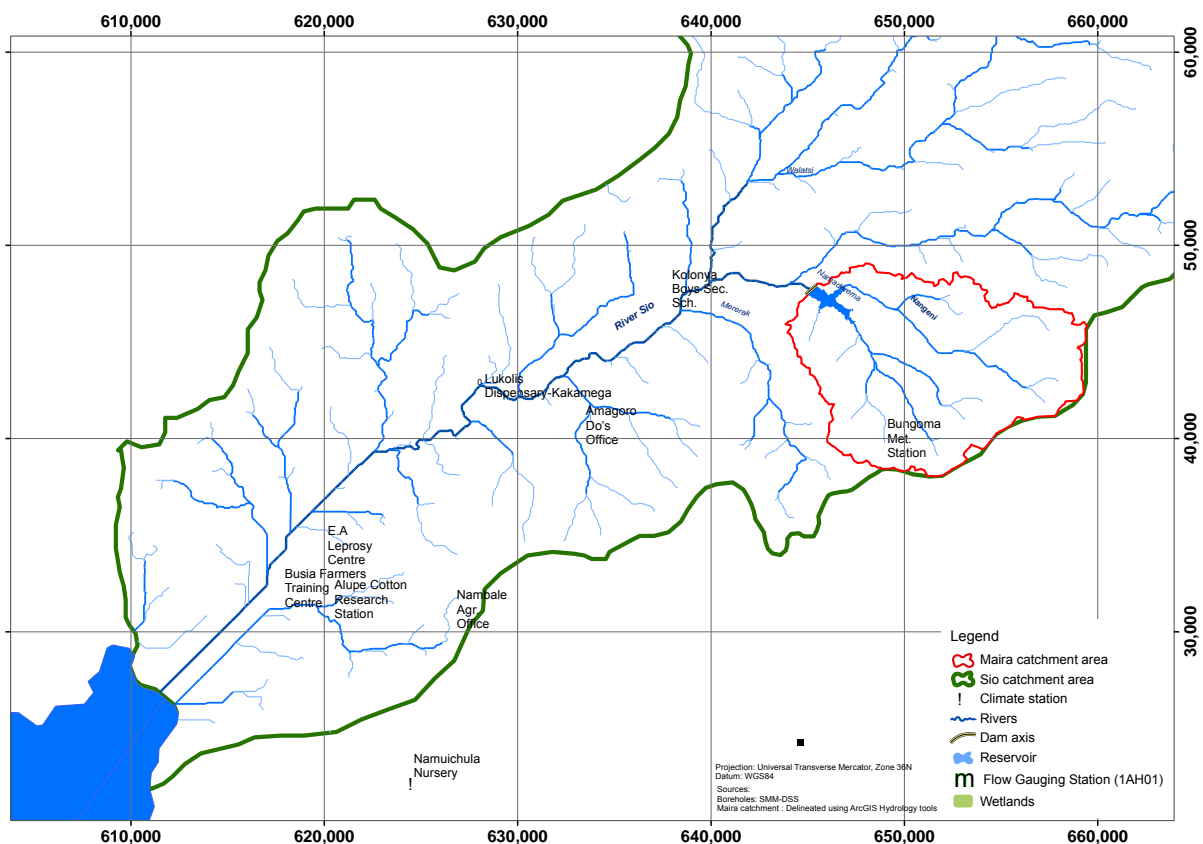


Figure 6-8: Location of Flow gauging and climate stations

Rainfall

The Sio basin area experiences bimodal rainfall pattern. The seasonal pattern of the rainfall regime is such that there are two rainy seasons extending from March to May (long rains) and late September to November (short rains) with generally high rainfall variability (Figure 4-9). The seasonal variation indicate the relatively dry period between December and February with monthly rainfall amounts predominantly below 100 mm. December is the driest month in the catchment while the wettest month is April with the average rainfall amounts recorded as high as 225 mm. The average annual rainfall recorded for Maira catchment is estimated at about 1500 mm.

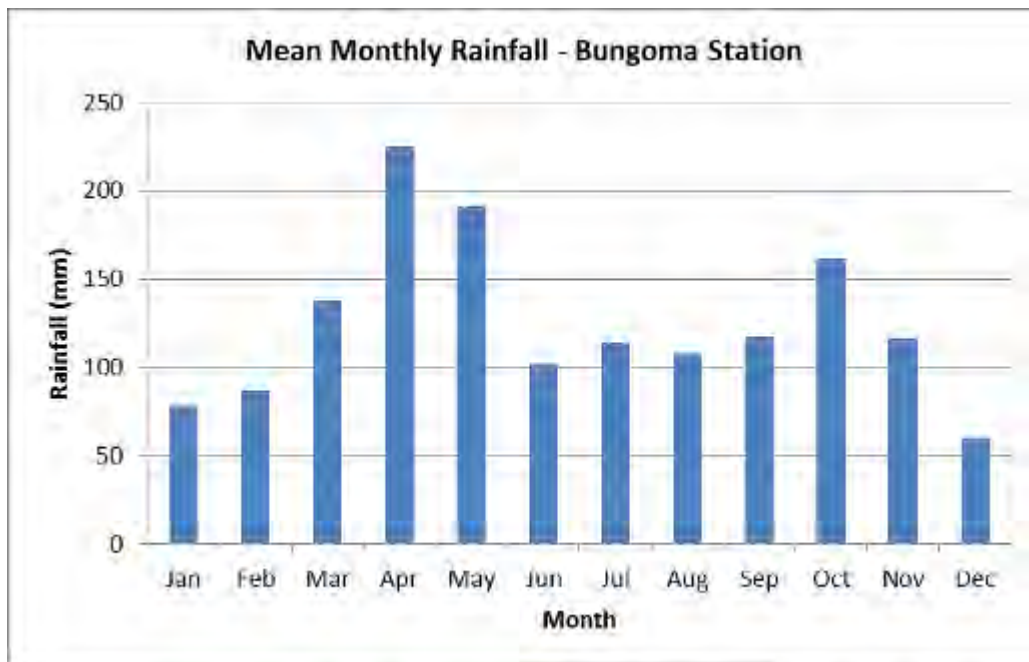


Figure 6-9: Seasonal rainfall pattern in Maira Catchment

Temperature

Mean maximum temperature in the SMM basin ranges from 27.5°C around low lying areas to 50°C around the slopes of Mt. Elgon. Mean monthly minimum temperature of 15°C was recorded in the plains, falling to 10°C higher up the slopes of Mt. Elgon. From the Busia station, mean maximum temperature in the area is 27.8 °C while mean minimum temperature is 15.9 °C (Bhundia, 2010) as shown in Figure 4-10.

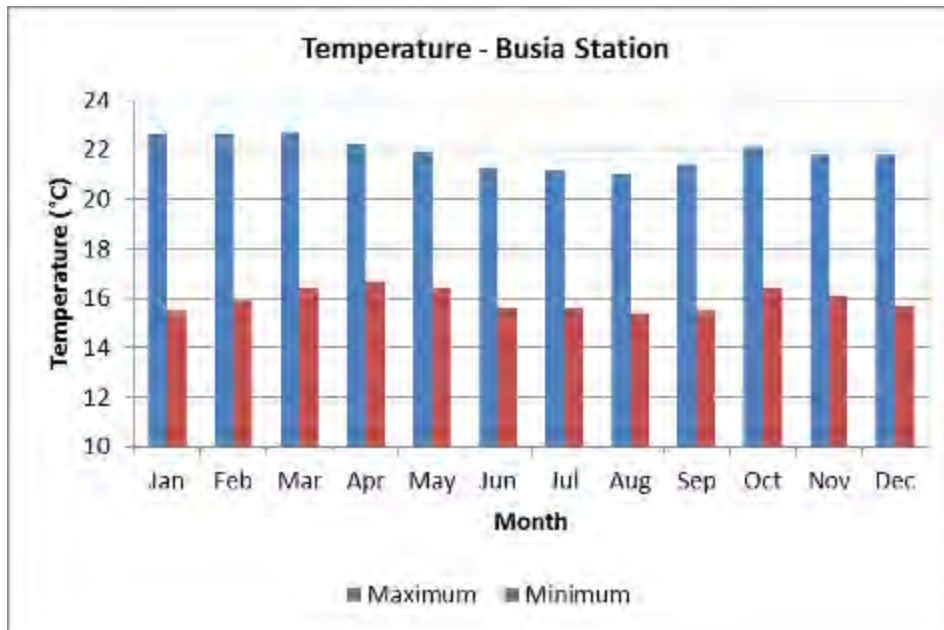


Figure 6-10: Seasonal variation of temperature in Maira

Evaporation

The seasonal variation of evaporation in Maira catchment ranges from 95 – 145 mm per month (Figure 4-10). As temperature is the key factor with a direct effect on evaporation, the pattern of evaporation variation at Maira follows the pattern of temperature variation. The highest rate of evaporation in Maira is recorded during the dry months of January and February with limited variation within the year. The mean annual total actual evaporation is estimated to be 1494 mm.

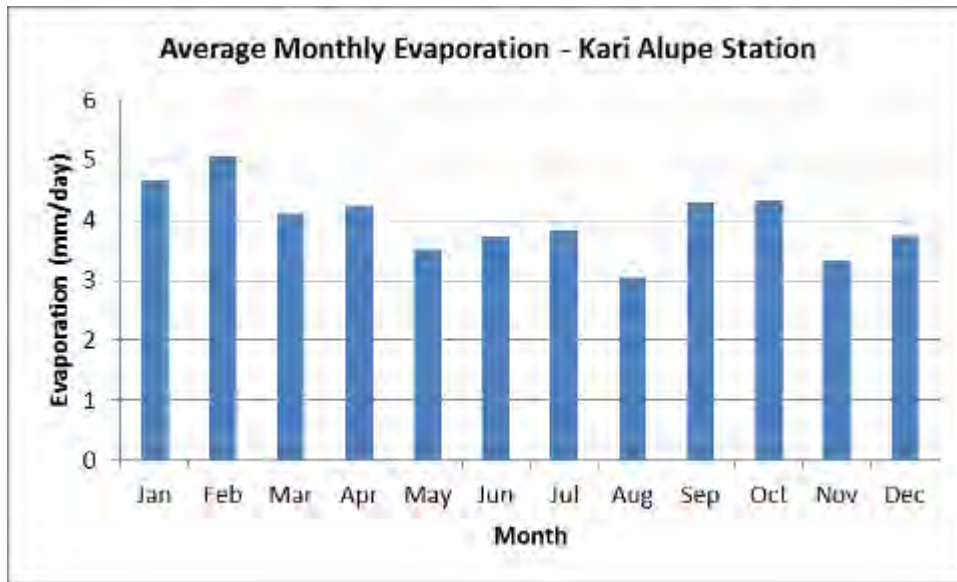


Figure 6-11 Evaporation Pattern in Maira

6.1.5.3 Water Yield in catchment

The water yield of any catchment depends on the existing surface and ground water resources. In this assignment, it was important to study these existing water resources as they would affect the water flow into the proposed Maira dam, and they too could also be affected by the dam.

6.1.5.4 Ground water resources

a) Groundwater Monitoring

A borehole monitoring network has been established by WRMA for monitoring changes in groundwater level and quality. To-date one monitoring borehole has been identified in Busia Town and three boreholes in Bungoma Town.

b) Existing Ground water resources

Ground water sources include boreholes, shallow wells and springs. Data obtained for each source includes yield, total depth, ground water level etc. These water sources are specifically for domestic water supply. Location of the existing ground water shown in Figure 6-12 , 6-13, 6-14 and 6-15 sources in and around the Maira catchment is

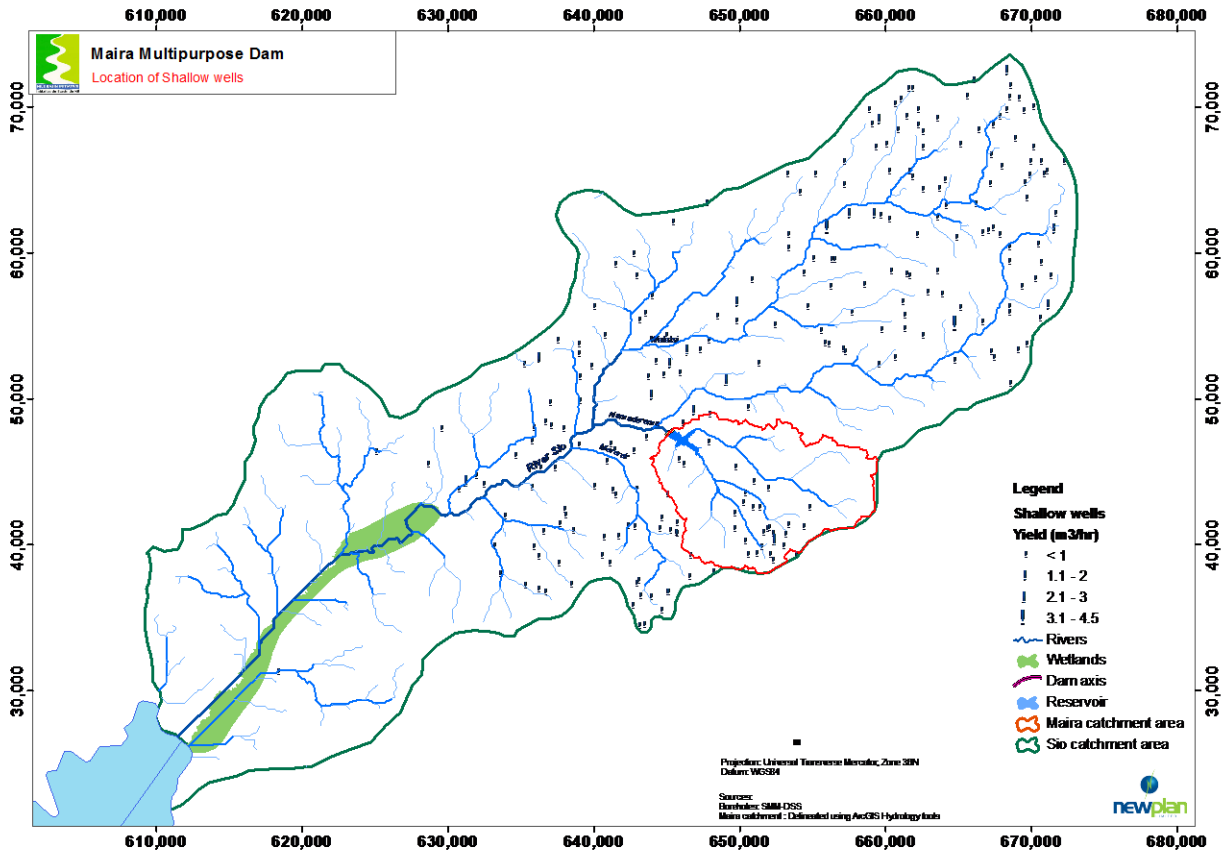


Figure 6-15

Figure 6-12: Shallow wells in the Maira catchment area

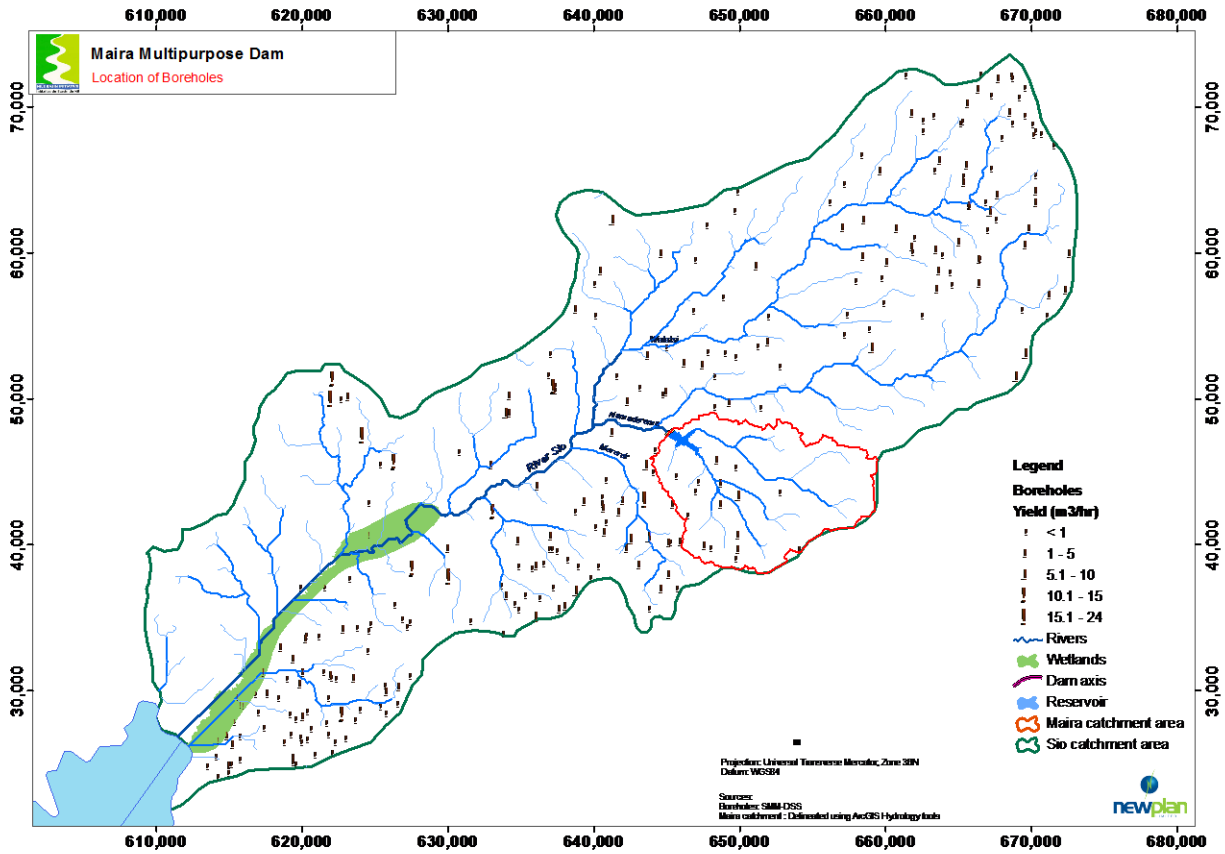


Figure 6-13: Existing drilled boreholes in Sio catchment

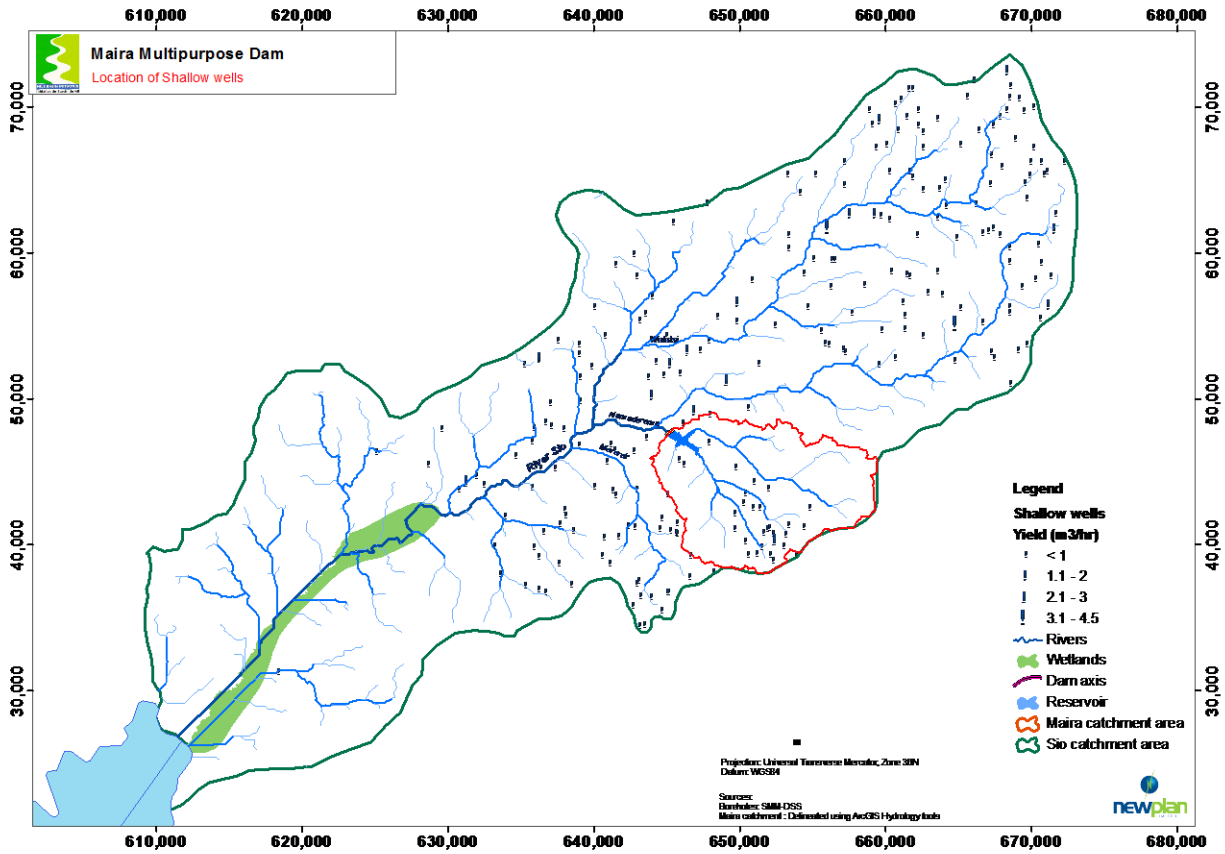


Figure 6-15: Existing shallow wells in Sio Catchment

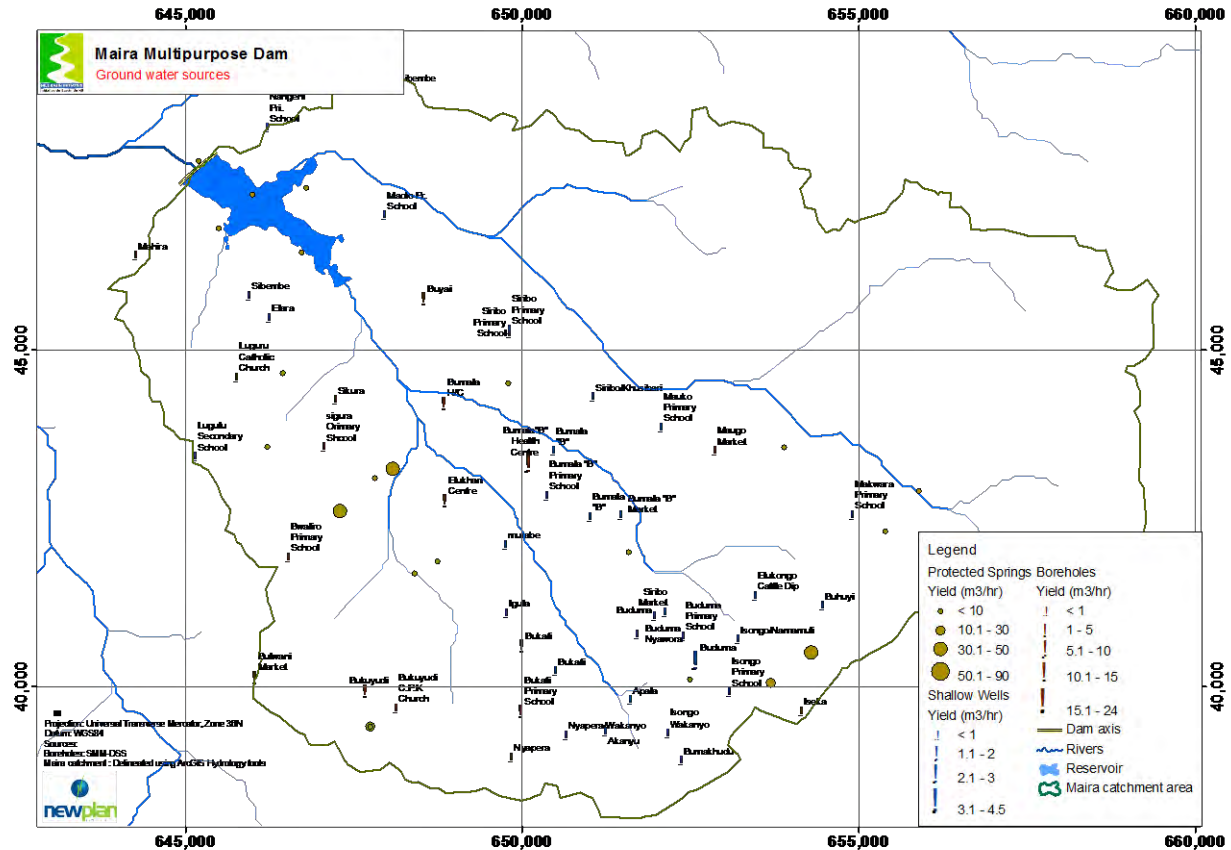


Figure 6-16: Ground water resources within the Maira catchment

6.1.5.5 Surface water resources

Surface water is the component of the hydrologic cycle that is found in streams, rivers, lakes, and wetlands. Surface water resources in the Maira catchment include the River Namanderema and its tributaries as shown in Figure 6-17 below. There are practically no wetlands left in the catchment as these have been encroached on by the farmers in the region.

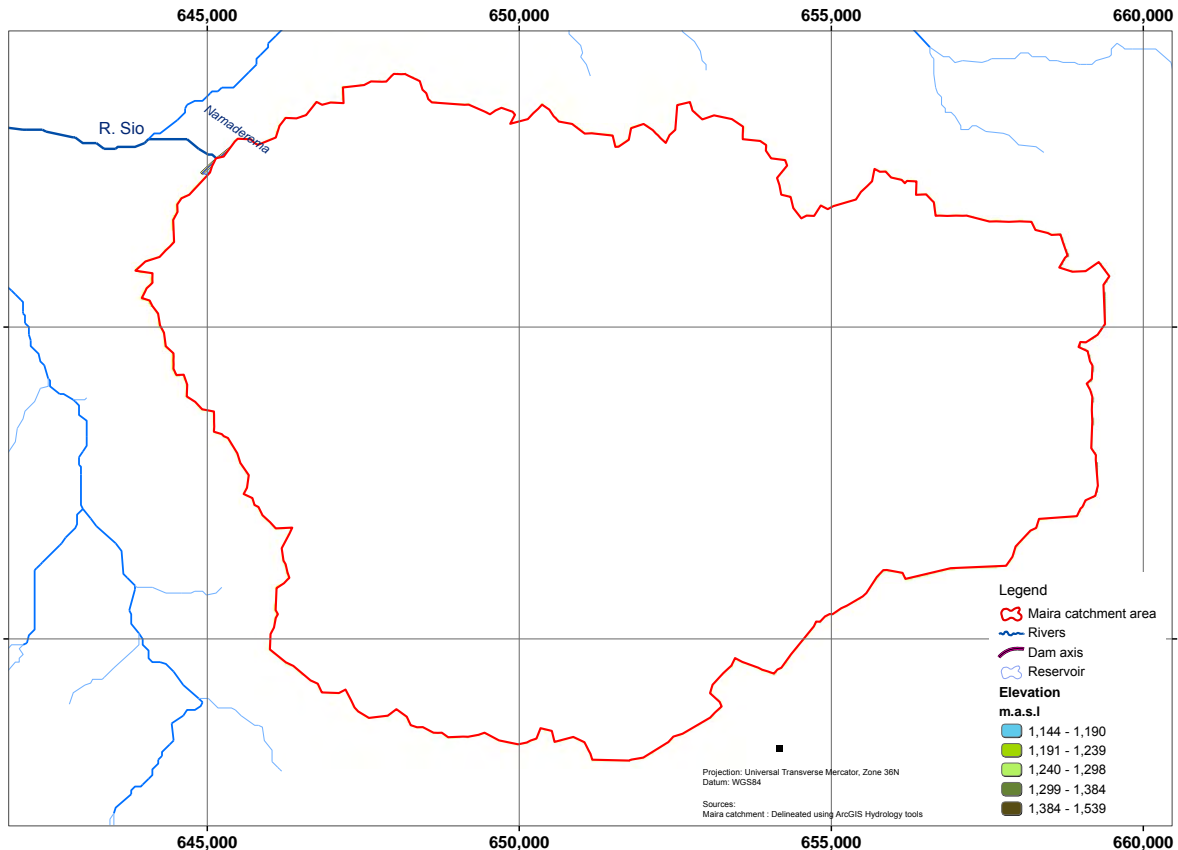


Figure 6-17: Location of Surface Water sources

6.1.5.6 Surface-ground water interaction

Investigation of the interactions between groundwater and surface water runoff were done by observing presence of springs discharging flow to the rivers/streams. There are a number of springs in and around the catchment indicating obvious interaction groundwater and surface runoff. The importance of springs is that they can contribute firm flow to streams during the dry season when surface runoff ceases. This contribution is of crucial importance to water supply. Flow records for River Sio show that it is perennial. During the dry season when there is no rainfall, the contribution of stream flow is mainly from groundwater flow. The groundwater contribution to stream flow is thus of great importance.

6.1.5.7 Water Use and Demand

a) Principal Water Users

It is important to identify the principal water users upstream and downstream of the proposed dam site as this facility is bound to impact the current and future uses of the water resource. Consultations with the local authorities in the area revealed that the major uses of water in the catchment include water for domestic, livestock, aquaculture and irrigation. Identified major water users are described below and presented in Table 6-2 and Figure 6-18 & Figure 6-21

b) Water for Domestic Use

In Busia district, the major town water supply system abstracts its water from the Sio river. This system, known as the Busia-Mundika water supply system supplies the Busia Municipality and consists of 4 pumps with a capacity of 100m³/hr each. Normal operation of the system involves three pumps working at the same time for 8 hours per day. This town water supply system is supplemented by 6-9 motorized boreholes located within the town.



Figure 6-18: Abstraction point for Busia-Mundika Water Supply system on River Sio

In Nambale district, the town water supply system (Figure 6-19 is based on a motorized borehole system comprising of 3 boreholes. Two of these boreholes are located at Nambale Primary school, each with a yield of 16m³/hr, while the third borehole is located near Suwo bridge.



Figure 6-19: Nambale Water Supply System based on motorised boreholes

Two motorized boreholes are located in Malanga location, one at the Malanga dispensary and another at Malanga Mixed Senior Secondary school.

Namasale water supply system (Figure 6-2020) is based on a high yielding protected spring that supplies two schools in Lugulu.



Figure 6-20: Namasale water supply system based on a protected spring

Table 6-2: Principal Domestic Water Abstractors

Name of facility	Location		Amount Abstracted (m ³ /s)
	Eastings	Northings	
1. Busia-Mundika water supply system			(3 * 100)
2. Nambale water supply system			
Borehole 1 (motorized)	638077	49475	16
Borehole 2 (motorized)	638071	49470	16
Borehole 3 (motorized)	639708	47933	16
3. Namasale water supply system	647476	45869	
4. Malanga Dispensary (motorized borehole)	644130	44819	16
5. Malanga Mixed Secondary School (motorized borehole)	643109	45913	16

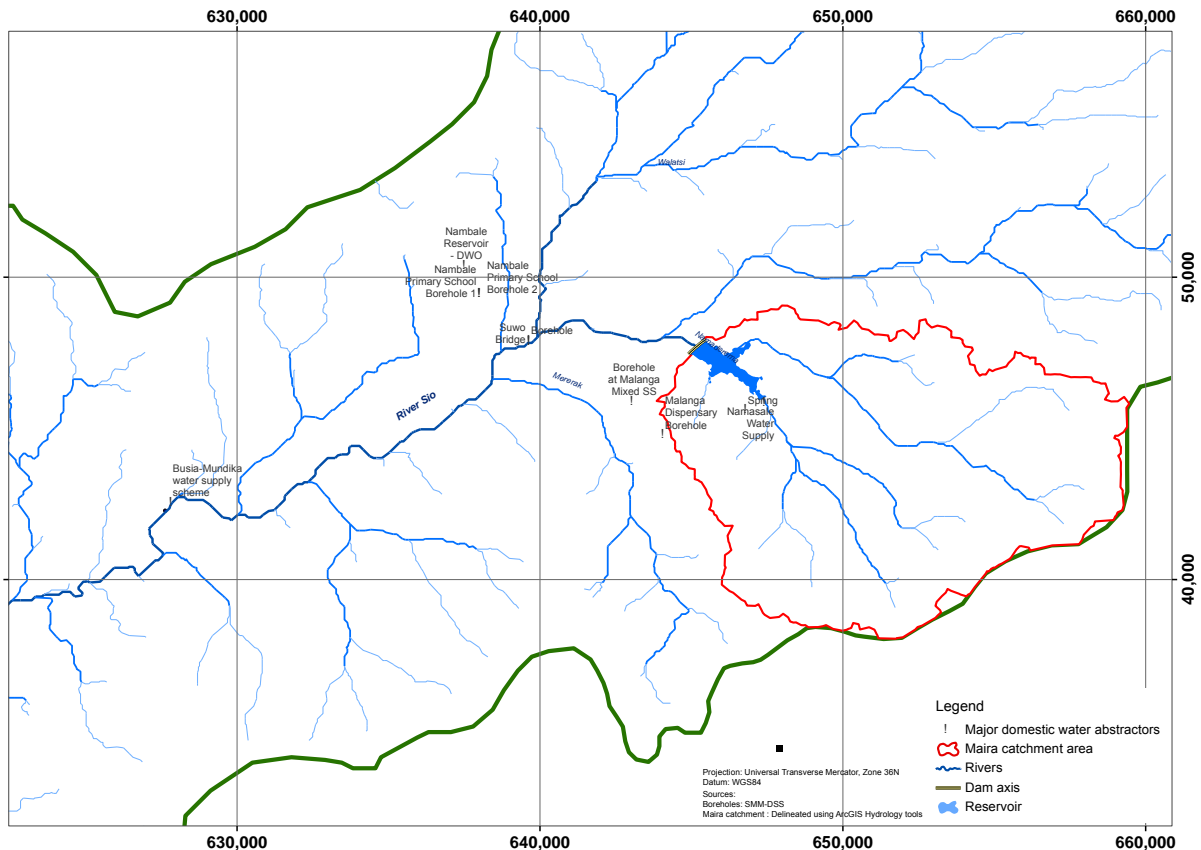


Figure 6-21: Major Domestic Water Abstractors in the Sio River basin

c) Water for irrigation

i) ***Existing Irrigation schemes***

A major irrigation scheme in the vicinity of the dam is the Maira Makemo Cluster Irrigation and Drainage system (**Figure 6-22**) located upstream of the dam embankment. The scheme is a combination of small-holder irrigation schemes that are community based. The scheme is approximately 50 hectares and a variety of crops are grown including maize, sorghum, millet, sweet potatoes, cassava, bananas, rice and horticulture crops. Crops grown are both for subsistence and commercial purposes.

The scheme comprises of an intake at the Namanderema stream that diverts water through a 5km canal system (with a lined stretch of 2.7km). Total water demand of the scheme is 60l/s.

Part of the scheme will be submerged by the proposed reservoir.



Figure 6-22: Maira /Mukemo Cluster Irrigation and Drainage Project- Marikemo

ii) Proposed Irrigation schemes

The Government of Kenya through the National Irrigation Board has just completed feasibility studies detailed design and tender documentation for Irrigation Investments in the Lower Sio Basin, based on direct abstraction from the river system. The objective of the assignment is to conduct a feasibility study for the development of a 4,000ha (command area) irrigation scheme in the Lower Sio Basin. The development of irrigation infrastructure in the Sio Basin would make it possible for the local communities to draw economic benefits from the water resources of the Sio River. The irrigation development would be located in the downstream flood-free areas of the basin but may include areas affected by seasonal flooding which can be effectively controlled to allow for agricultural production.

The project area, Lower Sio Basin, lies within Busia, Butula and Samia Districts in Western Province. The total area covered by the districts is 946.1km² and arable land of 57km².

An irrigation system comprising of weirs and canals has been proposed to supply 5 areas both by gravity and pumping as indicated in the Table 6-3 below.

Table 6-3: Proposed Irrigation Schemes in Lower Sio River basin

Area	Irrigation Scheme	Irrigable area (ha)	Main Canal		Secondary Canals		Gross Annual Water Requirement(m ³ /s)	Abstraction Source
			Pipe length (m)	Canal length (m)	No. of Units	Total Canal length (m)		
1	Namanderema–Balaam	1700	10,850	3,930	6	18,800	0.357	R. Namanderema
2	Busing–Mundika	970	1,780	7,865	11	15,787	1.296	R. Sio
3	Luigebu	1040	750	9,416	7	10,711	0.667	R. Namwitsula
4	Nasewa	660	2,380	9,680	10	10,412	0.13	R. Mulelekwe
5	Nanundu	720	-	6,900	5	5,401	1.038	R. Munana
Total		5090	15760	3779	39	61111	3.488	

SOURCE: Feasibility Study Report

The gross irrigation requirement was calculated based on the proposed cropping schedule. Figure 6-23 shows the existing and proposed irrigation schemes.

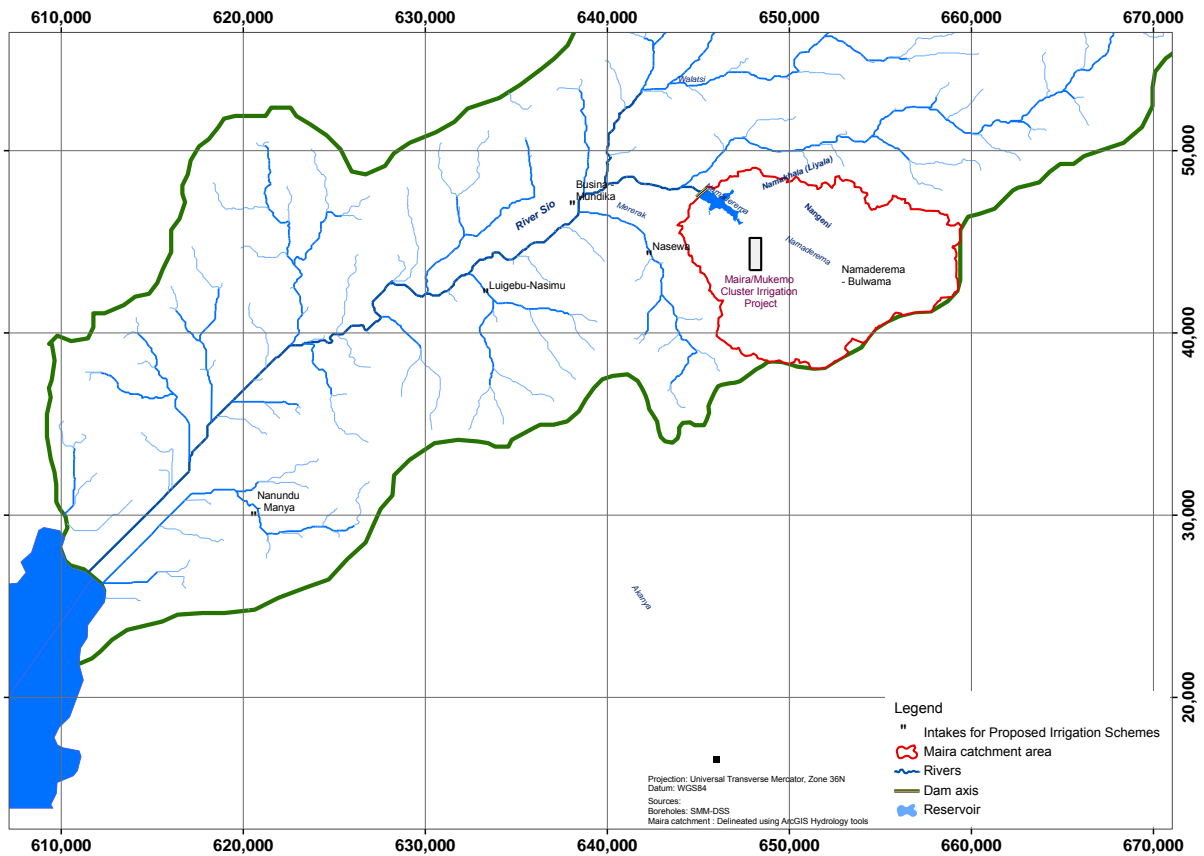


Figure 6-23: Existing and proposed irrigation schemes

6.1.5.8 Water Quality Assessment

Water samples were obtained at five different locations on Namaderema river, Nangeni and Namudoda rivers on 24th April 2012. The water samples were analysed in the laboratory of the Department of Water Quality and Control of the Lake Victoria North Catchment Area in Kakamega. The water quality parameters analyzed included pH, Electrical Conductivity (EC), Colour, Turbidity, Total Dissolved Solids (TDS), Total Hardness (TH), Total Alkalinity (TA), Iron, Chloride, Fluorides, Biological Oxygen Demand (BOD₅), Chemical Oxygen Demand (COD), Total Coliforms and Faecal Coliforms. The observed results of the laboratory analysis were then compared descriptively with the existing international standards, i.e., World Health Organisation (WHO). Results of the analysis are shown in Table 4-4 and copies of the Certificates of Analysis are attached in **Annex 2**.

