The Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT
FARM INCOME ENHANCEMENT AND FORESTRY CONSERVATION PROJECT II

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF TOCHI IRRIGATION SCHEME ALONG RIVER TOCHI, OYAM DISTRICT

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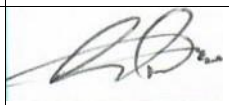
Pius Kahangirwe, MSc (NEMA Certified EIA Practitioner & Environrnental	Environmental Health and Safety Specialist	
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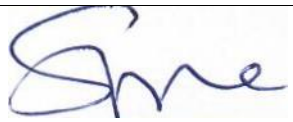
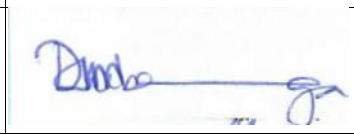
Edith Kahubire, MSc (NEMA Certifiëd EVA Practitioner & Environmental Auditor	Sociologist / Socio-economist	
Hassan Lubega, BSc (NEMA Certified EJA Practitio	Waste Management Specialist	
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ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
ALARP	As Low As Reasonably Practicable
AsDB	Asian Development Bank
CCA	Culturable command area
CEC	Cation Exchange Capacity
DEA	Directorate of Environmental Affairs
DEG	German Investment and Development Corporation
DEM	Digital Elevation Modal
DO	Dissolved Oxygen
DWD	Directorate of Water Development
DWO	District Water Officers
DWRM	Directorate of Water Resources Management
EAC	East African Community
EBRD	European Bank for Reconstruction and Development
ECe	Electrical Conductivity
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMMP	Environmental Management and Monitoring Plan
ESIA	Environmental and Social Impact Assessment
ESM	Environmentally Sound Manner
ESMP	Environmental and Social Management Plan
ETC	Crop Evapotranspiration
ETo	Evapotranspiration
FIEFOC	Farm Income Enhancement and Forestry Conservation
FIR	Field Irrigation Requirement
FMO	Netherlands Development Finance Company
FRL	Full Reservoir Level
GIR	Gross irrigation requirement
HIV	Human Immunodeficiency Virus
IADB	Inter-American Development Bank
IESA	Integrated Environmental and Social Assessment Guidelines
ILO	International Labor Organization
ISS	Integrated Safeguards Systems
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
Kc	Crop Coefficient
LC	Least Concern

LMC	Left Main Canal
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MDDL	Minimum Draw Down Level
MFPED	Ministry of Finance, Planning and Economic Development
MGLSD	Ministry of Gender, Labour and Social Development
MoH	Ministry of Health
MWE	Ministry of Water and Environment
MWL	Maximum Water Level
NAADS	National Agricultural Advisory Services
NASSEC	National Agriculture Sector Secretariat
NDF	Nordic Development Fund
NDP	National Development Plan
NEMA	National Environment Management Authority
NIA	Net Irrigation Area
NIR	Net irrigation requirement
NPA	National Planning Authority
NUSAF	Northern Uganda Social Action Fund
NWSC	National Water & Sewerage Corporation
ORP	Oxidative Reduction Potential
OS	Operational Safeguard
PCBs	Polychlorinated Biphenyl pH Potential of Hydrogen
PMA	Plan for Modernization of Agriculture Secretariat
POPs	Persistent Organic Pollutants
PRA	Participatory Rural Appraisal
RMC	Right Main Canal
SHM	Stakeholder Meetings
SIA	Strategic Impact Assessment Guidelines
TBL	Top Bund Level
TDS	Total Dissolved Solids
TN	Total Nitrogen
UN	United Nations
VES	Visual Encounter Surveys
VIP	Ventilated Improved Pit Latrine
VSLAs	Village Savings and Loans Associations

EXECUTIVE SUMMARY

The proposed Tochi Irrigation project is located at geographical coordinates: 36N 437492/ 267075 (UTM), at an elevation 1040 Metres above Sea Level (MSL) in Oyam District, Northern region of Uganda. The proposed irrigation scheme will cover three Sub-Counties (S/Cs) of Acaba, Minakulu and Ngai affecting 7 parishes.The parishes area; Abanya, Atekober and Dogapoio (Acaba Sub-County); Aceno, Atek and Amwa (Minakulu S/C) and Omac Parish (Ngai S/C).

This project is consistent with the National Development Plan (NDP) II of the years 2015/16-2019/2020 and Vision 2040, whose main goal is to eradicate poverty through appropriate investments and policies for agricultural sector transformation. In 2005, the Farm Income Enhancement and Forestry Conservation (FIEFOC) Project was established in Uganda with the aim of contributing to poverty reduction and livelihood improvement for the rural population.

The project is to be financed by the African Development Bank (AfDB), the Nordic Development Fund (NDF) and the Government of Uganda, and initially comprised of six sub-components that were reduced to four following the mid-term evaluation in 2009. The estimated project cost is UGX 26,673,439,000 (Uganda Shillings Twenty Six Billion Six Hundred Seventy Three Million Four Hundred Thirty Nine Thousand). Tochi Irrigation Project envisages irrigating an ayacut of 1000 Ha utilizing annual river flows of Tochi River. Presently only rain fed agriculture is being practiced in the proposed command area. This does not permit high yields of the crops grown in the area. The layouts of the canals, naturaldrains and access road systems have been designed based on the 30 meter SRTM Data. The total projectcommand area is divided into 2 command areas having 250 Ha area on both sides of the Tochi River. Each command area is to be irrigated by a network of secondary and tertiary canals and Quaternary canals. A 5.0 m width of all-weather inspection road is provided on the right or left side of the Main Canaland both sides of secondary canals for operation and maintenance.

This Environmental and Social Impact Assesment (ESIA) followed the Guidelines for Environmental Impact Assessment (EIA) in Uganda (NEMA, 1997) and Integrated Safeguard Systems of the AfDB's (2013). In undertaking the ESIA, the following methodology was adopted: Literature Review; Field surveys of the proposed project site, including baseline information of the environmental conditions and resources in the project area; in-depth stakeholder consultation; and Professional judgment. A review of the national policy, legal and institutional framework and the AfDB's operational safeguards and other multilateral development financial institutions was done.

A biophysical and socio-economic baseline is also presented. Alternative sites and technology was also evaluated. Several beneficial impacts envisaged will include: Employment of local communities during the pre-construction/mobilization and the construction phase; The project will contribute towards improvement of farm incomes, rural livelihood and food security; Local revenue to the communities, District; Improved flood water utilization in the area; Income generation; water will be availed throughout the year to ensure productivity even in dry season; Increased of Agricultural Production; Minimize Soil Deterioration; Crop diversification; Provision of Livestock Feed and; Restoration and Protection of Catchments.

Direct negative impacts will include: watershed degradation; encroachment of unique ecosystems and historical and cultural sites; biodiversity loss and change; proliferation of invertebrate and vertebrate pests and disease carriers; soil erosion and sedimentation, Noise during construction; poor water quality, and its delivery to the irrigated land; increased pollution by other chemical contaminants; occupational safety hazards, and HIV/AIDS risk associated with construction labour. An environmental and social management plan (ESMP) and monitoring plan has been put in place to address the adverse impacts and enhance positive impacts mentioned above.

1. INTRODUCTION

1.1 BACKGROUND

Water is a key factor in the production of adequate food for Uganda. Water resources are aprime factor in irrigation, livestock watering, aquaculture, fisheries, food processing andother agro-industry, and fishing industries, which provides opportunities for employment toa large proportion of the rural and urban populations. The provision of water for watersupply and agriculture to the poor segments of the society is a development imperative, bothfor reasons of social equity as well as food security and economic development (UNWater, 2005). As part of the government plans to modernizing Agriculture, increasing incomes and improving the quality of life of poor subsistence farmers and their households, government intends to establishment new irrigation schemes in different parts of the Country under Phase II of the Farm Income Enhancement and Forestry Conservation (FIEFOC) Project. Since majority of the population living in rural areas earn their living from agriculture, efforts to reduce poverty need to take in account increasing agricultural growth rates, diversifying agricultural production and expanding non- farm employment, without jeopardizing the dynamic stability of the agricultural ecosystems that ensures sustainability of the agricultural production. This project is consistent with the National Development Plan (NDP) II of the years 2015/16-2019/2020 and Vision 2040, whose main goal is to eradicate poverty through appropriate investments and policies for agricultural sector transformation.

It is against this background that in 2005, the FIEFOC Project was established in Uganda with the aim of contributing to poverty reduction and livelihood improvement for the rural population. Its overall objective is to improve farm incomes, rural livelihood and food security through sustainable natural resources management and agricultural enterprises development. It is being implemented by the Ministry of Water and Environment (MWE) and Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) with the former as the Executing Agency. The Project in Phase-1 was implemented directly using the existing line of administrative structures at central, districts and sub-county levels.

The project was financed by the African Development Bank (AfDB), the Nordic Development Fund (NDF) and the Government of Uganda, and initially comprised of six sub-components that were reduced to four following the mid-term evaluation in 2009. These project components are: Community Watershed Management, Tree Plantation, Apiculture Promotion, and irrigation sub-component that comprised of re-construction of Mubuku Irrigation Settlement Scheme in Kasese district, Doho Rice Irrigation Scheme in Butaleja district, and Agoro Irrigation Scheme in Lamwo district.