From Table 6-4 it is clear that while DO, temperature, EC, TDS, pH, colour, total hardness, total alkalinity, chloride, fluorides and BOD₅ are within the WHO guidelines, the TSS, Turbidity, COD, Total Coliforms and Faecal Coliforms are way above the standards and as such of concern to the quality of the water from the reservoir especially with regard to use of the water for domestic purposes.

The parameter EC indicates the extent of dissolved solids in the water and hence the intensity of non-point sources of pollution. The observed values of EC range from 76 – to 168 $\mu\text{S}/\text{cm}$. These values are relatively on the lower side indicating that the impact of human activities on water quality within the basin is still low. The results for EC can be related to the determined values of Total Dissolved Solids (TDS).

BOD₅ and COD are indirect measures of the quantity of oxygen being used by the microorganisms and the organic compounds in water. The high level of COD indicates a high level of microorganisms, a high content of organic material and hence organic pollution.

The high levels of both Total and Faecal Coliforms indicate faecal contamination of the water by both humans and animals. This shows that there is open defecation in the area a fact that is confirmed by the Public Health assessment of the area.

Turbidity is a measure of the ability of suspended and colloidal materials to diminish the penetration of light through the sample. The values of turbidity are expected to vary with season. Turbidity values are expected to be at a higher level during the start of the rainy season when surface runoff carries considerable amounts of suspended sediment. The high turbidity values observed at the sampling points ranged from 20 – 162 NTU and these can be attributed to sediments resulting from erosion taking place in the upper reaches of the dam catchments as was visually observed during the site visit.

Table 6-4: Water Quality Results

S/No	Parameters	Units	Sample Location					Average	WHO Guideline Standards for Drinking Water
			Nangeni before confluence with R. Sio	Nangeni River	Namudoda River	Namandere ma River	Confluence of Namanderema and Namudoda		
1	Dissolved Oxygen (DO)	mg/l	5.11	6.7	1.18	5.45	5.92	4.87	> 4
2	Temperature	°C	27.5	25.1	2.2	25.5	27.5	21.56	25 ± 5
3	E. Conductivity	µs/cm	76.2	73.4	167.8	82.6	76.8	95.36	< 1500
4	Total Dissolved Solids (TDS)	mg/l	42.4	40.6	61.3	43.8	40.1	45.64	< 1200
5	Total Suspended Solids	mg/l	130	140	30	90	100	98.00	< 30
6	pH		7.61	6.51	6.4	7.47	6.32	6.86	6.5 - 8.5
7	Colour	mgPtCo	5	7.5	10	7.5	7.5	7.50	< 15
8	Turbidity	NTU	146	162	20.3	126	141	119.06	< 5
9	Iron	mgFe/l	0.02	0.01	0.18	0.02	0.21	0.09	< 0.3
10	Total Hardness	mgCaCO ₃ /l	34	34	66	38	30	40.40	< 500
11	Total Alkalinity	mgCaCO ₃ /l	28	26	60	31	32	35.40	< 500
12	Chloride	mgCl/l	2.96	3.84	2.91	3.87	3.87	3.49	< 250
13	Fluorides	mgF/l	0.01	0.07	0.06	0.09	0.01	0.05	< 1.5

S/No	Parameters	Units	Sample Location					Average	WHO Guideline Standards for Drinking Water
			Nangeni before confluence with R. Sio	Nangeni River	Namudod a River	Namandere ma River	Confluence of Namanderema and Namudoda		
14	BOD ₅	mgO ₂ /l	1	1	4	1	1	1.60	< 10
15	COD	mgO ₂ /l	46.2	276.9	61.5	46.2	36.9	93.54	< 40
16	Total Coliforms	/100ml	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	0
17	Faecal Coliforms	/100ml	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	0

6.1.5.9 Sediment Yield Assessment

Due to high erosion rates experienced in the basin, soil and silt in large quantities are carried in both bed load and suspended load by the Sio River and its tributaries.

A rapid assessment of the sediment yield into the proposed dam was done by visual observation of the siltation in the rivers and the general watershed practices. The Sio River and its tributaries are heavily silted as shown in Figure 6-24. This is attributed to the poor farming practices in the watershed where farmers cultivate their land right up to the river banks. Sediment yield into the proposed dam is currently being assessed as it has bearing on the life period of the dam.



Figure 6-24: Heavy siltation in Namanderema River

6.1.5.10 Flood Assessment

It is clear from the field observations that floods are of great concern in this region. Figure 6-25 shows the Old Sio Bridge (at same location as the new bridge) before and after a heavy downpour. Flood assessment is also being carried out and the results will be included in the next phase of reporting.



Figure 6-25: Old Bridge near Sio Bridge before (left) and after heavy down-pour (right)

6.1.5.11 Environmental Flows Assessment

The proposed dam axis is located approximately 1.42km upstream of the confluence of Namanderema River with the Sio River (See Figure 11). Given that Namanderema river with its tributaries and a tributary of the Sio river contributing approximately 12% of the total flow in Sio, reduction in the flows from Namanderema tributary are bound to have a minimal effect on the total Sio river flow downstream. However, this reach of 1.42km will experience reduced flows because of water draw offs for other water uses of the dam during operation. A minimum environmental flow in this section of the river has therefore to be established that would be able to sustain the existing human and ecosystems throughout the life of the project.

Estimation of environmental flow

Methods for estimation of environmental flows can be grouped into methods based on (i) hydrologic or statistic value, (ii) physiographic principles, (iii) velocity and depth of water, and (iv) multi-objective planning taking into consideration ecological parameters. Hydrologic methods, based on statistical analysis of hydrological data available at a given site, are commonly used because they are the simplest and least expensive. These methods are based on the premise that the aquatic ecosystem of a river depends on its historical hydrological regime.

In-order to establish the environmental flow, the minimum flow requirements for the human and environmental environments both current and projected into the future were computed based on the baseline studies and surveys. The water baseline survey provided information on the population, water use and demands. For this study, in absence of more detailed ecological data on this reach, the hydrological method was adopted to establish the minimum ecological flow requirements. The total environmental flow was obtained as the total of human and ecological flow requirements as detailed in the sections below.

Human Environment

The affected area includes the sub-locations of Malanga and Sidende with a population of 6629 and 7579 persons respectively. The water demand is based on the socioeconomic survey, the percentage number of people that draw their water from the river is approximately 11.6%. From the water use figures and the total population for the affected sub-locations, the total water demand in the area was established as presented in the Table 4-5

Table 6-5: Current Total Water Consumption per day by affected communities

Water Use Type	Average per capita consumption (litres/person/day)	Total Consumption (litres/day)
Domestic	30	49,470
Brickmaking	25.03	41,274
Watering animals	50	82,450
Brewing	7.41	12,219
Other uses	3.96	6,530
Total	116.4	191,944

Projected water demand was computed based on the projected population (*using a population growth rate of 2.07% (CLA Fact book)*) and is as presented Table-----

Table 6-6: Project water demand in the project area

Year	Total population in Malanga and Sidende	Total population that draws water from the river	Projected water demand (m³/d*)	Projected water demand (m³/s)
2009	14,208	1649	192	0.007
2062	42,086	4882	568	0.02

1 day is equivalent to 8 hours based on water collection pattern

The current total amount of water that is drawn from River Namanderema in the two sub-locations is estimated at 0.007 m³/s. Projected to the year 2062, the flow requirements translates to approximately **0.02m³/s**.

Ecological Environment

The flora study carried out revealed a low density of plant species with the presence of distinctive vegetative types including wetland species, papyrus and other common plants. The cultivated area is characterized by food crops and very few scattered trees. The peripheral of the stretch of wetland vegetation are areas extensively covered by sugar cane plantations. One key species of special concern is the *Hallea stipulosa* listed as an endangered species on the IUCN (2007) red list, and as such requires conservation.

The faunal biodiversity in the area is poor and the species found can tolerate habitat disturbance. None of the fish, the amphibians and herpetile species recorded are globally or regionally threatened.

Computed environmental flow

For purposes of establishing the level of water to be released to flow downstream of the dams to maintain the environment a simple methodology referred to as ‘Montana Method’ proposed by Tennant (1976), where by an environmental flow regimes are prescribed on the basis of the average daily discharge or the mean annual flow (MAF) was used. In general cases, 10% of the MAF is recommended as a minimum instantaneous flow to enable most aquatic life to survive, while 30% MAF is recommended to sustain a good habitat.

Mean monthly flows for River Namanderema were computed from the recorded daily flow records from January 1959 – 2002 for Namanderema (*adjusted from the Sio gauge*). MAF for each year was computed by dividing the sum of all the individual daily flows by the number of daily flows recorded for the year. The sum of the MAFs for each year of record was then divided by the number of years of record to obtain the long-term mean annual flow for the period of record.

Furthermore the Q₉₅ (flow that is exceeded 95% of the time) value has been determined for comparison with the value of 10% of the MAF at the site. The constructed flow duration curve for Maira site is presented in Figure (Figure 6-26) below.

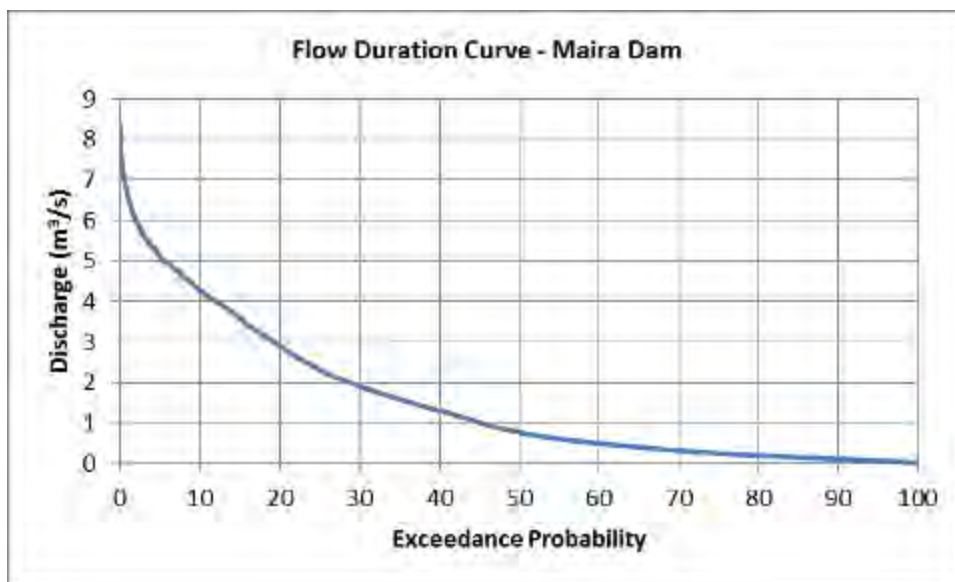


Figure 6-26: Flow Duration Curve for Maira dam

The 10% of MAF and Q_{95} indices are proposed to be the levels of flow required to be released downstream of the dams for purposes of maintaining the ecosystem. Computed 10% of MAF values are presented in Table 5. The Q_{95} value obtained from the flow duration curve are also presented in table 4-7.

Table 6-7: Various Environmental flow values

Dam site	Mean Annual Flow (MAF) (m³/sec)	10% of MAF (m³/sec)	Q_{95} from FDC (m³/sec)	Minimum daily flow (records) (m³/sec)
Maira	1.53	0.15	0.08	0.09

From Table 4-7 it can be observed that the 10% MAF values that were determined at the dam site is much higher than the estimated Q_{95} (the flow that is exceeded 95% of the time) and the minimum daily flow on record at the same site. In view of the of the relative importance of maintenance of the Nangeni wetland and its functions, the 10% of MAF values are recommended to be adopted as flow values to be released downstream of the proposed dam site for purposes of maintaining the ecosystem downstream.

It is recommended that the human demand (*obtained above as $0.02m^3/s$*) be met by the dam and therefore the average recommended environmental flow for the dam is that of the ecological flow computed above and is set as **$0.15m^3/s$** . The minimum total environmental flow for reach of the River Namanderema between the dam axis and the confluence with River Sio is presented in the table 4.8

Table 6-8: Recommended Environmental flow

Mean flow (m ³ /s)	Month												Average
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Environmental Flow	0.04	0.03	0.06	0.23	0.40	0.26	0.13	0.10	0.13	0.16	0.19	0.10	0.15

6.2 Biological Environment

6.2.1 Plants (Flora)

6.2.1.1 Vegetation Description

The project area is located in an area influenced by equatorial climate with thick and tropical rain forest vegetation. However, this is not the case because human population with intensive cultivation has led to decimation of the natural vegetation that has paved way for anthropogenic influenced vegetation. This is dominated by crops, a few trees around homes and relics of some natural tree species located in few places of the project area. The vegetation of a place is described from the species available and the environmental conditions prevailing and can be influenced by landform, soils, climate and anthropogenic factors like fire and grazing.

The Maira dam site is characterized by distinctive vegetative types that have been influenced by wide range of factors as indicated above. The vegetation types includes:-

Mash areas / Wetlands: Maira site is drained mainly by three streams/rivers Namanderema as the main river Namudoda to the east and Nangeni to the west. The presence of these rivers and the flooding associated has resulted into the establishment of vegetation cover characterized by dry and swampy plant species. These are composed of *Phragmites mauritiana* - (Poaceae) (water reed of an average height of 4m high), and scattered patches of *Cyperus papyrus* with *Mimosa pigra* mixing in this vegetation. Other common plant species in the area are mainly shrubs and herbs like *Polygonum setosulum*, *Cyperus latifolia* - (Cyperaceae), *Typha domingensis* (Typhaceae), *Echichnochloa pyramidalis* (Poaceae), *Cassia floribunda*, *Sesbania sesban*, *Fluegea virosa* and *Afromomum angustifolia* in the swamps typical of cultivated areas. The wet land vegetation was mainly dominated by *Phragmites mauritiana* grassland and patches of short grass typical of human transformed ecosystem. See **Figure 6-27** taken at 36 N 0645090 47628 and **Figure 6-28** taken at 36 N 645369 47197



Figure 6-27: Wetland vegetation near Bridge



Figure 6-28: Burnt Phragmites to pave way for cultivation in a wetland

Cultivated areas: Cultivated areas are characterized by food crops and very few scattered trees. In the peripheral of the stretch of wetland vegetation are areas extensively covered by sugar cane plantations as well as subsistence farmlands mainly of annual crops including; Maize, beans and assorted vegetables. See Figure 6-29 taken at 36 N 645055 47547 and Figure 6-30 taken at 36 N 645444 47393.



Figure 6-29: Sugarcane plantation in project area



Figure 6-30: Maize cultivation within the wetland

Home gardens: These are dominated by trees surrounding the homes that have been mainly influenced by the land owners (Figure 6-31).



Figure 6-31: Home garden with tree around the house

6.2.1.2 Species Richness

A total 131 species were recorded in the area, from 45 families. Family Asteraceae had the highest number of species (20), followed by Poaceae (14) and Euphorbiaceae each with 11 species, Fabaceae with 9 species and Labiatae with 6 species, while the rest of the families had less than 5 species each (**Annex 3**).

Hallea stipulosa is one of the endangered species that was observed in the study area as per the IUCN status. Many of the species that were observed in the area are of wide range distribution. Therefore, there will be minimal impact on biodiversity conservation.

6.2.1.3 Invasive plants

The survey documented some invasive plant species which included among others the aggressive herbs such as *Lantana camara*, *Mimosa pigra* and *Tithonia diversifolia*. *Lantana camara* was common in abandoned and uncultivated areas and *Mimosa pigra* was common in the wetter areas. Aquatic weeds observed in the project area especially in stagnant water included red algae and Water Lettuce (*Pistia stratiotes*). Other aquatic weeds reported by KARI to be in the the Western region of Kenya included , (Water Hyacinth (*Eichhornia crassipes*), Red Water Fern (*Azolla filiculoides*) Kariba Weed (*Salvinia molesta*)

6.2.1.4 Ecosystem services

The study area has been greatly transformed from a wetland that previously was rich in indigenous plants mainly papyrus for mat making to agricultural ecosystem and isolated grazing fields. The land remains useful for provision of other services like seasonal fishing from the rivers during the rainy season. The ecosystem service hitherto provided by the wetland such as flood storage, water quality amelioration and enhancement, wildlife habitat, and buffers during periods of high water regimes have been reduced. The ESIA study being undertaken may document the baseline status of the vegetation on which any future changes resulting from the proposed project may be based.

However, it may be difficult measure the impacts of the project on the different ecosystem services the river basin in question is providing.

6.2.2 Animals (Fauna).

The proposed dam site is located in area whose vegetation has been transformed leaving a stretch in valley dominated with natural plant represented *Phragmites* (**Figure 6-32**). The site is largely under sugar cane plantation. Yet the fauna abundance and richness depend on types of vegetation.



Figure 6-32: *Phragmites*, dominant natural vegetation at the project site

The area is generally poor in biodiversity. This is not surprising because the area is heavily degraded and cultivated. The remaining natural vegetation is mainly *Phragmites*. The wildlife that are found in the area are those that can tolerate habitat disturbance and cultivation.

The nearest protected areas include **Kakamega forest reserve and national park** (12,000 ha, 40 km north of Kisumu) (an Important Bird Area No. 58). **Mungatsi** (36 ha, 0° 27'67" N, 34°19'69"E) and **Malanga** (3 ha, 0°25'96"N, 34°18'44"E) are two of the four Busia Grasslands Important Bird Area (IBA No. 57) within 5-10 km from the project area. These grasslands are important sites for the afro-tropical migratory globally Vulnerable Blue Swallow *Hirundo atrocaerulea* (Bennun and Njoroge 1999).

A total of 45 **bird species** were recorded (**Annex 4**). The **Grey-crowned Crane is the only globally threatened species** (Endangered) that was recorded. In addition, two species of restricted range in the East African region were also recorded (**Table 6-9**). Six species of **fish (Table 6-10)** were recorded including *Gnathonemus longibarbis* (**Figure 6-33**). None of these species is threatened globally or regionally.

A total of **four species of amphibians** were recorded (**Table 6-11**) including Crowned Bullfrog *Hoplobatrachus occipitalis* (**Figure 6-34**). There are reports that the Nile Crocodile *Crocodylus niloticus* was sighted around the project area about ten years ago. The monitor lizard (Figure 6-38) was recorded in the project area. None of the herpetile species recorded and reported is regionally or globally threatened.

Four species of mammals were recorded: the Vervet monkeys (*Chlorocebus pygerythrus*), Civet cat (*Civetticus Civetta*) and a shrew (*Crocidura sp*) – Figure 6-37 shows a civet cat which had been trapped and killed by the workers in the sugarcane plantation.. These are all species of no conservation concern. There were reports that a Hippopotamus *Hippopotamus amphibius* (globally Vulnerable) was sighted around the project area two years ago. Eight species of **Dragon flies** (**Table 6-12**) and 6 species of **butterflies** (**Table 6-13**) were also recorded with no species of conservation concern.

Table 6-9: Birds of Conservation concern recorded in the project area

Species	Habitat	Threat category
GOLDEN-WINGED SUNBIRD <i>Nectarinia reichenowi</i>	F	R-RR
GREY CROWNED CRANE <i>Balearica regulorum</i>	WG	G-EN
PURPLE HERON <i>Ardea purpurea</i>	W	R-NT
WHITE-HEADED SAW-WING <i>Psalidoprocne albiceps</i>	F	R-RR

RR: Regionally range restricted, **G-EN:** Globally Endangered, **R-NT:** Regionally Near-threatened, **f:** Forest visitor, **W:** Waterbird, specialist – normally restricted to wetlands or open waters, **G:** Grassland species

Table 6-10: Fish species recorded from the Project area

Common name	Scientific name
Tilapia	<i>Astatotilapia sp</i>
Barbus	<i>Chrysichthys sp</i>
Barbus	<i>Synodontis afrofisheri</i>
Mormyrid	<i>Gnathonemus longibarbis</i>
Mormyrid	<i>Petrocephalus valentine</i>
Eel	<i>Mastacembelus frenatus</i>



Figure 6-33: *Ghanotbonemus longibarbis*



Figure 6-34: Crowned Bullfrog (*Hoplobatrachus occipitalis*)



Figure 6-35 Shrew –*Crociodura* sp



Figure 6-36: Civet cat (*Civetticus Civetta*) common in sugar plantations - trapped by workers



Figure 6-37: Monitor Lizard *Varanus niloticus*

Table 6-11: Species of frogs recorded in the project area

Species	Status
Mascarene Grass Frog <i>Ptychadena mascareniensis</i>	Very common
<i>Amietophrynus vittatus</i>	rare
<i>Hyperolius kivuensis</i>	rare
Crowned Bullfrog <i>Hoplobatrachus occipitalis</i>	rare

Table 6-12: Species of Dragonflies recorded in the project area.

species	Habitat preference
<i>Brachythemis leucosticta</i>	Grassy pools
<i>Elatteoneura glauca</i>	usually riverinne, prefers damp, shady spots, bush, woodland
<i>Hydrothemis camerensis</i>	Forest
<i>Orthentrum hintzi</i>	Streams and pools in bush, woodland
<i>Palpopleura lucia</i>	Pools in woodland and forest
<i>Pantala flavescens</i>	Temporary pools, desert to forest edge
<i>Pseudagrion sjoestedti</i>	Pools, streams, rivers
<i>Tetrathemis corduliformis</i>	Slow forest streams and pools

Table 6-13: Species of butterflies recorded in the project area

Species	Habitat preference
<i>Acraea encedana</i>	Swamp/wetland species
<i>Bicyclus jefferyi</i>	Forest edge/woodland species
<i>Catopsilia florella</i>	Migratory species

Species	Habitat preference
<i>Eurema brigitta</i>	Migratory species
<i>Eurema regularis</i>	Widespread species
<i>Junonia sophia</i>	Widespread species

6.3 Socio Economic Environment

6.3.1 Administrative Units

The Project falls within the Nambale and Butula Districts. Nambale District has 5 Locations and 14 Sub Locations while Butula District has 6 and 21 Sub Locations The proposed dam and the associated reservoir are mainly located in Nambale District, Nambale Division- Buhayo Central Location in Sub-locations of Malanga and Sinende. **Table 6-14 and Error! Reference source not found.3** show location and administrative boundaries). A small part is located in Butula District, Butula Division -Elugulu Location in Buhweso sub-locations and Marachi East location in Elukongo sub-location all in Kenya.

The two districts now fall under the larger Busia County as per the constitution of Kenya 2010. Politically, the project falls within Nambale (Malanga and Sidende) and Butula (Bwaliro and Elukongo) constituencies. Nambale and Butula are newly formed districts curved out of Busia District and are still in the process of establishing themselves. As a result, most of the technical facilities and offices are still at Busia District. Besides, the available literature for the two districts is still under the Busia District Reports.

Table 6-14: Administrative units within which the reservoir lies

District	Division	Location	Sub Location
Nambale	Nambale	Bukhayo Central	Malanga
			Sinende
Butula	Butula	Elugulu	Buhweso
			Maracha East

6.3.2 Demographic Characteristics

i) Population

According to the Kenya Housing and Census Report (2009), Nambale District has a population of 94,637 people while Butula had a population of 121,870. Table 6-15 below shows a summary of the

population distribution in the two districts by administrative unit, gender, area and density.

Table 6-15: Population Distribution by Gender, Number of households and Administrative units

Administrative Unit	Male	Female	Total	Households	Area (Km²)	Density
Nambale District	45,488	49,149	94,637	19,002	237.8	398
-Bukhayo Central Location	8,648	9,541	18,189	3,741	48	379
-Malanga Sub Location	3,119	3,510	6,629	1,334	19.2	345
-Sidende Sub Location	3,615	3,964	7,579	1,609	18	421
Butula District	57,025	64,845	121,870	25,953	247.1	493
Marachi East Location	14,909	16,760	31,669	6,603	68	466
-Elukongo Sub Location	5,855	6,633	12,488	2,581	27.2	459
-Elugulu Location	8,602	10,052	18,654	3,686	42	445
-Bwaliro Sub Location	2,111	2,494	4,605	958	11.2	411
Elukhari Location	6,293	6,957	13,250	2,682	26.3	505
-Bukati Sub Location	2,678	2,929	5,607	1,150	11.5	486

¹Source: 2009 Kenya Housing and Census Report

The statistics show that in general the women are more than the men in all the districts, locations and sub locations in the project area. As regards household characteristics, the average household size in the project area is 6 members with a minimum of one member and a maximum of 18 members which is higher than the average district average household size of 4.5. The average male and female distribution at household level is 3.0 for both genders. In terms of gender and age category most household members are those between the age brackets 0-30 years. However, there are more female members than male members of households beyond age 50 years.

The crude birth rate in both districts is 42/1000 and Crude death rate is 23/1000. Female life expectancy is 52.7 and male 52.8 years. Infant mortality is 75/1000 and the under 5 mortality is 111/1000 (GOK, 2008)

ii) Age and gender of household head

The household surveys showed that majority of the household heads (51.7%) were male and 48.3% were female. The percentage of female household heads in the area is quite high and this could be attributed a number of factors like the post-election violence that rocked the country in 2007-2008, HIV/AIDS among others.

¹ Population statistics for 2012 were difficult to get and only dependent on what was produced by Kenya Housing and Census report 2009

As regards age of the household heads, the results of the survey (Table 6-16) showed that the average age of the household heads was 45 years with the majority falling in the productive age group of 19-55 (68.1%) years. A sizeable number falls within the age group of more than 55 years (30.6%) and 1.3% are regarded as child heads of households. In Kenya a child is defined as a male or female below 18 years according to the Children’s Act CAP 141. Most of the child headed families are likely to be orphans.

Table 6-16: Gender distribution of household heads by age

Age category	Gender of household head			%	Total count	Total %
	Male count	%	Female count			
0-18	4.0	1.7	2.0	0.9	6.0	1.3
19-25	17.0	7.1	27.0	12.1	44.0	9.5
26-35	41.0	17.1	61.0	27.2	102.0	22.0
36-45	45.0	18.8	40.0	17.9	85.0	18.3
46-55	52.0	21.7	33.0	14.7	85.0	18.3
Over 55	81.0	33.8	61.0	27.2	142.0	30.6
Total	240.0	100.0	224.0	100.0	464.0	100.0

The above results imply that the population in the project area is highly commendable for employment as majority is still in the productive stage. The results further imply that there are vulnerable groups in the project area which will need special attention during the implementation of the project.

iii) Ethnic groups in the project area

The dominant ethnic group in the project area is Luhya (93.1%) particularly of the Bakhayo and Marachi sub clans. Minority groups were Luo ((4.3%), Teso (2.0%). The Nandi/Kalenjin were negligible. The Bakhayo are in Nambale district while the Marachi are in Butula. Major languages spoken in the project area are Swahili and Luhya.

iv) Religious Affiliation

Christianity is the main religion constituting about 96.0%. The protestant (57.8%), Catholic (38.1%) are the most dominant. Muslims (1.5%), African traditional and other non-believers are a negligible proportion.

v) Marital status of household head

Most household heads 388(83.6%) were in monogamous marriages, 12(2.6%) in polygamous marriage, 33(7.1%) single, (29(6.3%) widowed and 2(0.4%) divorced.

vi) Education of household head

The results from the household surveys showed that most of the household heads (54.4%) had attained formal primary level education and 19.2% had no formal education. These were mainly the elderly household heads who during their youthful years schooling was either not available or not compulsory or prioritized. Table 6-17 below shows the educational level of household heads by gender.

Table 6-17: Education by gender of the household head

Level of Education	Gender of household head				Total count	Total %
	Male count	%	Female count	%		
None	29	12.1	60	26.8	89	19.2
Primary	136	56.7	117	52.2	253	54.5
Secondary	55	22.9	41	18.3	96	20.7
Tertiary	12	5.0	2	0.9	14	3.0
University	8	3.3	4	1.8	12	2.6
Total	240	100	224	100	464	100

From the Table above, it is clear that access to formal education is to a great extent determined by gender. More male than female household heads at all educational levels had more access to formal education than female. This could be attributed to factors such as early marriages, low priority that is traditionally attached to girl child education among others. As regards literacy, 56.9% of the household heads said that they could read and write in the official language while 43.1% said that they could neither read nor write in the official language. As regards the local language, 70.3% said that they could read and write in a local language while 29.7% could not. When asked whether there was any member of the household who had received additional skills training, 19.8% answered in the affirmative. The skills most reported by households are: carpentry, driving, masonry and welding/metal work. The above results imply that due to low education levels of people in the project area, they can only mainly be employed as unskilled labour. However, the project should give an opportunity to people with skills to compete for skilled and semi-skilled jobs.

vii Household land size:

The household land sizes range from ¼ (10.11m²) acre to 35 (141,645m²) acres. However, the average household land size is 3 (12,141m²) acres. The Busia District Development Plan 2002-2008 indicated 2.5 acres (10117.5m²) as the average household land size. There are no large scale land holdings.

6.3.3 Sources of Livelihood

Majority of the household heads (86.6%) in the project area not employed while 13.4% are in paid employment. According to Busia District Environment Action Plan (2009-2013) agriculture is the

most important sector in the Districts of Busia, Butula and Nambale as it provides for over 65% of the total earnings in the Districts. Most people in the District are employed either directly or indirectly in this sector. Similarly in the project area, majority of the households (78.9%) are peasant farmers, 2.2% are commercial farmers, 5.8% are casual laborers, 5% are employed as civil servants, 4.1% are traders, 2.6% are in service provision (restaurants, driving), and 1.5% are engaged in other forms of economic activities like brick making. **The figure 4.38** below shows the major sources of livelihood of the people in the project area.

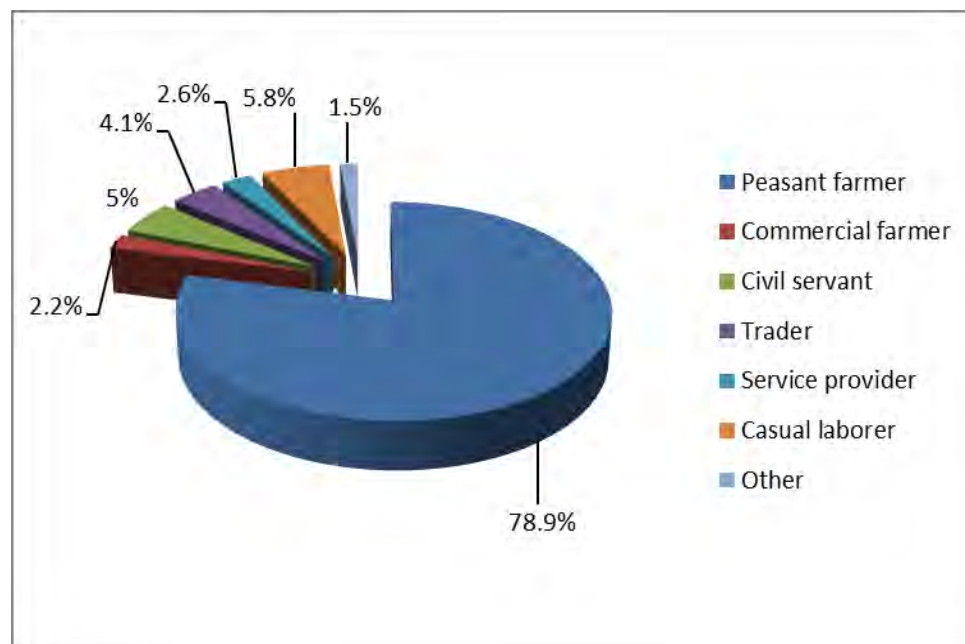


Figure 6-38: Source of Livelihood for households in the project area

Agriculture: As it is with other most parts of Kenya and in the study area, the predominant economic activity in the project area is agriculture with 78.9% of the households as peasant farmers and only 2.2% are commercial farmers. Of the households that engage in agriculture, majority use simple tools like hoes and slashers. Few households use ox-ploughs and tractors.

The main crops planted are: maize, beans, sweet potatoes, cassava, sorghum, finger millet as well as cabbage, kales and yams in the wetlands. Sugarcane plantations are dominant with farmers being contracted by Mumias Sugar Company. Other farms are individually owned but the product is still sold to the same company

In the valley cultivation is often done up to the river banks and crops include sugarcane, yams, cabbages and maize among others causing siltation and erosion (**Figure 6-39**). These are the crops expected to be affected by the reservoir.

Animal rearing: Animal rearing is practiced by some households in the project area. The most common animals reared include cattle, goats, sheep, pigs and poultry. The average number of livestock owned by households is 2 sheep, 2 goats, 3 cows, 3 pigs and 11 poultry (chicken, ducks)

Fish farming. Only 3% of the households practice fish farming. The fish caught is both for home consumption and for sale. According to Busia District Development Plan (2008-2012), aquaculture is practiced mainly in Nambale and Butula districts. In the project area, consultations showed that fishing was carried out especially during the heavy rains which brought about floods and the fish was subsequently trapped in the flooded water. Below is a picture (**Figure 6-40.**) showing fish traps in the flooded areas of the project area.



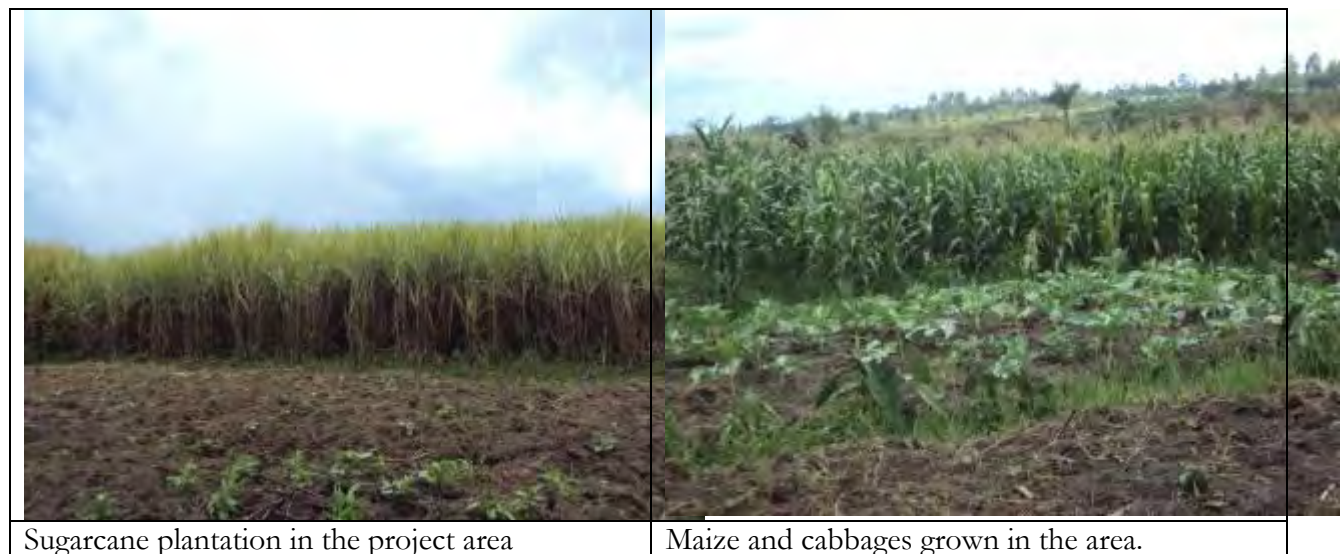
Figure 6-39: Gardens planted with maize and yams



Figure 6-40: Fish traps set up by the local people

Other economic activities: Other economic activities include, casual labour engaged in by 5.8% of the households, service provision (2.6%), traders (4.1%) and 1.5% are engaged in economic activities like brick making.

The most common crops planted are: Maize, beans, sweet potatoes, cassava, sorghum and finger millet. Sugarcane growing is widely practiced by many households in the project area (Figure 6-41). According to the Busia District Environment Action Plan (2009-2013), most of the available farmland is taken up by sugar cane farming as a cash crop leaving little room for food crops. This situation compels the farmers to encroach on the fragile areas like riverine catchments and wetlands for food production.



Sugarcane plantation in the project area Maize and cabbages grown in the area.

Figure 6-41: Common crops in the project area

6.3.3.1 Production and marketing

In terms of production, the **Table 6-18** shows the production of different crops in the area as reported by households included in the survey per unit measure per season. The main food storage facilities are on-farm granaries and stores.

Table 6-18: Production per unit measure

Crop	No. of households	Type of measure	Minimum production	Maximum production	Average production
Maize	85	Kilogram	2	900	131
Beans	23	Kilogram	1	160	38
Cassava	15	Tins/Kilogram	2	200	60
Sorghum	5	Kilogram	7	120	65
Groundnuts	3	Kilogram	2	2	2
Sugarcane	39	Tonne	1	10,000	273

By the quantities of production, it is clear that the agricultural production in the project area is low. Consultations revealed that there is a problem of food shortage in the area and as a result many households buy food from Uganda.

As regards marketing, Mumias Sugar Company was the main buyer of the sugarcane cash crop. Other cash crops are sold in local markets. However local traders, middlemen, private companies and schools were listed as buyers but they were insignificant as the quantities produced are very low. The main buyers of food crops were identified as: middlemen (25.2%) and local markets (18.5%). Other buyers identified were local traders and retailers. The main market centers where food crop sales take place are Nambale, Elugulu, Bukadanyi and Koyonzo. Most food marketing is done during market days spread every week in the respective market centers.

As regards livestock, 51.3% of households who rear livestock sell some of the animals while 48.7% do not sell their livestock. The main buyers of livestock were middlemen and local butchery owners. The main livestock markets are at Nambale, Koyonzo and Butula.

As regards distances to the marketing places, most market centers fall within walking distance. For 23.9% of the households the market center is less than 500 m away, 26.9% walk a distance of 500m-1km, 20.0% move 1-3kms to the market, 12.3% move a distance of more than 3km and 16.8% could not estimate the distance of their homestead to the nearest market. Overall however, the market centers are easily accessible as they are within walking distance.

The main problems cited by the households when marketing the farm products include low prices as reported by 34.7% of the households, fluctuating prices (24.7%), poor roads (15.4%), delayed payment (10.2%), very high deductions (13%) and others like lack of proper packing facilities (2%).

6.3.3.2 Household Income

According to the Busia District Development Plan (2008-20012), the average monthly income for households in the district is 1,239Ksh with wage employment and agriculture providing the highest proportions of incomes for the households.

The results from the household survey show that farming is the most important source of household income for most households while fish farming is the least important (Table 6-19). GOK (2008) indicated Kshs. 5,141 as the average monthly household income at county level. In terms of sectoral contribution to household income agriculture was 35.4%, rural self-employment 3.3%, wage employment 45.3%, urban self-employment 7.7% and other sources accounted for 8.3% (GOK, 2008).

Table 6-19: Household incomes per source

Source of income	No of households per source	Minimum income	Maximum income	Average income
Annual farming income	380	500	600,000	43,783
Annual employment income	62	1,000	384,000	107,093
Annual livestock sale income	102	500	200,000	18,689

Annual income	remittances	86	200	140,000	17,824
Annual income	fish sales	18	500	40,000	12,411
Annual income	business	105	500	240,000	29,875
Annual Total income		403	1	670,000	68,140

The Consultant investigated whether there were other household members who were working apart from the household head and the results showed that only 25.0% households had another member besides the household head in employment. The average annual income of other household members in employment was reported to be Kshs. 78,923. Agriculture provides employment to about 81.1% of all households members employed whether permanent or in casual employment (GOK, 2008). The figures above show that a household lives on about 2 dollars per day. Putting into consideration the average household size of a home which is at 6 persons in the project area, household members live on less than 1 dollar per day.

According to the Geographic Dimensions of Well Being in Kenya Report (2006), 68% and 70% of the people in Nambale and Butula Districts respectively lived below the poverty line. Table 6-20 below shows the poverty profile in the two districts.

Table 6-20: Poverty Profile in the two districts

District	Total population 1999 census	Estimate no. of poor individuals	% of people below poverty line	National poverty ranks out of 210 constituencies. 210=poorest	Constituency contribution to national poverty
Nambale	143,244	97 963	68	175	0.7
Butula	94,441	65 991	70	176	0.5

Source: GOK (2006) *Geographic Dimensions of Well Being in Kenya*

In general, the above statistics show that the population in the area can generally be categorized as poor.

6.3.3.3 Household Expenditure

In terms of expenditure, the household survey revealed that school fees and food took up the highest annual expenditures of households. 94.6% of the households spend on food, with average annual expenditure of Kshs. 50,000 and 73.1% of the households spend school fees with average annual expenditure of Kshs. 66,811. The expenditure on food was attributed to the fact that most of the households rely on food from Uganda as sugarcane growing takes a big percentage of their land

leaving less land for food production which has contributed to food insecurity in the area. When asked if there were any members of the household who had not eaten to satisfaction in the last 12 months due to lack of enough food, 80% answered in the affirmative. **Table 6-21** below shows the expenditure of households in the project area on different items and the amount of money spent on each item per year.

Table 6-21: Household expenditure (Kshs)

Expenditure item	Yes		No		No response		Annual average for expenditure per item at household level in Kshs.
	Count	%	Count	%	Count	%	
Food	439	94.6	25	5.4	-	-	50,000
Public transport	247	53.2	47	23.1	110	23.7	16,300
Medical bills	399	86.0	28	6.0	37	7.9	17,312
Clothing	366	78.9	44	9.5	54	11.6	11,203
Rent	12	2.6	232	50	220	47.4	23,800
Energy types	464	100	0	0	0	0	13,417
Water bill	35	7.5	224	48.3	205	44.2	15,750
School fees	339	73.1	64	13.8	61	13.1	66,811
Other items	11	2.4	80	17.2	373	80.4	17,200

6.3.3.4 Food Security

In the last 12 months 371(80.0) households showed that they missed food or did not have enough to eat. The reasons given were: Inadequate land for food production, yield is low due to prolonged drought/low soil fertility/pests/diseases, traditional seeds used for planting. Others sold most of the produce at harvest time but later lacked food. To some too much rain and/or flooding destroyed their crops. GOK (2008) reported that the entire Busia county food poverty was 61.4% while hard core poverty was 50.64%.

6.3.4 Property and Assets ownership

Some of the indicators of poverty are usually the nature of assets owned by households; the results of the interview indicated that the most common assets owned by households include, houses,

radios, land, livestock, cellphones, bicycles. About 7.3% of the households owned televisions, cars and motorcycles.

6.3.5 Land Tenure and Ownership

- a) Land ownership: The results from the socio-economic survey showed that majority of the households (98.9%) own land while 1.1% do not own land. In terms of gender, of the household heads who do not own land, 80% of them are female and only 20% of them are male. The average farm size owned for small scale farmers in the districts is 1.7 Ha while for large scale farms it is 2.8 Ha (Busia District Development Plan (2008-2012).
- b) Tenure: The socioeconomic interviews indicated that most of the land is under customary ownership (62.3%), 2.4% under leasehold, 1.7% freehold, and 31.1% had own taken succession from original land owner and they now have titles. There is no communal land ownership in the project area. Those who still own land under customary arrangement have yet to undertake succession from the original owner so that land title deeds are processed. Despite this they are legitimate land owners.
- c) Land use: The major land use types in the project area include food crop and cash crop farming which take up most of the household's land. Cash crop farming takes up the highest proportion of households' farmland up to a maximum of 15 acres but an average of 1.6acres per household compared to an average of 1.4acres of food crop farming. Other land uses include brick making, livestock rearing, settlements and sand mining but these do not take significant portions of household land.
- d) Household land size: The household land sizes range from $\frac{1}{4}$ (10.11m²) acre to 35 (141,645m²) acres. However, the average household land size is 3 (12,141m²) acres. The Busia District Development Plan 2002-2008 indicated 2.5 acres (10117.5m²) as the average household land size. There are no large scale land holdings.

6.3.6 Housing and Settlements

Settlements in the project area are scattered. However, in the trading centers they are concentrated and linear along the road. The settlements in the vicinity of the reservoir are in form of homesteads where in one compound there are several houses occupied by children and their families and a house that is occupied by the father and mother and this is often bigger than the other houses. Most of the houses are mainly temporary in nature and made of wattle and mud walls with grass thatches (**Figure 6-42**). There are a few permanent structures with a big proportion of semi-permanent houses. There were several structures that were observed in the proposed area for the reservoir.



Figure 6-42: Typical homestead in the project area

6.3.7 Social Structure and Mechanisms for Social Cohesion

The society in the project area is largely patrilineal in nature where the men are considered to be more superior as compared to the women. The men are the major resource property owners and decision makers on several aspects including land.

Consultations revealed that mechanisms for social cohesions included reliance on family members as most of them were staying near each other. As expected in a group-orientated culture, the extended family is the basis of the social structure. It includes relatives on both sides of the family as well as close friends. Quite often the husband's parents will live with the nuclear family when they get older and can no longer care for themselves. When people marry, they join their families, thus ensuring that there will always be a group to turn to in times of need.

Other mechanisms for social cohesion and social capital include religious organizations, farmers' associations and social groups/associations to support each other in times of need and to get credit among others.

6.3.8 Infrastructure

i) Education facilities

There are 41 primary schools and 12 secondary schools in the district of Nambale. **Table 6-22** below shows the distribution of schools in three out of four sub locations of the project area. From observations, majority of structures of the schools are of permanent nature and are in good condition.

Table 6-22: No. of Primary and Secondary Schools

<i>District</i>	<i>Sub location</i>	<i>No of primary schools</i>	<i>No of secondary schools</i>
Butula	Elukongo	4	2
Nambale	Sidende	3	1
	Malanga	3	1
<i>Total</i>		<i>10</i>	<i>4</i>

At primary school level the total enrolment for boys is 92.2% and 91.2% for girls. Total dropout rate for boys is 9.93% and 12.03% for girls. The teacher pupil ratio is 1:34 and the average years of school attendance is 6 years for both boys and girls (GOK, 2008). At secondary school level total enrolment for boys is 21.6% and 17.2% for girls. The dropout rate for girls is 5.63% and 4.96 for boys. Teacher student ratio is 1:16 (GOK, 2008). According to Busia District Development Plan (2008), there has been an increase in enrolment for both girls and boys due to Free Primary Education funds and Constituencies Development Fund and Constituency bursaries, which has led to increased enrolment in primary and retention in schools.

In terms of distance, 74.1% of the households interviewed said that their children travelled a distance of up to 1km to the nearest primary school, 22.2% travelled 1-3km, 1.1% travelled more than 3kms and 2.6% were not sure of the distance to the nearest primary school. For secondary school distance, 53.7% travelled up to 1 km to the nearest secondary school, 34.9% travelled 1-3kms, 9.9% travelled more than 3kms and 2.4% were not sure of the distance. The Figure 6-43 below shows the distances travelled by children from the households in the project area to reach the nearest primary and secondary schools.

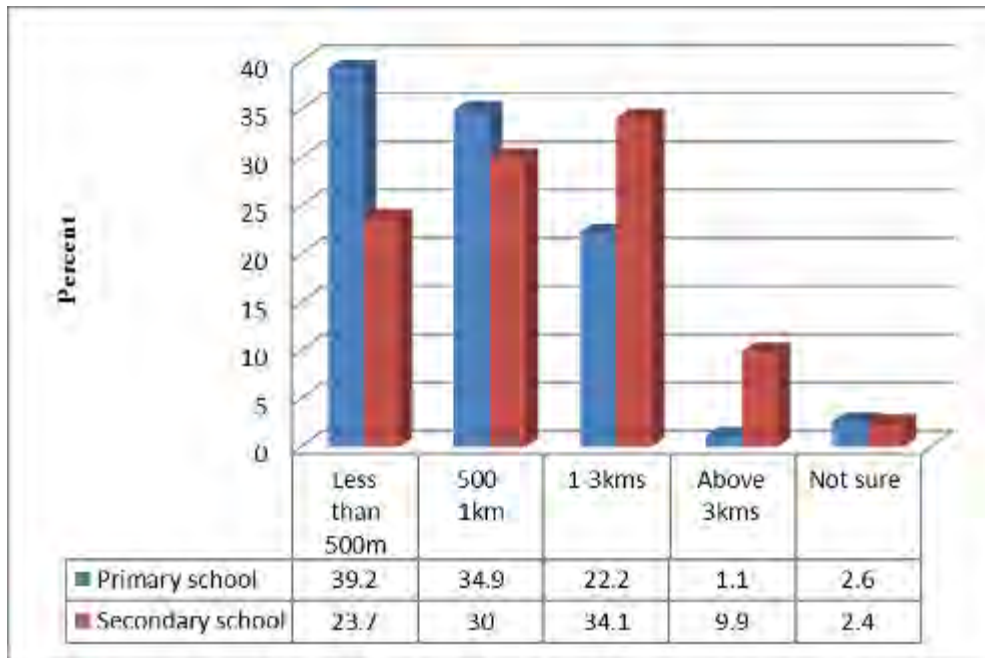


Figure 6-43: Distance to nearest Primary and Secondary Schools

The above results imply that both primary and secondary schools are within walking distance or accessible to most households in the project area.

ii) Water supply

According to Busia District Development Plan (2008-2012), there were 230 wells, 169 functional protected springs, 156 boreholes and 4 dams. In regard to access of water, 2.4% of the households in Busia - of which Nambale and Butula and part have access to piped water while 3.1% of the households had access to potable water points.

In the project area, results from the socio-economic survey indicated that the main source of water for people was the protected springs (36%). Other sources of water include, public boreholes (17.9%), unprotected springs/wells (14.2%), the river (11.6%) rain water harvesting (3.7%) and stand posts (1.3%).

In the proposed area for the reservoir there were several protected springs that were cited and these will be submerged by the reservoir. Figure 6-44 below show some of the water sources in the proposed area for the reservoir.



Figure 6-44: Some of the water sources in the project area

The water is used for domestic purposes like washing, drinking, cooking and bathing among others. Washing is sometimes carried out at the river source (**Figure 6-45**). Apart from domestic use, the other main use of water is watering domestic livestock (56.5%). Other minimal uses are brick making, brewing alcohol, fish farming, watering crops and construction among others.



Figure 6-45: Washing clothes near the water source



Figure 6-46: Typical latrine in the project area

In terms of water reliability and sufficiency, to most households (58.6%) there is sufficient water all the year round. 38.1% said that the water is insufficient throughout the dry season while only 3.2% said that water was insufficient throughout the year.

In terms of access to the nearest water point most households (52.8%) move less than 500m, 35.3% move 500-1km, 11.2% move 1km-3km and only 0.6% move over 3kms to reach the nearest water point. Therefore for most households water is easily within walking distance. GOK (2008) shows that the average distance to the nearest potable water point is 1km. As regards time, majority of the households (50%) spend less than 30 minutes fetching water on a single trip, 42.2% spent between 30 minutes to 1 hour, 7.1% spend 1-2 hours and 0.6% spend over 2 hours fetching water. The low time spent fetching water can be attributed to the proximity of water resources as majority of them are within walking distance for the households.

In terms of problems related to the water sources, long queues and overcrowding especially during the dry season were highlighted.

In terms of water quality, people’s perception of water quality was assessed from four dimensions (**Table 6-23**). That is, taste, color, smell and hardness. Majority of the respondents said that the water was good in terms of taste, color and smell. No responses were reported as regards hardness of the water since households have no experience of hard water.

Table 6-23: Water quality perceptions

Water quality	Good		Average		Poor	
	Count	%	Count	%	Count	%
Taste	372	80.2	85	18.3	7	1.5
Smell	368	79.3	89	19.2	7	1.5
Colour	363	78.2	91	19.6	10	2.2
Hardness	157	33.8	56	12.1	23	5.0

The project should ensure that water quality tests are carried out periodically throughout the project phase so as to measure the levels of contamination of water sources in the project source that could be as a result of the project.

iii) Sanitation

Consultations with the Chief of Bwaliro Sub Location revealed that latrine coverage at the sub location stood at 68%. At Elukongo sub location latrine coverage is 81% (Sub Chief’s Office, 2012). Latrine coverage for Malanga and Sidende sub locations of Nambale district is 100% and 99% respectively (Chief’s Office, Bukhayo East location, 2012).

The results from the socio-economic interviews showed that 95.5% of the households in the project area own latrines and only 4.1% did not. Therefore latrine ownership at household level is quite high. The main type of latrine owned is the pit latrine owned by 83.6% of the households. Other types of latrines include VIP latrines (8.3%), shallow pits (7.2%), ECOSAN (0.7%) and flush toilet (0.2%).

Typical latrine in the project area is shown in Figure 6-46. The households without toilets reported that they use neighbors’ toilets. Lack of money to pay for construction was the main reason for households not having pit latrine. However, some of them indicated they were constructing their own due to persistent reminder by the Chiefs and they had also become the subject of gossip in the village for not having a pit latrine.

In regard to waste disposal, majority of the households (37.7%) have shallow pits, 28.8% scatter in gardens, 16.6% use open dumps and 2% of the households used other methods such as composting and livestock bedding but these are not significant. Only 2.8% indicated that there is public garbage disposal area designated by government or local authority in the area. This is most likely to be at the market centers in the project area.

In general terms the area has poor sanitation facilities and some latrines are dug very close to the water sources exposing these water sources to contamination (**Figure 6-47**).



Figure 6-47: Latrine dug a few meters from R. Nangeni & fish structure made of phragmites

iv) Transport and Communication

The infrastructure in the two districts is relatively well developed. Most roads are earth roads and of gravel nature which are impassable during rainy seasons. The project area is served on the Eastern side by the bitumen Mumias –Nambale-Busia road. The area is also crisscrossed by several murram roads. The networks of rivers have permanent bridges across which can withstand the weight of heavy machinery. Table 6-24 below shows the road network in the districts of Nambale and Butula.

Table 6-24: Road Network in the two districts

Total Km of Road	Tarmac	Gravel	Earth	Other	Total
Butula	6.0	76.0	20.5	0	102.5
Nambale	31.6	89.0	23.9	0	144.5

In the project area, there are several bridges and roads that will be submerged by the river. There is a new bridge that is being constructed in the project area at Malanga –Sidende road. Other existing roads in the project area include that of Lugulu –Namisi road (**Figure 6-48**).



Figure 6-48: Lugulu –Namisi Road and Bridge in the project area

As regards communication, the project area is served by four mobile telephone companies – Safaricom, Airtel, Orange and Telkom. Interviews with household surveys showed that the people access information through the following; radio, places of worship, neighbours, telephones, local leaders and community meetings. The project implementers should consider these channels when disseminating information to the communities.

v) *Energy*

According to the results from the interviews with households in the project area, the main source of energy for cooking is firewood. The (GOK, 2008) report shows 96.2% of the households in Busia with Nambale and Butula inclusive use firewood and 1.6% use charcoal. In regard to energy for lighting, the results showed that majority of the households used paraffin for their lighting energy needs.

Firewood is a scarce commodity in the area despite many households depending on it as a primary source of fuel. In most cases raw stems are cut and dried at home; this has greatly depleted the existence of shrubs, trees and twigs. There is no evidence of woodlots in the area thus local community has to travel a long distance in search of firewood as a source of energy (**Figure 4-49**).



Figure 6-49: Children carrying firewood

As regards electricity, at district level only 3.3% households were connected to electricity in Busia (GOK, 2008). The results from the household survey indicated that only 38.6% of the household indicated the presence of the main power grid in their villages while the majority 61.4% said that there was no electricity grid in their villages. The electricity grid is found in Malanga and Elugulu villages. In regard to individual connection to the main electricity grid, only 10.6% of the households in the project area are connected to the main electricity grid while majority (89.4%) are not connected. The main reasons identified for lack of connection were: most villages are not connected to the grid, and the initial cost of connection is prohibitive for most households. Consultations revealed that it requires upfront payment of Kshs. 35,000 for one to be considered for connection by the Kenya Power and Lighting Company.

6.3.9 *Vulnerable Groups*

Vulnerable people are those persons who bear a substantive risk of suffering physical, social, psychological/mental and emotional harm in comparison with other persons in the similar environment. Examples of such people include Persons with Disabilities, children, women, the elderly and the very poor among others. Like any other person, these groups of people need equal

opportunities such as better education, employment, justice, right to own property among many others.

Household surveys and consultations revealed that in the project area there were vulnerable groups which included female headed households (48.3% %). This is quite a big percentage that could be associated with many social upheavals (death of husbands, divorce etc. Other vulnerable groups included PWDs, elderly headed households the unemployed youth among others. In regard to People with Disabilities, 11.9% of the households had persons with disabilities in their homes. Physical disability was the most common as reported by 60% of the households with persons with disabilities, followed by visual disability (16.4%), mental (14.5%) while other types of disability were reported by 1.1% of the households.

The vulnerable groups face a number of problems which include; heavy workload on women, low participation in decision making, lack of ownership of resources, early marriages for girls, defilement and rape, abuse and neglect of orphans, discrimination against and marginalization of people with disabilities, low incomes and thus high levels of poverty, high levels of illiteracy among others.

Special consideration should be given to the vulnerable groups in all stages of the project. The project should ensure that their already vulnerable situation is not made worse by the project.

6.3.10 Tourism

According to Busia District Environment Action Plan (2009-2013), Busia district has no major tourist attraction activities taking place, though there are potential tourist attraction sites For instance, some of the tourists on their way to Uganda go through the district and use the tourist hotels in the district; there also exists boating at Sio Port; there are important bird areas in Nambale and Yala swamp. Generally Lake Victoria is the main tourist attraction in the district.

6.3.11 Security

The project area is well served by the Kenya Police and the Kenya Administration Police. There is a fully fledged police station at Nambale town. At Elugulu market there is an Administration Police Unit at the Chief's Office. At Malanga market, the Bukhayo East Chiefs camp has an Administration police unit. The area has no known organized criminal or rebel group activities.

However, consultations with the Elugulu Chief revealed that like any other society, there were petty thieves, family conflicts and land conflicts, in the area. The major causes of crime and conflicts in the area include drunkardness, poverty, and land ownership among family members among others.

The Chief and village elders are the institutions that resolve conflicts between individuals or groups. In all cases the Village Headman is the first person to report the case to and to resolve it. The issues he/she cannot resolve are passed on to the respective Sub Chief. The issues beyond the sub chief are referred to the Chief. If the matter is not resolved by the Chief it is referred to the police for court arbitration. In all cases however, the Sub chief and Chief resolve disputes/conflicts with the help of selected elders. Other issues are resolved through a Chief's Baraza (regular Chief's public meeting). As it is, the communities live harmoniously and the potential for conflict in future is highly unlikely.

6.3.12 Gender considerations

6.3.12.1 Ownership and access to resources

Consultations with the women in the project area showed that generally the women do not own land. The household survey also showed only 23.1% of the married women owned land while 76.9% did not own land. The society being largely patrilineal land is mainly owned by the men. When asked whether the women/wives were allowed to make any decisions on issues regarding land, 42.2% said that they did while 57.8% said that the women/wives were not allowed to make decisions. These decisions were mainly in regard to tilling the land and growing crops. According to the **Busia District Development Plan (2008-2012)**, limited access to resources generally puts women at a disadvantageous position since men control resources such as land and other important assets which inconvenienced their female partners, especially when it comes to negotiations for credit facilities to initiate economic activities. Due to the limited ownership and access to resources, women play a very minor role in the decision making process in the area yet over 60% of the agricultural workforce are women.

6.3.12.2 Gainful employment

Few women in the project area are engaged in gainful employment. This is mainly because of low literacy levels and culturally related reasons. Women also rarely attend public barazas convened to make resolutions in local development concerns. Very few women take part in political activities hence leadership is dominated by men. Further still, men dominate most development committees from the district to village level. (Busia District Development Plan 2008-2012).

6.3.12.3 Division of labour

As regards division of labour or gender roles, the women do farming activities and most of the domestic chores like cooking, looking after the children, fetching water, washing clothes, collecting firewood. The children especially the girls help the mothers in most of the activities. On the other hand men are involved in farming, grazing and other activities which generate income like trading, farming, brick making, charcoal burning, fishing, and carpentry among others.

6.3.13 NGOs and CBOs in the area

In Busia district in general there are a number of NGOs and CBOs that operate in the area and these mainly target orphans, HIV/AIDS victims, women, widows, traders and farmers. Table 6-25 below shows some of the NGOs/CBOs in the project area.

Table 6-25: NGOs /CBOs Operating in the Project Area

Name of NGO/CBO	Activities	Target group	Area of operation
Rural Education Economic Enhancement Program (REEP)	Sensitization of the community about HIV/AIDS Home-based care	General community People with HIV/AIDS Children	Butula and Nambale Districts
International Child Service (ICS)	Child Support	Children	
ARDP	Agriculture	Farmers	Butula and Nambale Districts
Musokoto	Improving livelihoods of people		

Most households (56.0%) indicated some of their members belonged to local groups or community based organizations. Going by the names of the groups, all were self-help groups engaged in a variety of tasks geared towards improving their individual and collective situations. The activities range from assisting members accumulate household assets, livestock trade, helping each other during funerals, farming for business, financial support through merry go round and school fees to support members etc. The household surveys showed that there were at least 149 local self-help groups in the project area. Most of the groups or associations were for both men and women, others were for women only and a few were for men only.

6.3.14 Potential conflicts inherent in dealing with natural resources

During consultations, several potential conflicts regarding natural resources were pointed out and these mainly included land wrangles. The major causes of land disputes include land ownership between family members and land boundaries with neighbors.

The main mechanisms for resolving such conflicts include; family members, village elders in ascending order; village headman, Sub Chief and Chief. If the matter is not resolved by the Chief then it is referred to the Police for court arbitration.

6.4 Health and Safety

6.4.1 Health

The communities living in the vicinity of the proposed Maira dam site are mostly rural in character except for a few small trading centres along the main roadways. About 75% of the study population is within 3-4 km of a health centre. This is a favourable situation taking into consideration what is usually encountered in rural Kenya. However, it would 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 and transportation means, as well as 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 perfect in the sense that very little pollution of the air and soil is observed in this rural environment. However there is contamination to water and contaminants include chemical fertilizers and pesticides used for agriculture. Since the agriculture practiced in the area is mostly family size subsistence farming and absence of large commercial agricultural establishments, the level of contamination of the soil and water by these products is likely to be very small. One contaminant that can be regarded as threatening to the local populations is human excreta. Although over 68% of the population have pit latrines, most of this are constructed in area of high water table which makes it easy for the underground water table to be contaminated. In addition few people defecate in sugar fields hence this practice poses a significant risk to the health of the residents. Results from water analysis show high levels of both Total Suspended Particulates (TSP) and Faecal Coliforms (1600 per 100ml of water) an indicator of faecal contamination of the Namanderema and Nangeni rivers by both humans and animals (**Table 6-4**).

The crude birth rate in the project area 42/1000 and Crude death rate is 23/1000. Female life expectancy is 52.7 and male 52.8 years. Infant mortality is 75/1000 and the under 5 mortality is 111/1000 (GOK, 2008). The risk to fall sick is about 89.4% malaria, RTI and diarrhea as the major diseases affecting members in the community.

Morbidity is lowest at around age 15 and this has been taken as a reference point. The relative pressure of morbidity gradually declines from a value of about 8 at birth until the age of 12 to 15 when it starts rising again gradually as individuals advance in age. Male children have a slightly higher pressure of mortality than females. At about 6 years of age, the pressure of morbidity becomes equal between the sexes and soon after establishes itself at higher values for females and remains so for the rest of life.

The results from the interview showed that 89.4% of the households in the project area had a person who had fallen sick in the last 6 months.

6.4.1.1 Health Facility

According to the Busia District Development Plan (2008-2012), by 2008 there were 2 public hospitals, 5 public health centers, 1 private health center, 8 public dispensaries and 1 mission dispensary in Busia District of which Butula and Nambale were part. In addition, there were many partners in Busia District that complemented the activities of the Ministry of health. The services provided by the health facilities were both preventive and curative in nature. In the two districts of Butula and Nambale there was a health center in each sub location apart from Malanga Sub Location which has none. **Table 6-26** below shows the distribution of health centers in the project area.

Table 6-26: Health Centres in the project area

<i>District</i>	<i>Sub location</i>	<i>No of health centres</i>
Butula	Bukwesoo	1
	Elukongo	1
Nambale	Sinende	1
	Malanga	-
<i>Total</i>		<i>3</i>

From household interviews, the health centers are within walking distance for most households (Figure 6-50). Majority of the households walk up to 3km to reach the health centers. At Busia district level, the average distance to the health center is 4km, GOK (2008). However, the distance to the nearest referral hospital /district hospital is over 6km from the household. In fact Busia district hospital is about 25km away from the project area. However, relatively bigger hospitals are at Nambale and Butula as well.

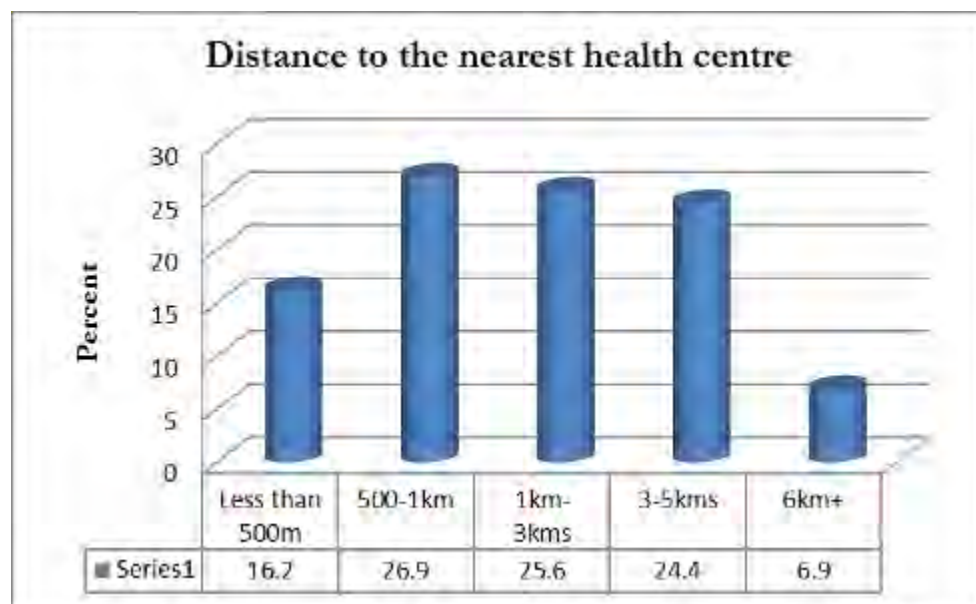


Figure 6-50: Distance to the nearest Health Centre

According to Busia Development Plan (2008-2012), the doctor/population ratio was 1:21,875. This indicates lack of enough doctors for the population.

As regards quality of services, the population in the project perceived the health services at the health centers as very good (33.8%), good (35.1%) and poor (17%). Overall, majority of the respondents favorably rate the quality of services. The reasons for positive evaluation are as follows: Presence of qualified, adequate doctors and nurses, presence of enough medicine and availability of

a laboratory. Reasons for poor services included; lack of enough medicine, lack of enough doctors and nurses and lack of adequate equipment.

6.4.1.2 Existing Health Status of the Population

The current public health situation in the project area (Maira) has been described by using information from general secondary data, household interviews and information for the month of April 2012 collected from one sub Division of Lwanyange in Nambale District (Table 6-27)

Table 6-27: Summary of Community Health Status

Item	Indicator	Number
1	Number of households	923
2	Total population	4,616
3	Total women 15-49 years	848
4	Total children 0-6 months	40
5	Total children under one year old	112
6	Total children under five years old	564
7	Adolescent and youth – Girls 13-24 years	444
8	Adolescent and youth – Boys 13-24 years	420
9	Total population of the elderly – 60+ years	482
10	households not treating water	125
11	households not using ITN	101
12	households without hand washing facilities e.g. leaky tins in use	555
13	without functional latrines	43
14	Total pregnant women	33
15	Number of pregnant women who did not attend at least 4+ ANC visits	09
16	pregnant women referred	05
17	pregnancies under 18 years	08
18	deliveries by unskilled attendants	03
19	Number of births	05
20	Number of newborns referred	05
21	women (15 -19 years) provided with FP commodities	147
22	children not fully immunized	18
23	children less than 5 years not supplemented with vitamin A	24
24	immunization defaulters traced	11
25	children not de-wormed	20
26	children <6 months not exclusively breast fed	09
27	severe malnutrition cases referred	01
28	moderate malnutrition cases referred	01
29	fever cases managed	04
30	diarrhea cases managed	0

Item	Indicator	Number
31	injuries and wounds managed	03
32	Total number of cases referred	06
33	people with chronic illnesses or cough for more than 2 weeks referred	20
34	people who do not know their HIV status	805
35	elderly persons who had routine check ups	16
36	Number of dialogue days	01
37	Number of community action days	01
38	Number of meetings with CHCs	02
39	Number of death, persons <1 year	0
	Number of deaths, persons <1-5 years	0
	Number of deaths, Maternal	0
	Number of deaths, other deaths	02
40	Number of households without staple food	40
41	Number of households without the package of IEC materials	03
42	Number of school drop outs (male)	164
	Number of school drop outs (female)	169

The information in the table above was generalized for the entire project and used together with household survey as a basis for the assessment of the health situation described briefly in the sections that follow.

a) *The disease Burden*

Results of interviews indicated that the major diseases affecting the household members are malaria suffered by 49.4% of the households, cough 13.4% and water related diseases. The GOK (2008) reported that malaria, RTI and diarrhea were the most prevalent diseases in the area.

Figure 6-51: Common diseases in the project area below shows the most common diseases suffered by households in the project area as per the results of the household survey.

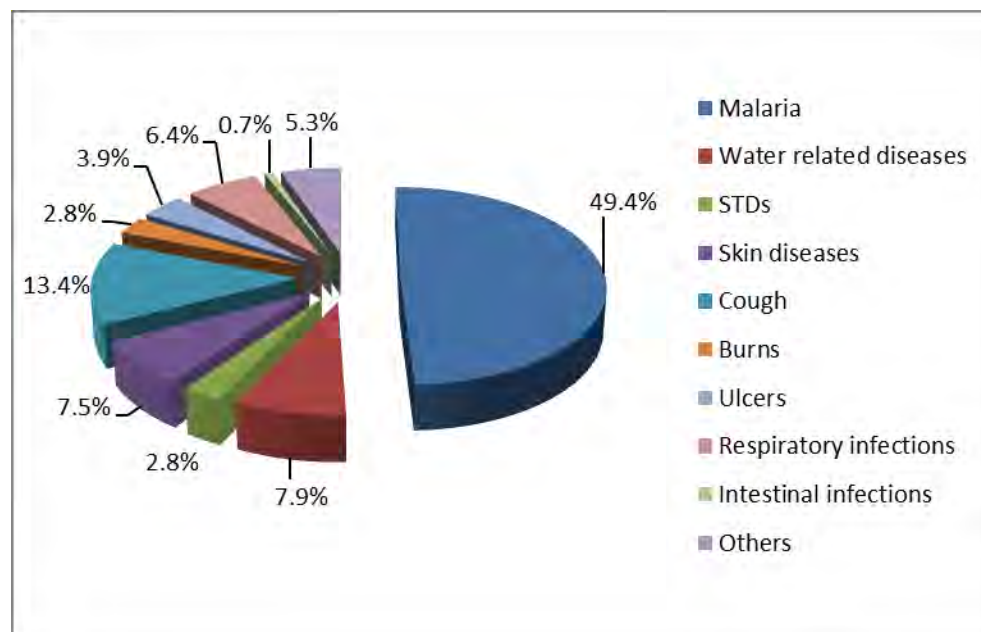


Figure 6-51: Common diseases in the project area

In general, terms the major disease burden includes: Malaria, Upper Respiratory Tract Infections (URTI), and Diarrhea especially among children, TB, Yellow fever, Cholera, Skin infections, Eye infections, and AIDS, Asthma, Dysentery, and worm infestations among children. The health programmes need to address these diseases.

i) Malaria

The health survey reveals that malaria is by far the greatest problem of concern in the project area. Overall infection rate is estimated at 51.1% with no significant difference between the females and the males. The female infection rate is 50.9% while for males it is 51.2%. This confirms the experience and concern in the areas that malaria is the greatest killer especially for children below the age of five years. The possible reason is that children are less immune to malaria than adults who have had enough time to develop it. Furthermore children are more exposed to the mosquito bites than the adults owing to poverty in which more adults have cover against mosquitoes than the children as shown by the social survey. The beddings for a child are usually just a papyrus mat and no more. This indicates the need to emphasize programmes for control of malaria particularly focused on ensuring the survival of children.

As mentioned above, the result from analysis of district data for malaria gives infection rate of 51%. This is a high infection rate for a random sample of the population. Experience in dam development projects elsewhere indicates that a 75% increase in the malaria arises as a result of creation of reservoir. This could happen even in the Maira project posing a significant potential danger that needs to be addressed. Mosquito nets should be given out to the communities by the project.

ii) HIV/AIDS and STDs

According to Busia Development Plan (2008-2012), the HIV/AIDS prevalence rate in Busia District was 7.4%, which is above the 5.4% national average. It was higher in the female population (9%) as compared to the male population (5.9%). This situation is created by the communities' attitude to sex as was highlighted by community members and shown below;

- That sex is as “normal as breathing”
- Girls 12 years of are marriage material and have slept with someone older.
- Polygamy is common with approximately 50 % of females are living in polygamous relations
- Re-marrying is also common.

In Kenya and in the project area in particular, HIV/AIDS still carries some stigma and this appears to influence even the frequency with which this is reported in the clinic records.

As regards households' knowledge about HIV/AIDS in the project area, 97.4% were aware of HIV/AIDS. The following methods of getting infected with HIV/AIDS were given by the households in the project area, having unprotected sex with an infected person, prostitution while others indicated unsafe blood transfusion. Furthermore 51.9% knew of some other person who had publicly declared he/she was HIV/AIDS positive. Overall, the people had the appropriate knowledge of how HIV/AIDS can be contracted.

iii) Nutritional related

There are few cases of malnutrition with this more frequently diagnosed in under-five children as expected. The household food consumption was recorded during the socioeconomic survey and indicated that 80% of 464 households showed that did not have enough to eat because reasons low production caused by land scarcity, prolonged drought, low soil fertility, pests and diseases. Thus, the area is generally food insecure and hence emerging food deficiency diseases.

iv) Water related Diseases

The following is a brief description of the genesis (characteristics, causes and incidences) of prevalence of these diseases in the project area. The water-related diseases will be classified into five epidemiological groups.

Waterborne infections: The areas surrounding the Maira project area do not have adequate portable water and as such experience waterborne infections spread through the oral-faecal route and these include; the bacterial diseases (typhoid fever, cholera and bacillary dysentery), viral diseases (polio and infective hepatitis). In this category faeces of an infected individual(s) come into contact with the water supply (source) and thus affect a large number of people. Since these infections are characterized by diarrhea, they are classified as diarrheal diseases. Diarrheal diseases were observed in the current medical records (Table...and Table...) and were found to be common in the project area predominantly affecting infants and small children. This emphasizes the poor access to safe water sources by the rural populations and inadequate toilet habits. Only 53.9 % have safe water

points leaving the rest of the population in the project area to unsafe sources ((unprotected springs or stream). The results from the socio-economic interviews showed that Therefore latrine ownership at household level is quite high. The main type of latrine owned is the pit latrine owned by 83.6% of the households. Other types of latrines include VIP latrines (8.3%), shallow pits (7.2%), ECOSAN (0.7%) and flush toilet (0.2%).

In terms of sanitation facilities, 95.5% of the households in the project area own latrines and only 4.1% did not. However, it was not made clear on the usage of these facilities. Per observation even those who own pit latrines appeared not to effectively use them due to cultural norms hence using the bushes for defecation

Water washed diseases: As emphasized above, the water supply for domestic consumption in the project area is inadequate and this creates conditions for water washed diseases. Water washed diseases are those due to lack of enough water for personal hygiene. Examples in this group are skin diseases particularly scabies and trachoma. In the project area, women and children have to walk some distances to the river and springs in search of water for the household; consequently there is never enough water in the household for personal hygiene. Skin diseases were reported by those parsons interviewed.

Water based diseases: This is the class of diseases of most concern to the project areas. Water based diseases are those where the intermediate host lives in infected waters. Examples are schistosomiasis (*bilharziasis*) and Guinea worm (*Dracunculosis*). The intermediate hosts (vectors) of schistosomiasis are aquatic snails belonging to the gastropods class which breed in ponds, lakes, streams, marshes, swamps, drains, dams and irrigation canals. Human beings acquire the infection during bathing, swimming, fishing, cultivating, wading and washing in infected water. For farmers and fishermen it is an occupational disease. In the project area, there exists potential for various intermediate host snails involved in transmission patterns and the wide range of man water contact activities. The two types of schistosomiasis, urinary and intestinal, are very debilitating and very expensive to treat. They should be prevented.

The intermediate host responsible for transmitting the guinea worm (*Dracunculosis*) is a water-flea (cyclops) which lives only in stagnant water. The water in shallow ponds and wells being stagnant with a high organic content favours the presence of the vector species of cyclops. Man becomes infected by drinking water containing infected cyclops.

Water arthropod diseases: Water-arthropod diseases are those diseases in which the arthropod vectors responsible for transmitting the diseases breed in water. Examples are Malaria and *Onchocerciasis* (river blindness). Malaria is a protozoal disease of wide distribution in the project area caused by sporozoa of the genus plasmodium. The arthropod hosts are females of certain species of Anopheles mosquito. Malaria has had far reaching consequences and is the leading cause of mortality in the project area. Onchocerciasis on the other hand is an infection caused by a nematode *Ochocerca volvulus* which exists in the project area. The intermediate host *Simulium damnosum* or naevi (blackfly) breeds in fast-running well oxygenated streams - where the larvae and pupae are found attached to submerged vegetation and stones. It is a very debilitating condition characterized by the

development of skin changes, subcutaneous nodules and ocular lesions which often lead to blindness.

v) Diseases associated with Atmospheric (Air) Pollution: Currently, the area is not polluted to unacceptable levels. However it should be noted that there are a number of human, disease patterns (such as upper respiratory tract infections) that are a consequence of either direct or indirect air pollution. While industries are the main source of this type of pollution, other significant sources include fossil fuel combustion, as well the burning of wood and crop residues to provide energy. All these activities take place in the project area environs, thus making it the medium for the transmission of diseases arising from air pollution. During construction pollutant diseases are likely to increase in magnitude and intensity during the implementation of project activities. These will be analyzed in the next stage of the project impact analysis. Pollution sources are described below.

- ***Pollution from energy sources:***

As source of energy and heating, a large percentage of the population in rural areas use cheap fuels which have been associated with high health risks and pollution of the domestic environment. Daily cooking, the most energy intensive activity is done with unprocessed bio fuels, which are wood, charcoal, dung and crop residues. Wood fuels are a popular source of energy because they are cheap for urban dwellers and easily available in rural settings. Combustion of wood fuels emit gases like sulphur dioxide, nitrogen oxides, polyaromatic hydrocarbon hydrocarbons and carbon monoxide, all of which have deleterious effect on human health. The commonly used cheap fuels are associated with more toxic emissions and discomfort.

Carbon monoxide gas for example has a strong affinity for haemoglobin in blood. Once absorbed by the lung it reduces the oxygen carrying capacity of blood. Other effects include mental function impairment, effects on foetal development and aggravation of cardiovascular diseases. Acute exposure to hydrocarbons on the other hand, causes eye, nose and throat irritation. Chronic exposure is suspected of causing cancer. Then, Nitrogen Oxides (NO₂) has been associated with respiratory tract diseases especially among children and aggravating emphysema and other lung diseases.

Sulphur dioxide (SO₂) is also a mild respiratory irritant. It aggravates respiratory diseases including asthma, chronic bronchitis and emphysema. It reduces lung function, irritates eyes and is associated with mortality increase.

Owing to the poor quality of houses, particularly as a result of poor ventilation especially in the project area as in any other rural areas and urban slums, the gases emitted by the wood fuels tend to concentrate indoors and affect the occupants especially the women who do the cooking. Infants and young children, a group particularly subject to life threatening respiratory diseases also often spend time in smoky conditions when their mothers are preparing food. Respiratory diseases, especially acute respiratory infections are therefore among the chief causes of mortality and morbidity in the area as shown by the preliminary social survey. The effect of poorly ventilated houses and unprocessed biofuels is compounded by overcrowding especially among trading centre - slum dwellers - in urbanised areas and in refugee camps. Overcrowding, lack of ventilation and poor air quality aggravate spread of Pulmonary Tuberculosis and droplets spray, droplets nuclei and dust.

- Pollution from vehicular traffic:

Still in the category of diseases due to air pollution are those arising from vehicular traffic which, emit carbon monoxide, hydrocarbons, oxides of sulphur and other gases into the air. The project will increase the vehicular movement in the area. The situation is worsened by the fact that a lot of leaded petrol is still available in this country. As a result lead is also emitted with other exhaust gases into the atmosphere. Yet children are particularly sensitive to the effects of lead in the environment with most of the effects felt on their central nervous systems. Lead effects include impairment of intellectual performance, difficulty in concentrating and behavioural disorders. The extent to which the project area children will be affected is unknown.

- Pollution from smoking tobacco:

Tobacco smoking, a social habits can have serious negative impacts on health. Smoking, for example, does not only pollute the air; but it causes development of many disorders of public health. This is because smoke emitted into the environment from cigarettes, pipes and cigars contains the same wide range of potentially toxic compounds that are known to be present in smoke that is inhaled directly by the smoker. The toxic substances number over eighty (80) and include hydrogen cyanide, carbon monoxide, methylene dichloride, acetone, acrolein, aldehydes, arsenic, cadmium, nickel, formaldehyde, methyl nitrite, nitrogen dioxide, phenol, polycyclic compound, tars and nicotine. These compounds are present in the air in workplaces, homes and public places wherever cigarettes are smoked; and are also absorbed by non-smokers; among whom they have been established as disease causing agents as well.

Irritation of the eyes and upper respiratory tract as a consequence of exposure to others' cigarette smoke is a relatively common occurrence. No studies have been carried on the effects of both smoking and passive smoking on the health of persons in the project area populations. However, but from work done elsewhere the following observations have been made. There is an increase in risk of lung cancer, e.g. non-smokers who are married to smokers have an increased risk of lung cancer compared with those whose spouses do not smoke. There is also an increased risk of heart diseases, cancer of cervix and respiratory tract symptoms among passive smokers. An association has been observed between exposure of the mother during pregnancy to other people's cigarettes smoke and lowered birth weight.