On the basis of the registered performance towards the delivery of set targets for each sub-component, the project worked satisfactorily and to some extent exceeded what it was set to do. Under the irrigation sub-component, it increased functionality of formal irrigated agriculture systems in the country by 3,000 ha that has been restored after the reconstruction of three medium irrigation schemes as mentioned above, which are now benefiting 5,790 farming families.

The project fits within the criteria for Category 1 projects of the AfDB which require a full Environmental and Social Impact Assessment (ESIA), including the preparation of an Environmental and Social Management Plan (ESMP). According to the Environmental and social assessment procedures developed for the AfDB's public sector operations; these projects are likely to induce important adverse environmental and/or social impacts that are irreversible, or to significantly affect environmental or 6

social components considered sensitive by the Bank or the borrowing country. The ESIA therefore according to the AfDB should examine the project's potential beneficial and adverse impacts, compare them with those of feasible alternatives (including the "without project" scenario), and recommends any measures needed to prevent, minimise, mitigate or compensate for adverse impacts and to enhance environmental and social project benefits.

The impact of irrigation development on the environment is equally important, as it affects the quality of the water resources and downstream water users as well as the ecosystem at large. It is therefore upon this premise that the Developer has carried out an Environmental and Social Impact Assessment (ESIA) for the proposed development in line with the Ugandan Environmental Impact Assessment (EIA) regulations of 1998 and the process has been guided by the EIA guidelines of 1997 published by NEMA as well as the Environmental and social assessment procedures developed for the AfDB's public sector operations.

1.2 THE PROPOSED PROJECT LOCATION

The proposed Tochi Irrigation Scheme is located in Northern region of Uganda inOyam district at at geographical coordinates: 200 24'51" North, 3200 26'22.35" East and at an elevation 1040 m above MSL. The proposed project will cover eighteen villages in 7 Parishes in the three Sub-Counties as shown in table 1 below

Table 1: Coverage of the proposed Tochi Irrigation Scheme

SUB-COUNTY	PARISH	VILLAGE
ACABA	ABANYA	1) Apuru Bonyo A, 2) Apuru Bonyo B, 3) Wigweng A , 4) Wigweng B, 5) Barowo A, 6) Barowo B, 7) Miciri, 8) Obot, 9) Bar Abia 10) Momotatwero
	Atekober	1) Omwon monu 2) Okalo 3) Oporo Wiye 4) Gwete 5) Oporo Wiye
	Dogapio	1) Atipe A 2) Atipe B 3) Abalere 4) Adomi A 5) Adomi B 6) Abela 7) Oboloyibe 8) Aditawunu 9) Apala 10) Ogwangpur A 11) Ogwangpur B 12) Apany 13) Awangool

MINAKULU	ACENO	1) 2) 3) 4) 5) 6) 7)	Bung- Imalo, Bung-Ipiny, Alaiye Odiro A Odiro B Aceno LC1 Anyapo yere
	Atek	1) 2) 3)	Culbanya Bar Akwiji Abuta Adii
	Amwa	1) 2) 3) 4) 5)	Amwa Abako Abako East Bar Olot Abang Ipiny
NGAI	OMAC	1) 2) 3)	Acandario Oromo Famu

The figures 1-3 below show the command area and location of the proposed Tochi Irrigation Scheme.