- Noise pollution:

At the time of this study, the main source of pollution was from traffic mainly in trading centres and road ways in the project area. There are industrial plants in the area and besides if they were the noise associated is usually confined to the plant and the effects are mainly occupational, though populations living near may be slightly get affected, The dam project may generate noise originating from cranes, hoisting equipment, concrete mixers, tractors, bulldozing equipment and delivery vehicles. Construction activities are taking place almost everywhere, more so in the intensive activity involved in this project. In addition vehicular noises originating from the exhaust system, tyres, engines and other special features may increase. The other source of noise pollution will include civil works and vehicular movement during dam construction.

b) Provision of Health Care Services

The health care sector aims to provide curative, preventive, rehabilitative and promotion services with the objective of reducing morbidity and mortality and to improve the health of the people of the area. In the project area there is a strong effort to provide both curative and preventive health services. This includes; outpatient service, laboratory services, Immunization, Family Planning, Antenatal, Maternity, and Maternal Child Health services. However, owing to inadequate funding, the efforts have not yielded enough health. Health care services in the project areas are inadequate.

In regard to health services, Maira project area is has health service staff shortage. For example Nambale district with 102,008 households of about 5 to 6 persons has one clinical officer, 7 nurses for a population of 400,000. In Maira, there are two nurses to 12,000 persons (i.e. a nurse population ratio of 1:6,000. This is dismal compared to the WHO ratio 1:800!). The only hospital in the radius of 25 Km is the Busia District Hospital. The other accessible health care facilities are lower and include health centres at Lwanyange and Malanga. These too suffer from shortages of drugs. The health centres therefore prescribe treatment and the persons buy the drugs from drug shops. There are two drug shops/chemists in the area of Nambale Health Centre.

Most of the ill-health among the rural population arises from preventable causes. Conditions which favour disease transmission are in evidence in the project area. These include disease agents, susceptible hosts and conducive environments (physical, socio-economic and biological). Sanitary control measures in the area are inadequate and this has resulted into poor control of pathogens, toxins, disease vectors, infection reservoirs as well as unpleasant physical and chemical agents. This is due to inadequate funding leading to scantily funded public health programmes. As a result water related diseases, food borne diseases, airborne diseases, and vector borne diseases are pronounced and are causing significant mortality, morbidity and economic loss. Provision of adequate and safe water supplies, proper disposal of refuse, excreta and waste, health education, control of disease vectors, improvement of housing and improvement of food hygiene are few of the measures which would go a long way to prevent the spread of communicable diseases and improve the health and well-being of the communities generally.

The provision of health services is urban biased - that is urban facilities are better equipped and manned by more qualified personnel and yet 56% of the population in Kenya reside in rural areas and have more health problems. Owing to the poor infrastructure long distances have to be walked to the nearest health facility.

The prospects in improving the situation are poor. The population is increasing without a corresponding economic growth and so the health facilities are over stretched and are busy with new epidemics such as HIV/AIDS and other preventable communicable diseases.

6.4.1.3 Occupational Safety

This project will be associated with the implementation of activities which will result into an increased use of various types of equipment e.g. vehicle, earth moving equipment, blasting, and

excavation, digging and scraping machines. In case the dam wall require being casted with concrete, it will be necessary to employ with high or long-reach cranes capable of depositing masonry, shuttering, reinforcing and concrete in the right places. A continuous supply of good-quality concrete will be necessary, and a concrete-mixing plant will be necessary alongside the dam workings, with the concrete either handled in batches by crane or pumped to the job. All these will be operated by personnel and have a high propensity to cause injury or death to workers. According to ILO, of all trades and business, construction work is the most risky for workers. Detailed analysis of impacts will have to be analyzed.

6.5 Archeology and culture

The project is located in and Western Kenya with multilingual dialects but homogenically connected by speaking the Swahili. There are three district social ethnic groups namely; Luhya - ***Bakhayo and Marachi sub clans*** (93.1%) the Luo ((4.3%) and the Itesot at (2.0%). The Bakhayo are neighbours to the the Samia, Marachi, Wanga and Bukusu and by the Teso, a non-Luhya Nilotic people. The Khayo refer to themselves as *Bakhayo*, their Luhya dialect as *Lukhayo* and their land Bukhayo. Bukhayo is divided into East, West and Central Bukhayo locations with Nambale, Matayos, Busibwabo, Mungatsi and Mabunge as their significant trade centers. The migration of the Baluhya to their present Luhya- land (endearment term of referring to the Luhya's primary place of settlement in Kenya) dates back to as early as the 1450s; the time the Bantu expansion were expanding to acquire new territory. The Luhya trace their ancestry with other tribal groups such as the Tutsi (who called their king 'Mwami,' just as the Maragoli do) and to other Nilotic peoples like the Kalenjin, Luo, and Maasai. By 1850, migration into Luhya-land was largely complete, and only minor internal movements occurred after that due to disease, droughts, domestic conflicts and the effects of British colonialism.

They inhabitants of the project area all practice crop farming although the Itesot do some cattle keeping. The culture of these tribes is characterized mainly by songs, poetry, the dance, stories and legends. Songs and dances are a common phenomenon during community functions such as weddings, burial and other rites

The majority of tribes subscribe to Christian at 96.0% (protestant -57.8% and Catholic -38.1%) while about (1.5%) practice Islam. The African traditional and other non-believers have negligible proportion.

6.5.1 Culture heritage and Social Setting

Luhya have more or less a culture more or less similarity to the Bantu . Polygamy was a common practice in the past but today, it is only practiced by few people, usually by men marrying under traditional African norms or Islamic beliefs. About 10 to 15 families traditionally made up a village, headed by a village headman (*Omukasa*). Oweliguru is a post-colonial title for a village leader coined from the English word "Crew." Within a family, the man of the home was the ultimate authority, followed by his first-born son. In a polygamous family, the first wife held the most prestigious position among women. The first-born son of the first wife was usually the main heir to his father,

even if he happened to be younger than his half-brothers from his father's other wives. Daughters had no permanent position in Luhya families as they would eventually become other men's wives. They did not inherit property, and were excluded from decision-making meetings within the family. Today, girls are allowed to inherit property, in accordance with Kenyan law.

Children are named after the clan's ancestors, or after their grandparents, or after events or the weather. The paternal grandparents take precedence, so that the first-born son will usually be named after his paternal grandfather (Kuka or 'Guga' in Maragoli) while the first-born daughter will be named after her paternal grandmother ('Kukhu' or 'Guku' in Maragoli.)

The Luhya have elaborate customs surrounding death making this a great celebration at the home of the deceased, with mourning lasting up to forty days. If the deceased was a wealthy or influential man, a big tree would be uprooted and the deceased would be buried there, after the burial another tree *Mutoto*, *Mukhuu* or *Mukumu* would be planted (This was a sacred tree and is found along most Luhya migration paths it could only be planted By a righteous Lady mostly Virgin or a Very Old Lady). Todate, mourning takes shorter periods of time (about one week) and the celebrations are held at the time of burial. "Obukoko" and "Lisabo" are post burial ceremonies held to complete mourning rites.

Animal sacrifices were also traditionally practiced. There was great fear of the "Abalosi" or "Avaloji"(witches) and "Babini" (wizards). These were "night-runners" who prowled in the nude running from one house to another casting spells.

Most modern day Luhyas are Christians and for some, (if not all), the word for God is Nyasaye or Nyasae.

6.5.2 *Cultural Heritage and the Law*

Culture is recognized in the *Constitution of Kenya* as the foundation of the nation and as the cumulative civilization of the Kenyan people and nation. The State is enjoined to promote all forms of national and cultural expression, recognize the role of science and indigenous technologies in the development of the nation, and promote the intellectual property rights of the people of Kenya.

Article 44 of the Constitution provides for the right to language and culture. Every person has the right to use the language and to participate in the cultural life of the person's choice. A community has the right to enjoy their culture and language; and to form, join and maintain cultural and linguistic associations and other organs of civil society. Issues of culture have to be taken into account during an EIA in order to address the impacts of the proposed development on the communities concerned. In addition the *National Museums and Heritage Act, 2006 (Cap 216)* provides for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya. The National Museums of Kenya (NMK) is established under the Act with the functions of serving as national repositories for things of scientific, cultural, technological and human interest; serving as places where research and dissemination of knowledge in all fields of scientific, cultural, technological and human interest may be undertaken; identifying, protecting, conserving and transmitting the cultural and natural heritage of Kenya; and promoting cultural resources in the

context of social and economic development. NMK is authorized to undertake EIAs subject to the provisions of the Environment Management and Co-ordination Act. It is the lead agency in respect to matters of heritage. The Act extends to heritage including monuments, antiquities and shipwrecks in lakes and waters within Kenya, or on the seabed within the territorial waters of Kenya.

6.5.3 Archaeological findings

A number of sites with archeological artifacts were identified and these are located in different parts of the project area as indicated in Figure 6-52. This is located in the sugar cane plantation 70m off the road at GPS 36N 0644974, 0047845, Elevation 1175m. The artifacts found here was characterized by four pottery shards (KPR) which was exposed by excavating the site



Figure 6-52: Artefacts characterized by pottery shards



Figure 6-53: Graves in sugarcane or pottery scatters

Within the project area, it was noted that there were homes some of which had, graves like at the home of Othieno Ojwanje, where six graves were recorded in the sugarcane plantations located at GPS 36N 0645220, 0047548 , Elevation 1195m (Figure 6-53).At Gps location; 36N 0647334, 0046118, Elevation 1196m, the survey team recorded another archaeological site characterized by pottery scatters.The team also noted the presence of traditional medicinal plants mostly belonging to *erythrina abyssinica* species (Epypyte-Tapinanthus).The local people noted that they normally get the back of the tree for medicinal use. In most of the areas surveyed, it was noted that most local trees left in the gardens have traditional or economic values. This particular site is characterized by two trees and has a tree which has grown on top of the two trees making it special and traditionally valued located at GPS 36N 0847397,0045963, Elevation 1198m (**Figure 6-54**). Another traditional tree of the same type was found at 36N 0647894 0044983, Elevation 1200m. Iron smelting site at GPS N 0646988, 0045067, Elevation 1212m was also recorded during the field excise. The site was evidenced by pieces of iron slag scatters along a village road and gardens at the above location (**Figure 6-55**).



Figure 6-54: Traditional medicinal tree



Figure 6-55: Iron smelting site characterised by iron slag scatters

Downstream at Emakina Village, a significant mixed site of Historical, Archeological, and religious importance was recorded. The site is characterized by rock shelters, currently used as prayer places by the local people (Figure 4-57). It has been used since the 1980s up to now. The area has lots of pottery, bones and pieces of iron slag, smoking pipes scattered over a wide place. The site is located at GPS 36N 0644782, 0050174, Elevation 1235.



Figure 6-56: Rock shelter at Emakina

7 EVALUATION OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

Environmental impact can be defined as; any alteration in the physical, chemical and biological properties of the environment caused by any type of matter or energy resulting from human activities that directly or indirectly affect the health, safety, and wellbeing of the population, social and economic activities, the biota, the aesthetic and sanitary conditions of the environment and the quality of the environmental resources.

This phase involves detailed assessment to evaluate the magnitude, duration, significance and probability of occurrence (*see impact assessment methodology in section 1.3.2*) of the identified potential environmental impacts. Mitigation measures have been proposed to mitigate negative impacts and enhance positive impacts. However mitigation measures will not be proposed for those overall impacts which are Low negative except if it is in a sensitive area or sensitive issue. Findings have also been used in the development of an Environmental and Social Management Plan (ESMP) to guide construction and operation of the proposed project. The ESMP will contain mitigation plan and monitoring programme against which performance can be monitored.

7.1 Positive Impacts of the action

7.1.1 Preparations Phase/Planning

✓ Creation of employment

The positive impacts associated with this phase include job opportunities for a few community members. During planning of Maia dam, there may be some jobs for casual laborers, translators and data enumerators being hired during the study phase of the project. Already 15 Research Assistants participated in socio-economic surveys. Others will be required during detailed RAP preparation etc. However, only a small number of people will be employed during this phase as compared to the many that need jobs, this opportunity will also be for a short period thus the magnitude of impact is regarded as **Low Positive**

7.1.2 Construction Phase

7.1.2.1 Socio- economic

✓ Increased employment opportunities

During construction, employment opportunities are anticipated to be available to the local communities for both men and women. However, with limited education, majority (54.4%) of the

people in the project area having attained formal primary level of education, the only jobs available will be to provide unskilled labour such as clearing the site, digging among others. The women will benefit mainly through cooking, cleaning the workers' camps'. It is expected that number of the project affected people will probably be able to get temporary employment during construction and a few may be eligible for permanent positions during the operational phase. It is expected that casual labourers will be recruited locally. Due to the temporary nature of the wage labour and relatively limited number of permanent positions the magnitude of the impact is considered to be **Low positive**.

Enhancement of positive impacts

- Sensitization of communities and information dissemination on the existing job opportunities in the project area.
- Priority should be given to local labour from the project area.

✓ **Increase in income**

Dam construction will provide trading opportunities to the local people. Farm produce, food stuffs and other basic goods will be sold to construction workers. In addition, local people who own rental units in Nambale and Trading Centers close to Maira will benefit through renting the premises to the project workers. Employment in the project will also be a source of income. All this will contribute to improved incomes and the general wellbeing of the local community. Although construction will take a short period and employment accessed by few, the multiplier effect resulting from activities indicated above will increase incomes of many people in the project area. The magnitude of this impact is therefore expected to be **Medium positive**.

Enhancement of positive impacts

- Sensitization of communities and dissemination of information about existing opportunities in the project.
- Conduct basic training and skill development for entrepreneurship

✓ **Skills development**

Those who will have the opportunity to work with the project during the construction phase, particularly the unskilled and semi-skilled, will get exposure and hence an opportunity for skill development. The unskilled are likely to be upgraded to semi-skilled while the semi-skilled will be exposed to better techniques and work methodologies. Improved skills are always beneficial as they result into more income opportunities for the holder. This impact is evaluated **high positive** because its effects may be long lasting and transcending generations.

Enhancement of positive impacts

- The contractor should provide an enabling environment for the workers to upgrade

their skills.

✓ **Improvement of vulnerable groups' livelihoods and welfare**

Guided by the World Bank policies, the project may help to improve livelihoods and welfare of vulnerable people through both direct and indirect employment opportunities. Focus will be on livelihood restoration program for PAPs specifically the vulnerable people e.g. women. Women's clubs will serve as platform where such people can network, learn, support each other, and undertake both group and individual income earning activities. The magnitude of this impact is expected to be **medium positive**; this is because a small number of women may benefit from the project.

✓ **Improved access roads**

There will need for the project to improve on the existing access roads to the site which will highly benefit the local community and the surrounding areas. For example Malanga –Sidende road is not wide enough to handle heavy equipment that will be used thus will require widening and maintenance. Improvement of the access roads would improve the transportation of agricultural goods especially sugarcane which is widely grown by people in the project area. With improved transportation, there will be enhanced opportunities for markets, access to social services and more trading centers may emerge in the area thereby leading to further development of the area. However it is expected that only a few access roads will be improved like Malanga –Sidende road and a few more accesses to material sources. Although the impact is long term it will benefit a few people as only a few access roads may be improved. Therefore the magnitude of this impact will be **Medium positive**.

Enhancement of the impact

Regular maintenance of the roads

7.1.3 *Operation and maintenance / Post construction stage*

7.1.3.1 *Physical Environment*

✓ **Control of flooding**

Construction of the reservoir at Maira will control floods that are presently a problem in Kisoko and other downstream areas. During the wet season, the downstream communities get affected by floods which sometimes destroy crops and other properties in the valley. With a dam in place, these floods will be controlled. This will therefore be a positive impact and contribute to climate change mitigation. This impact is long-term, and it will benefit a fairly large part of Sio valley downstream of Namanderema thus the magnitude of impact has been estimated as **Medium positive**.

✓ **Improved ground water recharge**

The creation of the reservoir leads to increased percolation of water to deeper levels resulting in localized increase in groundwater level and consequently overall quantity especially upstream of the dam. This will enhance recharge to groundwater which is desired since the area generally dries up during the dry season. The impact is long term although it covers a relatively small area, only areas around the reservoir hence evaluated as **Medium positive**

7.1.3.2 Biological Environment

The creation of a reservoir will change habitats significantly. The microclimate will be more amenable. The dam will ensure sustainable water supply hence creating conducive environment for water loving animals such as birds, reptiles, fish, insects and other aquatic organisms.

✓ **Creation of Wetlands**

A small strip of wetlands is likely to be created around the reservoir as a result of permanent water body which encourages growth of aquatic plants. This may start small but will increase with time. Such habitat may provide breeding sites, for fauna like fish; birds etc. and provide other wetland services. The impact is expected to be localized but long term, thus will be **Medium positive**.

✓ **Impact on Water Birds**

As recorded in the baseline some birds such as Grey-crowned Crane is globally threatened and endangered. The creation of the reservoir and the aquatic environment formed especially the reservoir edge vegetation will be beneficial to crane. The crested crane typically nests within or on the edges of wetlands and forages in the wetlands, nearby grasslands and croplands. Nesting usually occurs in wetlands where the vegetation is significantly high to conceal the bird and their nests. In addition, improved aquatic environment will benefit other water bird specialist species like Purple heron (*Ardea pupuea*) and Pied Kingfisher (*Ceryle rudis*) and non-water bird specialist species like African Pied wagtail (*Motacilla aguimp*) identified in the area some of which may congregate at the dam. The congregation of the birds at the dam is likely to be an attraction for visitors and the dam can hence be used as an ecotourism facility. The magnitude of the impact on water birds is generally considered to be **Medium positive**.

✓ **Impact on Hippopotamus and Nile crocodile**

The baseline information indicates presence of hippopotamus and Crocodile downstream as the river Sio approaches Lake Vitoria. However, Hippos use large section of the river and birth of young coincides with the periods when there are high amounts of water in the peak rainfall (October and April). The project will increase the amount of water in the reservoir but the hippo and crocodile

chance to move northwards to this reservoir may be limited thus the impact of the project on the breeding activities of the vulnerable hippo is **low-positive or negligible**.

Creation of suitable habitats for Fish, Amphibians and dragonflies

When the dam is operational, there will be more and permanent water. The wetlands surrounding the new dam will also be ideal habitats for littoral biota including fish, invertebrates and plankton. Amphibians and fish will thus thrive better in the new ecosystem. Such species keep the ecosystem balance and none of these animals is globally threatened, near threatened or vulnerable. Thus the impact of the project activities on all the animals is **Medium positive**.

7.1.3.3 Socio- economic

✓ **Improved water supply and sanitation**

The baseline findings indicated that about 25.8% fetch water from unprotected sources. One of the purposes of Maira multipurpose dam is to provide and improve water supply in the area and this will enable more households to access safe water if proper infrastructure is put in place.

Furthermore, the sanitation in the area will be improved further through hygiene improvement as there will be enough water to use. The magnitude of the impact regarding water supply and improvement of hygiene is expected to be **Medium positive** because its extent is expected to be large and is long-term.

Enhancement measure

- Water supply systems put in place should be regularly maintained.
- Proper management of water system should be put in place.
- Continuous sensitization of the communities in regard to use and maintenance of the facilities will be required at all levels.

✓ **Boost to Tourism and Recreation**

The Development of reservoir at Maira may bring about several recreational activities that have potential for tourism development. These activities may include among others; scenery viewing, canoeing, spot fishing and other forms of boating, tourist hotels, camping grounds, picnic grounds, sports such as volley ball and swimming. In addition, to water based attractions, the irrigation schemes in the area could attract visitors including students on study tours. Though secondary, this has a positive socio-economic impact on people living in the area as it creates job opportunities and other income generation ventures for the local people in the project area (Butula and Nambale Districts and the region in general). The magnitude of this impact expected to **Medium positive**.

✓ **Provision of employment**

During the operation and maintenance phase, a few employment opportunities will be available such as clearing of bushes around the dam site, maintenance of the fence, desilting the dam and provision of security for the dam among others. Although the people that will benefit from this impact will be directly employed over a long period of time, only a small number will be employed on this project.

However, the reservoir will have a multiplier effects where by people will also be employed indirectly in the activities that may result from the reservoir like fish farming, and crop farming that will be boosted by irrigation and constant availability of water etc. This impact will be long term and therefore described as **Medium positive**.

✓ **Skills enhancement**

From long term employment opportunities will be provided in dam construction, construction and maintenance of irrigation canals, reservoir fisheries, construction and maintenance of water supply system. Better farming and farm management skills using irrigation are likely to be developed and enhanced. This is a long term impact which may be adopted by quite a big number of people hence accorded a magnitude of **high positive**.

✓ **Generation of Hydropower**

The proposed Maira multipurpose dam has several potential benefits to the community of which generation of electricity is among. The generated electricity will improve the power supply in the region and could be used for domestic lighting, water supply through pumping and small scale industries which would create job opportunities for the local people. Although Electricity generation from this dam is a long term it may not generate enough to meet peoples demand hence evaluated as **Medium positive**.

Enhancement measure

- The electricity power tariff and connection fees should be subsidized to enable many people to access it.

✓ **Improved agricultural productivity**

One of the key priorities uses of the proposed Maira dam is irrigation with the intent increasing yields all year round. Presently there are 5 sub schemes proposed under Lower Sio Irrigation Scheme downstream of the proposed Maira dam that will benefit from this reservoir. It is anticipated that farmers the lower Sio and as well as Maira will be able to increase crop production through irrigation and hence improved incomes. In addition, land that is currently considered infertile will be utilized to grow a variety of crops under proper and organized irrigation sytems. This may greatly improve on the problem of food insecurity currently experienced in the area and people's incomes will be enhanced through sales of surplus farm produce. The magnitude of the impact is expected be **High positive** as it is long term, and it will benefit quite a number of people in the proposed irrigation schemes in the Sio valley.

Enhancement of positive impacts

- Government should endeavor to put in place infrastructure to facilitate irrigation
- Capacity building of the local people in proper irrigation methods.

✓ **Increased potential for fish farming and fisheries**

The creation of additional water bodies would have a positive effect by significantly increasing a fishery potential in the area. The baseline findings indicated that only 3% of the households practiced fish farming and a few of the households who do fishing in the Namanderema –Nangeni valley do it during flooding season using rudimentary methods. With the reservoir in place, there will be more potential for fisheries and this will contribute to the nutritional value of local communities and also offer possibilities of fishing being another source of income generation. This impact is expected to be **Medium positive** as it will be long term and may benefit only communities that are around the reservoir like those in Malanga, Sidende and few in Bwaliro and Elukongo sub-locations.

Enhancement of positive impacts

- Government should endeavor to put in place infrastructure to facilitate fisheries
- Continuous sensitization about fish farming.
- Potential fish farmers should be provided with fish stocks
- Provide fish stocks for the reservoir fisheries
- Training and capacity building for reservoir fisheries management.

7.2 Negative Impacts of the Action

7.2.1 Preparations Phase/Planning

✓ **Social expectations generated by disclosure of information to the Community**

This stage gives higher social expectations in anticipation for jobs from the project, fear for loss of property and general anxiety. Another potential impact at this stage is the fear generated in the mind of the public with regard to land acquisition and loss of crops as expressed during consultation meetings. This is a **high negative** impact as it affects all the people in the community and it will continue until the project has been implemented.

Mitigation Measures

- All information regarding the project and its relationship with the local community, including aspects of hiring labour and compensation should be disseminated to the community on a regular basis.
- There should be continuous community consultations and sensitization throughout the project cycle so that all queries and fears are answered, reduced or eliminated from the public mind.

7.2.2 Construction Phase

7.2.2.1 Physical environment

✓ **Increased Risk to Soil Erosion**

The nature of the project dictates use of heavy machinery during construction mainly for earth movement, leveling, excavations, murrum mining, and access roads construction and construction of campsite may destabilize the soil cover triggering soil erosion. Construction materials stockpiled and left for long period of time may be exposed to the elements such as rain, sun and wind. Heavy rains may wash away the materials hence leading to siltation to siltation rivers. However, due to gentility of the landscape and the fact that construction will be limited to the project area and expected to last for a short time and affect only those areas where construction and associated activities will take place (localized impact), the impact is expected be **Medium negative**.

Mitigation Measures

- Plan excavation and grading activities to be conducted during the dry season where possible.
- After construction, vegetation should be planted in areas where vegetation was removed including area where soil spoil was previously dumped.
- General catchment protection through vegetation and tree planting form part of the project
- Loose soils should always be removed from worksite.
- Proper drainage should be put in place along access roads, murrum pits and all other cut areas to avoid water seepage unstable and erosion prone areas
- Identify a suitable site for mining construction material that will not be easily subject to erosion
- The contractor shall avoid excessive stockpiling the construction material to ensure that all material brought on site is completely used up

✓ **Impact on Aesthetics**

There will be some negative impact of the scenic nature of the surrounding landscape, mainly due to excavations and construction works. Maira area is generally low lying, most areas covered with sugarcane and other crops with houses scattered in different places. It is regarded as having medium aesthetic quality. Loss of vegetation and landscaping activities compounded by the soil spoil and waste generated during construction and the borrow pits left open will introduce a visual obstruction to the surrounding areas hence affecting the beauty of the project area. The section of the valley where the dam will be constructed and the cleared area for inundation will lead to loss of green nature of the area. However, this impact will be limited to specific area (localized impact) short term and the effects are mitigable hence the magnitude of impact is **Medium Negative**.

Mitigation Measures

- Restoration of excavated areas and other open areas like those at murrum pits should be carried out as soon as construction is completed. This should include covering of pits, leveling, grassing of bare areas and planting of trees.
- Tree planting in the project area should be encouraged as part of catchment protection. This also brings out the natural beauty of the surroundings.
- The visual impact on the landscape can also be improved by keeping a neat and tidy construction phase

✓ **Solid Waste Generation**

During the construction stage solid waste is expected from different activities; land clearance, leveling, excavation, construction of access roads, campsites, construction of the dam foundation and excavation at murrum pits/stone quarries. However, much of the earth and rubble can be used in the erection of the dam wall. In addition, human activity involving workers at camp site will also result into waste being generated and this will include metal scrap/ bars, waste oil,tyres, plastics, food waste, empty cement bags, human waste, paper waste associated with sanitation.

The solid wastes from campsite (locations are yet to be identified) are usually a source of soil pollution and health risk. Waste from this source is not expected to be so much as few workers are expected. However, due the amount debris and waste generated the impact is estimated to be high but this will stop after construction hence expected to have short term impact and mitigable thus magnitude of impact is expected to be **Medium negative**.

Mitigation

- Manage waste in a manner stipulated in waste management Regulations, Legal Notice No.21, Part II (2) and acceptable guide waste Management hierarchy (3 or 4Rs – reduce, reuse, recycle (and recover) **Figure 7-1**
- Dispose waste to a facility provided by the Local Authority or hire a person licensed to transport and dispose such waste in designated waste disposal facility at Busia or Nambale
- Waste should be minimized by applying cleaner production principles eg
 - Soil Spoil found suitable should be used in back filling
 - Overburden or spoil material should be used for rehabilitation of borrow areas, Sand pits and rock sources
 - Any other top soil remaining at material sources should be stored and used in Landscaping for grassing and tree planting.
- Dust bins shall be placed at different locations especially in the camp sites and properly labeled for degradable and non-degradable and disposed as per waste management regulation
- Pit latrine shall be constructed at the camp site if camp site is located at an area with low water table while a mobile toilet could be used at the quarry and murrum burrow area.

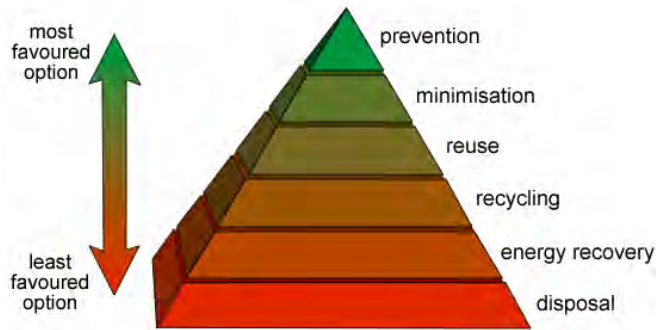


Figure 7-1 Waste management Hierarchy

Source: <http://encrypted.google.com>

✓ Oil spill and subsequent contamination of soil

It is expected that during construction, different types of oils will be required for the equipment. This is likely to be stored at the workshop or campsites and/or campsites. Oil accidental spillages are likely to occur during loading and off-loading at the storage sites (where necessary). More oil spillage is expected during vehicle maintenance and repair at the park yards where these vehicles will be parked. The fuel related wastes are also envisaged to become a menace both at the camp sites and at the construction sites and/or park yards. This results from poor disposal techniques and occasionally fires causing damage and contamination of the adjacent environment. Although the construction period is short term and area affected is localized, the probability of contamination is high but mitigable. Therefore the magnitude of impact is expected to **Medium negative**.

Mitigation Measures

- An oil interceptor should be put in place at the work shop area so as to contain any oil spills.
- Containers used for oil storage should be placed on top of wooden structures during loading and offloading and these can be kept well for further use to minimize the extent of spilling oil in several locations.
- Containers can also be placed on paved surface so that incase of spill, oil can be washed and directed to the interceptor.
- All records of major spillages should be well kept to enable proper monitoring
- Ensure that all machinery and equipment is regularly maintained
- Limit servicing and repair of machinery and equipment to designated areas
- Dispose any used oil at a designated place in accordance with the law

✓ **Negative Impacts of noise and vibrations**

Noise pollution in the project area will occur mainly during construction (excavations, blasting, and clearance of vegetation within the project area, access roads, burrow pits and noise from camp). The major noise sources are vehicles, earth moving equipment and explosives. The effect of noise is not only to the persons operating a noise-making machine, but all receptors including wild animals' nests, feeding and breeding grounds causing many animals to flee to safer grounds. The impact also causes noise-induced hearing loss, but also obstructs other sounds that are important for communication. High impact noise is expected from crushing plants which are continuous otherwise other sources like from moving equipment noise levels fluctuate and of less intensity. Although the noise impacts associated with this phase are significant, none of these are spread over a large area, relatively restricted within the project area and more site specific being experienced by only a small number of individuals. This phase will be temporary in that after construction phase noise intensity from transport vehicles, blasting, excavations and camps will disappear or be minimal and therefore considered **Medium Negative**.

Mitigation Measures

- Formulation of a Grievance Management Plan within the Environmental and Social Management Plan to handle complaints on noise;
- Limiting construction vehicles to travel during certain hours of the day;
- Limiting the speed of construction and operational vehicles;
- Limiting blasting to acceptable times during the day;
- Limiting social activities of camps like discos to certain acceptable times e.g. up to midnight

✓ **Deterioration of Air quality**

Air quality in the project area can be evaluated in terms of aerial dust particulate matter and toxic gases like carbon monoxide, carbon dioxide and other acidic gases. During construction, air pollution in Maira project is likely to arise due to vehicular movements, machinery used for excavation works at project site and quarry /borrow pits. These sources will lead to the emission of toxic gases such as CO₂, CO, NO, SO₂ and fine particulate matter. It is expected that there will be maximum air pollution during dam site clearing and construction that will affect workers and communities neighboring these sites. However it will be temporary in that after construction phase intensity of air pollution from transport vehicles, blasting, excavations and quarries will disappear or be minimal at worst. Air pollution can be minimized through mitigation measures as described below. This renders air pollution to be evaluated as **Medium Negative**.

Mitigation Measures

- Put in place dust control management plan in order to prevent dust emissions from construction machinery and vehicles on unpaved roads;
- Ensuring project vehicles are in good conditions and that they are properly and regularly maintained and serviced;
- Watering unpaved roads and trails during vehicle movements;
- All trucks carrying the granular material should be covered;
- Providing dust respirators with filters to employees exposed to dust; and
- Instituting and enforcing speed controls through speed limits on roads used by project vehicles.

✓ Disturbance of natural water flow

The creation of a water retaining dam will necessitate impoundment of Namanderema River there by disturbing the river's natural water flows. This will be particularly significant during construction, as the river will have to be diverted to allow for construction of the embankment. A number of downstream users will be affected by the impact. However, this will be short-term (*only during construction of the embankment*) and therefore the magnitude of this impact is considered to be **Medium Negative**.

7.2.2.2 *Biological Environment*

✓ Loss of Vegetation

The natural habitat in the project cannot be in pristine condition because it has been modified with basic ecosystem functions predominantly unchanged. The area has low density of plant species with the presence of distinctive vegetative types including *Phragmites* and *papyrus*. During construction this vegetation will be cleared hence interfering directly with these existing natural wetland plant species including a rare and endangered tree species. *Hallea stipulosa* that was encountered upstream of the proposed dam is listed as an endangered species on the IUCN (2007) red list). However, such habitat is well represented elsewhere along the same river and hence cannot be considered a loss of critical habitat as defined by Guidance Principles of the IFC and does not represent "significant" loss of natural habitats, as per the World Bank's Natural Habitats Policy (OP 4.04) . This impact is rated as **Medium Negative**.

Mitigation Measures

- Ensure that the adjacent areas of similar habitat outside the future reservoir are excluded from any ancillary development related to the dam construction
- All mixing of cement, transporting of rock material, etc. should take place within the area to be inundated, and not in these adjacent areas.

- Create a buffer zone between the dam and existing natural vegetation
- Propagate and replant *Hallea stipulosa* as part of the vegetation around the reservoir

✓ **Introduction and spreading of non-native invasive plant species.**

The construction activities involved in this project will result in areas of bare soil being exposed, which are vulnerable to colonization by invasive non-native plant species. A number of potential invasive species are already present in the vicinity of the project, in particular the aggressive invasive herbs such as *Lantana camara*, *Mimosa pigra* and *Titbonia diversifolia*. These plants are localized and only a small part of the project area will be disturbed and besides these plants are easy to control hence the impact is considered to be **Medium Negative**

Mitigation Measures

- Remove these aliens /evasive plants as soon as they are detected, by spraying recommended environmental friendly herbicides or by physical removal.
- Rapid rehabilitation should take place, using local species rather than other species taken from elsewhere
- The project management should be sensitized about evasive plants and the need to remove them as soon as they are seen;

✓ **Impact on Faunal Species**

The project is located in an area with few faunal biodiversity although some especially the avifauna (Crested crane) are listed among the globally and threatened species. The proposed works concern the dam site, reservoir area, access roads and campsite with fauna species likely to be affected in one way or the other. As indicated in the baseline, faunal groups recorded in the project area include mammals, birds, fish, reptiles, insects etc. In general, the impact on faunal species can be divided into animal breeding/ feeding site, migration patterns and kills.

- i) *Breeding /feeding*: Construction activities will lead to substantial increase in damage of the natural environmental in the project area especially at the dam site and reservoir area .The removal of vegetation will lead to exposure of habitat for some animal species. This project is likely to cause direct interruptions in the breeding cycle and decrease in the breeding success of some animals. Endangered and world species of conservation status will be the most affected. This coupled with human presence, noise and dust arising from the construction equipment is likely to result in significant disturbance of wild life particularly at the dam site and the reservoir area which is a very important habitat for faunal species especially birds.
- ii) *Faunal species migration Patterns*: Although the project area has fewer animal species that migrate extensively, there are those that could be affected e.g mammals, Fish and Amphibians. The project impact on this will be minimal because the project area is already modified through cultivation. Secondly construction activity will be a short term besides these animals have other habitats to migrate to.

- iii) *Animal kills*: Some animals in the process of vegetation clearing, and construction workers moving around in the bushes will be exposed to danger with some killed in the process. Although this impact is short term it may lead to complete annihilation of some species.

It also important to note that most of the mammals recorded were not of major conservation importance and the Hippo (globally Vulnerable) can survive in the less disturbed wetland areas close to Lake Victoria. Of the 45 bird species recorded only the Grey-crowned Crane is globally threatened and two other bird species have restricted range in the East African region. None of the Fish, amphibians, and dragonflies are globally threatened and can easily find another suitable habitat close to the project area. Although project activities are short term and affecting a small area, the impact of the project on the ecology and conservation of these species during this phase will be **Medium Negative** as it will affect globally threatened animals such as the Grey Crested Crane.

Mitigation Measures

- Conduct awareness campaigns among the workers about animal species of conservation concern.
- Ensure that construction activities are not done early-morning (before 7.00am) or late-evening hours (after 5.00pm) in the vicinity of the animal since these will disturb wildlife feeding and breeding behavior.
- Carefully remove vegetation to minimize and avoid destruction of breeding habit for certain bird species especially those that are rare and threatened (crested crane).

7.2.2.3 Socio- economic

✓ Influx of people

The construction phase usually comes with increase in population. Presently the population density of Malanga Sub-location is 345 while that of Sidende is 421. Already Sidende sub-location has higher population density than for the Nambale district (398). The increase in population is as a result of the workforce (both skilled and unskilled) that is required by the project and will settle in the area until the project is completed. Besides, the influx of people looking for work is a common phenomenon with all development projects, especially in communities with limited possibilities for paid labour. Additionally, businessmen may want to settle in the area and utilize the opportunity of available market for their products. The increase in population in the area will come with its associated negative consequences like increased conflicts, struggle for the limited resources, and increase in diseases like HIV/AIDS, insecurity, and increase in the price of commodities. Though influx of people in the project area is temporary, considerable pressure will be felt in some sectors in particular the health, sanitation and water sectors thus the impact will be considered **Medium Negative**.

Mitigation measures

- The Developer in collaboration with the Contractor shall prepare a workers recruitment plan that prioritizes local people and local staff employment percentage shall be

determined. This will help in reducing the influx of people in the area and avoid marginalization of local communities in securing employment opportunities.

- Local authorities shall need to be strengthened to deal with the increased cases of indiscipline.
- Project should plan for an increase in infrastructure e.g. sanitary facilities, health facilities, and water facilities among others.

✓ **Pressure on sanitation facilities**

The baseline findings indicated that there was high latrine coverage in the project area. However, most of the toilets are poor in nature (built out of temporary materials). In regard to waste disposal, most of the households used shallow pits for garbage disposal and only 2.8% reported that there was a designated garbage disposal area designated by the local government. The increase in population during the construction phase will affect sanitation by putting pressure on the existing infrastructure leading to deterioration in sanitation. Although poor sanitation can easily lead to diseases such as diarrhea, cholera and dysentery which are life threatening, the fact that the current situation is not alarming and the impact can be mitigated qualifies the magnitude of the impact to be **Medium Negative**.

Mitigation measures

- The project should provide additional sanitation facilities to its workers.
- Bins for solid waste and garbage collection should be placed at the workers' camp to ensure that any wastes generated at the site are properly disposed.
- The local people should be given priority for job opportunities.

✓ **Increased pressure on wood fuel**

Like many rural societies in the country, wood fuel is the major source of energy for the households in the project area. However, it was reported that firewood was scarce in the area despite many households depending on it as a primary source of fuel. An increase in population will mean increased demand for wood which will in turn lead to decimation of the few existing trees. This impact is long term and will not only affect the local area but the entire region. However, after construction the population is likely to reduce hence reducing the pressure on demand for wood. Although not very many people are expected in the area during construction and impact is mitigable, the area will take long to recover from effects of degradation hence considered as **Medium Negative**.

Mitigation measures

- Continuous sensitization of the communities about the dangers of deforestation should be carried out.
- Employment opportunities should be extended to the local people to reduce on the influx of people in the area.
- Encourage tree planting in the project area

✓ **Insecurity**

Usually, the influx of new people in a project area comes with all sorts of vices including stealing project materials and equipment. The local leaders of all affected sub locations of Malanga, Sidende, Elukongo etc. indicated that the area is secure. However a few elements may come up through influx of people in the area and may cause some Materials prone to theft include cement, fuel and equipment. Theft of materials will lead to an increase in the project cost and project delays. Although the impact is reversible and short term as it is likely to occur in the construction phase only, it will have a great impact on project costs and project schedule thus qualifying it to be **Medium negative**.

Mitigation measures

- The developer and Contractor should collaborate with the community and encourage community policing in order to identify the culprits and to ensure safety of project materials.
- The Contractor should put in place an internal control system to curb cases of theft of materials and also employ private security guards at the construction site.
- Collaborate with the local security organs in the area.

✓ **Conflicts between the local people and the new comers**

With new people coming into the area, it is likely that there will be an increase in conflicts in the area. No serious conflicts. This could be as a result of people of different backgrounds settling in the area. Learning and complying with the values and norms of the area might take some time and the process might come along with clashes and conflicts between the local people and the new comers. No major conflicts were reported in Maira and the project area at large. The magnitude of the impact therefore is expected to be **Low negative** due to the fact that it will be short term in nature since most people will go back to where they came from after construction works are complete.

Mitigation

- Local labour should be given priority for employment as this will solve many of the problems associated with influx of people.
- There should be sensitization of the workers in cultural values and norms of the area.
- Local authorities shall need to be strengthened in order to deal with any cases of indiscipline and conflict brought about by the increased population influx, and any disputes that are likely to ensue;

✓ **Impact on vulnerable groups**

The baseline findings indicated that there were vulnerable households in the project area and these included female headed households which constituted 48.3% of the interviewed households. Surveys also indicated that 1.3% of households interviewed were child headed. The high percentage of female heads of households in the project area was attributed to social upheavals such as death of husbands and divorce. Other vulnerable groups included People with Disabilities, elderly headed households and the unemployed youth. All these groups are vulnerable. Vulnerable people tend to be affected more by development projects as compared to other people due to their hard situation. Vulnerable groups in the area are likely to be affected by a reduction in farm land, unequal consideration during the recruitment process and exploitation by men thereby making their situation worse. Although the impact is expected to be long term and it is mitigable and impact is local. Thus the magnitude of impact is considered **Medium Negative**.

Mitigation measures

- Livelihood restoration strategies should be extended to the vulnerable groups and their income levels monitored closely during the implementation process.
- Jobs should be equitably distributed to both women and men and other vulnerable groups as long as one has the qualification.
- Project should put in place a plan to deal with vulnerable groups

7.2.2.5 Health and Safety

During construction, occupational health issues may arise from exposure to excessive and harmful noise, dust, vibration and toxic substances. Health and safety issues also occur at quarries and borrow pits as well as the construction sites themselves, and at camps, and during processes such as working over water. Disease issues may arise during construction as a result of environmental modification (e.g. un drained pools of water becoming breeding sites for disease vectors such as mosquitoes), from worker interaction (e.g. STDIs transmission) and through improper food safety or hygiene practices. In addition to work on-site, a major contributor to construction-related accidents is construction traffic; this may affect both construction workers and the public. Construction traffic may include project staff vehicles driven at excessive speeds, workers in the back of pick-up trucks liable to severe injury in the case of collisions or roll-overs, and heavy vehicles (trucks), often paid per load and therefore with an incentive to drive fast. Further risks arise due to the lack of vehicle and speed awareness of the resident population, especially children and livestock.

✓ **Increased risk of STDs including HIV /AIDS**

Sexually transmitted infections and HIV/AIDS are obviously not linked to the environment but to human behaviour. Social changes can favour the transmission of these pathogens. From Busia Development Plan (2008-2012), HIV/AIDS prevalence rate in Busia District was 7.4%, which is way much higher than the 5.4% national average. This was attributed to different factors such

polygamy, remarriages without HIV/AIDS testing, early marriages especially for the girls and the fact that Busia town is a border town with people from different parts of the country in particular and other East African countries in general who are engaged in cross border trade including sexual trade. The project will require a significant number of workers from outside the project area, even though much of the earthwork activity is mechanised. Some of the workers will live in camps but the unskilled workers drawn from the locality and will commute returning home every day. It is inevitable that this temporary influx of paid male labour (including higher levels of staff) will encourage prostitution to escalate the already pathetic situation by engaging in risky behaviours. A combination of single men with cash away from home, and a poor local population in which women have low educational levels and status may escalate sexual relationships (with women, young girls in the project area and sexual workers at the border). Considering the consequences of STIs, especially HIV/AIDS, this is a highly significant potential impact likely to increase the risk of STDs including HIV/AIDS to both workers and the communities. The magnitude of impact is estimated to be **High Negative** because HIV/AIDS effects are felt even after construction therefore are long term, impact is widespread not local, infection not reversible and the fact that HIV/AIDS prevalence rate is already high in Nambale , the already vulnerable situation will be made worse.

Mitigation measures

These should be based on the objectives of ACT NO. 14 of 2006 - HIV and AIDS Prevention and Control Act.

- There should be a sensitization program targeting the workers and the communities regarding the spread of Sexually Transmitted Diseases (STDs) including HIV/AIDS spearheaded by NGOs specialized in such work like The AIDS Support Organization.
- HIV/AIDS awareness campaigns in schools and communities should be undertaken periodically.
- Provide health care to those suspected of having contracted HIV
- Avoid discrimination of all forms especially in employment
- All the people should be protected from the infection (eg provision of condoms)

✓ **Increase in Malaria**

During construction, pools of stagnant water in the excavated area are expected especially during the rainy season and may act as breeding places for mosquitoes and therefore may increase the malaria burden in the area. Already malaria prevalence is high at 51 % in the Busia district area. Although malaria has far reaching effects, the impact can be mitigated, it is reversible and the probability of its happening is medium thus the magnitude of the impact is expected to be **Medium Negative**.

Mitigation measures

- Malaria control strategies should be put in place by the project such as distribution of Low cost mosquito nets to communities in villages in close proximity with the reservoir.
- Introduce fish in the reservoir to feed on mosquito larvae
- Sensitization of communities in primary health care so as to reduce on other means of spreading of malaria.

✓ **Increased pressure on health infrastructure and services**

The influx of people in the project area during the construction phase will stress the already inadequate health infrastructure and services in the area. The baseline findings showed that the health infrastructure and service delivery in the project area were in poor condition and inadequate. In addition, the health facilities are characterized by inadequate drugs and inadequate personnel, lack of electricity among others. With an increase in population in the area, the health facilities will be overwhelmed and may not be able to offer adequate services to the population. However the population will reduce after construction. Therefore, the impact of the project on the health infrastructure and services is expected to be **Medium Negative**.

Mitigation measures

- The project should plan for additional health infrastructure for its workforce to cater for the increased population.
- Where possible the project should support health centers which are nearer to the project in terms of laboratory equipment, anti-malarial drugs, etc.
- Employment opportunities should be extended to the local people to reduce on the influx of people in the area.

✓ **Occupational Health and Safety**

The project will require skilled, semi-skilled and unskilled workforce. However, given the nature of the project, the workforce is likely to be made up of more semi-skilled and unskilled labourers compared to the skilled workers. Usually, the unskilled and semi-skilled workers are recruited locally and may never have been exposed to projects of such nature, and therefore may not be aware of the safe operating procedures while undertaking their assignments. It is likely that the limited exposure might increase the likelihood of occurrence of occupational accidents. Likely occupational hazards include; exposure to physical hazards from use of heavy equipment , trip and fall hazards, exposure to dust and noise, exposure to falling objects and increased risk of accidents as a result of blasting. Although, the impact has far reaching consequences if not properly handled, it can be mitigated and will be short term mainly during construction thus it is regarded as **Medium Negative**.

Mitigation measures

- Training of workers in safe operating procedures.
- Provision of appropriate Personal Protective Equipment (e.g. helmets, overalls, nose masks, ear muffs, etc.)
- Labeling of danger zones and hazardous materials.
- Restrictions/control of access to potential danger zones or usage of hazardous chemicals.
- Instituting, enforcing and disseminating procedures to be followed when blasting.

✓ **Community Health and Safety**

During construction of the dam, it is likely that onlookers will be attracted to the construction sites curious to see the different activities going on. Furthermore transportation of materials may result into accidents to the local people, noise and air pollution. There is also a likelihood of increased traffic in terms of humans and vehicles. The magnitude of the impact is estimated to be **Medium Negative** as it will be short term and mitigable and its extent will be local.

Mitigation measures

- Together with local authorities, enforce restrictions on unnecessary entry into the project site or even the protected zone.
- Instituting speed limits on project vehicles.
- Putting warning signs, etc.
- Skilled and properly trained drivers should be employed.
- Safe speed limits should be instituted and enforced.
- Flag men where necessary should be employed by the project in order to control traffic.
- Sensitization of the communities.

7.2.2.6 Archaeology and cultural resources

✓ **Destruction of sites and Artifacts mishandling**

There is a high possibility that a number of archaeological sites in the project area both in Maira Dam site as well as those that are outside will be encroached on. The baseline surveys of the project area showed pottery shards, pottery scatters, graves, traditional medicinal plants (*Erythrina abyssinica*) and trees of spiritual importance all in the reservoir (within 1198masl). Just outside the reservoir is iron smelting site and rock shelters (at 1235masl). The projected sites for acquisition of materials such as stones and murrum might encroach on important cultural assets with traditional and archeological values. In the process of material excavation some artifacts may be unknowingly destroyed due to limited skills by some contractors. Although impact would be irreversible the impact of the project on archaeological sites and culture can be evaluated as medium negative as

some may not get affected, while that on archaeological assets can be evaluated as **Low negative** as the sites and value of the assets are currently not known.

Mitigation measures

- Contractors need to work hand in hand with professional archaeologists so that any chance findings may be rescued and taken to the National Museum of Kenya
- Contractors should be trained in basic skills of handling artifacts so as to avoid breakage, destruction and loss of priceless assets that may be found during construction
- All potential quarry sites for (Sand, murrum and stone/rock) should be surveyed first to ascertain availability of cultural assets and artifacts.
- Work closely with the residents of Maira to avoid mishandling of cultural issues that are sensitive and likely to result into stigmatization .

✓ **Destruction and exposure of human remains and burials.**

Historically, people living in the project areas have been settled for a long time and have passed on their cultural values from generation to generation. It is expected that in an area where people have lived some are born while others die and are buried with are relics of their remains represented by graves. According to the baseline information almost every homestead in Maira has burial grounds. The project activities, (construction of the dam, access road, camp sites, exaction of building material and establishment of other axillaries) may lead to the destruction of these graves, thus expose human remains. Although this impact is short term, localized and is mitigable, it may lead to desecration of cultural values and may dishonor the affected households. The impact of the project on burial grounds and graves is evaluated as **Medium negative**.

Mitigation measures

- Sensitization of communities on the project and possible impacts on the burials and human remains.
- Consulting the area elders on the way forward and requirement needed in case of relocation of human remains
- For all the graves that are likely to be affected by the construction activities of the project, the developer should facilitate the relocation of ancestors.

7.2.3 Operation and Maintenance /Post Construction phase

7.2.3.1 Physical environment

✓ **Change in Water quantity downstream the dam**

The process of reservoir filling will result in a drop in water level and cause changes in water quantity in downstream reaches of River Namanderema. The River will not be completely

impounded but will allow environmental flows for both the ecosystem and any other activity that may be undertaken downstream at any given time. Besides, excess flow during rainy season targeted for filling of the dam. It is also worth noting that filling of a dam is normally gradual and may take about 6 months done to avoid abrupt change on the ecosystem. After reservoir filling the flow will stabilize but will still reduce from what it is now. Although the period of reservoir filling is short, the reduced flow impact will be long term and throughout the life of the project (estimated at 25years). There is a high probability that flow will reduce and the impact will have a wide extent as it will affect most areas downstream. However, the impact is mitigable; therefore considered to be **medium-high negative**.

Mitigation

- Reservoir area should be cleared before inundation to avoid eutrophication.
- The environmental flow (**0.15m³/s** – see section 6.1.5.11) should be maintained throughout all project stages especially Operation and Maintenance.

✓ **Emission of Green House Gases**

Reservoirs contribute to GHG emissions (particularly methane) due to the decomposition of flooded vegetation. According to Intergovernmental Panel on Climate Change (IPCC) the emission factor of methane from dams is $0.63 \text{ kgCH}_4(\text{ha}\cdot\text{day})^2$. Using this emission factor the amount of methane generated will be about 35 tonne of CH_4 per year (i.e. from the total inundated land of about 125.9 ha (311.3 acres). However, of the total land to be inundated, 43ha is swampy (Nangeni wetland) meaning it is already generating some methane. Hence the additional methane generation will be from the 82.9 ha (i.e. about 19,062.8 Kg CH_4 per year) which is negligible. Furthermore, methane will be generated for just a short time after reservoir filling. This impact therefore is considered **Medium Negative**.

✓ **Reservoir Sedimentation**

Rivers carry different types of sediment down their riverbeds and the presence of a dam will block the flow of sediment downstream, leading to downstream reduction of these sedimentary deposits and increased sediment build-up in the reservoir. This will eventually lead to a reduced water-storage capacity due to the exchange of storage space for sediment and will result in decreased ability of the dam to serve its intended multiple purpose uses. From the baseline studies it was observed that Sio and its tributaries are silted due to vegetation clearing and cultivating up to the river. Agricultural activities taking place along the river banks and within the catchment area often lead to erosion in which result into sedimentation of the reservoir. Although this impact is reversible and mitigable; the magnitude is considered **High Negative** because it is a long term with high probability of happening.

² IPCC 4th Assessment Report

Mitigation measures

- Minimize the erosion in the catchment by adopting an integrated approach of managing and conserving the dam catchment by the appropriate local institutions.
- Institute and enforce good watershed management practices including afforestation, terracing, and good agricultural practices.
- Mitigate soil erosion by applying appropriate embankment protection technology e.g. planting grass
- The project shall work with the Village Environmental Committee to ensure the above e.g. the Committee may put in place by-laws to protect the project components.
- Preliminary dam design as provided for bottom outlets in the embankment to allow for seasonal flushing of sediments.
- Set up catchment management programs to reduce the amount of sediments into the rivers

✓ **Impacts on river system and flow patterns**

The proposed dam will result in changes in the flow regime of the river downstream of the dam. With the reservoir full of water, the inflow flood hydrographs will get modified as they travel through the reservoirs (i.e. from inlet, storage and outlet over the spillway). The modification, which will take place, is that the peak of the inflow hydrograph will be reduced (peak attenuated) stretching the time base of the inflow hydrograph such that there is lag between the time of the peak of the outflow hydrograph and the time of the peak of the inflow hydrograph. The overall pattern of river flow will be changed by reducing its overall volume and changing its seasonal variations. The magnitude of this impact is considered **Medium Negative**.

✓ **Impacts on river quality in downstream**

When reservoir is filled, biomass and waste in the reservoir area will cause deterioration of water quality through eutrophication. Increased water depth within the reservoir will result in thermal stratification, bringing about anoxic bottom layers. However, eutrophication will take a short time and the impact will clear. Clearing of the reservoir before filling is ideal, but very expensive, so it will not be necessary since this impact will clear quickly. Furthermore, the creation of the reservoir denotes that a new environment, developing its own typical water quality problems that may affect the downstream section to some extent. The changes in annual flow and sedimentary regime downstream and upstream of the dam too will affect the water quality. The Impoundment may increase or decrease (dilution) the pollutant load of receiving waters while withdraws may indirectly lead to an increase of pollutant loads Accumulation of sediments in the reservoir will increase the concentration of organic matter thereby affecting its quality. The magnitude of this impact is considered **Medium Negative**.

✓ **Impact on downstream water uses**

The baseline on current water use indicates that approximately 11% of the population in the project draws their water directly from the river. Impoundment of the water in the dam will reduce the amount of water in the river. Given the importance of the river a source of water for various purposes by the communities, this impact is considered to be **High Negative** because it is long term impact, probability of happening is high and there are many communities downstream using this river.

Mitigation measures

- Dam should provide proper water supply systems for provision of water to the surrounding communities.
- Environmental flow should be maintained in the river. The environmental flow has been estimated at **0.15m³/s**.

✓ **Dam safety related impacts and Flooding**

Poor dam design and maintenance may lead to dam breakage and therefore flooding downstream that may lead to deaths and destruction of property. The probability that this may happen is low because the design team has put in place measures to prevent dam break and the dam is a small dam. In the event that dam breaks down, it can have far reaching impacts on the downstream communities. However, emergency plans and procedures have been developed to handle such an incident. Although its occurrence may have far reaching consequences and its extend large, the impact is mitigable and the probability of its occurrence will be minimized through dam safety plans and thus is the magnitude of this impact is expected to be **Medium negative**.

Mitigation measures

- Emergency plans and procedures have been developed and are contained in the Dam Safety Report (**Annex 8**).
- Any destroyed property as a result of dam breakage should be compensated.
- Sensitization of the community of an emergency plan of action in case of a disaster should be done continuously.
- Ensure regular observation is done to monitor the dam structure
- Regulate traffic on road passing over the dam
- Ensure trees are not allowed to grow on the dam structure

✓ **Increase in Groundwater level**

Impoundment of the rivers may lead to increased percolation of water to deeper levels resulting in localized increase in groundwater level and consequently overall quantity. If this is not checked it may lead to water logging and salinization of soils especially in area where the water table is too near to the surface and Maira has such. Much as this may be good for recharge to groundwater, it may not be desired as it may impact on the quality of the river downstream, degrade the soil nutrient downstream and make pit latrine construction impossible (for settlements closer to the reservoir).

Although this impact mitigable and reversible it is long term hence described as **Medium Negative**.

7.2.3.2 Biological Environment

✓ Disruption of aquatic ecological functions downstream

The impounding of Namanderema River will reduce the flow may reduce that reaches the downstream aquatic system. These will disrupt the fish and other aquatic life and the whole ecological system. This situation will continue for the whole dam operation period (about 25years). The impact is long term and will affect a large area. The biodiversity survey of the river undertaken recorded few endangered species that but this can survive once the recommended ecological flow is maintained. Thus the magnitude of impact on aquatic ecology is considered to be **Medium negative**.

Mitigation

- Maintain the recommended environmental flow of 0.15m³/s to ensure sustainability of the ecosystem has been computed and should be maintained at all stages of the project.
- A staff gauge should be installed downstream of the embankment to ensure the river flow rate does not go below the minimum river flow rate (environmental flow) at any one time.

✓ Introduction and spreading of aquatic invasive plant species.

The presence of the reservoir would be potential habitat for the infestation and proliferation of four invasive aquatic plants that are already in the region (Water Lettuce (*Pistia stratiotes*), Water Hyacinth (*Eichhornia crassipes*), Red Water Fern (*Azolla filiculoides*) and Kariba Weed (*Salvinia molesta*). These water plants spread rapidly and can be a nuisance if not controlled and hence their impact on the reservoir may be significant although they can be controlled and therefore the magnitude will be **Low -Medium Negative**.

Mitigation measures

- Control the invasive plant species by using a combination of physical biological control methods.
- Recommendations for suitable mitigation measures to be implemented as part of the project are included as part of the ESMP to address the potential problem of invasive aquatic plant species

✓ Impacts on Crocodiles and Hippopotamus

The common Hippopotamus and Crocodile suspected in the project area may eventually find the created reservoir a conducive habitat for their survival. If crocodiles and Hippos become

established in the reservoir this may have human implications as there will be increased danger from these animals. On the other hand the reservoir is meant for human use hence constant disturbance of these animals from human activities. Besides, these animals may have limited movement out of the reservoir since the surrounding areas are under cultivation. Since numbers of these animals may be low and the impact mitigable it is considered to be a **Low negative**.

Mitigation measures

- In order to prevent any animal disturbing humans and humans disturbing animals it is proposed that a fence is constructed all around reservoir.

7.2.3.3 Socio- economic

✓ **Loss of Land, change of tenure and land use**

The reservoir at Maira will require a total of 311.35 acres of land which will permanently be acquired. More land for camp site and material sources will be acquired on a temporary basis while the canals in the new irrigation areas will also require land permanently. Although some of this land is owned by government especially land at the river banks, land located further away from river banks is owned by individuals. Besides, land at the river banks is being utilized by several households for crop cultivation such as sugar plantations and vegetables. With construction of the project, there will be permanent land loss, change in land use and also change in land tenure. The impact will be permanent, irreversible, and direct and will affect people's livelihoods. The impact of the magnitude is thus expected to be **High Negative**.

Mitigation measures

- Project Affected People should be fairly and promptly compensated.
- Provision of alternative land for PAPs with more than 20% land loss should be considered.
- Livelihood restoration programs should be put in place to ensure that PAPs livelihoods are restored.

✓ **Loss of residential and other structures**

The Construction of the dam and clearing of the reservoir area will lead to physical displacement of about 25 households. In addition, institutions such as a church and a school might lose some of their structures. Physical displacement is associated with psychological stress, loss of social networks and loss of livelihoods. Other project components such as access roads, irrigation canals may also displace a number of people with agricultural land, residences, business and a community playground which currently helps the youth to play football and other games. The magnitude of the impact is expected to be **Medium Negative** as it is long term, irreversible and comes with other induced negative impacts.

Mitigation measures

- A comprehensive Resettlement Action Plan should be prepared in accordance with the national laws and the World Bank guidelines
- All households losing any structures should be compensated fairly and adequately.
- In-kind compensation for the displaced households should be considered as an option by the implementing agency.
- Livelihood restoration programs should be put in place to ensure that PAPs' livelihoods are restored.

✓ **Destruction of access roads, bridges and footpaths**

The project will lead to loss of some access roads, bridges and footpaths currently used by the local community will be destroyed leading to social network/communication breakdown and restricting people's movements to different areas such as schools, health centers. From baseline studies it was found that part of Malanga –Sidende road and the bridge as well as 2 other foot bridges and foot paths currently used by the local community will be inundated. The magnitude of the impact is expected to be **Medium negative** as this is long term and many people not only from the project area will be affected. With the alternatives routes provided and all destroyed infrastructure replaced the impacts will be minimized.

Mitigation measures

- Construct a road on the dam weir (Proposal in the dam design) as alternative route to the inundated Malanga –Sidende road and Bridge.
- All inundated community infrastructure should be replaced and these should be similar in nature or better than those affected.

✓ **Loss of irrigation infrastructure**

Part of the existing irrigation structures in Maira and Mukemo being implemented by the irrigation board is likely to be affected by the project and this impact is long term, but can be mitigated thus described as **medium negative**.

Mitigation measures: Optimize the project to avoid the already established structures

✓ **Loss of water supply facilities**

The proposed area for the reservoir has several protected springs, Boreholes and shallow well used by the local people for domestic and livestock purposes. Most of the water sources especially the boreholes have disinfection system, a programme put in place by government to improve water quality. Many boreholes in Maria village along the Namanderema River have this system. Inundation as a result of the reservoir will lead to loss of these facilities and therefore bring about a problem of

water scarcity in the area. This is a long term impact and will affect all areas that will be inundation but will be mitigated. There the magnitude of the impact is expected to be **Medium Negative**.

Mitigation measures

- Alternative water supply should be provided to the community especially by extending water supply from the reservoir.

✓ **Risk of increased water borne diseases**

Malaria vectors and other vectors such as snails will find the reservoir and immediate environs conducive for their survivor. The water in the reservoir will be stagnant and will act as a breeding ground for these vector carrying pathogens hence likelihood in the prevalence of malaria and billharzia in the project area. Malaria is already high at 51% prevalence rate. The water in the reservoir may also be contaminated by human activities in the vicinity of the dam, thereby leading to water borne diseases such as cholera , diarrhea and dysentery. Although this impact is long term and has multiple effects to the livelihoods of the people, it is reversible and can easily be mitigated hence **Medium Negative**.

Mitigation measures

- Sensitize communities to constantly sleep under treated mosquito nets
- Distribute low cost treated mosquito nets to communities surrounding the reservoir.
- Clear bushes around the reservoir periodically
- Human activities around the dam should be monitored.

✓ **Risk of drowning**

During this phase there is a risk of drowning by both children and adults in the reservoir. The children or adults may be enticed to swim in the reservoir and may end up drowning or may drown accidentally while passing by. Furthermore, domestic animals may also drown in the reservoir while trying to drink from it. Although this risk leads to loss of lives it can be avoided and mitigated thus the magnitude of the impact is considered to be **Medium Negative**.

Mitigation measures

- Use live fence around the reservoir to avoid any accidents to the humans and livestock
- Sensitization of the community of an emergency plan of action in case of a an accident
- Personnel should be recruited to guard the dam and to ensure that drowning incidences are minimized.

7.3 Overall impact Assessment

Referring to the Impact assessment methodology section **1.3.2**, the overall impact assessment has been arrived at by combining the value of the baseline conditions (**highlighted chapter 6.0**) for each aspect (the impact zone and the magnitude of impacts highlighted in the section **7.2** above. This overall assessment for the whole project has been summarized in **Table 7-1**.

For example the baseline information indicates that fish, amphibians etc. found in the project area are of low conservation value. The magnitude of impact during construction was found to be **low negative**. The overall impact on these species during construction is **minimal**.

However, during operation and maintenance (reservoir in place) there will potential for creation of suitable habitats for these animals which will lead to their increase. The magnitude of impact is expected to be **medium positive**. Combining the value of conservation (**low**) and the magnitude of impact (**medium positive**), the conclusion is that the proposed project will have **small positive** impact on the small animals (fish, amphibians etc.) of the project.

Table 7-1 Overall impact assessment of the whole project

Study	Degree Value/vulnerability	Degree of impacts	Overall impact Assessment (without mitigation measures)
Scale	Low/Med/High	Negative High Medium Little/No Med High	
POSITIVE IMPACTS			
<i>Planning /pre-construction phase</i>			
Employment creation	-♦-	-♦-	small positive (+)
<i>Construction Phase</i>			
Increased Employment	-♦-	-♦-	Medium positive (++)
Increased income	-♦-	-♦-	Medium positive (++)
Skills development	-♦-	-♦-	Large positive (+++)
Improved access roads	-♦-	-♦-	Medium positive (++)
<i>Operation & Maintenance</i>			
Control of floods	-♦-	-♦-	Medium positive (++)
Creation of wetlands	-♦-	-♦-	Medium positive (++)
Increased habitat for birds	-♦-	-♦-	Large positive (+++)
Impact on Hippos & Nile crocodile	-♦-	-♦-	Small positive (+)
Creation of habitats for fish, amphibians etc.	-♦-	-♦-	Medium positive (++)
Improved water supply	-♦-	-♦-	Large positive (+++)
Potential for tourism	-♦-	-♦-	Medium positive (++)
Provision of employment	-♦-	-♦-	Medium positive (++)
Electricity generation	-♦-	-♦-	Medium positive (++)
Improved crop farming	-♦-	-♦-	Very Large Positive (++++)
Increased fisheries	-♦-	-♦-	Medium positive (++)
NEGATIVE IMPACTS			
<i>Planning Phase</i>			
High social expectations	-♦-	-♦-	Large negative (---)

Study	Degree Value/vulnerability	Degree of impacts	Overall impact Assessment (without mitigation measures)
Scale	Low/Med/High	Negative High Medium Little/No Med High Positive	
Construction Phase			
Risks of soil Erosion	-♦-	-♦-	Medium negative (--)
Loss of Aesthetic value	-♦-	-♦-	Small negative (-)
Solid waste increase	-♦-	-♦-	Medium negative (--)
Oil spill	-♦-	-♦-	Medium negative (- -)
Noise pollution	-♦-	-♦-	Medium negative (- -)
Air pollution	-♦-	-♦-	Medium negative (- -)
Disturbance of water flow	-♦-	-♦-	Medium negative (--)
Sedimentation of the River	-♦-	-♦-	Medium negative (- -)
Drop in Water level	-♦-	-♦-	Medium negative (- -)
Spread of Invasive plant Species	-♦-	-♦-	Medium negative (- -)
Loss of Vegetation	-♦-	-♦-	Medium negative (- -)
Impact on Faunal Species	-♦-	-♦-	Small negative (-)
Influx of people	-♦-	-♦-	Medium negative (- -)
Increased pressure on health, sanitation, fuel wood and other services	-♦-	-♦-	Medium negative (--)
Insecurity	-♦-	-♦-	Medium negative (--)
Increased conflicts	-♦-	-♦-	Small negative (-)
Impact on vulnerable people	-♦-	-♦-	Medium negative
Increased STDIs	-♦-	-♦-	Large Negative (- - -)
Occupational Health and Safety	-♦-	-♦-	Medium negative (--)
Community Health and safety	-♦-	-♦-	Medium negative (--)
Destruction of Archaeological sites	-♦-	-♦-	Small negative (-)

Study	Degree Value/vulnerability	Degree of impacts	Overall impact Assessment (without mitigation measures)
Scale	Low/Med/High	Negative High Medium Little/No Med High	
Displacement of graves	-◆-	-◆-	Medium negative (--)
Operation& Maintenance			
Changes in water quantity	-◆-	-◆-	Medium negative (--)
Emission of Greenhouse gases	-◆-	-◆-	Small negative (-)
Reservoir sedimentation	-◆-	-◆-	Very Large negative(----)
Impacts on river system and flow patterns		-◆-	Medium negative (--)
Impact on Water quality	-◆-	-◆-	Small negative (-)
Impact on downstream communities & users	-◆-	-◆-	Medium negative (--)
Dam safety related impacts and flooding	-◆-	-◆-	Medium negative (--)
Spread of invasive plants	-◆-	-◆-	Medium negative (--)
Loss of Land	◆-	-◆-	Large negative (- - -)
Loss of Settlements	-◆-	-◆-	Large negative (- - -)
Loss of Infrastructure (bridge, road etc.)	-◆-	-◆-	Medium negative (--)
Loss of water supply facilities	-◆-	-◆-	Medium negative (--)
Increased risk of water borne diseases	◆-	-◆-	Medium negative (--)
Risk of drowning	-◆-	-◆-	Medium negative (--)

7.3.1 Residual Impacts following Mitigation Measures

When the Social and environmental mitigation measures have been implemented, there may be some residual impacts that may remain. However, in Maira dam project, the residual negative impacts are expected to be either small or minimal. Long-term monitoring will be required to minimize these residual impacts. Therefore they are considered to be manageable and acceptable.

Furthermore the positive impacts are likely to be enhanced leading to improvement of general environment. With enhancement measures it is expected that all positive impacts will bring better benefits especially on water supply and source of income when reservoir is in place and in operation. See table.7-2.

Table 7-2: Residual Negative Impacts and enhancement of positive impacts

Study	Degree Value/vulnerability	Degree of impacts	Overall impact Assessment (without mitigation measures)
Scale	Low/Med/High	Negative High Medium Little/No Med High	
POSITIVE IMPACTS			
<i>Planning /pre-construction phase</i>			
Creation of employment	-♦-	-♦-	small positive (+)
<i>Construction Phase</i>			
Increased Employment	-♦-	-♦-	Medium positive (++)
Increased income	-♦-	♦-	Medium positive (++)
Skills development	-♦-	-♦-	Medium positive (++)
Improved access roads	-♦-	-♦-	Medium positive (++)
<i>Operation & Maintenance</i>			
Control of floods	-♦-	-♦-	Large positive (+++)
Creation of wetlands	-♦-	-♦-	Medium positive (++)
Increased habitat for birds	-♦-	-♦-	Medium positive (++)
Impact on Hippos & Nile crocodile	-♦-	-♦-	Small positive (+)
Creation of habitats for fish, amphibians etc.	-♦-	-♦-	Medium positive (++)
Improved water supply	-♦-	-♦-	Large positive (+++)
Potential for tourism	-♦-	-♦-	Large positive (++)
Employment and income	-♦-	-♦-	Large positive (+++)
NEGATIVE IMPACTS			
<i>Planning Phase</i>			

Study	Degree Value/vulnerability	Degree of impacts	Overall impact Assessment (without mitigation measures)
Scale	Low/Med/High	Negative High Medium Little/No Med High Positive	
High social expectations	-♦-	-♦-	Small Negative (-)
Construction Phase			
Risks of soil Erosion	-♦-	-♦-	Small negative (-)
Loss of Aesthetic value	-♦-	-♦-	Small negative (-)
Solid waste increase	-♦-	-♦-	Small negative (-)
Oil spill	-♦-	-♦-	Small negative (-)
Noise pollution	-♦-	-♦-	Medium negative (--)
Air pollution	-♦-	-♦-	Small negative (-)
Disturbance of water flow	-♦-	-♦-	Small negative (-)
Sedimentation of the River	-♦-	-♦-	Small negative (-)
Drop in Water level	-♦-	-♦-	Small negative (-)
Spread of Invasive plant Species	-♦-	-♦-	Small negative (-)
Loss of Vegetation	-♦-	-♦-	Minimal (0)
Impact on Faunal Species	-♦-	-♦-	Minimal (0)
Loss of Land	♦-	-♦-	Small negative (-)
Loss of Settlements	-♦-	-♦-	Small negative (-)
Influx of people	-♦-	-♦-	Small negative (-)
Increased pressure on health, sanitation, fuel wood and other services	-♦-	-♦-	Small negative (-)
Insecurity	-♦-	-♦-	Small negative (-)
Increased conflicts	-♦-	-♦-	Minimal or no Impact (0)
Impact on vulnerable people	-♦-	-♦-	Small negative (-)
Increased STDIs	-♦-	-♦-	Medium negative (--)
Increased Malaria	-♦-	-♦-	Small negative (-)
Occupational Health	-♦-	-♦-	Small negative (-)

Study	Degree Value/vulnerability	Degree of impacts	Overall impact Assessment (without mitigation measures)
Scale	Low/Med/High	Negative High Medium Little/No Med High Positive	
	----- -----	----- ----- ----- -----	
and Safety			
Community Health and safety	-◆-	-◆-	Small negative (-)
Destruction of Archaeological sites	-◆-	-◆-	Small negative (-)
Displacement of graves	-◆-	-◆-	Small negative (-)
Operation& Maintenance			
Reduced flow (inundation and drop in water level)	-◆-	-◆-	Small negative (-)
Noise and vibration	-◆-	-◆-	Minimal or no impact (0)
Emission of Greenhouse gases	-◆-	-◆-	Minimal or no impact(0)
Reservoir sedimentation	-◆-	-◆-	Small negative(-)
Impact on Water quality	-◆-	-◆-	Minimal or no Impact (0)
Impact on downstream communities & users	-◆-	-◆-	Small negative (-)
Dam safety related impacts and flooding	-◆-	-◆-	Small negative (-)
Spread of invasive plants	-◆-	-◆-	Small negative (-)
Loss of Infrastructure (bridges, accesses, etc.)	-◆-	-◆-	Small negative (-)
Loss of Water supply facilities	-◆-	-◆-	small negative (-)
Loss of vegetation &species of conservation concern	◆-	-◆-	Minimal or no Impact (0)
Increased risk of water borne diseases	◆-	-◆-	Small negative (-)
Risk of drowning	-◆-	-◆-	Small negative (-)

7.4 Decommissioning and restoration

Decommissioning of the construction site is generally rehabilitation by the contractor in which a decommissioning plan is provided on campsites, temporary access roads, borrow areas, quarry mines if any, crushing plant if any, material stock pile, general site rehabilitation etc.

Although Ministry of Water and Environment /NELSAP has the overall responsibility of environmental compliance, at the project level the Contractor will be responsible for decommissioning. The sections below give the decommissioning plan.

Campsites: The campsite whose location is yet to be identified will be made of temporary material mainly iron sheets, timber, metal bars and other fabricated material. In cases permanent structures are put up, it will be an agreement between the land owner or the community and the contractor so that the structures are left for the land owner /community to use. The structures could either be used as school facilities or houses for rent.

In the case where temporary structures are constructed the materials will be salvaged and either sold or taken for re-use at other sites on project completion. The water supply system could be handed over to the local authorities to be used by the neighbouring communities.

Most sanitary facilities on contractors' camps are pit latrines; in case a septic tank is used, the septic tank should be emptied with cesspool emptier and the pit backfilled.

Temporary access roads: In case some temporary access roads have been created, these will be blocked shall be rehabilitated through top soiling and grassing. In a case where campsite structures are left for the community or the land owner, the temporary access roads have to be left to continue in use.

Burrow areas and quarry mines: The burrow pits and quarry areas (where necessary) created by the project will have to be covered and area rehabilitated. This can be done by utilizing the soil spoil obtained through the widening of the access roads in the project area especially the smaller ones other than the Malanga –Sidende and other wider roads. Top soiling, gassing and planting of trees should be done to provide soil cover to prevent soil erosion and improve esthetic beauty of the area.

Crushing plant if any

Decommissioning activities at the crushing plant area include: removal of all unused materials; restoration of all opened up areas through top soiling and re-vegetation; Compensation of any affected neighbors and disassembling of crusher components and removal.

Material stockpile areas

Areas that have been used for temporary storage of materials shall be leveled after materials have been used. Such areas shall be restored through grassing.

Fuel Station/bulk storage

The dam site is far away from fuelling stations which are in Busia town. There is a small pump at Nambale which will not be sufficient for the many and big equipment expected at the project. It might be necessary to establish a small fuel station at the camp site.

This should be de-commissioned as follows;

1. Initial soil tests for Volatile Organic Compounds (VOCs)

2. Cordoning off of site.
3. Dismantling of surface installations e.g. pipes, pumps, canopies, electrical systems etc.
4. Draining of tanks, pipes
5. Safe transportation of residual products and pipes
6. Tank exhumation by specialized contractor in presence of supervising Environmental
7. Consultant, NEMA etc.
8. Haulage of tank to appropriate storage
9. Soil and groundwater sampling and testing etc.

Decommissioning of the dam structure and reservoir at the end of its life will very much depend on the detailed design when the kind of structures to be put in place are clearly known.

7.5 Cumulative impacts

While the direct impacts resulting from the development of the multipurpose dam and associated infrastructure have been discussed in the preceding sections, it is important to consider possible cumulative impacts that may result. Within the project area, there are a number of irrigation schemes including those in the project area and neighbouring areas. The existing irrigation scheme in the area is Maira Mukemo Cluster irrigation scheme covering about 50Ha. Lower Sio irrigation scheme with command area of about 4,000Ha is also being planned. Construction of Maira dam will increase water supply for irrigation and more area and more farmers will be served by irrigation increasing crop production. There is therefore likely to be **medium positive** cumulative impact on crop production and increased income.

Since the projects in the Lower Sio are under the Ministry of Water irrigation suffice to suggest the implementation of the recommendations contained in the ESMP be combined

Noted cumulative impacts include among others

a) Positive

- Increased land acreage under irrigation for Improved agricultural productivity
- Creation of employment opportunities on the farm especially for the youth and women.
- Water regulation to control floods during high river flows and thus optimize agricultural production during the dry period.

b) Negative Impacts

Some of the main negative impacts are:

- Potential for increased groundwater recharge due seepage
- River siltation resulting from erosion of riverbanks,
- Possible salinization resulting from increased waterlogging which may impact the quality of river water and soil nutrient profile.
- Health and safety risks/hazards associated increase of water related diseases causing vectors

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS (ESMP)

8.1 Introduction

Environmental and Social Monitoring and Management Plan (ESMMP) means a description of all relevant actions that will be taken by the developer including monitoring of impacts and establishing capacity for ongoing management during the implementation or construction stage of the project up to post-commissioning /operation.

8.1.1 *Why EsMP*

In the course of this ESIA, project design decisions have been made taking into account the need to avoid, minimise and reduce negative environmental and socio-economic impacts, and the opportunity to enhance positive impacts. This ESMP therefore has been developed to ensure that the actions are managed fully and that unforeseen or unidentified impacts of the project are detected and resolved. The Contractor will be provided with a copy of the ESMP.

The ESMP will;

- assist in ensuring continuing compliance with Ugandan legislation;
- provide a mechanism for ensuring that measures identified in the ESIA to mitigate potentially adverse impacts and unforeseen or unidentified impacts are implemented until construction is complete,
- provide assurance to regulators and stakeholders that their requirements with respect to environmental and socio-economic performance will be met; and
- Provide a framework for Ministry of Water and Irrigation (MWT) compliance auditing and inspection programs.

8.1.2 *Structure of the ESMP*

The proposed ESMP has the following sections.

- Key responsibilities and management structures
- Mitigation Plan and Costs;
- Environmental and Social Monitoring Plan and costs;
- Review of Capacity for Stakeholders and Capacity Building

8.2 Key responsibilities

8.2.1 *Ministry of Water and Irrigation (MWI)-*

Being the overall coordinator and supervisor of all the ministries responsible for the water sector, it is presumed that Ministry of Water and Irrigation (MWI) will take the overall responsibility for the development of Maira Multipurpose dam project. Although the Contractor will have the primary roles in delivering on the measures set out in the ESMP, MWI will have the ultimate responsibility for ensuring that measures to mitigate any negative impacts are delivered. In this respect, MWI will review and approve Contractor plans for delivery of the actions contained in the ESMP and subsequently during project implementation, will review Contractor performance through monitoring, audits and inspection.

During preparation, Construction and operation of the Maira Dam project, Environmental Management Specialist (EMS)(who will be part of the Consultant's Team) will be responsible for ensuring that the overall objectives of the environmental and social mitigation measures are met, while a Community Liaison Officer (CLO) will be responsible for overall achievement of socio-economic objectives and engagement with stakeholders. The CLO will work closely with the MWI Sociologist while EMS will work closely with MWI's Environmental Specialist. The Water Resources Users Association or any other committees set up to represent the community will work with the Contractors Environment Manager, the EMS, the CLO and Contractors Liaison Officer.

When working on site, the EMS and CLO will report to the Site Engineer (part of the Consultant's Team) who has the power to stop the work at any time should the actions established in the ESMP or otherwise required are not adhered to. Monthly reports shall be submitted to the Client by the Consultant and these will include detailed environment, social and Occupational Health Safety (OHS) issues. EMS will also prepare Annual Monitoring reports on behalf of MWI to be submitted to NEMA.

8.2.2 *The Contractor*

During site preparation, installation and operation and decommissioning the Contractor will be responsible for ensuring compliance with all relevant legislation (highlighted in section 3.0 of this report) as well as adherence to all environmental and socio-economic mitigation measures specified in the ESMP. The Contractor is also responsible under the contract for managing the potential Environmental, socio-economic, safety and health impacts of all contract activities whether these are undertaken by themselves or by their sub-contractors.

Regarding Occupational Health and Safety, the Contractor will have in place an OHS Policy and the OHS Guidelines that comply with OHS Act of 2007. The Contractor also has to have in place guidelines that comply with Public health Act Cap 242 and Act No. 40 of 2006 HIV & AIDS prevention and Control as well as all the relevant legislation already indicated in the earlier section.

The contractor will also be expected to demonstrate commitment to the ESMP included in Environment and Social Impact Statement (ESIS) at all levels in the contractor's management

structure. The Contractor will also be required to prepare a standalone ESMP as a tool to assist in planning of Environment and Social management activities to be implemented alongside construction activities. The Contractor is further required to have in place individuals responsible for overall environment management (including community liaison) and, safety and health management. The Contractor's community liaison team will be required to work with Consultant's CLO to implement the stakeholder engagement plan. The Contractor will be required to undertake regular environmental and socioeconomic Inspections and provide reports to MWT's EMS and CLO to monitor and evaluate performance against the measures and objectives established in the ESMP. Detailed monthly reports including detailed environment and social issues shall be submitted to the Consultant.