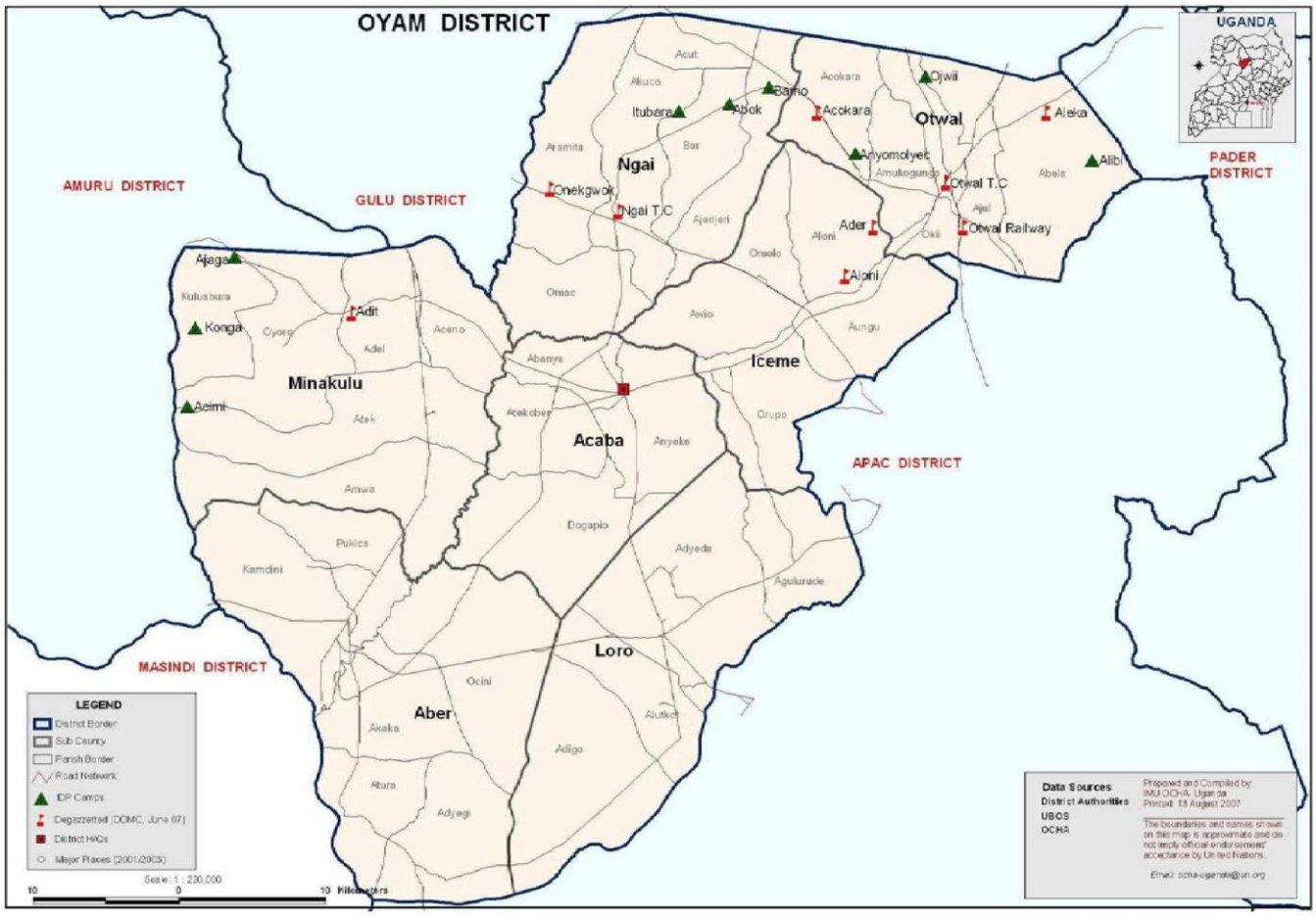

Figure 1: Showing Project Sub-Counties and Parishes and surrounding areas

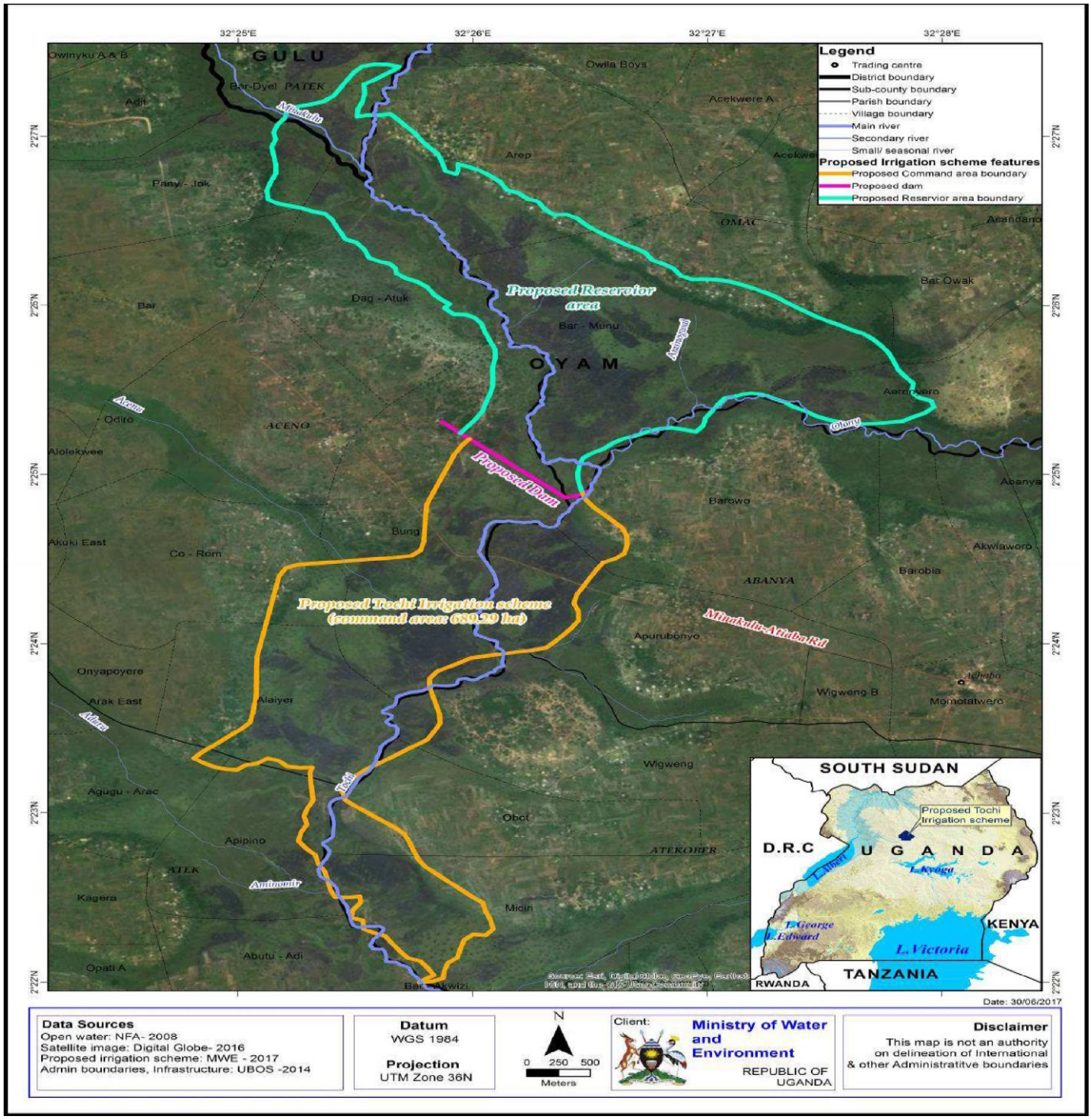

Figure 2: Location of Project command area and immediate surroundings

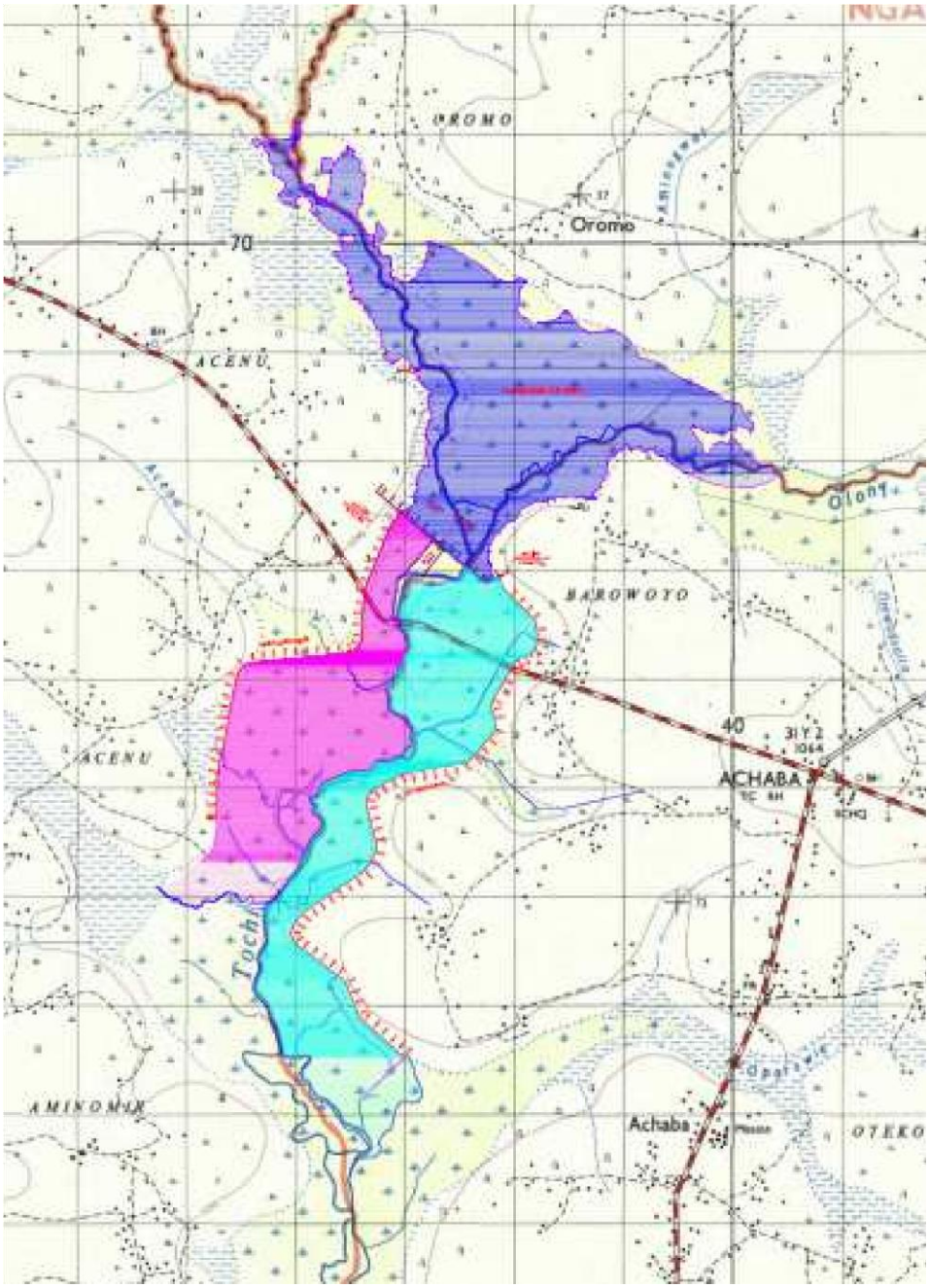

Figure 3: Map showing lay out of proposed Tochi Irrigation Scheme

1.3 OBJECTIVES

1.3.1 Project Objective

The overall objective is to achieve improvement of farm incomes, rural livelihood and food security through implementation of the project. This will foster Government programme of modernizing agriculture that aims at increasing incomes and improving the quality of life of poor subsistence farmers and their households. It will further ensure food security and provision of gainful employment through improved agricultural enterprise development and promotion of sustainable land use and management of natural resources. The project design is hinged on community-based participation with the districts and sub-counties as focus of implementation, and the private sector as main technical service providers. The focus therefore is to develop the identified sites into modern irrigation schemes with farmer based sustainable institutional management arrangements.

ESIA objectives as listed in the EIA guidelines (NEMA, 1997) include;

- Detailed analysis of the key national and international legislation under which the proposed project will profess compliance;
- Identification of any significant impacts that the proposed project may pose to the environment;
- Analyze the significance of the adverse environmental impacts and propose suitable and adequate preventive or mitigation actions;
- Formulation of an environment management and monitoring plan for the implementation of the mitigation actions during the construction and operation phases.

1.4 ESIA PROCESS

Environmental Impact Assessment (EIA) procedure in Uganda is stipulated in the Environmental Impact Assessment Regulations (National Environmental Management Authority (NEMA), 1998), Guidelines for Environmental Impact Assessment in Uganda (NEMA, 1997) and.Integrated Safeguard Systems of the AfDB's (2013). The overall EIA procedures consist of Screening, Environmental Impact Study and Decision. Stakeholder Meetings (SHM) are required throughout the study period, from the Scoping, through the EI Study, to the project implementation and entire lifecycle.

The ESIA process followed the procedure laid forth by the EIA guidelines of 1997, capturing key requirements set forth by the Environmental lead agency in Uganda. Environmental and social assessment procedures developed for the AfDB's public sector operations were also referred to in the construction of this report.

1.4.1 Scope of Work

The nature and scope of the ESIA includes a detailed description of the elements of the construction and operation of the TochiIrrigation Scheme. A review of the legislation, policies and institutional framework that is relevant to the project and the sustainable use of water resources for various purposes, in particular, irrigation was done. The review also entails specific requirements for ESIA and a scope of field studies required. The report also provides baseline information on the natural resources within the project area, including but not limited to, topographic conditions, hydrology and hydraulic

conditions, biodiversity surveys (including flora and fauna studies), water quality geological characterizations and stakeholder consultations.
The ESIA report identified the nature of environmental and social impacts that the irrigation scheme and ancillary developments/operations would generate; this includes elaborating the source of the impacts, receptors, describing in detail social impacts and impacts on the ecosystems in the project area. The ESIA identified prevention measures and proposed mitigations based on recommendations from similar projects and professional opinion from the consultant. An Environmental Management and Monitoring Plan (EMMP) has been prepared to mitigate negative environmental and social impacts and enhacement options for positive impacts provided. A monitoring criterion for the proposed actions has also been prepared.

1.5 STRUCTURE OF THE REPORT

The report is has been presented in order of the following chapters.

Chapter No.	Title
	Executive summary
1	Introduction, Background, Project and ESIA objectives
2	Project Description
3	Methodology
4	Policy, Legal and Institutional Framework
5	Biophysical and Social economic Baseline
6	Alternatives Analysis
7	Stakeholder Engagement
8	Impact assessment and mitigation measures
9	Environmental Management and Monitoring Plan
	Conclusion
	Annexes

2. PROJECT DESCRIPTION

2.1 PROPONENT CONTACT AND PROJECT COST ESTIMATE

The details of the Developer are listed below:
Main Contact Name: Mr. Mugabe Motram
Address: P.O Box 20026, Kampala, Uganda
Organization: Ministry of Water and Environment
Tel: +256 782 717 329
The estimated project cost is UGX 26,673,439,000 (Uganda Shillings Twenty Six Billion Six Hundred Seventy Three Million Four Hundred Thirty Nine Thousand). The breakdown of costs is as shown below;

Bill No.	Description	Costs in UGX
A	Head works	15,769,001,586
B	Main Canals	8,822,610,681
C	Secondary Canals, Tertiary Canals, Quartenary Canals	2,081,825,892
GRAND TOTAL		26,673,439,000

2.2 PROPOSED PROJECT

Tochi Irrigation Project envisages irrigating an ayacut of 1000Ha utilizing Annual River flows of Tochi. Presently only rain fed agriculture is being practiced in the proposed command area. Rainfall follows auni-modal pattern; a period being of short duration. The intervening period experiences long dry spells. This does not permit high yields of the crops grown in the area.

The annual river flows will be impounded by constructing dam across Tochi River and then drawingthe water from the reservoir as per irrigation requirement spread over the year. The 'Irrigation and Drainagesystem meant to deliver water from the reservoir to the fields comprises structural system made of canalsand natural drainage network including the canal and structures. Canal network is designed to convey irrigation water from head works to fields and to deliver it as equitably as possible, matching the supply closely to the water requirements of crops in the command area, during all stages of crop growth.

2.3 PROJECT COMPONENTS

2.3.1 Canals

The irrigation system comprises of canals to provide and distribute the irrigation water and natural drains to collect and remove excess irrigation water and surface runoff. The layouts of the canals, natural drains and access road systems have been designed based on the 30 meter SRTM Data. The total project command area is divided into 2 command areas having 250 Ha area on both sides of Tochi

river. Each command area is irrigated by a network of secondary, tertiary canals and Quaternary canals.
A 5.0 m width of all-weather inspection road is provided on the right or left side of the Main Canal and both sides of secondary canals for operation and maintenance.

Table 1: Canal Definition

Canal	Definition
Main Canal	Two main conveyor canals one on the left side and other on right side serving all the project command areas starting at the dam outlet point. The Main Canal is designed for 24 hr continuous irrigation supply when irrigation is required.
Secondary Canal	Secondary canals off take from the Main Canal deliver water to the individualcommand areas. There are a total of 2 secondary canals in the Left Main Canal and3 secondary canals in the Right Main Canal are proposed in this project and linedwith cement concrete lining. The boundary of the blocks is in most cases naturaldrainage.
Tertiary Canals	A canal which off takes from the secondary canals and delivers irrigation water to tertiary blocks. The tertiary canals are designed for 24 hour irrigation supply. Tertiary canals are generally unlined canals in balanced cut and fill.
Quarternary Canals	The quaternary canals will be unlined fill canals which off take from tertiary canals. In most cases the area of served by a quaternary canal is limited within the range of 8 - 16 ha irrigation unit bounded by tertiary canal, quaternary canal, natural drain and SC block boundary
Field Canals	Unlined field channels will serve an area of 2.0 ha within the quaternary unit.

Table 2: Area Definitions

Area	Definition
Field	The field is the smallest unit considered in the design of the project; generally 2 ha
Unit	Units are groups of fields, ideally 8 but also in multiples of 4 or 2 with an area of between 8 and 16 ha NIA (Net Irrigation Area). All fields within a unit will be irrigated during one rotation cycle. Where there are less than 8 fields in a unit the irrigation cycle will be truncated and the irrigation stream diverted elsewhere in the block.
Block	The area irrigated by a tertiary canal off taking from a secondary canal. Blocks are variable in size being built up from groups of units.
Command Area	The area irrigated by a secondary canal off taking from the Main Canal. Individual command areas consist of a number of blocks.

2.3.2 Command Area

The total command area available for irrigation is 2800 Ha, however a net command area of 1000Ha was selected for irrigation development in this Phase. After a detailed layout of fields and network of canals, a net command of 1000 ha was found for the proposed Tochi Irrigation Project excluding the

areas lost due to network of canals, drains and project roads which constitutes about 20% of area available for irrigation development.

Selection of areas to be irrigated

Delineation of the command area and irrigation blocks will be carried out according to the project size, shape and topography of the command area, type of crops to be grown and skill of operating unit.The canal outlets drawing regulated water from the Tochi reservoir and feeding to the Main canals are located on the Left & Right bank of the river. The methodology for the determination of the command area boundaries has been set out as a number of policy decisions:

- Gullies are to be excluded.
- Natural Forestry is to be excluded.
- Any land on the periphery of the irrigated area with a slope in excess of 5% is to be excluded.
- Any plantation forest areas (Eucalyptus plantation areas) on the periphery of the irrigated area to be excluded. Other plantation areas to be included.
- Any land with dense population infrastructure (Village Areas) to be excluded based on Resettlement Action Plan study recommendation.
- Any land surrounding isolated homesteads to be included in the net irrigated area.
- Any land that cannot be efficiently supplied with irrigation to be excluded.
- Command Area boundaries will not necessarily follow existing individual or collective field boundaries.

As it has been discussed above the command areafor Tochi Irrigation Scheme is dissected with small rivulets and gullies. Accordingly 2 blocks are found in the entire command area with 500 Ha command area on Left bank & 500 Ha on Right bank of the Tochi River.

2.3.3 Headworks

The head works of the proposed Tochi Irrigation scheme consists of earthen dam; spillway and canal head works (Head regulators). To make water flowing in the river available for irrigation use, it will be diverted by means of a diversion dam (spillway) and head works. The purpose of the diversion dam includes heading up of river flow water level, provision of undisturbed condition at intake section, reduction of sediment load to intake etc. It is not desirable from design considerations to extend the spillway section (diversion dam) across the entire river channel; the length which will not be closed by a spillway section will be closed by a non overflow section with concrete gravity dam or earthen dam or dike.

Hence, it is proposed to construct an earthen dam across the Tochi River to make water flowing in a stream available for irrigation use. The spillway is proposed on the left flank of the Tochi River to heading up(raise) or control the water surface in the river so that the desired flow may be diverted into the canal and yet function properly as a spillway for flood flows. The purpose of the head work structure is to control and regulate the flows into the diversion canals.

2.3.4 Earthen dam or Earth dikes

A homogeneous earthen dam is proposed across the Tochi River to allow impounding of water in the reservoir. The total length of the dam including spillway and max height of the dam proposed are 1182m & 6.725m for irrigating an ayacut of 500 ha and 1272m & 8.95m for irrigating an ayacut of 1800 ha.

The top width should be sufficient for the travel of trucks or cars for inspection, maintenance, and access to the spillway section and head works, hence top width of 4.50 m is proposed.

The upstream slopes will be protected against erosion, wave action, and the destructive work of rodents. The upstream slope of earthen dam will be protected with 450 mm thick riprap laid over 200 mm thick graded metal and 200mm sand, it as acting as filter. The downstream slope will be protected with grass (turfing) to prevent the erosion by rain water and chute drains are proposed at 45 m interval. Inclined and horizontal sand filter of 1.0 m thick along with a rock toe will be provided on the downstream of earth dam and will help to relieve seepage problems in the downstream areas of an embankment on impervious foundations. The rock toe will be overlain by coarse sand and gravel to prevent embankment materials being drawn into it, a situation that could ultimately reduce the permeability of the toe and cause subsidence of the dam. Free board will be provided to prevent overtopping by wave action and an additional safety factor.

2.3.5 Spillway

In selecting the type of spillway section, the following controlling factors were considered; character and strength of foundation, availability of construction material, necessity for a controlled crest and cost. The types of spillway sections are Concrete ogee solid gravity, Concrete dam with control gates on crest, Concrete ogee slab and buttress, Concrete slab on compacted earth fill and Rock fill. The concrete ogee solid gravity spillway is proposed at 0.53Km on the right flank of the earth dam in order to reduce the height of the spillway instead of providing a spillway in the river or gorge portion. The Concrete ogee solid gravity section will have a vertical upstream face and a rounded crest with an ogee face downstream.

2.3.6 Canal head works (Head Regulators)

The canal head works are proposed to divert water into main canal from reservoirs or. The purpose of the head work structure is to control and regulate the flow into the diversion canal. The canal head works will be located along the main bank of a stream where the source of water is to be obtained and at a point which in general is determined by the position of the diversion canal.

The Head regulators are proposed at km 0.060 and 0.907km on both flanks of the Tochi River to irrigate an ayacut of 500ha on each side. The Head regulators are proposed at 0.117Km (LHS) and 0.965km(RHS) on both flanks of the Tochi River to irrigate Anaya cut of 1100ha on left side(0.117 Km) and 700ha on right side (0.965Km).

2.3.7 Gates

The flow through the structure will be controlled by top sealed radial gates or vertical lift gates which will be located near either the centre of the embankment or the upstream end of the conduit. Two gates are proposed for Head regulator i.e one is service gate and other one is emergency gate. The size of the vertical gate proposed is 1.2 x 1.4m for design discharge of 1.139cumecs to irrigate Anaya cut of 250ha on both sides of the Tochi River.