8.2.3 Stakeholder Involvement

MWI should continue to engage with the stakeholders throughout project cycle. A system should be established with the stakeholders to ensure that stakeholders receive information on the progress of work and its implications, employment and others. The stakeholders who will be involved in the project were identified at scoping level and more discussion on institutional framework is in section 3.3. Stakeholders include different government departments both at national and local levels, NGOs and the communities. They include institutions like NEMA, Water Resources Management Authority (WRMA), Directorate of Irrigation, Drainage and Storage, National Water Conservation and Pipeline Cooperation etc. **Once the construction is complete, the dam will be handed over to WRMA who will be responsible for the overall management.** The Water Resources User Association will form part of the stakeholders. Grievance Redress Committee which will participate in handling grievances during RAP implementation will also form part of the stakeholders. Grievance Redress Committee structure shall be fully established when Resettlement Action Plan (RAP) has been completed and the actual affected people are known as they form part of this structure. Grievances shall be handled through the structure that will be established by the project and the existing Local Council system as has been discussed in Preliminary RAP. This mainly falls under the Ministry Lands.

An Organization chart for the construction and management of the Maira dam project has been proposed in figure 8-1

8.2.4 Water Resources Users Associations (WRUAs)

One of the statutory ways to promote an effective catchment management strategy is for WRMA to “provide mechanisms and facilities for enabling the public and communities to participate in managing the water resources within each catchment area” (S 15(3)(e)) of Water Act, 2002. S 15(5) then goes on to say that “... the catchment management strategy shall encourage and facilitate the establishment and operation of water resources users associations as fora for conflict resolution and co-operative management of water resources in catchment areas.” The Water Resources Management Rules (2007) define a WRUA as “an association of water users, riparian land owners, or other stakeholders who have formally and voluntarily associated for the purposes of cooperatively sharing, managing and conserving a common water resource”.

All WRUAs levy a joining fee, and then an annual membership fee, which varies according to membership category. This is usually their source of funding.

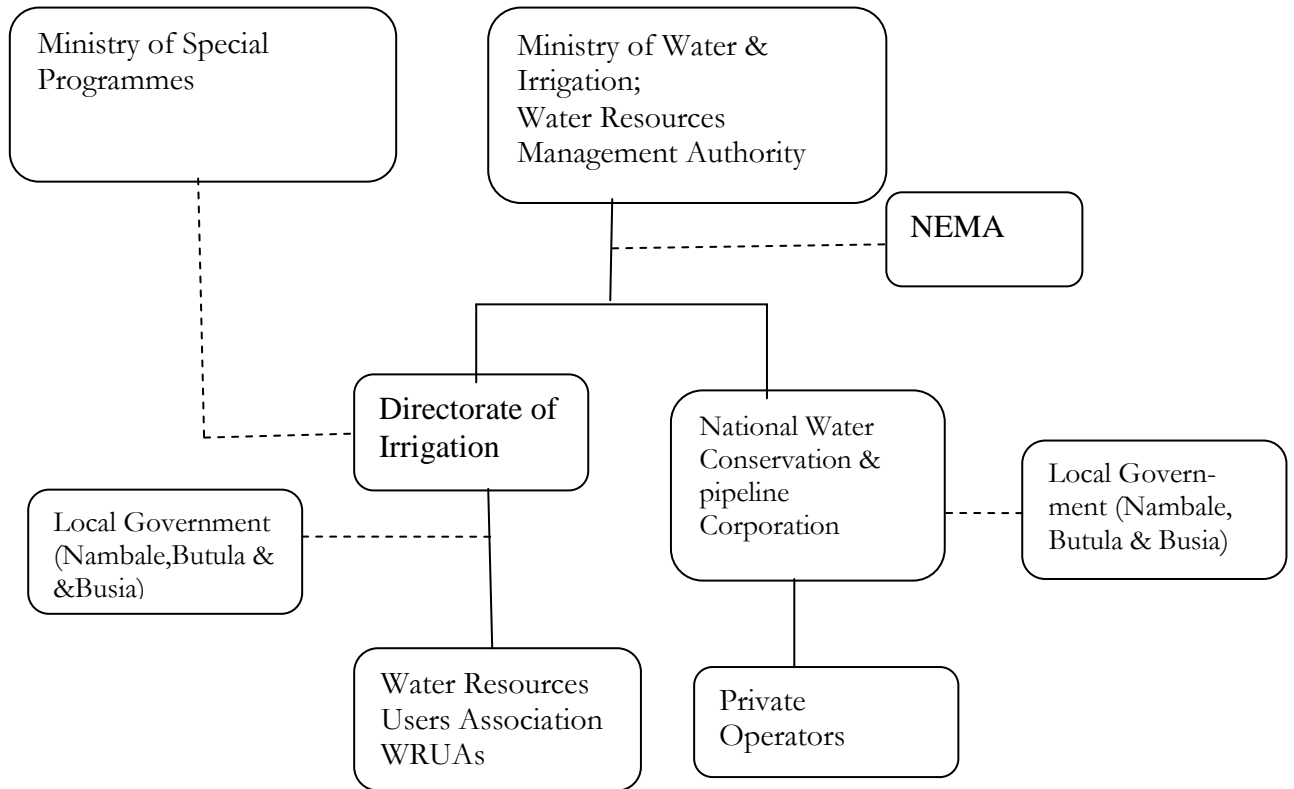
Membership and management of WRUAs is detailed in their constitution, the contents of which are largely governed by their legal status. The constitution of an Association, registered under the Societies Act, is often based upon the specimen provided by the Registrar, as modified to suit individual requirements. More detailed management provisions may be contained in bye-laws made subsidiary to the constitution.

Activities of WRUA

The objectives of a WRUA are set out in its constitution; and typical are:-

- (a) Promote legal water abstraction from the River
- (b) Promote efficient and proper water use of water abstracted from the River
- (c) Promote sustainable water use, water management and water development on the River
- (d) Promote soil and water conservation practices within the catchment area
- (e) Promote conservation of water quality of river
- (f) Promote a situation in which the available river flow is reasonably shared between the environment, wildlife and all the communities relying on river, in a manner that recognizes the following priority ranking of water use:-
 - i. Domestic
 - ii. Livestock
 - iii. Environment, wildlife, fisheries
 - iv. Irrigation
 - v. Recreation
 - vi. Manufacturing industry
 - vii. Other
- (g) Provide a forum to discuss, prevent and resolve water use conflicts
- (h) Promote dialogue between water users and GoK in regard to water policy and enforcement of the Water Act in respect of activities relating to Namanderema River
- (i) Promote a situation in which all modifications to existing river abstractions and all new river abstractions must be approved by the Association before being considered by the relevant water boards.

Figure 8-1 Key Stakeholders participation Structure for Maira Dam Project



8.2.5 Roles of some institutions

Some roles in the project have been identified and are shown below;

Table 8-1: Roles of some Institutions in carrying out impact Mitigation measures

Name of Institution	Usual activities	Emergency
Ministry of Water and Irrigation		Dam construction and repairs in case of serious linkages and flooding. Water allocation and distribution. Conflict resolutions through CAACs and WRUAs.
National Water Conservation and Pipeline Corporation	Dam Construction and repair works	Dam Construction, Dam Repair and flood control
President's Office (District Commissioners)	Community mobilization, enforcement of law and order, coordination of responsible agencies	Community Mobilization and mobilization of relevant institutions including chairing the District Disaster management Committee. Enforcement of law and order through chiefs and other security agencies.
Ministry of Roads and Public Works		Repair and construction of bridges in case of flooding or dam overflows
Health (public Health)		Management of disease outbreaks Occupation safety. Enforcement of sanitation and hygiene rules.
Ministry of Lands	oversee all matters related to land acquisition under its semi-autonomous bodies of the Land Arbitration Tribunal, Valuers Registration Board and Land Control Boards	
NEMA	Monitoring compliance, Water bank conservation and management	
Ministry of Special Programs		Early warning signals to the community through radio programs.

8.3 Mitigation Plan

The Table 8-2 below gives a summary of both positive and negative environmental and social impacts of the proposed project; proposals for enhancement of positive impacts; proposals for mitigation of negative impacts; estimated costs of enhancement and mitigation and the responsibility centre for each activity.

Table 8-2: Environment and Social Mitigation Plan

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
Site preparation, Construction and Dam Operation Phase				
Creation of employment opportunities	<ul style="list-style-type: none"> - Sensitization of communities and information dissemination on the existing job opportunities in the project. - Priority should be given to sourcing local labour from the project area. 	<ul style="list-style-type: none"> a) Meetings for Ministry staff, District staff, Sub-county staff b) Training of Sub-county staff, communities; c) Training of dam operators, regular and casual workers; d) Stationery and communication 	<ul style="list-style-type: none"> a) 9,000 b/c) 7,000 d) 3,000 	Ministry of Water and Irrigation, Ministry of Labour Consultant and Contractor; Local government leaders in Butula , Nambale and Busia Districts Local Government;
Increase in income	<ul style="list-style-type: none"> - Sensitization of communities and disseminating information about existing trade opportunities in the project. - Conduct basic training and skill development for traders and those interested in trade 	<ul style="list-style-type: none"> a) Meetings with district commercial officers and local leaders b) Session for Business development 	<ul style="list-style-type: none"> a) Part of meetings b) 5,000 	Local leaders in the three districts of the project area Consultant and Contractor
Improvement of vulnerable groups' livelihoods and welfare	<ul style="list-style-type: none"> - Train the vulnerable people and provide them with information about the project 	<ul style="list-style-type: none"> a) Training sessions for different vulnerable b) Brochures about the project 	Contractors Budget	Contactors and consultant, NGOs advocating for the vulnerable people
Improved access roads	<ul style="list-style-type: none"> - Support the budget for regular 	<ul style="list-style-type: none"> a) Road maintenance 	Contractors	Ministry of roads and

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
	maintenance of the roads		Budget	public Works , District Works, contractor /Consultant
Flood control	- Conduct awareness campaigns	Awareness meetings for different project stakeholders	Cost catered under awareness Budget	NEMA, Consultant/Contractor
Potential for creation of Wetlands	- Conduct awareness about the importance of wetland	Awareness meetings	Contractor's Budget	MWI/Consultant, NEMA , wetland officers consultant
Impact on Faunal species	- Awareness about Faunal species and the project	Meetings	Budget catered under awareness	NEMA , wild life department
Improved water supply and sanitation facilities	- Continuous sensitization of the communities in regard to use and maintenance of the facilities - Train water user committees and facilitate them to do their work. - Regular maintenance programs should be put in place.	The Leadership in the three districts of the project area	Contractors budget	MWI Local government and division level and water existing Water User committees
Employment provision	- Details of specific job opportunities must be released and information provided on application procedures and supply of locally available construction materials, goods and services. - Develop specific employment programs for women, young, poor and other	a) Information dissemination	Contractor's budget	Labour officers , Contractor

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
	vulnerable groups.			
Generation of Hydropower	- Hold consultation meetings with power generation authorities	Meetings with Kenya Power Authority	Contractor's Budget	Kenya power Authority , contractor
Improved crop farming	- Development irrigation infrastructure - Capacity building of the local people in proper irrigation methods.	Cost of constructing of irrigation structures	Contractors Budget	Ministry of water and Irrigation
Improved fish farming	- Continuous sensitizations about fish farming - Potential fish farmers should be provided with fish stocks - Training and capacity building in fish farming methodologies.	Amount to include fish procurement and training	10,000	Fisheries department , Local government in the project area
Decommissioning				
Boost to Tourism and Recreation	- The local communities should be motivated from time to time through sharing the proceeds that may arise from the use of cultural assets	Cost of putting up community managed bandas	Contributions from CSR	National Museums of Kenya
Reconstruction phase/Planning				
Social expectations generated by disclosure and information to the community.	- Sensitisation of communities by informing them the rights to compensation. - Provision of sufficient project information's avoid negative social expectations	Sensitization meetings Production of information leaflets and flyers	Already catered for under RAP	Consultant and Ministry of Culture and Community Development. Developer and consultant , Community leaders
Site preparation and Construction				

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
Increased Risk to Soil Erosion	<ul style="list-style-type: none"> - Enhance catchment protection through vegetation and tree planting as part of the project - Proper drainage along access roads, murrum pits and all other cut areas to avoid water spreading on the surface 	Cost of tree seedlings and assorted grass species	5,000	Ministry of Roads and public works, Ministry of Environment and Minerals resources
Waste management	<ul style="list-style-type: none"> - Place well labelled waste bins and skimps in convenient locations of the project site - Procure the services waste management sub contactor - Develop simple guidelines on waste management and give these to workers 	a) Cost of 10 waste bins and 3 skimps b) Fees for the waste management sub-contractor c) Cost of guidelines included in the general information	2,500 2,500 pa Already catered	Contractor /NEMA /Local government
Impact on Aesthetics	<ul style="list-style-type: none"> - Restoration of excavated areas by leveling and planting trees / grass - Remove all waste and debris from construction sites 	Cost include in the restoration budget		Contractor /Tourism, ministry
Oil spill and subsequent contamination of soil	<ul style="list-style-type: none"> - Put in place an oil interceptor to contain any oil spills - Erect wooden structures in oil stores rooms - Employ the service of a motor service and mechanic expert for the maintenance of project machinery and equipment 	a)Cost of 3 oil interceptors b) Cost of wooden structures	4,500 4,000 20,000pa	Contractor /NEMA/MEMR

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
		c) Fees for the Mechanic d) Cost of spares parts in the contractors budget		
Disturbances of people nearby (Noise, vibrations and dust)	<ul style="list-style-type: none"> - Minimize disturbed areas and amount of noise, dust and vibrations caused - Quarry sites locations should be away from settlement. - Discuss and formulation of a grievance within ESMP to handle complaints - Plant trees and conserve vegetation especially around the campsite 	Contractors Budget		Contractor /NEMA.Local government
Impacts related to reservoir inundation	<ul style="list-style-type: none"> - Clear reservoir before inundation to avoid eutrophication. 	Cost in the Contractors Budget		Contractor/MWI
Sedimentation of the River system	<ul style="list-style-type: none"> - Suitable site for mining construction material that will not be easily subject to erosion should be recommended. - Avoid excessive stockpiling of the construction material to ensure that all material brought on site is completely used up 	contractors Budget		Contractor/NEMA
Loss of Vegetation	<ul style="list-style-type: none"> - Conduct awareness among workers to minimize degradation - Create a buffer zone between the dam and existing natural vegetation 	<ul style="list-style-type: none"> a) Awareness included in the public campaign budget b) cost of tree planting 		Contractor/ NEMA,/ Ministry of Forestry and Wild life /Local leaders

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
	- Propagate and replant <i>Hallea stipulosa</i> as part of the fencing materials around the reservoir	in the general rehabilitation budget		
Introduction and spreading of non-native invasive plant species.	<ul style="list-style-type: none"> - Sensitization of the project workers about evasive plants and the need to remove them as soon as they are seen; - Remove alien /evasive plants as soon as they are detected, by spraying recommended environmental friendly herbicides or by physical removal. - Rapid rehabilitation should take place, using local species rather than other species taken from elsewhere 	<ul style="list-style-type: none"> a) Budget under rehabilitation and sensitization budgets b) Cost of herbicides 	To be determined	Contractor. NEMA and Local Government
Impact on Faunal species	- Awareness campaigns among the workers about animal species of conservation concern.	Cost under the contractor's budget		Contractor/ Ministry of Forestry and Wildlife
Pressure on infrastructure (water & sanitation, health and other community facilities)	<ul style="list-style-type: none"> -Prioritizes recruitment of the local people. -Project should plan for an increase in infrastructure e.g. sanitary facilities, health facilities, and water facilities among others. 	-		MWI/ Contractor
Pressure on wood fuel leading to decimation of trees	<ul style="list-style-type: none"> - Continuous sensitization of the communities about the dangers of deforestation should be carried out. - Employment opportunities should be extended to the local people 	Cost already included under sensitisation Cost already catered for	-	MWI , District Environmental Officers, Local leaders

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
	- Encourage tree planting in the project area	under tree planting		
Insecurity and theft of project materials	- Empower local authorities to handle the - Employ private security guards at each construction site - Put in place an internal control system to curb cases of theft of materials.	Contractor’s budget		Contractor/Developer Local Government/ Local Communities
Conflicts between the local people and the new comers	- Recruit local labours to curb most problems associated with influx of people. - Sensitize project workers about norms and values of the area - Strengthen local authorities to deal with any cases of indiscipline, conflict or disputes	Budget already included under sensitization Training and facilitation	- 5,000	MWI, Contactor / Local leaders
Impact on vulnerable groups	- Livelihood restoration programmes - Jobs should be equitably distributed to both women and men and other vulnerable groups	RAP Budget		Contractor/Local leaders, Minister for Gender, Children and Social Development
	-			
Increased risk of Diseases(STDs including HIV /AIDS and Malaria)	- Sensitization program targeting the workers and the communities regarding the dangers and spread of	Cost already for awareness campaigns		Contractor /public Health/MOH/ Local leaders

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
	<p>Sexually Transmitted Diseases (STD) including HIV/AIDS.</p> <ul style="list-style-type: none"> - Support local programmes by Ministry of Health regarding HIV/AIDs and facilitate at least 3 health centres in the project area to handle HIV/AIDS voluntary testing and counseling. - Project workers should be provided with condoms. - Sensitization of communities in primary health care so as to reduce on other means of spreading of malaria. - Distribution of mosquito nets and other malarial preventive measures 	<p>Boost 3 health centers with testing kits, source of energy and other requirements</p> <p>Contactors Budget</p> <p>Distribute 6000 mosquito nets to about 1000 households, (6 nets per household) each nets USD 4</p>	<p>Contractors Budget</p> <p>24,000</p>	
<p>Increased pressure on health infrastructure and services</p>	<ul style="list-style-type: none"> - Put in place additional health infrastructure for its workforce to cater for the increased population. - Where possible the project should support health centres which are nearer to the project in terms of laboratory equipment, anti-malarial drugs, etc. - Employment opportunities should be extended to the local people to reduce on the influx of people in the area. 	<p>Contractors Budget</p>		<p>Contractor/MOH</p>

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
Occupational Health and Safety	<ul style="list-style-type: none"> - Training of workers in safe operating procedures. - Provision of appropriate Personal Protective Equipment (e.g. helmets, overalls, nose masks, ear muffs, etc. 	To be included in Contractors' budget		Contactor, MWI/ Consultant/Local Leaders
Community health and safety	<ul style="list-style-type: none"> - Sensitization of the communities about the - Cost of putting warning signs, speed limits etc. - Skilled and properly trained drivers should be employed. - Monthly payment for flaggers to control traffic. - Project workers should be given protective gear 	To be included in Contractors' budget		Contractor / public health/MoH
Destruction of sites and Artifacts mishandling	<ul style="list-style-type: none"> - Train contractors trained in basic skills of handling artifacts so as to avoid breakage, destruction, and loss of priceless assets. - All murrum and stone/rock quarry sites need to be first surveyed by archaeologists in order ascertain the intensity of the cultural assets in the place. 	Included in RAP Contactor's Budget Contactor's budget		Contractor/Consultant, District Local Govt., National Museum of Kenya

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
Destruction of graves and exposure of Human remains	<ul style="list-style-type: none"> - Sensitization of communities on the project and possible impacts on the burials / human remains. - Consulting the area elders on the way forward and requirement needed in case of relocation of human remains - For all the graves that are likely to be affected by the construction activities of the project, the developer should facilitate the relocation of ancestors. 	RAP budget		Contractor National Museum of Kenya
Post construction Operation phase				
Reservoir sedimentation	<ul style="list-style-type: none"> - Institute and enforce good watershed management practices including afforestation, terracing, and good agricultural practices. - Dam design has provided for bottom outlets in the embankment to allow for seasonal flushing of sediments. 	Government budget for catchment management	Contractors budget	Contractor/Community Environment committees
Disruption of aquatic ecological functions downstream	<ul style="list-style-type: none"> - Install a gauge downstream of the embankment to ensure an environmental flow of 0.15m³/s is maintained at all stages of the project. 	Cost of a gauge	Not costed	MWI / Consultant and Contractor
Impact on downstream water uses	<ul style="list-style-type: none"> - Dam should provide proper water supply systems for provision of water to the surrounding communities. 	Cost under Contractors budget		Contractor / WRUAs

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
Introduction and spreading of invasive plant species.	- Control the invasive plant species by using a combination of physical biological control methods.		3,000	Contractoe Consultant/NEMA Environment Dept. at Nambale and Butula
Loss of Land, change of tenure and land use	-Livelihood restoration programs for PAPs Project Affected people should be fairly compensated.	Cost under RAP		
Loss of residential and other community facilities and services (Access roads, footpath etc.	-Compensation for all destroyed or affected structures and facilities	Cost catered under RAP budget		Contractor/ MoH
Risk of drowning	- Sensitization of the community about dangers of dam - Planting trees to form a buffer around the dam - Personnel should be recruited to guard the dam	Already catered under awareness Cost in the contractors budget		Contractor/Local governments
Dam safety related impacts and Flooding a	- Early warning system put in place - Any destroyed property as a result of dam breakage should be compensated. - There should be coordination of the different institutions in case such an event occurs. - Sensitization of the community of an	The budget has just been estimated at this cost but there should be an emergency fund at the national level (under Disaster preparedness) in case the problem goes to	10,000 annually	MWI/ Ministry of Disaster Preparedness/ Department at the district in charge of disaster

Potential Positive Impact	Enhancement measures	Cost Description /unit	Total Cost (USD)	Responsibility
	emergency plan of action in case of a disaster should be done continuously.	a disaster level.		
Environmental impacts of quarries, borrow pits and overburden disposal sites Stockpiles of rock and earth materials	<ul style="list-style-type: none"> - Minimize disturbed areas; - Obtain NEMA clearance to operate quarries, borrow pits and overburden disposal sites; 	- Cost included as part of contractors budget	-	- MoE/Consultant

Total cost for the Implementation of the mitigation measures excluding compensation and resettlement has been estimated at USD 114,500.

8.4 Environmental and Social Monitoring and Management Plan

Table 8-3 provides information regarding impact, monitoring indicators, frequency of monitoring and responsibility.

Table 8-3: Environment Monitoring and Management Plan (EMMP)

Potential Impact	Mitigation Measures/enhancement	Planning	Construction	Oper	Environmental Monitoring Indicator	Frequency of Monitoring	Responsibility
Social expectations generated by disclosure and information to the community.	Provide all information regarding the project, including aspects of hiring labour	√			No. of community meetings held Attendance lists Information material	Monthly	Contractor's Environment and Social Manager (CESM), Ministry of Water & Irrigation (MWI)/ Consultant
Creation of employment opportunities	Sensitization of communities and information dissemination on the existing job opportunities in the project.	√	√	√	No. of community meetings and minutes No. of training sessions and attendance list	Monthly	Contractor's Environment and Social Manager (CESM), MWI Local Leaders
Increase in income	Sensitization meetings and disseminating information on existing trade opportunities Conduct basic training and skill development for traders and those interested in trade		√	√	No. of meetings and minutes Number of training session and reports Quarterly reports		Contractor's Environment and Social Manager (CESM), MWI, Local Leaders
Improved livelihood for Vulnerable groups	Training vulnerable people to benefit from IGAs		√	√	Training session No of Vulnerable people benefiting from IGAs	Quarterly	Contractor's Environment and Social Manager (CESM), NGOs advocating for the vulnerable people

Improved access roads	- Support the budget for regular maintenance of the roads				No. of roads and distance maintained	Monthly	Contractor's Environment and Social Manager (CESM), Ministry of roads and public Works , District Works department, contractor /Consultant
Creation of wetlands and change in Faunas species	- Awareness about wetland importance			√	No. of meetings and Inventory report	Monthly	Contractor's Environmental Manager (CESM) Ministries Environment/ Tourism
Improved water supply and sanitation facilities	- Sensitization meetings		√	√	No. of meetings No. of WRUAs trained and facilitated	Monthly	Contractor's Environment and Social Manager (CESM) Local government WRUAs).
Hydropower generation	- Conduct planning meeting and facilitate households to be connected		√	√	No. Planning meetings held and Minutes No. of Households connected to power	Annually	Contractor's Environment and Social Manager (CESM) Kenya Power Authority , contractor
Improved crop farming	- Training of beneficiaries in best irrigation practice		√	√	No. of Farmers trained No. of farmers using irrigation system on their farm Crop yield	Monthly	Contractor's Environment and Social Manager (CESM) MoA, NIB, MWI)
Improved fish farming	- Technical training - Facilitating house holds with fish stock			√	No. Of training sessions conducted No. of HHs involved in fish farming	Monthly	Contractor's Environment and Social Manager (CESM) Fisheries department

Boost to Tourism and Recreation	- Meetings			√	No. of People involved in Tourism activity	Annually	Contractor's Environment and Social Manager (CESM) MoT
Increased Risk to Soil Erosion	- Catchment protection activities		√	√	Size of acre under tree planting Quarterly reports	Annually	Contractor's Environment and Social Manager (CESM) Forestry department MoR
Solid Waste management	- Putting in place solid waste bins and skimps - Hiring a waste management specialist		√	√	No. of Solid management facilities Monthly reports	Monthly	Contractor's Environment and Social Manager (CESM) , MEMR, Local government
Impact on Aesthetics	- Planting of trees - Landscaping and , - Grassing of all exposed areas			√	-Size of land planted with trees & grass -Landscaped size of land	Monthly	Contractor's Environment and Social Manager (CESM), MW
Oil spill and subsequent contamination of soil	- Putting in place Oil interceptors to contain Oil spillage - Erect wooden structures in oil store rooms		√	√	No. Of interceptors installed No. of wooden structure for holding oil drums A mechanic employed and appointment letter	Quarterly Monthly	Contractor's Environment and Social Manager (CESM) NEMA

Introduction and spreading of non-native invasive plant species.	<ul style="list-style-type: none"> - Sensitizing community and workers about Invasive plant species - Removal of invasive plant species - Rehabilitation of the cleared areas with proven local plant species 	√	√	√	Meetings held and minutes List of plant species removed Area rehabilitated and reports	Monthly Daily observation Monthly	Contractor’s Environment and Social Manager (CESM) MWI, County Environmental Officer (CEO), Forestry Officer
Impact on Faunal species	<ul style="list-style-type: none"> - Awareness meetings 	√	√	√	No. of meetings and minutes	Quarterly	Contractor’s Environment and Social Manager (CESM Ministry of Forestry and Wildlife ,Local Government
Pressure on water / sanitation and other community facilities	<ul style="list-style-type: none"> - recruitment of the local people - plan for an increase in infrastructure e.g. sanitary facilities, health facilities, and water facilities among others 		√	√	% Local workers No. of facilities supported by the project	Quarterly	Contractor’s Environment and Social Manager (CESM), Local Leaders
Pressure on wood fuel leading to decimation of trees	<ul style="list-style-type: none"> - sensitization of the communities about the dangers of deforestation - Employment of local people - Tree Planting 		√	√	Meetings and reports % of local workers on the project Number of trees planted	Monthly	Contractor’s Environment and Social Manager (CESM), Local Leaders, Forestry department
Theft of project materials	<ul style="list-style-type: none"> - Employ private security guards at each construction site - Put in place an internal control system to curb cases of theft of materials. 	√	√	√	No. of theft cases reported	Daily	Contractor’s Security head /Developer Local Government/ Local Communities

Conflicts between the local people and the new comers	<ul style="list-style-type: none"> - Employ local workers - Meetings about norms and values - Capacity building for local leaders 	√	√	√	Cases of conflict reported and handled No. of meetings Training sessions for leaders	Daily Monthly Quarterly	Contractor's Security head /Developer , Local leaders Local government police
Negative Impact on vulnerable groups	<ul style="list-style-type: none"> - Livelihood restoration programmes - Give jobs to vulnerable group members 		√	√	No. of Vulnerable individuals benefiting for livelihood programme Proportion of vulnerable groups by gender employed as project workers	Monthly Monthly	Contractor's Environment and Social Manager (CESM), Local leaders, Minister for Gender, Children and Social Development
Increased risk of (STDs including HIV /AIDS	<ul style="list-style-type: none"> - Sensitization for workers and community - Support HIV/AIDS programme - Provide project staff with protective gear - 	√	√	√	No. of sensitization meeting ad list of attendance No. of health centre supported No. of community members /Workers accessing condoms	Weekly Annually	Contractor's Environment and Social Manager (CESM), District health heads /HIV/AIDS focal person, Community health workers, NGOs, Local leaders
Increased Malaria and other water borne diseases	<ul style="list-style-type: none"> - Provide Mosquito nets - Clear bushes around the reservoir periodically 				No. of Community members /Project workers accessing Mosquito nets	Monthly	Contractor's Environment and Social Manager (CESM), District health heads /HIV/AIDS focal person, Community health workers, NGOs, Local leaders

Increased pressure on health infrastructure and services	<ul style="list-style-type: none"> - Put in place additional health infrastructure for its workforce - Support health centre nearest to the project area 		√	√	No. of additional facilities put in place No. of health centre supported	Monthly	Contractor’s Environment and Social Manager (CESM), District health heads /Community health workers,NGOs,Local leaders
Occupational Health and Safety	<ul style="list-style-type: none"> - Training of workers in safe operating procedures. - Provision of Appropriate Personal Protective Equipment (e.g. helmets, overalls, nose masks, ear muffs, etc. 		√	√	Training session Incidences of injury and body harm	Daily	Contractor’s Environment and Social Manager (CESM), District health heads /Public health officer workers,NGOs,Local leaders
Community health and safety	<ul style="list-style-type: none"> - Sensitization of the communities about the possible dangers - Cost of putting warning signs, speed limits 	√	√	√	No. of meetings and minutes Number of accidents reported	Monthly Weekly	Contractor’s Environment and Social Manager (CESM), District health heads /Public health workers ,NGOs, Local leaders
Destruction of sites and artifacts mishandling	<ul style="list-style-type: none"> - Train contractors trained in basic skills of handling artifacts 		√	√	No. of staff trained Survey reports for quarry sites	Quarterly Once at beginning	Contractor’s Environment and Social Manager (CESM), Local leaders , National Museum of Kenya
Destruction of graves and exposure of Human remains	<ul style="list-style-type: none"> - Sensitization of communities on the project impacts of graves - Consultations about grave handling - Compensate all the affected HHs 		√	√	Consultative and awareness meetings No. of HHs compensated	Monthly	Contractor’s Environment and Social Manager (CESM), Local leaders , National Museum of Kenya

GHG mission	<ul style="list-style-type: none"> - Sensitization of Communities about climate change - Tree planting in areas of the reservoir - Institute management committee for the reservoir 			√	No. of meetings and attendance list No. of trees planted	6 month Quarterly	Contractor’s Environment and Social Manager (CESM) MWI, County Environmental Officer (CEO)
Reservoir sedimentation	<ul style="list-style-type: none"> - Good watershed management practices - Mechanism to allow sediment flushing 			√	Watershed areas are protected Sediment gate is installed	Monthly Quarterly	Contractor’s Environment and Social Manager (CESM) MWI, county Environmental Officer (CEO), Water officer
Impact on downstream water uses	<ul style="list-style-type: none"> - Alternative water supply sources for downstream communities 			√	HHs accessing water No. of water points established	Quarterly	Contractor’s Environment and Social Manager (CESM) MWI, County Environmental Officer (CEO), Water officer
Influx of the people	<ul style="list-style-type: none"> - Recruitment of local labour for all project work 	√	√	√	% of local people working on the project		Contractor’s Environment and Social Manager, NEMA, Local Government
Loss of Land, change of tenure and land use	<ul style="list-style-type: none"> - Put in place Livelihood restoration programs for PAPs - Compensate all PAPs 		√	√	List of programmes and No. of HHs benefiting List of PAPs compensated	Monthly	Contractor’s Environment and Social Manager (CESM) Ministry of Lands, Local leaders
Flooding and Dam safety	<ul style="list-style-type: none"> - Early warning signs to the community in case of disaster - Proven coordination 			√	Incidences reported	Monthly	Contractor’s Environment and Social Manager (CESM) MWI, County Environmental Officer (CEO Department at the district in charge of disaster, Dam safety expert

Environmental impacts of quarries, borrow pits and overburden disposal sites Stockpiles of rock and earth materials	- Put in place proper management of such sites	✓	✓	✓	Reports	Monthly	Contractor’s Environment and Social Manager (CESM) MWI, Country Environmental Officer (CEO)
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Table 8-4: Monitoring Budget

Management Plan (ESMP)					
1. Construction					
a) Fees /allowance					
Staff /Monitors	No.of staff	Days of work per month	Total Days for 1.5years	Unit cost (USD)	Total Cost (USD)
1. Environment Management Specialist (EMS)	1	10	180	300	54000
2. Community Liaison Officer (CLO)	1	20	360	150	54000
3. Site Environmental Officer (SEO)	1	20	360	150	54000
4. District Environmental Officers (DEO) & other Officials	2	2	36	70	2520
Total					164,520.00
b) Reimbursible					
Item	No of trips	Unit cost per trip (USD)			Total
Transport	18	500			9000
Perdiem EMS	18	280			5040
Perdiem SEO	6	280			1680
Perdiem CLO	6	280			1680
Water quality	6	1,500			9000
Miscilleneous					1000
Total					27,400.00
2. Liability Period					
a) Fees /allowances					
Staff	No.of staff	Days of work/yr	Total days	Cost /day	Total cost
EMS	1	5	30	300	9000
Total					9,000.00
Reimbursable					
Item	No. of trips/tim	Cost per trip			Total
Transport	6	500			3000
Perdiem	6	280			1680
Total					4,680.00
Total fees					173520
Total Reimbursible					32080
Grand Total					205,600.00
The cost of environmental monitoring is estimated at USD205,600					

According to the feasibility Team, construction of the dam and associated infrastructure will take a period of 1.5 years and liability period of about 6months has been assumed. The EMS will make one trip per month to the site but the SEO and the CLO are full time. However the SEO and the CLO may visit Nairobi once in a quarter. During liability period, only the EMS will be expected on the site to carryout environmental monitoring. Other stakeholders may also participate but have not been budgeted for.

8.5 ESMP Budget

The total budget for ESMP will consist of the budget for Mitigation plan and that of Environment Monitoring Plan. Mitigation plan cost was estimated at 114,500 while that of monitoring plan has been estimated at **USD 320,100**. Therefore a budget of USD 205,600 has been estimated for the ESMP for Maira Multipurpose Project excluding RAP costs which are detailed in Preliminary RAP report.

8.6 Review of Capacity and Capacity Building

Management of the project will involve a number of stakeholders that will include but not limited to; Ministry of Water and Irrigation, ministry of local Government/provincial Administration, Ministry of Lands, Ministry of Roads and Public Works, NEMA, Private companies and locally based Dam Management committees.

At present, the Ministry of Water and Irrigation is the principal institution given its mandate especially through the Directorate of Irrigation and drainage and water Storage. The capacity of the ministry to manage a big project such as the proposed dam is low as its current clients are individual smallholders and small holders' group-based farmers. Through consultations with the districts of Butula, Nambale and Busia, it was found out that the current capacity of the directorate of irrigation, drainage and water storage at district level is very low. The district offices in the project area are grossly under staffed. There is only one technical officer in the three project districts(Busia, Butula and Nambale) yet according to the structure of these ministries, a district is supposed to be manned by four (4) technical staff in charge of; irrigation and drainage, irrigation water management, planning and design-including surveying

There is a general lack of knowledge and skills in environment project related fields among key stakeholders (the directorate, contractors and dam operation and maintenance staff). These include but not limited to; environment impact assessment, environment management plan, environmental regulations and acts, environmentally sound construction management.

Other skills gaps exists in areas of dam safety, In stream Flow Releases (IFR) and best practices in the operation and maintenance of dam projects

Training

In order to address the above capacity needs/ gaps among key stakeholder, table 8-5 outlines the proposed training for DIDWS staff, dam operating staff and employees of the contractor. The training is intended to provide practical aspects of environmental monitoring and management

Table 8-5: Training of, Contractors’ Employees and Dam Management Staff (DWS)

No	Training Recipients	Mode of Training	Aspects to be Covered	Training Providers
1	Ministry of Water and Irrigation	Workshops Study Tours Lecture Methods	Environment and social overview Environment Management plans Environmental and social regulations and acts Environmentally sound construction management Requirement of resettlement plan	Supervision consultant Environment and Social Specialist
2	Contractors Staff	Workshops Study Tours Lecture Methods	Environment and social overview Environment Impact assessment Environment Management plans Environmental and social regulations and acts Environment Pollution associated with irrigation dams Environmentally sound construction management Requirement of resettlement plan	Supervision consultant Environment and Social Specialist
3	Dam Operation and Maintenance staff	Workshops Study Tours Lecture Methods	Best practices in dams operation and maintenance Aspects of dam safety Best Environmental practices Environment Pollution associated with irrigation dams	In stream Flow Releases (IFR) specialist Supervision Consultant Environment and Social specialist

8.7 Reporting

Monthly progress report accompanied by environmental monitoring reports that include illustrations and records shall be prepared by the Consultant (EMS) and submitted to MWI for purposes of review of environmental management performance of the Contractor. Annual reports containing all data obtained during the environmental monitoring throughout the year shall be submitted to NEMA by MWI up to end of construction period. According the Part V of the Environmental (Impact Assessment and Audit) Regulations, 2003, section 31 an environmental audit study is to be under taken on developments that are likely to have adverse effects. New projects undertaken after completion of the Environmental Impact Study are also considered (section 31 b). Therefore an annual Audit report shall be submitted to NEMA by NEMA by MWI. During operation and Maintenance MWI is expected to continue following up on environmental issues especially maintenance.

9 CONCLUSION AND RECOMMENDATIONS

9.1 Conclusions

A number of positive impacts will come along with this project especially those related improved incomes through improved agriculture and irrigation as well as employment and, improved water supply. The project will also have negative impacts however, once the proposed mitigation measures are implemented, most of the negative impacts will either be eliminated or minimized except those related to loss of land , loss of structures and displacement, influx of people which is related to HIV/AIDs as well as social expectations. Mitigation and monitoring of the residual impacts will therefore be long term impacts. However the main conclusion of this Environment Impact Assessment is that there is no environmental obstacle to implementation of the project, if environmental and social management plan (ESMP) is properly implemented. For the implementation to be carried out smoothly, recommendations have been proposed.

9.2 Recommendations

9.2.1 *Institutional Cooperation*

A number of institutions will be involved in this project in all phases as was indicated in stakeholder identification. In order to enhance implementation of the proposed mitigation measures there is need for collaboration between Ministry of Water and Irrigation, NELSAP and all relevant stakeholders indicated under stakeholder involvement. It is imperative that clear roles and responsibilities for the different institutions be streamlined before construction activities start. This has been discussed but more will need to be done before project commencement.

9.2.2 *Sensitization*

Continuous sensitization should be done during project Construction, Operation and Maintenance phase. Key issues for emphasis during sensitization include but not limited to; Health and safety, HIV /AIDs, opportunities, Compensation issues, Grievance Procedures, gender issues and others

9.2.3 *Employment Opportunities*

The active work force has not yet been estimated but what is clear is that there will be both skilled and non-skilled / casual labourers. It is recommended that workers should be recruited from the local communities, especially in non-skilled positions, whenever possible. Employing local people will not only benefit the communities but also eliminate or reduce the costs of providing housing and logistics. Local people should be given priority and proper consideration should be made to ensure that some manual

work being' flag women' is given to women as well as work in the traditionally female areas of cooking and market activities.

9.2.4 Cultural and Archaeological aspects

During consultation and field surveys, there were some archaeological resources identified in the project area. Therefore it is recommended that the department museum in Kenya be involved in the training of the contractors before start of contraction so that chance finds are not ignored. Once these are found, the museum officials should be informed and the finds delivered to the museum

9.2.5 Planning and Co-ordination with Local Authorities

Throughout all phases of the project, local authorities should be informed of the decisions taken by the Ministry of Water and Environment and consulted whenever possible. This will ensure good cooperation with the communities and avoid misunderstandings. A committee with representatives from the Districts, Lower local Governments and Communities has already been proposed and should be established in order to ease communication during construction.

9.2.6 Resettlement Action Plan (RAP) and Property Valuation

During this ESIA study, a preliminary RAP was prepared alongside and indicative property likely to be affected and types of assets in the affected area. This is in line with ***Annex A of the Involuntary Resettlement Policy of African Development Bank***. A RAP detailing individual affected persons, sizes of land and other individual property, grievance procedures, eligibility and criteria, payment mechanism and others will need to be carried out in the next phase of this study. Actual valuation of property and crops is to be affected should be done before construction. During construction, if any damage that was not envisaged is experienced, the valuation of such should be done. This will ensure that the process of compensation is prompt and fair.

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ANNEXES

Annex 1: Socio-economic Tool

My name is _____
I am here on behalf of the Nile Basin Initiative/Nile Equatorial Lakes Subsidiary Action Program (NBI/NELSAP). This is an organization formed to develop the River Nile and its resources in an equitable and sustainable way for the benefit of the people of the Nile Basin. The NBI also aims at promoting regional peace and security.