3. ESIA METHODOLOGY

3.1 INTRODUCTION

The consulting team executed the following tasks in pursuit of the ESIA Study;

- Literature Review and reference to the already existing published information including laws, regulations and policies to verify how the proposed development would conform to them; The process also encompasses the review of literature from similar projects, on the lessons learned and way forward;
- Field surveys of the proposed project site, including baseline information of the environmental conditions and resources in the project area;
- An indepth stakeholder consultation, including members of the local community and lead agencies with regard to the proposed project; and
- Professional judgment for all the issues related to the nature of the proposed development project.

3.2 BASELINE SURVEY

Field surveys were conducted for the baseline and these included a collection on information for the Physical, biological and social environment within the project areausing methods discussed in this section.

3.2.1 Physical Environment

Water Quality

Water samples were taken from different locations on both the Southern and Northern banks of Tochi River. Two sets of samples were taken, one for bacteriological quality and the second one for physiochemical analysis. Microbiology samples were collected in sterilized bottles obtained from Makerere University, Chemistry Department. All samples were transported in cool box to the laboratory on the same day of sampling and kept at 4^0C before analysis on the following day.

During sample collection, on-site measurements were carried out, and these included pH, temperature, dissolved oxygen (DO) (mg/L), DO Saturation (%), conductivity (mS/cm or microS/cm), total dissolved solids (TDS) (mg/L), oxidative reduction potential (ORP) (mV), resistivity (ohm.com or Mohm.cm or Kohm.com), salinity (PSU), and atmospheric pressure (mmHg). For each site the elevation above seas level (easl) and locations were recorded. Onsite measurements were carried using HANNA HI 9828 multi-parameter water quality meter.

Soil surveys

Samples were collected from 30cm depth and were analyzed at Makerere University College of Agriculture and Environmental Sciences. Besides this, the soil maps published by Ugandan Government were also studied and maps were prepared for both command and catchment area of Tochi area.The soil chemical characteristics of the soil was analyzed and discussed

Agronomy

Literature review for Land holdings, landuse, cropping patterns, crop rotation was undertaken after which the area was surveyed to determine current agricultural practices in the Tochi area. Interviews with farmers in the area and the local leadership informed consultants on issues dealing with agricultural practice and with that crop yields were estimated against the national average through the years. Crop production constraints and potential in the Tochi area was investigated through and assessment of the current practice of farming technology, capital, post-harvest technology facilities, farm input supply system, marketing and climate. This helped to inform the crop and scheme water requirements, most of which (climatic data) was obtained from Gulu meteorological station.

3.2.2 Biological Environment

- **Vegetation**

A general base line (gradsect) (Wessels et al. 1998) traversing multiple vegetation types was used as the main technique during the surveys. Transect lines traversing different vegetation structures within the project area, were established to guide the surveys.

Site specific vegetation descriptions and classifications were determined based on species dominance and floral features such as herb, shrub and tree land coverage at each sampling site. Sampling intervals were varied between 250-500 metres, within sampling points. At the sampling points, 10 x 10 meter and 5 x 5 meter quadrats were established at each sampling site, to capture woody and herbaceous-weedy species respectively. Vegetation/ habitats types were classified, and the flora species were systematically recorded per site.

Plant species that were encountered were assessed for their conservation significance against the IUCN red data lists (IUCN 2016), and for tree species reference was made against the National Forestry Authority list of reserved species. Notably the occurrence of invasive species within or near the project area was also recorded. Photographic records of the floristic features were also taken.
Species of plant that were not easy to identify in the field were collected as voucher specimens for subsequent identification at the Makerere University Herbarium. Literature reviews was conducted, to support field findings.

- **Birds**

Birds were surveyed along transects. Transects and points counts were made along the River course on either sides. Transects were established to ensure they cut across the different vegetation types. Using the 10-minute species time count method, species records were made based on sight of flying birds, patching birds or nests and sound at 100meter interval along the transects. Habitat information was recorded and described with inputs from the vegetation classification by the botanist. Opportunistic Records (i.e. records made outside regular count times) were added to the overall lists of species for each respective habitat recorded. Field identification of the species followed Williams & Aalott (1996) birds of East Africa. Identification of Birds of Conservation Concern will be done. Species of conservation concern were assessed/ identified based on habitat use/ dependence and whether they are listed on the IUCN RedList Species.

- **Mammal**

Transect walks were made to detect, and observe for signs of mammal presence in the project area based on animal sightings, prints or fecal material, animal parts and callings. The surveys aimed at obtaining data on habitat use and preferences by the different species. Photographic records of species and ecologically sensitive-mammal features were observed and recorded. The use of Visual Encounter Surveys (VES) and Opportunistic Encounters also complimented the field techniques.

Local Consultations

Local consultations with communities were also made being that they are constantly in touch with their environment. Communities encounter animals of different kinds during their daily activities. Communities mentioned species of which some were later confirmed through field observations during the surveys.

- **Herpeto fauna**

Field data was obtained by conducting a survey of amphibians and reptile species within habitats around and or along the project area to determine the impacts of the project footprint on their biological life. The methods used are described below.

Visual Encounter Surveys

The use of Visual Encounter Surveys (VES) is a well known method for surveying hepterofauna. They can be used to document presence of reptiles and amphibians. This constitues moving through a habitat watching out for and recording surface-active species. The data gathered using this procedure provides information on species richness of the habitat. During the study VES was done in the environs of river Tochiand the surroundings to sample all amphibians and reptiles that were visible.

Opportunistic Encounters

This method involves recording any amphibian or reptilian species encountered anywhere and at any time within the study area. Opportunistic records occur outside the sampling points but within the project surrounding. Such records are likely to be impacted upon by the project. The opportunistic encounters compliment the herpetofauna checklist within the project area, because of their high mobility levels. Therefore Opportunistic searches were used to maximize the number of species encountered in the study area.

Local Consultations

Local consultations with communities were also made being that they are constantly in touch with their environment. Communities encounter amphibians and reptiles of different kinds during their daily activities. Communities mentioned species of which some were later confirmed through field observations during the surveys.

Identification of herpetiles will follow Channing & Howell (2006), The AmphibiaWeb (2014), and The Reptile Database (Uetz, P. & Jirí Hošek (eds.) 2014), while the conservation status will be measured against the IUCN Red Listing.

o Aquatic Ecology

The assessment covered the area directly under the project footprint. Five sites along Tochi River within the project area were selected for sampling and techniques for sample collection focused on the algae, zooplanktons, benthic macro invertebrate and fish.

i. Fish

Methods for sampling Fish

Minnow traps were used to obtain fish samples during the study. All the fish caught were counted, identified to a species level using the descriptions given in Greenwood (1966).The fish specimens that were not identified with certainty in the field were preserved in a 95% ethanol solution and stored in labeled jars for subsequent laboratory identification ii. Phytoplankton

Samples were taken with Van Dorn bottles, fixed with 0.2ml Lugol, to preserve and colour the cells, and then bottles rapped with aluminum foil prior to transportation to the laboratory. The relative abundance and diversityof the different algal groups wereestablished using the standard literature and the taxonomical criteria of Talling (1987) and Komarek & Kling (1991).

iii. Zooplankton

Samples were collected using a Schindler sampler concentrated through a 53µm sieve and preserved with 75% ethanol. In the laboratory, samples were washed with distilled water over a 53µm sieve to remove the fixative and species identification was done under a microscope to the lowest possible taxon using published keys (Pennak, 1953, Rutner-Kolisko, 1974).

iv. Benthic macro-invertebrate

Benthic macro-invertebrates were collected with a frame benthos net fitted with a 500 µm mesh net. Sampling was done by positioning the benthos net disturbing one square meter to dislodge the upper layers of cobble, debris and scrape the underlying bed sediment. Samples were drained of water and placed into appropriate sealed plastic bags and fixed with 70% ethanol. Samples were then placed in a plastic container for transportation to the laboratory. In the laboratory, macro-invertebrates were sorted out from the sediments with the help of a hand lens and pair of forceps, analyzed and determined to the level of species, genus or family using taxonomic identification keys.

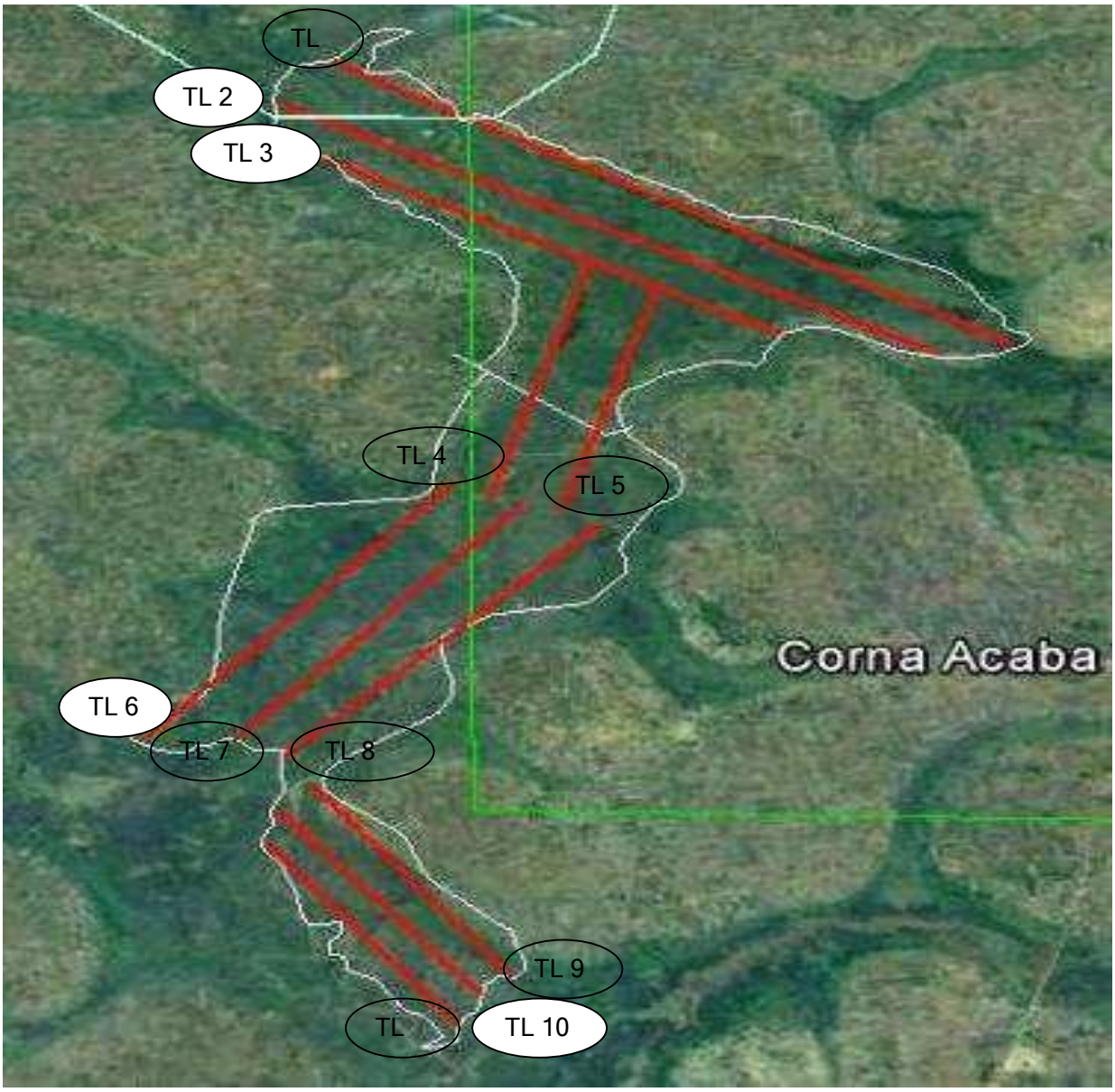

Figure 4: Illustrations of the biodiversity survey transects within the project boundary

NB: TL = Transect Line

3.2.3 Social Survey

- Review of Documentation: All necessary relevant documents relating to plan, policies, progress, account procedures of the existing schemes were reviewed to get an insight into these aspects. This information was used to design data collection tools like household survey questionnaire and focused group discussion interview guide.
- Stakeholder Consultations: Stakeholders were be consulted at two levels, the first being gained entry into the study area and capturing of key issues relating to the study. The second level of stakeholder consultations related to understanding the different alternatives proposed in the project and the selection of the best option.
- Primary Data Collection: A household survey data collection tool was developed and a total of 460 questionnaires were administered in the 7 parishes affected by the project in the three parishes of Abanya, Atekober and Dogapio (Acaba S/C), Aceno, Atek and Amwa (Minakulu S/C) and Omac (Ngai S/C). 65 questionnaires were administered in each parish in the villages affected by the project
- Data Entry & Analysis: Both, quantitative and qualitative data entry and analysis was applied. SPSS software were used for data analysis.
- Needs Assessment & Capacity Building Plan: After the demographic and institutional analysis, a capacity needs assessment was undertaken in order to address the gaps identified.
- Training: A study tool and field training manual will be prepared by the Sociologist Expert, on which the technical staff, extension agents and farmers' associations will be trained. The study tool and field training manual will be discussed with the Client and prior approval will be taken before imparting training activities.

3.2.4 Impact Significance

Virtually all human activity imposes some disturbance to components of the environment because of physical impacts on natural systems or due to interactions with other human activities and human systems. Often such impacts are slight or transitory and have an effect that may be regarded as insignificant. There is no statutory definition of significance and the determination of significance is therefore necessarily subjective.

Table 3: Overall significance criteria for the ESIA

	Low magnitude	Medium Magnitude	High Magnitude
Low sensitivity	Minor	Moderate	Moderate
Medium Sensitivity	Moderate	Moderate	Major
High sensitivity	Moderate	Major	Major
Impact significance			
No Impact or insignificant	Impacts are indistinguishable from the background/natural level of environmental and social/socioeconomic change.		

Minor Significance	Impacts of low magnitude, within standards, and/or associated with low or medium value/sensitivity resources/receptors, or impacts of medium magnitude affecting low value/sensitivity resources/receptors.
Moderate significance	Broad category within standards, but impact of a low magnitude affecting high value/sensitive resources/receptors, or medium magnitude affecting medium value/sensitivity resources/receptors, or of high magnitude affecting medium sensitivity resources/receptors.
Major Significance	Exceeds acceptable limits and standards, is of high magnitude affecting high or medium value/sensitivity resources/receptors or of medium magnitude affecting high value/sensitivity resources/receptors.

3.2.5 Mitigation Measures

A key objective of the ESIA is to identify means of reducing the impact of the Project on the receiving environment. To achieve this, mitigation measures have been developed and integrated into the Project design in response to impacts that are anticipated to be of significance. These mitigation measures have been established through legal, best practice industry standards or specialist environmental input from the ESIA team.

3.2.6 Unplanned Impacts

In addition to the predicted impacts, those impacts that could result in the event of an accident or unplanned event within the Project (e.g. accidents at worksite), or in the external environment affecting the Project, are taken into account. These impacts are termed unplanned impacts and are defined as being a combination of event or incident frequency (probability) and the environmental consequences of the event or incident. Unplanned impacts are considered in much the same way as predicted impacts save for the inclusion of the probability factor. Probability and consequence are elaborated upon in table 9.

Table 4: Overall unplanned impact Significance

Potential Consequence (Significance)	Frequency of Event/Incident Occurrence (Probability)		
	Low	Medium	High
Minor	Minor	Moderate	Moderate
Moderate	Moderate	Moderate	Major
Major	Moderate	Major	Major
Low	Continuous Improvement Zone		
Moderate	ALARP Zone – demonstrate that the likelihood of the environmental impacts has been reduced to As Low As Reasonable Practicable and that contingency measures are in place to minimize the consequences.		
High	Intolerable Zone: Unacceptable to the countries of origin, affected countries and Nord Stream.		

4. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This Chapter provides a review of the national policy, legal and institutional framework relevant to the proposed irrigation projects. A review of the operational safeguards among multilateral development financial institutions such as World Bank, AfDB has also been made and presented in this Chapter.

4.1 POLICY FRAMEWORK

Table 5: Policy Framework relevant to Tochi Irrigation Scheme

Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
The National Water Policy, 1999	To manage and develop the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with the full participation of the stakeholders.	▪ Water Resources Management (covering policy objectives, principles and strategies for monitoring, assessment, allocation and protection of the resource and management framework) ▪ Water Development and use (covering policy objectives, principles and strategies for the development and use of water for domestic water supply, water for agricultural production, and other water uses including industry, hydropower, recreation and ecosystem needs) ▪ Development and efficient use of water in agriculture. ▪ Promotion of measures for control of pollution of water resources.
The Uganda National Land Policy, 2013	To ensure an efficient, equitable and optimal utilization and management of Uganda's land resources for poverty reduction, wealth creation and overall socio-economic development	▪ Ensure large-scale investment decisions and activities do not compromise the sustainable management and conservation of natural resources ▪ Strengthen community level institutions for effective management of land development and land use regulation ▪ Restore and maintain the quality of land resources to enhance the proprietary value of land resources ▪ Ensure sound land use practices and appropriate conservation measures for land quality and land-based

Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
		▪ resources ▪ Develop guidelines to Control of soil degradation and industrial waste disposal ▪ Provide special protection for fragile ecosystem, including unique and sensitive biodiversity colonies, like hill tops, wetlands, water catchment areas, lake-shores and river banks ▪ Discontinue the alienation of designated wetlands, hilltops, water catchment areas, lake shores, river banks and other sensitive eco-systems by enforcing legislation, regulations, guidelines and standards ▪ Take measures to develop programmes for restoration of waste disposal sites and polluted water courses
The National Fisheries Policy, 2004	To ensure increased and sustainable fish production and utilization by properly managing capture fisheries, promoting aquaculture and reducing post-harvest losses	▪ Set binding minimum standards for the protection of the environment from fisheries and aquaculture activities ▪ Establish and/or maintain systems to monitor the quality of aquatic environments that support active fisheries
The National Health Policy, 2010	To reduce mortality, morbidity and fertility, and the disparities therein.	▪ Address the increasing burden of disease resulting from water borne diseases associated with safe and clean water, hygiene and environmental sanitation.
The National Policy for the Conservation and Management of Wetlands Resources, 1995	To promote the conservation of Uganda's wetlands in order to sustain their ecological and socio-economic functions for the present and future well-being of the people.	▪ Require that all proposed modifications and restorations on wetlands be subject to an environmental impact assessment (EIA), the result of which will determine whether such restoration modification should proceed and if so to what extent ▪ No drainage of wetlands unless more important environmental management requirements supersede. Thus artificial large-scale removal or exclusion of water from a wetland by whatever means such as pumping, by excavation of water channels and perhaps and other drainage means which include building of dams upstream

Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
		of a wetland be avoided
The Uganda Gender Policy, 2007	To establish a clear framework for identification, implementation and coordination of interventions designed to achieve gender equality	▪ Recognize the role of women and youth in access and use of water at household levels. It anchors the importance of gender responsiveness in terms of planning, implementation and management of water related initiatives
The National Forestry Policy, 2001	To establish an integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by all Ugandans	▪ Establish watershed protection forests that can be rehabilitated and conserved. ▪ Promote the rehabilitation and conservation of forests that will protect the soil and water in the country's key watersheds and river systems.
The National Environment Management Policy, 1994	to promote sustainable economic and social development that enhances environmental quality without compromising the ability of future generations to meet own needs	▪ Develop local capacity for community management and maintenance of water resources and institute measures to prevent environment degradation around water points; ▪ Increase the level of community awareness on the importance of water particularly with regard to hygiene; ▪ Strengthen the capacity to measure and to continuously assess and monitor quality and quantity of water resources ▪ Establishment of environmental standards for permissible levels of pollution ▪ Establishment of a system for monitoring compliance with water, land and air pollution control standards and regulation ▪ Develop and promote the wider application of appropriate technologies for infrastructure development such as water supply and sanitation for example recycling solid waste and waste water for agriculture use and industrial use.
The National Agricultural Policy, 2013	To achieve food and nutrition security and improve household incomes through coordinated interventions that focus on enhancing sustainable agricultural productivity and value addition.	▪ Develop capacity to harvest and utilize rain water for agricultural production ▪ Support development and sustainable use, management, and maintenance of water and land resources for agriculture to boost production, enhance value-addition, and reduce the effects of climatic shocks.

Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
The Uganda Vision 2040	Uganda aspires to transform the Agriculture sector from subsistence to commercial agriculture through mechanization and introduction of modern irrigation systems	▪ As a way of increasing agricultural productivity, Government will invest in the development of all major irrigation schemes in the country. ▪ Government will also reform the extension system in the country to increase information access, knowledge and technologies to the farmers; ensure that land fragmentation is reversed to secure land for mechanization.
The National Development Plan, 2010 – 2015	To enhance agricultural production and productivity.	▪ Enhance productivity of land through sustainable land use and management of soil and water resources ▪ Increase supply of water for agricultural production ▪ (irrigation, water for livestock, aquaculture). ▪ Establish new irrigation schemes (informal, small scale, commercial).
The National Irrigation Master Plan for Uganda (2010-2035)	The overall objective of irrigation development in Uganda, in line with the NDP is therefore: "Poverty Alleviation and Economic Growth as a result of the sustainable realization of the country's irrigation potential mitigating the effects of climate change and contributing to the transformation of Uganda society from a peasant to a modern and prosperous country".	▪ Under the Plan, irrigation will present the following benefits: ▪ Reduce the risk of climate shock (drought and flood) and allows adaptation against climate change and hence not only renders risk averse farmers willing to invest in seasonal inputs and longer term productivity and sustainability measures, it also reduces the perceived risks of farming system diversification; ▪ Increase productivity and can increase quality of crops; ▪ Subject to certain caveats, publicly funded irrigation has significant poverty alleviation potential; and Appropriate irrigation development planning, by facilitating intensified production, can reduce the unit costs of input, extension and post-harvest services.

4.2 LEGAL FRAMEWORK

Table 6: National Laws relevant to Tochi Irrigation Scheme

Law	Requirements	Relevance
The Constitution of Uganda, 1995	The Constitution includes basic requirements including: The state to ensure that all Ugandans enjoy rights and opportunities and access to clean and safe water (Objective XIV); ▪ The state to take all practical measures to promote a good water management system at all levels (Objective XXI); ▪ The state to promote development sustainable development and the public awareness of the need to manage water resources in a balanced and sustainable manner for the present and future generations (XXVII). ▪ Every Ugandan has a right to a clean and healthy environment (Article 39).	Development of this project will put into consideration catchment based IWRM aspects and water source protection planning for a clean and health environment.
The National Environment Act Cap, 153	Section 19 subsection 3 stipulates that an environmental impact assessment shall be undertaken by the developer where the lead agency, in consultation with the executive director, is of the view that the project– a) may have an impact on the environment; b) is likely to have a significant impact on the environment; or c) will have a significant impact on the environment. No person is permitted to carry out activities in relation to a river or lake without a permit No person is permitted reclaim or drain any wetland; erect, construct, place, alter, extend, remove or demolish any structure that is fixed in, on, under or over any wetland or disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse effect on the wetland or deposit in, on or under any wetland any substance in a manner that has or is likely to have an adverse effect on the wetland or destroy, damage or disturb any wetland in a manner that has or is likely to have an adverse effect on any plant or animal or it habitat or introduce or	An ESIA has been undertaken, the purpose for which this report has been written. The developer will ensure that the proposed environment and social management plan is adhered to and that the contractor develops site specific ESMPs.

Law	Requirements	Relevance
	plant any exotic or introduced plant or animal in a wetland without approval of NEMA.	
The Water Act, 1997	It's a principal law for the management of water resources in Uganda. The Act provides for the use, protection and management of water resources and supply. A person who is responsible for the production, storage, discharge or deposit of any waste or is engaged in any trade; or owns or occupies any premises, shall not cause or permit any waste to be discharged directly or indirectly into any water unless he or she gets a waste discharge permit. Provides for water abstraction permit.	The developer will prepare a water source protection plan and obtain a water abstraction permit. A wastewater discharge permit will also be obtained and the requirements of the above permits will be implemented and monitored e.g. water flow levels, water quality and quantity being discharged.
The Land Act, Cap 227	The Land Act provides for the tenure, ownership and management of land. It requires a person who owns or occupies land to manage and utilize the land in accordance with the environmental laws and other laws including the Water Act. That the Government or a local government shall hold in trust for the people and protect natural lakes, rivers, ground water, natural ponds, natural streams, wetlands, forest reserves, national parks and any other land reserved for ecological and touristic purposes for the common good of the citizens of Uganda and thus the Government or a local government shall not lease out or otherwise alienate any natural resource.	The land on which the project is to be located is owned by the community and an understanding will be reached between the community local leaders, Oyam Local Government and MWE on how the land will be utilized
The Occupational Safety and Health Act, 2006	This Act consolidates, harmonizes and updates laws relating to occupational safety and health. It provides for the health, workplace safety and welfare of Employees thus it is relevant to the proposed project. Article 39 gives workers a right to a clean and healthy environment while article 40(1) Empowers Parliament to enact laws to provide for the rights of persons to work under satisfactory, safe and healthy conditions.	The provisions of this Act shall be adhered to during implementation phases, especially at the construction stage where many workers will be on site to ensure a safe working environment is kept.
The Employment Act, 2006	The employment act spells out the general principles regarding forced labour, discrimination in employment sexual harassment and provisions to settle grievances. The Act further stipulates in	The Contractor will apply principles of this Act and will not engage any child workers at the project site at any one time during the project lifecycle.

Law	Requirements	Relevance
	section 31 subsection (1) that a child under the age of twelve years shall not be employed in any business, undertaking or workplace. It further states in subsection (2) that a child under the age of fourteen years shall not be employed in any business, undertaking or workplace, except for light work carried out under the supervision of an adult aged over eighteen (18) years and which does not affect the child's education.	
The Workers' Compensation Act Cap. 225	This law provides for compensation to workers for injuries suffered in the course of their employment. Under the Act, an employee is entitled to compensation for any personal injury from an accident or disease arising out of, and in the course of his or her employment even if the injury or disease resulted from the negligence of the employee.	The Contractor will ensure that compensation is paid to workers that sustain injuries during the execution of project work and a register should be kept at site for all injuries on duty as per OSH, 2006 requirements for Uganda. The Contractor shall take a work mans compensation insurance to cover all the workers.
The Physical Planning Act Cap. 30	Establishes a district and urban physical planning committees to provide for the making and approval of physical development plans and for the applications for development permission and for related matters.	According to the District Urban Planner, the area was designated for agricultural activities. Therefore the development falls within the gazetted landuse of the area.
The Local Government Act Cap. 243	The Local Governments Act defines roles for different levels of government in provision and management of water related activities.It provides that the provision of water services and maintenance of facilities is a responsibility of local councils in districts and urban centres with the support and guidance of relevant central government agencies.	Local Government officials will be responsible for monitoring the implementation of the EMMP during the project cycle.