We would therefore like to ask you some questions of which the responses will help in the planning, construction and operation phases. The information you will give will be treated with utmost confidentiality.

Socio-Economic Survey Tool

Serial No. -----

SECTION 1: Locational Details

Country-----District/County-----
Division ----- Location-----
Sub Location -----Village-----
Name of interviewer: -----
Date of interview -----
Time begin interview: -----
Time end interview: -----
Duration of interview: -----

SECTION 2: Demographic Details

Gender of household head 1-Male 2- Female

Age in completed years for household head -----

In addition, tick right code

1-0-18 2-19-25 3-26-35
4-36-45 5-46-55 6-Over 55

Highest level of education attainment of household head

1-None 2-Primary 3-Secondary
4-Tertiary 5-University
6-Other (Specify)

Marital Status of head of household

1-Married 2-Single 3-Widowed
4-Divorced 5-Cohabiting 6-Other (Specify)

Ethnic group of household head_____

Religious affiliation of household head

1-Protestant 2-Catholic 3-Muslim

4-African tradition 5-No belief 6-Other (Specify)

Household members

Age bracket	Male	Female	Total
0-10yrs			
11-20yrs			
21-30yrs			
31-40yrs			
41-50yrs			
51-60yrs			
Above 60			
Total			

Is there any orphan in this household? 1-Yes 2- No

If yes, what was the cause of death of their parents?

- Malaria 1
- HIV/AIDS 2
- Other diseases 3
- Accident 5
- War 6
- Others specify 7

Presence of disabled person in the household? 1-Yes 2- No

If there is any member of the household who is disabled, what is the type of disability?

- Physical 1
- Blind 2
- Mental 3
- Other (specify) 4

SECTION 3: SOURCE OF LIVELIHOOD, INCOME AND EXPENDITURE

Livelihood status 1-Employed 2-Not employed

Main Source of livelihood (only one answer)

- 1-Peasant Farmer 2-Commercial Farmer 3-Civil Servant
- 4-Trader 5-Service Provider (E.G. Salon, Hotel, Transport)
- 6- Casual Laborer
- 7-Other (Specify)

Other sources of livelihood (Multiple answers)

- 1-Peasant Farmer 2-Commercial Farmer 3-Salaried worker
- 4-Trader 5-Service Provision (E.G. Salon, Hotel, Transport)
- 6- Casual Laborer
- 7-Other (Specify)

Total income per year

Farming _____
 Employment _____

Type of livestock. (Multiple responses possible)

- Sheep 1 Number.....
- Goats 2 Number.....
- Cattle 3 Number.....
- Pigs 4 Number.....
- Poultry 5 Number.....
- Other (specify other animals) 6 Number.....

Do you sell some of the animals?

- Yes 1
- No 2

Main buyer for Livestock _____

Are you a fish farmer? 1-Yes 2- No

If yes, do you sell some of the fish caught? 1-Yes 2- No

What is the distance to the main marketing point for your products?

- Less than 500ms 1
- 500-1km 2
- 1-3kms 3
- Above 3kms 4

What problems do you encounter when marketing your farm produce?

- Low prices 1
- Fluctuating prices 2
- Poor roads 3
- Delayed payment 4
- Very high deductions 5
- Other (specify) 6

Apart from household head, how many other household members are working? -----

What items/services take up most of your expenditure? Please rank them in order of highest expenditure by assigning them numbers from 1-9. The highest expenditure rank -1, lowest expenditure rank 9

Item	Yes (1) No (2)	Average amount spent (yearly)	Rank
Food			
Transport			
Medical bills			
Clothing			

Rent			
Energy			
Water bills			
School fees			
Other (specify)			

How many other members of the household are working? -----

Average income for other household members per year -----

SECTION 4: LAND OWNERSHIP AND TENURE

Do you own land?

Yes 1

No 2

Under what tenure system is your land? (Only one answer)

Customary 1

Leasehold 2

Freehold 3

Communal 4

Private/title deed 5

SECTION 5: ASSETS OWNED

Assets owned by the household (Multiple answers acceptable)

Radio 1

TV 2

Bicycle 3

Motorcycle 4

Car 5

Cell phone 6

Land 7

House 8

Animals (cattle, pigs, goats, sheep, poultry) 9

Others 10

SECTION 6: SOURCES OF ENERGY

What kind of fuel do you use for cooking at home? (Multiple responses)

Firewood 1

Charcoal 2

Paraffin/Kerosene 3

Electricity 4

Gas 5 Biogas 7

Solar 6 Others 8

What kind of fuel do you use for lighting at home? (Multiple responses)

Firewood 1

Charcoal 2

- Paraffin/Kerosene 3
- Electricity 4
- Gas 5
- Solar 6
- Biogas 7
- Others 8

Electricity in your village? 1-Yes 2- No

Connected to electricity main power? 1-Yes 2- No

SECTION 7: ACCESS TO INFORMATION

How do you access information about different aspects? (Multiple answers acceptable)

- Radio 1
- TV 2
- Newspapers 3
- Community meetings 4
- Village public speakers 5
- Telephones 6
- Place of worship 7
- Neighbor 8
- Other (specify) 9

Are you connected to any mobile money transfer system e.g. M-pesa? 1-Yes 2- No

Do you own a television or radio? 1-Yes 2- No

Frequency of reading a newspaper

- 1-Daily 2- Weekly
- 3-Fortnight 4- Not at all

SECTION 8: FOOD SECURITY

In the last 12 months, are there days when your household did not have lunch or supper or did not eat to satisfaction because of lack of enough food?

- Yes 1
- No 2

If yes, what were the reasons for the food shortage (not being enough)? (Multiple answers acceptable)

- Land not enough for food production 1
- The yield was poor due to poor weather, pest, diseases, soil fertility, rodents, other animals 2
- Poor seeds used in planting 3
- Sold most of the produce 4
- Did not plant enough 5
- Drought 6
- Flooding/too much rain 7
- Other reason (specify) 8

SECTION 9: EDUCATION

Is there any member of your of household who is of school going age but does not go to school?

Yes 1
No 2

If no, why isn't he/she in school?

Lack of money for school fees 1
Lack of money for scholastic materials 2
Lack of interest 3
Cultural does not allow 4
Has to look after family 5
Has to get married 6
Others (specify) 7

What is the distance to the nearest primary school?

Less than 500ms 1
500-1km 2
1-3kms 3
Above 3kms 4

What is the distance to the nearest Secondary school?

Less than 500ms 1
500-1km 2
1-3kms 3
Above 3kms 4

Has any member of this household received any other training (skills)?

Yes 1
No 2

If yes, specify

Do you know how to read and write in the following languages?

Official language Yes 1 No 2
Any local language Yes 1 No 2

SECTION 10: HEALTH

Has any member of the household been ill in the last 6 months? 1-Yes 2- No

If yes, what was he/she suffering from?

Malaria 1
Water related diseases (Cholera, Worms, Dysentery, Typhoid, and Diarrhea) 2
STDs (Syphilis, HIV, Gonorrhoea etc) 3
Skin diseases 4
Cough 5
Burns 6
Ulcers 7
Respiratory infections 8
Intestinal Infections 9

Others 10

What is the distance to the nearest health Center?

- Less than 500m 1
- 500-1km 2
- 1km- 3kms 3
- 3-5kms 4
- 6km+ 5

What is the distance to the nearest (district hospital) referral health unit?

- Less than 500m 1
- 500-1km 2
- 1km- 3kms 3
- 3-5kms 4
- 6km+ 5

What do you think of the services offered by the nearest health center?

- Very good 1
- Good 2
- Average 3
- Poor 4

Give reasons for your answer above

Reasons for very good and good (Multiple answers accepted)

- There are qualified doctors 1
- There are enough doctors and nurses 2
- There is enough medicine 3
- There is a laboratory 4
- There are enough equipment 5
- Others (specify) 6

Reasons for average and poor (Multiple answers accepted)

- Lack of qualified doctors 1
- Lack of enough doctors and nurses 2
- Lack of enough medicine 3
- Lack of a laboratory 4
- Lack of enough equipment 5
- Others (specify) 6

Have you heard of HIV/AIDS?

- Yes 1
- No 2

Do you know of anybody who has publicly declared that he was HIV/AIDS?

- Yes 1
- No 2

What are the major causes of HIV/AIDS?

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

SECTION 11: WATER SUPPLY

What is the main source of water for your household? (only one answer)

- Public boreholes 1
- Privately owned boreholes 2
- Rain Water harvesting 3
- Protected Spring/well 4
- Unprotected Spring/well 5
- River, Lake, stream, swamp 6
- Valley Tank/Earth dam 7
- Stand post 8
- Others (specify) 9

What other alternative sources of water are available for your household? (Multiple responses acceptable)

- Public boreholes 1
- Privately owned boreholes 2
- Rain Water harvesting 3
- Protected Spring/well 4
- Unprotected Spring/well 5
- River, Lake, stream, swamp 6
- Valley Tank/Earth dam 7
- Stand post 8
- Others (specify) 9

Apart from domestic use, what else do you use the water for?

- Brick making 1
- Watering animals 2
- Fish farming 3
- Agricultural use / Irrigation 4
- Brewing 5
- Other (Specify) 6

How sufficient is this water?

- Throughout the year 1
- Insufficient during dry season 2
- Insufficient throughout the year 3
- Others (specify) 4

What is the distance from your home to the water source?

- Less than 500m 1
- 500-1km 2
- 1km- 3kms 3
- Above 3kms 4

How much time per day do you spend fetching water on a single trip?

- Less than 30 minutes 1
- 30 minutes to 1 hour 2
- 1 to 2 hours 3
- More than 2 hours 4

How many jerry cans of water does your household use per day?

- Domestic use.....
- Brick making
- Watering animals
- Brewing
- Others

What problems do you encounter with the water source? (multiple responses accepted)

- Too steep 1
- Expensive 2
- It dries up 3
- Long distance 4
- Swampy 5
- None 6
- Others(Specify) 7

What do you think of the quality of water delivered?

- Taste: 1 Good 2 Average 3 Poor
- Smell: 1 Good 2 Average 3 Poor
- Color: 1 Good 2 Average 3 Poor
- Hardness: 1 Good 2 average 3 Poor

SECTION 12: SANITATION

Do you have a toilet/latrine?

- Yes 1
- No 2

What type of latrine does your household use in your homestead?

- Traditional pit latrine 1
- Flush toilet 2
- VIP 3
- Ecosan 4
- Shallow pits 5
- Others (specify) 6

If no, where do you go to the toilet?

- Neighbor 1
- Public toilet 2
- Bush 3
- Others (specify) 4

What are the reasons that inhibit you from owning a latrine?

- Lack of money to construct toilet 1

- Lack of interest 2
- Poor soils 3
- Culture does not allow 4
- Others (specify) 5

How does your household dispose of the solid wastes? (Multiple responses acceptable)

- Open dumps 1
- Burning 2
- Shallow pits 3
- Scatter in gardens 4
- Others (specify) 5

Are there any public garbage disposal areas in designated by the local authorities or the government?

- Yes 1
- No 2

SECTION 13: GENDER ISSUES

Does your wife own land?

- Yes 1
- No 2

Is your wife allowed to make decisions on issues regarding land?

- Yes 1
- No 2

Do you or any member of your household belong to any group or association?

- Yes 1
- No 2

If yes, answer the questions in the table below

Name of group	Type of group (see codes below)	Main activity/services of the group

Codes:

Type of group 1=Women only group 2=Men only group 3=Mixed group 4=Cooperative Society
 5=Association 6=Other (specify)

SECTION 14: EXPECTATIONS AND FEARS FROM THE PROJECT

What are your expectations of the project?

What are your fears in regard to the project?

Please give suggestions on how these fears can be overcome or mitigated

Annex 2: Certificate of Water Analysis

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
	DEPARTMENT: Water Quality & Pollution Control	ISSUE NO.: 01
	ISSUED BY: WQ & PCO	REV. NO.: 0
AUTHORIZED BY: TM	DATE OF ISSUE: 15th March, 2010	
		PAGE: 9 of 10

SERIAL No.:79.....

Name of Customer: ... NEW PLAN - KAMPALA


Address: ... P.O. Box 7544 KAMPALA

Sample No.: 202/012.....

Sample Source: Confluence of namalema & namudoda

Date Sampled:.....24 04 2012..... Date analyzed:.....24 04 2012.....

Parameters	Units	RESULTS	ANALYST	WHO GUIDELINE STANDARDS FOR DRINKING WATER
Dissolved Oxygen	mg/l	5.92	Muiruri/judy	>4
Temperature	°C	27.5	Muiruri/judy	25 ± 5
E. Conductivity	µS/cm	76.8	Muiruri/judy	<1500
Total Dissolved Solids	mg/l	40.1	Muiruri/judy	<1200
Total Suspended Solids	mg/l	100	Muiruri/judy	<30
pH	pH Scale	6.32	Muiruri/judy	6.5 - 8.5
Colour	mgPtCo/l	7.5	Muiruri/judy	<15
Turbidity	NTU	141	Muiruri/judy	< 5
Iron	mgFe/l	0.21	Muiruri/judy	< 0.3
Total Hardness	mgCaCO ₃ /l	30	Muiruri/judy	<500
Total Alkalinity	mgCaCO ₃ /l	32	Muiruri/judy	<500
Chloride	mgCl/l	3.87	Muiruri/judy	<250

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
	DEPARTMENT: Water Quality & Pollution Control	ISSUE NO.: 01
	ISSUED BY: WQ & PCO	REV. NO.: 0
	AUTHORIZED BY: TM	DATE OF ISSUE: 15 th March, 2010
		PAGE: 10 of 10

Fluorides	mgF/l	0.01	Muiririjudy	< 1.5
BOD₅	mgO ₂ /l	1	Muiririjudy	< 10
COD	mgO ₂ /l	36.9	Muiririjudy	< 40
Total Coliforms	/100ml	≥1600	Muiririjudy	0
Faecal Coliforms	/100ml	≥1600	Muiririjudy	0

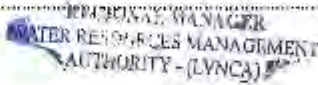
Receipt No.:


Date... 16/05/012

Issued by: Rose S Ogara
 Assistant Technical Coordination Manager (WQ & PC)

Approved by: Joab M. Obam
 REGIONAL MANAGER

FOR: Regional Technical Manager



	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
		ISSUE NO.: 01
	DEPARTMENT: Water Quality & Pollution Control	REV. NO.: 0
	ISSUED BY: WQ & PCO	DATE OF ISSUE: 15th March, 2010
AUTHORIZED BY: TM	PAGE: 5 of 10	

SERIAL No. 77.....

Name of Customer: NEW PLAN - KAMPALA


Address: P.O. BOX 7544 KAMPALA.....

Sample No.: 209/012.....

Sample Source: NAMADELEMA RIVER @PT.4

Date Sampled: 24 - 04 - 2012 Date analyzed: 24 - 04 - 2012.....

Parameters	UNITS	RESULTS	ANALYST	WHO GUIDELINE STANDARDS FOR DRINKING WATER
Dissolved Oxygen	mg/l	5.45	Muiruri/judy	>4
Temperature	°C	25.5	Muiruri/judy	25 ± 5
E. Conductivity	µS/cm	82.6	Muiruri/judy	<1500
Total Dissolved Solids	mg/l	43.8	Muiruri/judy	<1200
Total Suspended Solids	mg/l	90	Muiruri/judy	<30
pH	pH Scale	7.47	Muiruri/judy	6.5 - 8.5
Colour	mgPtCo/l	7.5	Muiruri/judy	<15
Turbidity	NTU	126	Muiruri/judy	< 5
Iron	mgFe/l	0.02	Muiruri/judy	< 0.3
Total Hardness	mgCaCO ₃ /l	38	Muiruri/judy	<500
Total Alkalinity	mgCaCO ₃ /l	31	Muiruri/judy	<500
Chloride	mgCl/l	3.87	Muiruri/judy	<250

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
		ISSUE NO.: 01
	DEPARTMENT: Water Quality & Pollution Control	REV. NO.: 0
	ISSUED BY: WQ & PCO	DATE OF ISSUE: 15 th March, 2010
AUTHORIZED BY: TM	PAGE: 6 of 10	

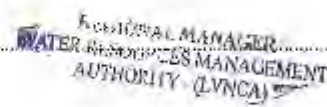
Fluorides	mg/l	0.09	Muiruri/judy	< 1.5
BOD ₅	mgO ₂ /l	1	Muiruri/judy	< 10
COD	mgO ₂ /l	46.2	Muiruri/judy	< 40
Total Coliforms	/100ml	≥1600	Muiruri/judy	0
Faecal Coliforms	/100ml	≥1600	Muiruri/judy	0

Receipt No.:

Date: 16/03/2010

Issued by: Rose S Ogara
 Assistant Technical Coordination Manager (WQ & PC)

Approved by: M. Obam
 FOR: Regional Technical Manager





WATER RESOURCES MANAGEMENT AUTHORITY

TITLE: Analytical Certificate	REF. NO.: F/9/2/3
DEPARTMENT: Water Quality & Pollution Control	ISSUE NO.: 01
	REV. NO.: 0
ISSUED BY: WQ & PCO	DATE OF ISSUE: 15 th March, 2010
AUTHORIZED BY: TM	PAGE: 7 of 10

SERIAL No.:...78.....

Name of Customer:... NEW PLAN - KAMPALA


Address:... P.O. BOX ...7544 KAMPALA

Sample No.: 201/012.....

Sample Source: NAMUDDA RIVER @PT.5

Date Sampled:...24 – 04 - 2012..... **Date analyzed:**...24 – 04 - 2012.....

Parameters	UNITS	RESULTS	ANALYST	WHO GUIDELINE STANDARDS FOR DRINKING WATER
Disolved Oxygen	mg/l	1.18	Muiruri/judy	>4
Temperature	°C	24.2	Muiruri/judy	25 – 5
E. Conductivity	µS/cm	167.8	Muiruri/judy	<1500
Total Dissolved Solids	mg/l	61.3	Muiruri/judy	<1200
Total Suspended Solids	mg/l	30	Muiruri/judy	<30
pH	pH Scale	6.90	Muiruri/judy	6.5 - 8.5
Colour	mgPtCo/l	10	Muiruri/judy	<15
Turbidity	NTU	20.3	Muiruri/judy	< 5
Iron	mgFe/l	0.18	Muiruri/judy	< 0.3
Total Hardness	mgCaCO ₃ /l	66	Muiruri/judy	<500
Total Alkalinity	mgCaCO ₃ /l	60	Muiruri/judy	<500
Chloride	mgCl/l	2.91	Muiruri/judy	<250
Fluorides	mgF/l	0.06	Muiruri/judy	≤ 1.5
ROD ₅	mgO ₂ /l	4	Muiruri/judy	< 10

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
	DEPARTMENT: Water Quality & Pollution Control	ISSUE NO.: 01
	ISSUED BY: WQ & PCO	REV. NO.: 0
	AUTHORIZED BY: TM	DATE OF ISSUE: 15 th March, 2010
		PAGE: 8 of 10

COD	mgO ₂ /l	61.5	Muiruri/judy	<10
Total Coliforms	/100ml	≥1600	Muiruri/judy	0
Faecal Coliforms	/100ml	≥1600	Muiruri/judy	0


Receipt No.:

Date... 7/6/2012

Issued by: Rose S Ogara
 Assistant Technical Coordination Manager (WQ & PC)

Approved by: Josh A. Obam
 FOR: Regional Technical Manager

REGIONAL MANAGER
 WATER RESOURCES MANAGEMENT
 AUTHORITY – (LVNCA)

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
		ISSUE NO.: 01
	DEPARTMENT: Water Quality & Pollution Control	REV. NO.: 0
	ISSUED BY: WQ & PCO	DATE OF ISSUE: 15th March, 2010
AUTHORIZED BY: TM	PAGE: 3 of 10	

SERIAL No...76.....

Name of Customer... NEW PLAN - KAMPALA


Address... P.O. BOX ...7544 KAMPALA

Sample No.: 199/012.....

Sample Source: NANG'ENI RIVER @ PT.5

Date Sampled...24-04-2012.....Date analyzed...24-04-2012.....

Parameters	UNITS	RESULTS	ANALYST	WHO GUIDELINE STANDARDS FOR DRINKING WATER
Dissolved Oxygen	mg/l	6.70	Muiruri/judy	>4
Temperature	°C	25.1	Muiruri/judy	25 – 5
E. Conductivity	µS/cm	78.4	Muiruri/judy	<1500
Total Dissolved Solids	mg/l	40.6	Muiruri/judy	<1200
Total Suspended Solids	mg/l	140	Muiruri/judy	<30
pH	pH Scale	6.51	Muiruri/judy	6.5 – 8.5
Colour	mgPtCo/l	7.5	Muiruri/judy	<15
Turbidity	NTU	162	Muiruri/judy	< 5
Iron	mgFe/l	0.01	Muiruri/judy	< 0.3
Total Hardness	mgCaCO ₃ /l	34	Muiruri/judy	<500
Total Alkalinity	mgCaCO ₃ /l	26	Muiruri/judy	<500
Chloride	mgCl/l	3.84	Muiruri/judy	<250

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
	DEPARTMENT: Water Quality & Pollution Control	ISSUE NO.: 01
	ISSUED BY: WQ & PCO	REV. NO.: 0
AUTHORIZED BY: TM	DATE OF ISSUE: 15 th March, 2010	
		PAGE: 4 of 10

Fluorides	mgF/l	0.07	Muiruri/judy	<1.5
BOD₅	mgO ₂ /l	1	Muiruri/judy	<10
COD	mgO ₂ /l	276.9	Muiruri/judy	<40
Total Coliforms	/100ml	≥1600	Muiruri/judy	0
Feecal Coliforms	/100ml	≥1600	Muiruri/judy	0


Receipt No.:

Date: 16/05/012

Issued by: Rose S Ogara
 Assistant Technical Coordination Manager (WQ & PC)


Approved by: M. Cab. N. Dbam
 FOR: Regional Technical Manager

REGIONAL MANAGER
 WATER RESOURCES MANAGEMENT
 AUTHORITY - (LVNCA)

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
		ISSUE NO.: 01
	DEPARTMENT: Water Quality & Pollution Control	REV. NO.: 0
	ISSUED BY: WQ & PCO	DATE OF ISSUE: 15th March, 2010
	AUTHORIZED BY: TM	PAGE: 1 of 10

SERIAL No.: 75.....
Name of Customer: NEW PLAN - KAMPALA
Address: P.O. BOX 7544 KAMPALA.....
Sample No.: 198/012.....
Sample Source: NANG'ENI RIVER B4 CONFLUENCE WITH R. SIO
Date Sampled: 24 - 04 - 2012... **Date analyzed:** 24 - 04 - 2012.....

PARAMETERS	UNITS	RESULTS	ANALYST	WHO GUIDELINE STANDARDS FOR DRINKING WATER
Dissolved Oxygen	mg/l	5.11	Muiruri/judy	≥4
Temperature	°C	27.5	Muiruri/judy	25 ± 5
E. Conductivity	µS/cm	76.2	Muiruri/judy	<1500
Total Dissolved Solids	mg/l	42.4	Muiruri/judy	<1200
Total Suspended Solids	mg/l	130	Muiruri/judy	<30
pH	pH Scale	7.61	Muiruri/judy	6.5 - 8.5
Colour	mgPtCo/l	5	Muiruri/judy	<15
Turbidity	NTU	146	Muiruri/judy	< 5
Iron	mgFe/l	0.02	Muiruri/judy	< 0.3
Total Hardness	mgCaCO ₃ /l	34	Muiruri/judy	<500
Total Alkalinity	mgCaCO ₃ /l	28	Muiruri/judy	<500
Chloride	mgCl/l	2.96	Muiruri/judy	<250
Fluorides	mgF/l	0.01	Muiruri/judy	< 1.5

	WATER RESOURCES MANAGEMENT AUTHORITY	
	TITLE: Analytical Certificate	REF. NO.: F/9/2/3
	DEPARTMENT: Water Quality & Pollution Control	ISSUE NO.: 01
	ISSUED BY: WQ & PCO	REV. NO.: 0
AUTHORIZED BY: TM		DATE OF ISSUE: 15 th March, 2010
		PAGE: 2 of 10

BOD₅	mgO ₂ /l	1	Muiruri/judy	< 10
COD	mgO ₂ /l	46.2	Muiruri/judy	< 40
Total Coliforms	/100ml	≥1600	Muiruri/judy	0
Faecal Coliforms	/100ml	≥1600	Muiruri/judy	0

Receipt No:

Date...16/05/012

Issued by: ...Rose S Ogara...
 Assistant Technical Coordination Manager (WQ & PC)

Approved by: ...Jobo K. Obam...
 FOR: Regional Technical Manager

REGIONAL MANAGER
 WATER RESOURCES MANAGEMENT
 AUTHORITY - (LYNCA)

Annex 3A : Flora list for Maira

Family	Identification	Life form	Occurrence
Acanthaceae	<i>Asystasia gangetica</i>	Herb	Abundant
Acanthaceae	<i>Acanthus pubescens</i>	Shrub	Frequent
Agaveceae	<i>Agave sisalina</i>	Shrub	Rare
Amaranthaceae	<i>Amaranthus sp</i>	Herb	Occasional
Apiaceae	<i>Centella asiatica</i>	Herb	Frequent
Apocynaceae	<i>Secamone africana</i>	Climber	Frequent
Apocynaceae	<i>Carrisa spinorum</i>	Shrub	Occasional
Apocynaceae	<i>Mondia whytei</i>	Climber	Rare
Apocynaceae	<i>Voacanga thouarsii</i>	Tree	Rare
Araceae	<i>Pistia stratotis</i>	Herb	Frequent
Asteraceae	<i>Aspilia africana</i>	Herb	Abundant

Asteraceae	<i>Aspilia mossambicensis</i>	Herb	Abundant
Asteraceae	<i>Bidens pilosa</i>	Herb	Abundant
Asteraceae	<i>Laggera alata</i>	Herb	Abundant
Asteraceae	<i>Tithonia diversifolia</i>	Shrub	Abundant
Asteraceae	<i>Tridax procumbens</i>	Herb	Abundant
Asteraceae	<i>Vernonia amygdalina</i>	Tree	Abundant
Asteraceae	<i>Ageratum conyzoides</i>	Herb	Frequent
Asteraceae	<i>Conyza sumatrensis</i>	Shrub	Frequent
Asteraceae	<i>Erlangea tomentosa</i>	Shrub	Frequent
Asteraceae	<i>Galisonga parviflora</i>	Herb	Frequent
Asteraceae	<i>Vernonia lasiopus</i>	Shrub	Frequent
Asteraceae	<i>Guizotia scabra</i>	Herb	Occasional
Asteraceae	<i>Vernonia campanea</i>	Shrub	Ocasional
Asteraceae	<i>Gynura scandens</i>	Herb	Rare
Bignoniaceae	<i>Markhamia lutea</i>	Tree	Frequent
Bignoniaceae	<i>Stereospermum kunthianum</i>	Tree	Ocasional
Caesalpinianaceae	<i>Senna didymobotrya</i>	Shrub	Frequent
Caesalpinianaceae	<i>Dalbergia alata</i>	Shrub	Ocasional
Caesalpinianaceae	<i>Senna occidentalis</i>	Shrub	Ocasional
Caesalpinianaceae	<i>Senna sanguine</i>	Shrub	Ocasional
Celestraceae	<i>Maytenus heterophylla</i>	Shrub	Ocasional
Combretaceae	<i>Combretum paniculatum</i>	Shrub	Ocasional
Combretaceae	<i>Combretum collinum</i>	Tree	Rare
Commelinaceae	<i>Commelina africana</i>	Herb	Frequent
Convolvulaceae	<i>Ipomoea cairica</i>	Climber	Abundant
Convolvulaceae	<i>Lepistemon owariense</i>	Climber	Abundant
Cyperaceae	<i>Cyperus cyperoides</i>	Herb	Abundant
Cyperaceae	<i>Cyperus latifolius</i>	Herb	Abundant
Cyperaceae	<i>Cyperus papyrus</i>	Herb	Dominant
Cyperaceae	<i>Cyperus denudatus</i>	Herb	Frequent
Cyperaceae	<i>Kyllinga alba</i>	Herb	Ocasional
Dracaenaceae	<i>Sansaveria dawei</i>	Herb	Rare
Draceanaceae	<i>Draceana fragrans</i>	Shrub	Rare
Erythroxylaceae	<i>Erythroxylum fischeri</i>	Shrub	Rare
Euphorbiaceae	<i>Bridelia scleronuera</i>	Tree	Abundant
Euphorbiaceae	<i>Euphorbia hirta</i>	Herb	Abundant
Euphorbiaceae	<i>Alchornea cordifolia</i>	Shrub	Frequent
Euphorbiaceae	<i>Euphorbia macrophylla</i>	Herb	Frequent
Euphorbiaceae	<i>Flueggea virosa</i>	Shrub	Frequent
Euphorbiaceae	<i>Phyllanthus ovalifolius</i>	Herb	Frequent
Euphorbiaceae	<i>Acalypha villicaulis</i>	Herb	Ocasional
Euphorbiaceae	<i>Croton megalocarpus</i>	Tree	Ocasional

Euphorbiaceae	<i>Phyllanthus capillaris</i>	Herb	Ocasional
Euphorbiaceae	<i>Ricinus communis</i>	Shrub	Rare
Euphorbiaceae	<i>Sapium ellipticum</i>	Tree	Rare
Fabaceae	<i>Tylosema sp</i>	Climber	Ocasional
Flacourtiaceae	<i>Doryalis macrocalyx</i>	Shrub	Rare
Guttiferae	<i>Harungana madagascariensis</i>	Tree	Ocasional
Labiatae	<i>Leonitis nepetifolia</i>	Shrub	Abundant
Labiatae	<i>Ocimum gratissimum</i>	Shrub	Abundant
Labiatae	<i>Ocimum rothii</i>	Herb	Abundant
Labiatae	<i>Hoslundia opposita</i>	Shrub	Frequent
Labiatae	<i>Plectranthus sp</i>	Herb	Ocasional
Labiatae	<i>Spermacoce princeae</i>	Herb	Ocasional
Malvaceae	<i>Sida acuta</i>	Shrub	Abundant
Malvaceae	<i>Sida ovate</i>	Shrub	Abundant
Malvaceae	<i>Hibiscus cannabis</i>	Shrub	Ocasional
Melastomataceae	<i>Dissotis trothae</i>	Herb	Ocasional
Menispermaceae	<i>Cissampelos mucronata</i>	Climber	Frequent
Mimosaceae	<i>Mimosa pigra</i>	Shrub	Dominant
Mimosaceae	<i>Mimosa pudica</i>	Herb	Frequent
Mimosaceae	<i>Albizia coriaria</i>	Tree	Ocasional
Mimosaceae	<i>Albizia grandibracteata</i>	Tree	Ocasional
Mimosaceae	<i>Acacia abyssinica</i>	Tree	Rare
Mimosaceae	<i>Acacia polycantha</i>	Tree	Rare
Moraceae	<i>Ficus vallis-chaude</i>	Tree	Frequent
Moraceae	<i>Ficus sycomorus</i>	Tree	Ocasional
Myrsinaceae	<i>Maesa lanceolata</i>	Tree	Abundant
Myrtinaceae	<i>Psidium guajava</i>	Tree	Abundant
Myrtinaceae	<i>Eucalyptus sp</i>	Tree	Frequent
Myrtinaceae	<i>Syzygium cuminii</i>	Tree	Ocasional
Palmae	<i>Phoenix reclinata</i>	Tree	Frequent
Papilionaceae	<i>Desmodium torturosum</i>	Herb	Abundant
Papilionaceae	<i>Desmodium repandum</i>	Herb	Abundant
Papilionaceae	<i>Pseudartharia bookeri</i>	Shrub	Abundant
Papilionaceae	<i>Desmodium uncinatum</i>	Herb	Frequent
Papilionaceae	<i>Desmodium nightii</i>	Herb	Frequent
Papilionaceae	<i>Indigofera arrecta</i>	Shrub	Ocasional
Papilionaceae	<i>Sesbania sesban</i>	Shrub	Ocasional
Papilionaceae	<i>Erythrina abyssinica</i>	Tree	Rare
Papilionaceae	<i>Crotalaria incana</i>	Shrub	Ocasional
Poaceae	<i>Cynodon dactylon</i>	Grass	Abundant
Poaceae	<i>Digitaria diagonalis</i>	Grass	Abundant
Poaceae	<i>Digitaria scalarum</i>	Grass	Abundant

Poaceae	<i>Phragmites karka</i>	Herb	Dominant
Poaceae	<i>Imperata cylindrica</i>	Grass	Frequent
Poaceae	<i>Panicum maximum</i>	Grass	Frequent
Poaceae	<i>Panicum sp</i>	Grass	Frequent
Poaceae	<i>Eragrostis aspera</i>	Grass	Ocasional
Poaceae	<i>Eragrostis exasperata</i>	Grass	Ocasional
Poaceae	<i>Eragrostis tenuifolia</i>	Grass	Ocasional
Poaceae	<i>Hyparrhenia ruffa</i>	Grass	Ocasional
Poaceae	<i>Setaria sphacelata</i>	Grass	Ocasional
Poaceae	<i>Sporobolus pyramidalis</i>	Grass	Ocasional
Poaceae	<i>Sporobolus africana</i>	Grass	Ocasional
Poaceae	<i>Panicum hotchsteteri</i>	Grass	Ocasional
Polygonaceae	<i>Polygonum setosulum</i>	Herb	Abundant
Proteaceae	<i>Grevillea robusta</i>	Tree	Ocasional
Rubiaceae	<i>Hallea stipulosa</i>	Tree	Ocasional
Rubiaceae	<i>Rothmania whitefieldii</i>	Tree	Rare
Sapindaceae	<i>Paulinia pinnata</i>	Climber	Frequent
Sapindaceae	<i>Blighia unijugata</i>	Tree	Rare
Solanaceae	<i>Solanum incanum</i>	Shrub	Frequent
Solanaceae	<i>Capsicum frutescens</i>	Shrub	Ocasional
Solanaceae	<i>Solanum nigrum</i>	Shrub	Ocasional
Sterculiaceae	<i>Dombeya rotundifolia</i>	Shrub	Frequent
Tiliaceae	<i>Triumfetta rhomboidea</i>	Shrub	Abundant
Tiliaceae	<i>Triumfetta tomentosa</i>	Shrub	Abundant
Tiliaceae	<i>Grewia mollis</i>	Shrub	Dominant
Tiliaceae	<i>Triumfetta macrophylla</i>	Shrub	Frequent
Typhaceae	<i>Typha capensis</i>	Herb	Abundant
Urticaceae	<i>Laportea ovalifolia</i>	Herb	Rare
Verbenaceae	<i>Clerodendron rotundifolia</i>	Shrub	Ocasional
Verbenaceae	<i>Lantana camara</i>	Shrub	Ocasional
Verbenaceae	<i>Lantana trifolia</i>	Shrub	Ocasional
Verbenaceae	<i>Vitex doniana</i>	Tree	Ocasional
Verbenaceae	<i>Clerodendron myricoides</i>	Shrub	Rare
Vitaceae	<i>Cissus oliveri</i>	Climber	Ocasional
Zingiberaceae	<i>Afromomum angustifolia</i>	Herb	Dominant

Annex 3B: The species of birds recorded around the project area

	Family	Species	Habitat	Threat
1	ACCIPITRIDAE	Black Kite <i>Milvus migrans</i>	pA	
2	ACCIPITRIDAE	Black-shouldered Kite <i>Elanus caeruleus</i>	G	
3	ALCEDINIDAE	African Pygmy Kingfisher <i>Ceyx picta</i>	fw	
4	ALCEDINIDAE	Pied Kingfisher <i>Ceryle rudis</i>	W	
5	ALCEDINIDAE	Woodland Kingfisher <i>Halcyon senegalensis</i>		
6	ARDEIDAE	Black-headed Heron <i>Ardea melanocephala</i>		
7	ARDEIDAE	Common Squacco Heron <i>Ardeola ralloides</i>		
8	ARDEIDAE	Purple Heron <i>Ardea purpurea</i>	W	R-NT
9	COLIIDAE	Speckled Mousebird <i>Colinus striatus</i>		
10	COLUMBIDAE	African Mourning Dove <i>Streptopelia decipiens</i>		
11	COLUMBIDAE	Laughing Dove <i>Streptopelia senegalensis</i>		
12	COLUMBIDAE	Red-eyed Dove <i>Streptopelia semitorquata</i>	f	
13	COLUMBIDAE	Ring-necked Dove <i>Streptopelia capicola</i>	f	
14	CUCULIDAE	Blue-headed Coucal <i>Centropus monachus</i>	W	
15	CUCULIDAE	Klaas' Cuckoo <i>Chrysococcyx klaas</i>	f	
16	CUCULIDAE	White-browed Coucal <i>Centropus superciliosus</i>		
17	ESTRILDIDAE	Bronze Mannikin <i>Lonchura cucullata</i>		
18	ESTRILDIDAE	Common Waxbill <i>Estrilda astrild</i>	wG	
19	GRUIDAE	Grey Crowned Crane <i>Balearica regulorum</i>	WG	G-VU
20	HIRUNDINIDAE	White-Headed Saw-wing <i>Psalidoprocne albiceps</i>	f	R-RR
21	MALACONOTIDAE	Brown-crowned Tchagra <i>Tchagra australis</i>		
22	MALACONOTIDAE	Tropical Boubou <i>Laniarius aethiopicus</i>	f	
23	MONARCHIDAE	African Blue-flycatcher <i>Elminia longicauda</i>	f	
24	MONARCHIDAE	African Paradise-flycatcher <i>Terpsiphone viridis</i>	f	
25	MOTACILLIDAE	African Pied Wagtail <i>Motacilla aguimp</i>	w	
26	MOTACILLIDAE	Yellow Wagtail <i>Motacilla flava</i>	wG	
27	MOTACILLIDAE	Yellow-throated Longclaw <i>Macronyx croceus</i>	G	
28	MUSCICAPIDAE	Swamp Flycatcher <i>Muscicapa aquatica</i>	W	
29	NECTARINIIDAE	Golden-winged Sunbird <i>Nectarinia reichenowi</i>	f	R-RR
30	NECTARINIIDAE	Scarlet-chested Sunbird <i>Chalcomitra senegalensis</i>	f	
31	PHASIANIDAE	Helmeted Guineafowl <i>Numida meleagris</i>	G	
32	PLATYSTEIRIDAE	Brown-throated Wattle-eye <i>Platysteira cyanea</i>	f	
33	PLOCEIDAE	Baglafaecht Weaver <i>Plocenus baglafaecht</i>	f	
34	PLOCEIDAE	Black-headed Weaver <i>Plocenus cucullatus</i>		
35	PLOCEIDAE	Southern Red Bishop <i>Euplectes orix</i>	G	

	Family	Species	Habitat	Threat
38	PLOCEIDAE	Yellow-mantled Widowbird <i>Euplectes macrourus</i>	G	
39	PYCNONOTIDAE	Common Bulbul <i>Pycnonotus barbatus</i>	f	
40	PYCNONOTIDAE	Yellow-throated Greenbul <i>Chlorocichla flavicollis</i>	f	
36	SYLVIIDAE	Tawny-flanked Prinia <i>Prinia subflava</i>	fw	
37	SYLVIIDAE	White-chinned Prinia <i>Prinia leucopogon</i>	F	
41	SYLVIIDAE	Grey-backed Camaroptera <i>Camaroptera brachyura</i>	f	
42	SYLVIIDAE	Red-faced Cisticola <i>Cisticola erythropus</i>	w	
43	TURDIDAE	African Thrush <i>Turdus pelios</i>	f	
44	VIDUIDAE	Pin-tailed Whydah <i>Vidua macroura</i>	G	
45	ZOSTEROPIDAE	Yellow White-eye <i>Zosterops senegalensis</i>	f	

KEY

- F Forest generalist – less specialised, also occur in small patches of forest
 f Forest visitor
 W Waterbird, specialist – normally restricted to wetlands or open waters
 w Waterbird, no-specialist – often found near water
 G Grassland species
 R-NT Regionally Near-threatened
 R-RR Regionally restricted range species
 G-EN Globally Vulnerable Endangered

Annex 4: Hydrology Report Maira

No.	Bridge	Coordinates	Description	Comment
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Annex 5: Condition of bridges likely to be affected in case of dam breach

1	Suwo (Sio)Bridge	36N 0639618	UTM 0048025	On D256 (Nambale-Butula) road- Murram. Reinforced concrete 2 span bridge. 7.5m width, 40m high. Built after old, shorter, disused 4 span bridge 5.6m in width and 12m high. The old bridge proved inadequate because it used to over top easily.	Old bridge forms a blockage to the flood flows and should be removed. Second major crossing downstream of Maira dam.
2	Suwo(Sio)Bridge- edge of floodplain	36N 0639618	UTM 0048152	Two additional box culverts 3.5m highX5.1m wide, and 3.0m highX3.4m wide.	
3	Nangeni Bridge	36N 0645072	UTM 0047987	2 spans reinforce concrete bridge, 3.0m high. With 2 sets of twin relieving culverts 900mm diameter	Under construction. First crossing about 300m immediately downstream of dam.
4	Nangeni Bridge Relieving culverts	36N 0645095	UTM 0048013		
5	River Nangeni & River Sio Confluence	36N 0644592	UTM 0048408		River Sio wider than River Nangeni at this point
6	NaMAnderema Bridge	36N 0647398	UTM 0046170	Reinforced bridge 3.15m high, 5.4m wide on an unclassified murram road in Butula District.	The river bed is grossly over grown with thick bush and silt and needs clearing up. Around 3.3km from Maira dam axis along Namanderema river and may be flooded by inundation of Maira dam. The deck levels have to be compared to the reservoir depths at that point to

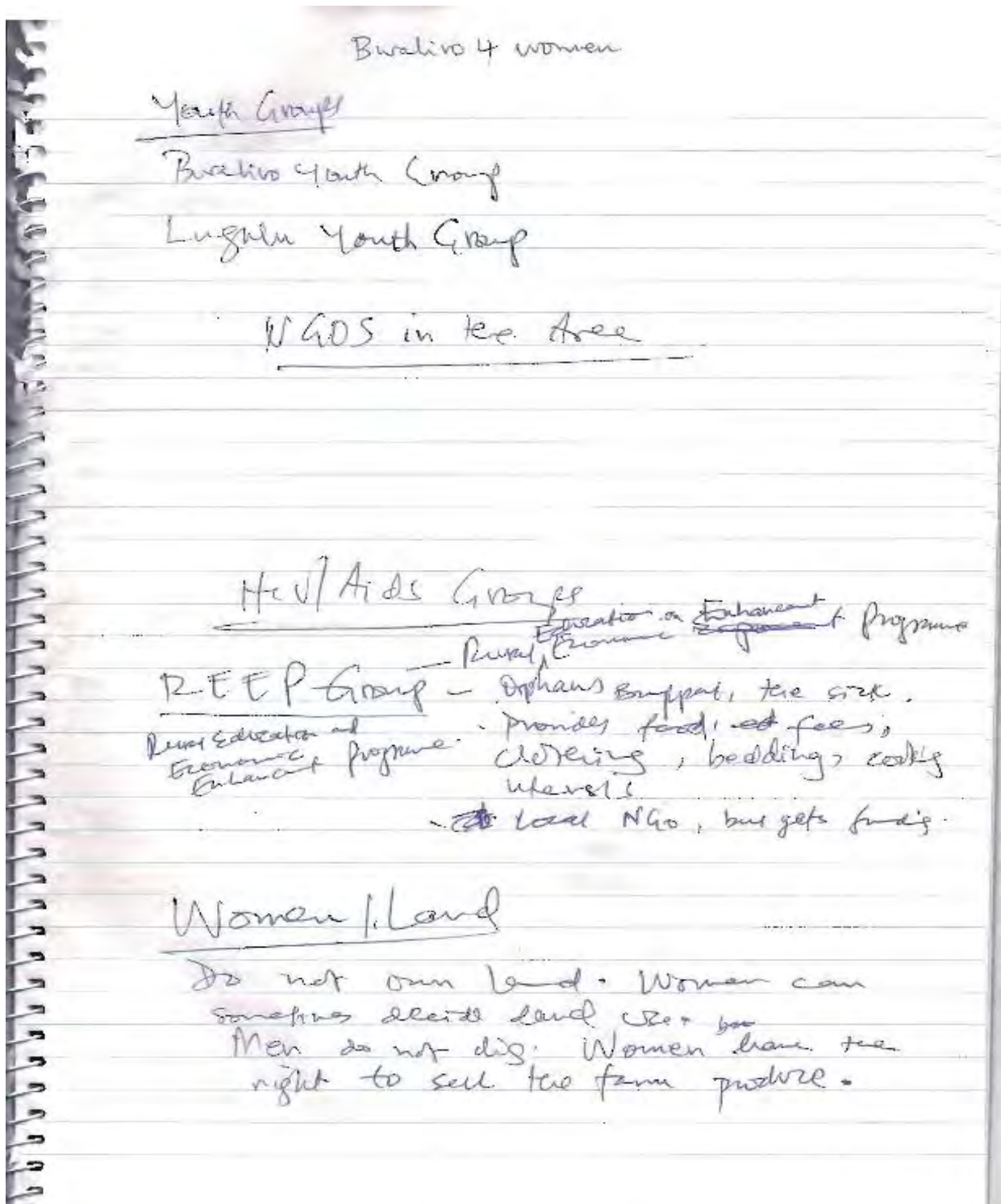
					confirm effects.
7	Namanderema Bridge twin culverts	36N 0647369	UTM 0046159	Has two sets of twin culverts	The culverts are silted up, and need desalting.
8	Nangeni Bridge	36N 0648862	UTM 0047226	Reinforced bridge 4.0m high, 5.4m wide and 14.8m long on an unclassified murram road in Nambale District on Lugulu Sibembe road.	The guard rails have been vandalized. Around 4.5km from Maira dam axis along the river Nangeni. The deck levels have to be compared to the reservoir depths at this point to confirm effects.
9	Malanga water project sign post	36N 0642919	UTM 0046000		On the road that leads to Nangeni bridge under construction
10	Sio bridge on Busia-Kisumu road	36N 0627445	UTM 0042680	5.9m high, 8m wide, 20m long reinforced concrete bridge. Under Kenya National Highways Authority. It is a class B1 road	Floods regularly in the months of April to May, and August to October. Third major crossing downstream of Maira dam.
11	Busia water supply intake	36N 0627474	UTM 0042734	Pumps water to the treatment plant towards Busia nearby	Floods have never reached the intake building.

Annex 6: Persons Consulted:

Date	Name	Designation	Organization
	Eng. Mohamed Badaza	Project Manager	Sio-Malaba-Malakisi Project
23/01/2012	Mr. Cosmus Muli	Project Officer	Sio-Malaba Project
23 rd Jan & 18 th April	Raphael Waswa	District Irrigation Officer	Ministry of Water and Irrigation
23 rd Jan. 2012	Mr. Wanyonyi E.S	Manager	LVCA
	Mr. Palapala Muteshi	District Environment Officer	Nambale
	Mr. Thomas Kasimiri	District Water Officer	Nambale
	Miss. Kezia Nagiri	Environment Officer	NEMA-Kakamega
	Mrs. Jenipher Lutomia	District Agriculture Officer	Nambale
18 th April 2012	Francis Nyanguzo	Commissioner	Nambale district
18 th	Mr. Wilfred Magoba	AIDS Control Coordinator	Constituency
18 th	A.M.Gitonga	Commissioner	Busia District
18 th	Stephen Anjekhe	District Public Health Officer	Nambale district
	Eng. J.O.Amadi	Regional Manager	Kera Rural Roads Authority- Busia Region
	Dixty Manase Obingo	County Work Officer	Ministry of Public Works – Busia County
	Kennedy Mulangi	Deputy Physical Planner	Busia County
	Daniella Mwindo	Intern DEO's office	NEMA-Busia District Environment Office
	Henry Nziga	District Fisheries Officer	Busia district
	Angelica Odwor	Roads Officer	Kera Rural Roads Authority- Busia Region
	Onyango Charles	Deputy Regional Manager	Kera Rural Roads Authority- Busia Region
20 th April 2012	Mr. Kimani Waichari	District Development Officer	Busia and Nambale
	Mr. James Omimo	District Crops Officer,	Nambale
	Mr. George Mbakoya	District Monitoring Officer,	Nambale
	Mr. John Agolla	District Livestock Officer,	Nambale
	Juliet Okoth	Assistant Chief,	Malanga
	Boniface Waku Openi	Assistant Chief,	Sidende
21 st April 2012	Mr. Eugene Ofula	In Charge of Enterprise Development for People	

		living with HIV/AIDS – Rural Education and Economic Enhancement Program (REEP)	
2 nd May 2012	Mr. Magero Nicholus	Chief	Bukhayo Central
	Mr. Mangeni Chrispinus	Administrative Officer	Busia District
	Mr. Omondi	District Works Officer	Busia/Nambale/Butula
	Mr. Afande Boniface Fibanda	Deputy District Water Officer	Nambale
	Mr. Josephat Wandera	Area Councilor,	Elugulu Location
	Mr. Fredrick Otele	Area Councilor,	Marachi East Location
3 rd May 2012	Mr. Peter Baraza	Councilor,	Malanga
	Mr. Alex Kyesa	Councilor,	Elukongo
10 th May 2012	Eng. Robinson K. Gaita & Eng. Odede	Director of Irrigation and water storage	Ministry of Water and Irrigation
25 th July 2012	Mr. Patrick Waweru	Principal Physical Planner Physical Planning Unit	Ministry of Lands
2 nd Aug.	Mr. Wangwe Baraza	Principal Wetlands Officer	National Environment Management Authority (NEMA)
6 th August 2012		Director Cultural heritage Department	National Museums of Kenya
8 th August 2012	Mrs. Anne Chele	Deputy Director of Agriculture; Head of Environment Management and Land use Planning Division	Ministry of Agriculture

Annex 7: Minutes of meetings and Attendance lists:



Bwabis 5 women

Women Challenges

- Lack of seeds
- Lack of fertilizer
- Expensive labour (makes women cultivate a smaller area)
- Sometimes lack of market, hence sale at low prices to middlemen.
- Transporting farm produce to ~~large~~ market.
- Lack of credit in this area. ~~that~~
Would prefer a credit scheme to be in the area. Lack of info. on credits available.
- That the most challenged women are the widows, the poor, have land but no resources.
At:
- That ~~some~~ some widows lose their land to the powerful or land officers in Bwisa.

The meeting ended with a prayer. The host Chief closed the meeting.

Sign: 

Title: chair lady

Date: 21-4-2012

tel: 0712862744

TERESA ATIENO DWITTY

Elara 1

COMMUNITY MEETING 20/4/2012
ELARA VILLAGE - BWALIRO SUBLOCATION

Time: 3:00 pm

Time End: 4:30 pm

Agenda

1. To introduce the Project to the Community.
2. To receive feedback from the Community about the project.

3. A.O.B.

- The Assistant Chief invited the Chief to address the meeting and invite the Consultant to address the community meeting. The Chief also said that the Assistant Chief is newly appointed and will soon be officially installed.

Agenda I: To introduce the project to the Community.

The Maira Multi-purpose dam is a Government of Kenya project in partnership with the World Bank and the Community. The project is under the Nile Basin Initiative. The aim is to utilize sustainably the water in the river to support livelihoods, improve food security, diversify agricultural production, improve water safe water for domestic consumption and possibly generate electricity.

The dam construction will create a

Elas 2

lake which will submerge some farmlands. The owners will be compensated and given adequate notice to relocate. The dam ~~has~~ will have many positive consequences but may also have negative ones. The people are therefore requested to make their opinions about the project and propose mitigation measures.

2. To receive feedback from the community about the project.

- The people supported the project because of the benefits expected.
- The people wanted
- The people wanted to know whether there will be fish introduced.
- That the people fear the dam for their safety and would wish that the dam be fenced to avoid drowning of children.
- There is fear that that the road from Lugulu to Maito primary school may be submerged. So how will the communication between the two areas
- That with the dam there is possibility of increased mosquito infestation so they wonder whether the government will address that possibility of malaria increasing.
- In terms of employment local people should be prioritized before foreigners are considered.
- That women should also be considered for employment including casual labour.

Exam 3

B. A. O. B. 2

The meeting ended with a word of prayer.

Sign: [Signature]

Title: SNR CHIEF

Date: 20/4/2012

Designation: SNR CHIEF
KELUGU

Time: 4:30 P.M. 5

Malanga I

Malanga Sub Location Community Meeting

20/4/2012

Time: 9.30

End Time: 11.00 am.

Agenda

1. To introduce the project to the Community
2. To receive feedback from the Community concerning the project.
3. A.O.B.

The meeting began with prayer.

The Assistant Chief introduced the purpose of the meeting, welcomed the members of the Community to the meeting. The Asst Chief also informed the members of the ongoing household interviews. She asked the community to cooperate in the entire exercise.

The community members introduced themselves and what they do, designations.

1. To introduce the project to the Community

This is a Government of Kenya project being implemented by World Bank and Government of Kenya with the aim to improve access to water, introduce irrigation and conserve the environment.

Malanga 2

- The Project is implemented under the Nile Basin Initiative. ~~Area~~
- The aim of the meeting is to explain to the community the purpose of the project and as well to obtain feedback, concerns of the ^{people} project.
- The dam will provide people with domestic water and irrigation.
- There are possibilities of other benefits from the project such as tourism and the business environment is likely to improve.
- ~~It is expected that~~
- We expect that the community will support the project from today until it is completed.
- Currently there are Enumerators undertaking household interviews in this sublocation for the next two days. The aim is to obtain socio-economic information and livelihood status of the people in this project area.

2. To receive feedback from the Community concerning the Project

- They wanted to know the size of the dam and whether the dam
- Wanted to know whether the ~~wall~~ dam-wall will be used as a road.
- Were ~~for~~ afraid that the ^{Lugulu - Maslo} ~~Maira - Sidende~~ road may be submerged so they were afraid of lack of road to access Malanga to Maslo. So what will happen to these people in terms of communication. That the communication will be a problem for all. Also Sidende - Maira Road may be submerged.

Malanga 3

- Propose that there must be fence ~~to~~ to protect the dam from the people to avoid drawing.
- That there is fear that there may be imminent relocation from their farms. They propose that the project buys for those affected alternative land elsewhere.
- That there is fear of drawing.
- For compensation, there is possibility of family conflict due to money. Therefore the local leaders must be part of the compensation to forestall family conflicts.
- That the government could construct a hotel around the dam so that local people can also
- That the project will boost the status of Nambale area for hosting such a huge project.
- That if the project will generate electricity ~~it~~ more and more households will be connected.
- As part of the compensation to the community there should be constructed a referral hospital area.
- Propose that agriculture extension staff should be available to advise farmers

Malanga 4

on better farming practices since irrigation ~~will~~ will be a new phenomenon.

- The project will create employment to local youth. Local people be prioritized for employment.
- Locally available materials eg hardcore, sand be used during construction of the dam.
- During construction there is fear that children who go to school across the river either side may miss school. That has to be addressed to ensure children are not deprived of school.
- How about if some people will resist to be relocated?
- There is possibility that the improved local economy as a result of the dam may lead to improved security.
- The dam is likely to increase food security in the area including improved health. The improved economy will lead to higher education. So for them the project has many positive benefits.

3. A.0.B

- That there is another project for irrigation in this area.
- The community were all supportive of

Malanga 5

the dam project.

- That ~~the~~ some houses near the proposed dam were photographed but they are not sure what ~~the~~ the issue was. Since the photographs were taken there has been no communication.
- That safety precautions must be paramount by fencing ~~it~~ an electric fence around it. That there should be clearly marked signs "Danger".
- That during flooding local people get fish from the river. The fear is that when the dam is constructed the local people may no longer catch fish.
- Those affected with relocation be informed in good time to organize for their relocation.
- That every homestead should be connected to piped water.
- The fear that there could be conflict with people downstream ~~to~~ of the dam after the dam construction especially ~~the~~ in the dry season when there is water scarcity.

Sign! 

Name: JULIUS KIRIRO OROIT

Position: Assi. CHIEF MALANGA

Date: 20/04/2012

Time: 9.30am.

TEL: 0721519935

Sidende
SIDENDE SUBLOCATION
COMMUNITY MEETING

20/4/2012

Time: 11:30
End Time: 1:20pm

Agenda

1. To introduce the project to the Community
2. To obtain community feedback about the Project
3. A.O.B.

The meeting began with prayer.

The Assistant Chief called the meeting to order and requested the Area Chief to address the meeting. The Area Chief welcomed the participants to the meeting and asked them to be free to contribute in opinions, suggestions and ask questions or seek clarifications. The chief said the project has many benefits to this location.

1. To introduce the project to the Community

This is a Government of Kenya project in collaboration with the World Bank and the Government of Uganda.

The aim of the project is to ~~increase~~ utilize available water resources abundant in

Sidende 2

area to support livelihoods sustainably - to increase access to safe water and for irrigation to increase agricultural production.

This project is under the Nile Basin Initiative and a sister project similar to this one is being implemented in eastern Uganda under the same project.

The project name is called Sio-Malaba River Basin - to develop the resources in this basin for improved livelihoods. The name of the project is Maira Multipurpose Dam.

The aim of this meeting is to obtain feedback, because you know more about the character of this river, in terms of changes in water volume. There is plenty of water ~~at some parts~~ ^{sometimes} of the year - and sometimes there is water scarcity leading to food insecurity.

The Nile Basin Initiative, GOK and Govt of Uganda found it that local people can utilize the water to increase food production and cleaner water for domestic ~~and~~ use and even for recreation purposes.

Also the project may have positive and negative aspects therefore be free to contribute.

2. To obtain community feedback about the project.

The purpose of this meeting is

- The Area Chief asked the community ~~members~~ ^{members} to feel free to ask questions. Those with an issue were asked to raise their hand for attention.

- That the people are supportive of the project.

Sidewall 3

- The people wanted to know the extent of the dam wall on either side of the river.
- What is the recommended distance for settlement from the dam.
That people should know that the land does not belong to anybody but to government.
That they do not support the rumour that people should not accept the project.
- Will each landowner be required to have a title deed before compensation?
- The Bishop of the area also said that he supports the project. That the experience of ICS - an NGO ~~star~~ concerning Nangeni primary school ~~school~~ and the subsequent development of Maabo primary school should not be repeated in this dam project.
The people want the project to proceed.
- That some farmers ~~there~~ have small pieces of land and are afraid that the project may ~~to~~ force him to relocate. He has fear that he may lose his freedom if forced to relocate to a new area away from his traditional home.
- Initially people were afraid that they would be forced/expelled out of their houses. But now they are satisfied that they will be compensated for their land.
- That dams had always been constructed in

Sidende 4

other parts of the country, so they are happy that they also have a dam.

- There will be a need to have a bridge to allow people to move to the other side of the river.
- What will happen to land owners who are widowers (widows) during compensation time? Will they be left out or they will be ~~forced~~ required to go with their children.
- That all ~~social~~ hand based labour be specifically reserved to local youth. This
Women should also be considered for employment during construction of the dam.
- The people also said that trees that will be ~~so~~ within the project area should also be compensated.
- Stones and Sand should be sourced from the local area.
- That skilled people are available. Therefore before construction commences the contractor should first do a survey to find out locally available skilled people in various ways before outsiders can be considered.
- In future adequate notice should be given before any activity on the dam project is undertaken so that all people are informed and participate.
- Where possible the elderly people should also be considered for employment ~~at the~~ during the project commencement.

Sidende 5th

- That local people have been planting their crops along the river bank and the adjacent swamp ~~which~~ but during rains all the crops are washed away. Therefore they are happy the dam will control floods.
- That people here depend on the swamp for domestic water. Their fear is that in the process of construction the water for domestic use may be polluted. They would like the project to address access to ~~water~~ domestic water during the construction process.
- The meeting ended by prayer led by the Bishop.

3. A.O.B

Sign: Nmagero

Name: Nicholas Wasang Magero

Title: Senior Chief

Mobile phone: 0700261431 0734641990

Date : 20-04-2012

Time : 1.25 PM

COMMUNITY MEETING ^{Bwaliro 1 woman}
WOMEN ONLY MEETING ^{29/4/2012}
BWA-LIRO SUBLOCATION
BWA-LIRO ~~VILLAGE~~ VILLAGE

Time Start
Time End: 11:45 AM
Agenda

1. Introduce the project to the Community.
2. Obtain women feedback about the project
3. A.O.B.

The Assistant Chief called the meeting to order at 10:35 am. He asked one of the women to lead a prayer. He then introduced the Consultant to the ~~team~~ ^{women}.

1. Introduce the project to the Community

The Maira Multi-purpose dam is a Government of Kenya and World Bank project being considered for construction under the Nile Basin Initiative. The aim is to construct a dam that will be used to support irrigation, improve access to clean water and improve agricultural production. Generation of electricity may also be a possibility. The project is being implemented under the larger Sio-Malaba River Basin Project.

Once the dam is constructed ~~land~~ ^{low}-lying farmland and/or homesteads and other utilities ~~will~~ will be submerged. Some people will be relocated or forced to relocate but only after compensation at market rate. The aim of this meeting is to enable the local community to give their opinions about the Project:

Bwakhio 3 Women

proposed dam may submerge the pump and ~~be~~ deprive water to the beneficiaries. They wanted to know whether precautions will be taken to safeguard the water pump.

Women Groups / CBO's

Mwabini Women Group - Began 2009 and Registered
- Merry Go Round and Agricultural labor for members.
- chicken

Malambisia Self Help Group - Agriculture - Commercial
Obtained rice, maize seeds from Ministry of Agriculture
- Began 2009, and registered.
- chicken

Mchaka Mchaka Self Help Group - Agriculture, commercial, maize, sorghum, beans. They also share the farm produce, chicken.
- began ~~2011~~ 2011, not registered.

Ekholo Kho Walia - Began 2011, not yet registered
- Agriculture, cattle, chicken.

Mulukoba Self Help Group - Registered in 2012
Agriculture - maize, cassava, sorghum.

Musiamba ^{Self Help} - Registered in 2010
- Agriculture

Bwaliro 2 women

2. Obtain women feedback about the project

- The women supported the project overall.
- That they fear that the dam may lead to drowning of people.
That rivers have fish and the women wanted to know whether they will be allowed to undertake fishing. More fish could also be introduced so that they get fish near instead of currently going obtaining fish too far.
- The dam must be fenced and watchmen employed as a security measure.
- They appreciate that as mothers they will obtain vegetables all year round. Currently they have difficulty obtaining water during dry season, they go far away. With the dam they will be assured of water.
- The contractor will provide women with employment. During construction women should also be employed.
- They fear that some land owners may not be compensated especially those in the upstream.
- They wanted to know the connection between the proposed dam and the existing water pipeline project.
- They fear that the Lugala - Elara - Maolo road may be submerged.
- The existing water project has a pump at Namasale or Mungebo area. They fear that the

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for a proposed small Multi-Purpose Dam for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country: _____ District/County: BUNYORO Division: BUNYORO
 Location: ERARA Date: 20-04-2012 Venue: ESIBEMBE PR. SCHOOL Time: 2:30 PM
 SUBLOCATION: BWALIRO

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
16	Rosalba Anjago		✓	ERARA	FARMER	-
17	Phanica Makoola		✓	MAIRA	BUSINESS	-
18	Consolata Anjago		✓	ERARA	BUSINESS	-
19	Pauistine D. Anjago		✓	ERARA	FARMER	-
20	William Atieno		✓	ERARA	BUSINESS	-
21	Catherine Atieno		✓	ERARA	FARMER	-
22	Leah Neketa		✓	ERARA	FARMER	-
23	Jessica Mwiria			Esibembe	FARMER	-
24	Pamela Mwiria			Elata	FARMER	-
25	Violet Malaba			Esibembe	FARMER	-
26	Bethie Mwiria			Elata	FARMER	-
27	Maurice D. Mwach	✓		ERARA	BUSINESS	
28	Jackton Saba	✓		ERARA	AREA LEADER	
29	Martin Obago	✓		SIKURA	AREA LEADER	
30	James Malaba	✓		ESIBEMBE	FARMER	

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country KENYA District/County BUTULA Division BUTULA
 Location ELARA VILLAGE Date 20/7/2022 Venue ESISEMBE PLS SCHOOL Time 3:30pm
 Sublocation: BWALIRO

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
1	Robert Odipo	✓			AREA RENDER	<i>[Signature]</i>
2	Sylvester Ataro	✓		Esimebe	FARMER	<i>[Signature]</i>
3	Christine Obara		✓	Esimebe	Business	<i>[Signature]</i>
4	Kenge Shop	✓		ESISEMBE	BUSINESS	
5	Kevin Ataho					
6	ERAK PASHO					
7	Frank Juma					
8	NICOLAS Ojuni	✓		ELARA A	FARMER	<i>[Signature]</i>
9	BENJAMIN ODUYA	✓		ELARA	FARMER	<i>[Signature]</i>
10	Raman Nyang'ema	✓		ELARA	FARMER	<i>[Signature]</i>
11	Victoria Opanolo		✓	Esimebe	FARMER	<i>[Signature]</i>
12	Charles Omondi	✓		ELARA	FARMER	<i>[Signature]</i>
13	Mary Odipo		✓	ESISEMBE	FARMER	<i>[Signature]</i>
14	Christine Atieno		✓	ESISEMBE	BUSINESS	
15	Rosa Olando	✓		ELARA	BUSINESS	<i>[Signature]</i>

NBI/NELSAP –Sio-Malaba-Malakisi River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for a proposed small Multi-Purpose Dam in Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country: KENYA District/County: BUNIA Division: BUNIA
 Location: ELUWA Date: 28-11-2012 Venue: ELUWA Time: 8:30 PM

VILLAGE SUBLOCATION: BWALIRO PRT SCHOOL

No.	Name	Gender M F	Village	Designation/Occupation	Signature
32	Nabwohe Didimo	✓	Elora 'B'	Teacher	[Signature]
33	TOBIAS OBOLO	✓	MUKONO	FARMER	[Signature]
34	Washington Musamba	✓	Elbembe	Farmer	[Signature]
35	Joseph Ndege	✓	ELORA 'A'	FARMER	[Signature]
36	STEPHEN OLANO	✓	ELORA 'A'	RTO TEACHER	[Signature]
37	FRANCIS O. WABUKO	✓	LUWA	ASST. CHIEF	[Signature]
38	Albert Mango	✓	Namudoko	ARTISAN	[Signature]
39	PATRICK WED OUKWANGI	✓	MABAGA	SNR. CHIEF	[Signature]
40	George Dwangi	✓	MUKONO	UNEMPLOYED	
41	Victorine Amollo		ELORA 'B'	Farmer	[Signature]
42	Gladys Njula		ELORA 'A'	Farmer	

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba River Basin – Maira
 Data

ATTENDANCE LIST

Country KENYA District/County BUNDA Division BUNDA
 Location ELUWUK Date 26-11-2012 Venue ELUWUK PRS Time 9:30 PM
SUBLOCATION: BWALIRO SCHOOL

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
43	Dorothy Drock		✓	ELARA 'B'	FARMER	[Signature]
44	Lilian Akinyi		✓	ELARA 'B'	FARMER	[Signature]
45	Mary Abieno		✓	ELARA 'A'	FARMER	Mary
46	Celestina Oponal		✓	Esibanzoo	FARMER	C.O.
47						
48						
49						
50						
51						
52						
53						

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment, and Development of Resettlement Policy Framework for a proposed small Multi-Purpose Dam at Maira – Baseline Report

ATTENDANCE LIST

Country KENYA District/County NAMBALE Division NAMBALE
 Location BUKHAYA CENTRAL Date 20/4/2012 Venue St Peter Mukemo Time 9:30 AM
 Sublocation: MALANGA.

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
1	JULIET ATIENS OROTH ASSISTANT CHIEF MALANGA		✓	MUKEMO	ASSISTANT CHIEF MALANGA	
2	JACKSON W. AWOJAI	✓		MUKEMO	VILLAGE ELDER	
3	JACKSON M. WASIKE	✓		MUKEMO	CHAIRPERSON OF NIB	
4	FREDRICK TRUS WASIKE	✓		MUKEMO	CHAIRPERSON MALANGA	
5	DORCUS A. WAKHU		✓	MUKEMO	FARMER	
6	RENEACE A. ONGATA		✓	MUKEMO	FARMER	
7	EVERINE ABONGO		✓	MUKEMO	FARMER	
8	CAROLINE AUMK		✓	MUKEMO	FARMER	
9	MILK WERE	✓		MUKEMO	FARMER	
10	LILIAN ADONGO AJURGI		✓	MUKEMO	FARMER	
11	HELEN WASIKE		✓	MUKEMO	FARMER	

NBI/NELSAP –Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country: KENYA District/County: NAMBALE Division: NAMBALE
 Location: BUKHATO CENTRAL Date: 20/04/2012 Venue: ST. PETER MUKEMO Time: 9-30 AM
 SUB LOCATION – MALANGA

No.	Name	Gender	Village	Designation/Occupation	Signature
12	DANIEL WANZALA	M ✓	MUKEMO	FARMER	
13	FRANCIS ODONGO	V ✓	MUKEMO	FARMER	
14	FESTO ODUNGA	V ✓	MUKEMO	FARMER	
15	CALLISTO OUMA	V ✓	MUKEMO	FARMER	
16	JUSTUS MEJA	V ✓	MUKEMO	FARMER	
17	GABRIEL WADENYA	V ✓	MUKEMO	FARMER	
18	HELEN AWINDO	V ✓	MUKEMO	FARMER	
19	BENSON WANGA	V ✓	MUKEMO	FARMER	
20	TOBIAS OKUKU	V ✓	MUKEMO	FARMER	
21	JOEL BOINDI OILWARA	V ✓	MUKEMO	VILLAGE ELDER	
22	FRANCIS SIWWEBWE	V ✓	MADLO	FARMER	

NBI/NELSAP –Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country KENYA District/County NAMBALE Division NAMBALE
 Location BUCHAYO CENTRAL Date 20/01/2012 Venue NANGENI Time 11:30
VILLAGE: NANGENI SUBLOCATION: SIDANGI

No.	Name	Gender	Village	Designation/Occupation	Signature
1	CHRISTOPHER ODUOR	M ✓	Nang'eni	Farmer	
2	Michael Barasa	✓	Nang'eni	Teacher	
3	John Oduor	✓	Nang'eni	Farmer	
4	CHRISTOPHER OKODE	✓	Nang'eni	Farmer	
5	Patrick Makoicha	✓	Nang'eni	Farmer	
6	James Okado	✓	Nang'eni	Farmer	
7	David MURONO	✓	Nang'eni	Farmer	
8	Titus Okello	✓	Maira	FARMER	
9	William Kweyu	✓	Nang'eni	Farmer	
10	Barasa Sidawa	✓	Nang'eni	Farmer	
11	Laurence Okere	✓	Nang'eni	Farmer	

NBI/NELSAP –Sio-Malaba-Malakisi River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba-Malakisi River Basin – Maira Dam

ATTENDANCE LIST

Country KENYA District/County NAMBALE Division NAMBALE
 Location BUKHAYO CENTRAL Date 20/11/2012 Venue NANGENI Time 11:30
 VILLAGE: NANGENI SUBLOCATION: SIBENDE

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
12	Alfred Okou	✓		Nang'eni	Farmer	
13	Stanly Tigili	✓		Nang'eni	Farmer	
14	Simon Okuro	✓		Nang'eni	Farmer	
15	Peter Mugoeli	✓		Nang'eni	Tailoring	
16	Selina Sulwe		✓	Nang'eni	Farmer	
17	Agnes Kudoyi		✓	Nang'eni	Farmer	
18	Nora Okado		✓	Nang'eni	Farmer	
19	Tantrix Naswa		✓	Nang'eni	Farmer	
20	Sorophina Akumu		✓	Nang'eni	Farmer	
21	Mary Okado		✓	Nang'eni	Farmer	
22	Lina Ambani		✓	Nang'eni	Farmer	

NBI/NELSAP –Siomafara River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sioma'sa River Basin – Maira Dam.

ATTENDANCE LIST



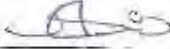
Country: KENYA District/County: NAMBALE Division: NAMBALE
 Location: BURHAYO CENTRAL Date: 20/4/2012 Venue: NANG'ENI Time: 11:30
 SUB-LOCATION: NANG'ENI SIDEWIDE VILLAGE: NANG'ENI

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
23	Margret Gwango		✓	Nang'eni	Farmer	Margret
24	Rose Kwena		✓	Nang'eni	Farmer	Rose
25	Moses Kwena	✓		Nang'eni	Farmer	Moses
26	MUSE MUKOCHA	✓		Nang'eni	Farmer	Muse
27	JACKSON MUDINYA	✓		Nang'eni	Farmer	J.M.
28	Bernard Ochieng'	✓		Nang'eni	Farmer	Bernard
29	Samuel Ongulo	✓		Nang'eni	Farmer	Samuel
30	Patrick Barasa	✓		Nang'eni	Farmer	Patrick
31	Paul Okere	✓		Nang'eni	Farmer	Paul
32	Stephen Obulialia	✓		Nang'eni	Farmer	Stephen
33	Emmanuel Odhiambo	✓		Nang'eni	Farmer	Odhiambo

NBI/NELSAP –Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for a proposed small Multi-Purpose Dam for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country: KENYA District/County: NAMBALE Division: NAMBALE
 Location: BUKHAYA CENTRAL Date: 22/4/2012 Venue: NANG'ENI Time: 11:30
VILLAGE: NANG'ENI SUBLOCATION: SIDENDE

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
34	Zakayo Muma	✓		Nang'eni	Farmer	
35	Praxicides Anyango		✓	Nang'eni	Farmer	PA
36	Albert Olando	✓		Nang'eni	Farmer	Olando
37	Peter Anyango	✓		Nang'eni	Farmer	
38	Lusanya Otsieno	✓		Nang'eni	Farmer	Lusanya
39	Peter Otsieno	✓		Nang'eni	Farmer	
40	James Okau	✓		Nang'eni	Bishop	
41	Everline ^{Atsieno} Atsieno		✓	Nang'eni	Farmer	E.N.
42	Gladys Nanzala		✓	Nang'eni	Farmer	Gladys
43	Conzolata Lusanya		✓	Nang'eni	Farmer	everline

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for a proposed small Multi-Purpose Dam for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country: KENYA District/County: NAMBALE Division: NAMBALE
 Location: BUKHWA CENTRAL Date: 20/11/2017 Venue: NANG'ENI Time: 11:30
 SUBLOCATION: SIDENDE VILLAGE: NANG'ENI

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
44	Mark Ouma	✓		Nang'eni	Farmer	
45	Kassim Makocha	✓		Nang'eni	Farmer	
46	Christopher Ouyango	✓		Nang'eni	Farmer	
47	Sosaphat Bwike Odendo	✓		Nang'eni	Farmer	
48	VINCENT OTENO	✓		Nang'eni	Farmer	
49	Bonaro Okumu	✓		Nang'eni	Farmer	
50	patrick Oosterio			Nang'eni	Farmer	
51	Osama potus	✓		Nang'eni	farmer	
52	Patrick Owino	✓		Nang'eni	Farmer	
53	Fredrick Owino			Nang'eni	Farmer	

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country-----District/County-----Division-----
 Location-----Date-----Venue-----Time-----

No.	Name	Gender M F	Village	Designation/Occupation	Signature
54	Silvanos Ogola	✓	Maira	Farmer	<i>[Signature]</i>
55	Julias Ouma	✓	Nang'eni	Farmer	<i>[Signature]</i>
56	Simon Kwena	✓	Nang'eni	Farmer	<i>[Signature]</i>
57	Grado Osama	✓	Nang'eni	Farmer	<i>[Signature]</i>
58	Samuel Ovingi	✓	Mundudi	Farmer	<i>[Signature]</i>
59	VITALIS OSIKE	✓	Nang'eni	Farmer	<i>[Signature]</i>
60	Lukas Okwero	✓	Nang'eni	Farmer	<i>[Signature]</i>
61	Makana Dishon	✓	Maira	Farmer	<i>[Signature]</i>
62	Peter Olukey	✓	Nang'eni	Farmer	<i>[Signature]</i>
63	Nicholas Odhiambo	✓	Nang'eni	Farmer	N.O
64	Emmanuel Odaro	✓	Nang'eni	Farmer	<i>[Signature]</i>

NBI/NELSAP –Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for a proposed small Multi-Purpose Dam for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

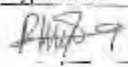




Country-----District/County-----Division-----
 Location-----Date-----Venue-----Time-----

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
66	Christina Olaka		✓	Nang'eni	Farmer	Olaka
66	Agnes Kwena		✓	Nang'eni	Farmer	AS
67	Everline Wolwire		✓	Sibemba	Farmer	A
68	Felista Akello		✓	Nang'eni	Farmer	P.A
69	Judith Oundo		✓	Nang'eni	Farmer	Jo
70	Paskalia Kwena		✓	Nang'eni	Farmer	PK
70	Eunice Okode		✓	Nang'eni	Farmer	EU
72	Elizabeth Opala		✓	Nang'eni	Farmer	EO
73	Fleria Odhiambo		✓	Nang'eni	Farmer	FO
74	Mary Nyongesa		✓	Nang'eni	Farmer	Mary
75	EVERLINE JACKA		✓	Nang'eni	VILLAGE ELDER AREA LEADER	Ev

NBI/NELSAP – Sio-Malaba-Malakisi River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for a proposed small Multi-Purpose Dam in Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country:-----District/County:-----Division:-----
 Location:-----Date:-----Venue:-----Time:-----

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
76	BONFACE WAKHU OPEMI	✓		ESIDENDE	AREA ASS/ CHIEF	
77	LEO MAKOKHA	✓		NANG'ENI	VILLAGE ELDER	
78	Patrick Omondi	✓		Nang'eni	Farmer	P.O.
78	Abrose Odwari	✓		NANG'ANI	PERSON	
80	Okoth Moses	✓		Maira	Farmer	
80	MARK OSIKE	✓		Nang'eni	Farmer	Moses
82	NICHOLAS MAGERO	✓		SIBEMBE	CHIEF	Nyera
83	Fredrick Ouma	✓		Nang'eni	Farmer	
84	Colombani Ouma	✓		Nang'eni	Farmer	C.O.

NBI/NELSAP –Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country: KENYA District/County: BUNGUA Division: BUTULA
 Location: ELUGULU Date: 27/11/2012 Venue: CHIEF'S OFFICE ELUGULU Time: 10:30
 Sublocation: BWALIRO VILLAGE: BWALIRO C.

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
1	BRIGDE MAKHA DPANNO			BWALIRO	HOUSE WIFE	X X
2	TERESA ALENE OWITTY			BWALIRO	HOUSE WIFE	<i>[Signature]</i>
3	HELLEN KINIENI WIMBOGWA			BWALIRO	HOUSE WIFE	<i>[Signature]</i>
4	MARI AKHOMBA AKHOMBA			BWALIRO	HOUSE WIFE	
5	EUNICE ANIMBO LINDO			BWALIRO	HOUSE WIFE	
6	SELESTINE BUMA MUMFAY			BWALIRO	HOUSE WIFE	
7	RISCHAL HAWOIRE			BWALIRO	House wife	EB
8	Mary Onyango			Bwaliro	House wife	MO
9	Fenah Hara			Bwaliro	House wife	PH
10	Angelina Adhamba			Bwaliro	House wife	AA
11	EUNICE BUMA			BWALIRO	HOUSE WIFE	EA

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for proposed small Multi-Purpose Dams for Sio-Malaba River Basin – Maira Dam

ATTENDANCE LIST

Country KENYA District/County BUTULA Division BUTULA
 Location ELUGULU Date 21/4/2012 Venue CHIEF'S OFFICE ELUGULU Time 10.30
 SUBLOCATION: BWALIRO VILLAGE: BWALIRO

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
12	KINIKINDA ALMA		✓	BWALIRO	HOUSE WIFE	KA
13	PRISCILLA ABONYE		✓	ELUGULU	HOUSE WIFE	KA
14	ROSEBELLA A. WERE		✓	BWALIRO	HOUSE WIFE	RWA
15	JANETRIX ONYANGO		✓	ELUGULU	HOUSE WIFE	J.O
16	ANGARCO OPANDA		✓	BWALIRO	HOUSE WIFE	O
17	FREDRICK ODHAMBO	✓	✓	BWALIRO "A"	VILLAGE ELDER	(Signature)
18	JANE LUCY AKINYI		✓	BWALIRO	VILLAGE WIFE	J.A
19	MARYA JUMA		✓	ELUGULU	HOUSE WIFE	M.A
20	FLORENCE OUMA		✓	ELUGULU	HOUSE WIFE	F.O
21	CELINA AUMA		✓	BWALIRO	HOUSE WIFE	(Signature)

NBI/NELSAP – Sio-Malaba River Basin Project
 Environmental and Social Impact Assessment and Development of Resettlement Policy Framework for 4 proposed small Multi-Purpose Dams for Sio-Malaba River Basin, Maira
 Dam

ATTENDANCE LIST

Country KENYA District/County BUTULA Division BUTULA
 Location ELUGULU Date 21/11/2022 Venue CHIEFS OFFICE, ELUGULU Time 10:30
SUBLOCATION, BWALIRO VILLAGE, BWALIRO

No.	Name	Gender		Village	Designation/Occupation	Signature
		M	F			
22	BEATRICE MBUYA		✓	LUGULU	HOUSE WIFE	BA
23	JOSEPHINE WERE		✓	LUGULU	HOUSE WIFE	Blene
24	GODLIVER ANIND		✓	BWALIRO A	HOUSE WIFE	GA
25	MILCENT OKIYA		✓	LUGULU	HOUSE WIFE	Milcent
26	ROSEMARY HADONDI		✓	LUGULU	'' ''	Rosemary
27	ROSELING ORNJA		✓	LUGULU	'' ''	Roselina
28	JUDITH NAMANI		✓	LUGULU	'' ''	Judith
29	FRANCISCA AKINYI		✓	LUGULU		
30	JANET ATGIENJO		✓	LUGULU		
31	WINNY MAKUHIA		✓	LUGULU		

Annex 8: Dam Safety Report

This is attached separately.