Law	Requirements	Relevance
The Public Health Act Cap. 281	It place duties on the Urban and local authorities in matters pertaining to public health.It requires every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes, whether the supply is derived from sources within or beyond its district and for purifying any such supply which has become so polluted. Such Local authority can take measures, including if necessary, proceedings at law, against any person so polluting any such supply or polluting any stream so as to be a nuisance or danger to health.	Local Government officials will be responsible for monitoring the implementation of the EMMP during the project cycle and ensure that public health concerns have been addressed.
The Mining Act, 2003	It restricts mining activities in water. Under the Act all rights in wetlands and in the waters of any spring, stream, river, watercourse, pond or lake on or under public land, are vested in Government; and no such wetlands or water shall be obstructed, dammed, diverted, polluted or otherwise interfered with, directly/indirectly, except in accordance with the provisions of Part II of Water Act.	The planned project activities do not require any mining activities however, in an event that mining is required an new ESIA will be carried out and a mining licence will be required.
The Rivers Act Cap. 357	Section 4 of the Act states under subsection (1) that it shall not be lawful to dredge in any river without a license from the Minister, which shall be in Form A of the Second Schedule to the Act. (2) Any person dredging in a river without a license, or contrary to the terms of the license, commits an offence and is liable on conviction to a fine not exceeding one thousand five hundred shillings for every day during which the offence continues.	Dredging in a river requires a license and if this activity is to be done, the developer will apply for the permit.

Law	Requirements	Relevance
The Control of Agricultural Chemicals Act Cap 29	This Act regulates the manufacture, storage, distribution and trade in, use, importation and exportation of, agricultural chemicals and for other purposes connected therewith. It establishes the Agricultural Chemicals Board and one of the members should be a public officer appointed by the Minister responsible formatters relating to the environment. The Board is charged with ensuring that agricultural chemicals are properly managed through registration, labelling, issuance of licences regulating quality and importation.	Approved chemicals and recommended measurements will be followed during the operation stage. Storage, use and disposal of chemicals and waste will observe internationally acceptable waste management measures.
The National Environment (Wetlands, Riverbanks and Lakeshores Management) Regulations, 2000	The regulation provides that resources in riverbanks lakeshores and wetland should be utilized in a sustainable manner compatible with the continued presence of wetlands and their hydrological functions and services. Environmental impact assessment as required under the statute is mandatory for all activities in the wetlands, riverbanks and lakeshores and special measures are essential for protection of riverbanks, lakeshores and wetlands of international, national, and local importance of ecological systems and habitat for fauna and flora species, and for cultural and aesthetic purposes, as well as for their hydrological functions and values for preventing soil erosion, siltation and water pollution.	Mitigation measures and an ESMP have been proposed to ensure that construction activities will not modify any aspect of the function of the wetlands and river banks functionality. Due to wetland alterations or encroachment that is envisaged as a result of implementing project activities, a wetland use permit will be applied for.
Environmental Impact Assessment Regulations, 1998	Regulation 10 sub-regulation (1) outlines the provisions under which an EIA should be undertaken. It states that an environmental impact Study shall be conducted in accordance with terms of reference developed by the developer in consultation with the Authority and the lead agency. Regulation 13 (1) stipulates that where the Executive Director has, under sub-regulation (1) of regulation 9 determined that an environmental impact study be made under these regulations, the developer shall make an environmental impact statement on completing the study.	Scoping and ToR were done and approved and the approval by NEMA is appended to this ESIA report, purpose for which it has been written in keeping with regulation 13(1). EIS was submitted to NEMA for approval.

Law	Requirements	Relevance
The Water (Waste Discharge) Regulations, 1998	Under these regulations, the National environment management authority sets the standards for discharge of treated effluent or waste into water or on land in consultation with the lead agency under section 26 of the National Environment Act, Cap 153. The regulations prohibit the discharge of effluent or waste under regulation 4 (1) by stating that no person shall discharge effluent or waste on land or into the aquatic environment contrary to the standards established under regulation 3 unless he or she has a permit in the format specified in the First Schedule issued by the Director. Regulation 4 (2) obliges a person granted a permit under sub-regulation (1) to (a) ensure that the effluent or waste discharged conforms to the maximum permissible limits established under regulation 3.	The developer will not discharge any waste or effluent into the environment unless prior permission from NEMA has been given, in consultation with the lead agency (DWRM) on the medium into which they intend to discharge. All discharges to the wetland will be consistent with the set National standards as stipulated under the Schedule (Regulation 3). The water to be released back into the environment will follow the required minimum water quality standards and the developer will apply for a wastewater discharge permit from DWRM before commencement of the operation stage.
The National Environment (Waste management) Regulations 1999	Regulation 4 outlines the requirement for sorting and disposal of domestic waste. Under sub-regulation (4), a person who generates domestic waste shall sort the waste by separating hazardous waste from non-hazardous waste in accordance with the methods prescribed under sub-regulation (3). Sub-regulation (5) stipulates that a generator of domestic waste may, without a license issued under these Regulations, dispose of non-hazardous waste in an environmentally sound manner in accordance with by-laws made by a competent local authority.	The contractor during construction and the developer during the operation, in keeping with this regulation will engage NEMA licensed waste transportation companies to collect waste from the worksite and dispose of it at gazette and prior agreed sites with the Authority.
The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999	The regulations outline the standards for effluent into the environment in regulation 3 (1). They further set out the obligations to mitigate pollution in regulation 4 (1) which states that every industry or establishment shall install at its premises, anti-pollution equipment for the treatment of effluent chemical discharge emanating from the industry or establishment.	The water to be released back into the environment will follow the required minimum water quality standards and the developer will apply for a wastewater discharge permit from DWRM before commencement of the operation stage.

Law	Requirements	Relevance
The National Environment (Noise Standards and Control) Regulations, 2003	Regulation 3; The purpose of these Regulations is to ensure the maintenance of a healthy environment for all people in Uganda, the tranquility of their surroundings and their psychological wellbeing by regulating noise levels, and generally, to elevate the standard of living of the people. Regulation 8; (1) It is the duty of the owner of machinery or the owner or occupier of a facility or premises, to use the best practicable means to ensure that the emission of noise from that machinery, facility or premises does not exceed the permissible noise levels.	Both during construction and operation phases, noise generated should not exceed limits prescribed by these regulations i.e. construction sites 60dB and 50dB for day and night respectively. Regular monitoring to ensure compliance will be undertaken.
Draft National Air Quality Standards, 2006	Considering that construction equipment and machinery are powered by diesel/ gasoline engines, pollutants such as CO_2, NOx, SOx, VOC and particulates are expected to be emitted thus monitoring of air quality is necessary especially during construction phase.	There will be no burning of polythene or any other material for that matter which could led to high carbon emissions thus causing air pollution. Maintenance of vehicles and other equipment to minimize emissions has been proposed as a mitigation measure. Regular air quality monitoring will be undertaken.
Water Resources Regulations, 1998	The regulations apply to motorized water abstraction from boreholes or surface watercourses or diverting, impounding or using more that 400 cubic meters of water within a period of 24 hours. Part II, Regulation 3 requires a water permit for operation of motorized water pump from a borehole or waterway. Under Regulation 6, application for permit may be granted on conditions of projected availability of water in the area, existing and projected quality of water in the area and any adverse effect which the facility may cause among other considerations.	The contractor will be using water from the NWSC network for construction water need. However, in the event that the contractor decides to abstract water for the construction purposes, a water abstraction permit must be obtained from MWE/DWRM as per provisions of this regulation.
The National Environment Regulations (Soil Management), 2001	Regulation 3 sets out the purpose of these Regulations which is, as specified under sub-regulation (a) to establish and prescribe minimum soil quality standards to maintain, restore and enhance the inherent productivity of the soil in the long term.	Soil sampling and analysis was done thus a baseline has been established for future monitoring purposes. Recommended fertilizer application ratios will be observed in an event these suppliments are to be applied.

4.3 INSTITUTIONAL FRAMEWORK

Table 7: Institutions with an interest in the TochiIrrigation Scheme

Institution	Responsibility/Mandate	Application in ESIA
Ministry of Water and Environment (MWE)	MWE has the responsibility for setting national policies and standards, managing and regulating water resources and determining priorities for water development and management. It also monitors and evaluates sector development programmes to keep track of their performance, efficiency and effectiveness in service delivery. MWE has three directorates: Directorate of Water Resources Management (DWRM), Directorate of Water Development (DWD) and the Directorate of Environmental Affairs (DEA).	MWE is the principal Executing Agency for the project and will be responsible for the overall monitoring and management of the project during both construction and operation, including ensuring the implementation of the mitigation and enhancement measures and adherence to Uganda's environmental regulations and the Bank's Operational Safeguards.
Directorate of Water Development (DWD)	Water for Production Department is working towards development and utilization of water resources for productive use in crop irrigation, livestock, aquaculture, rural industries and other commercial uses.The Ministry of Water and Environment is in the process of developing an irrigation master plan. Currently, the Ministry is overseeing reconstruction of four irrigation schemes of Mobuku in Kasese District, Doho in Butaleja District, Agolo in Kitgum District and Orweny in Lira District under the Farm Income Enhancement Forestry Conservation (FIEFCO) Project. These proposed projects are under this department.	DWD will monitor implementation activities to ensure water resources are not polluted and degraded by ensuring that environmental flows are maintained.
Directorate of Water Resources Management (DWRM)	Directorate of Water Resources Management (DWRM) will monitor all activities and will be involved in the project as a key stakeholder from preconstruction to decommission phase. The department also sets the quota of allowable abstraction/diversion of the river based on ecosystem need.	Responsible for monitoring water resources specifically water quality assessments, monitoring surface water resources, laboratory and field works and ultimately water pollution control.

Institution	Responsibility/Mandate	Application in ESIA
Directorate of Environmental Affairs (DEA).	Wetlands Management Department (WMD) is mandated to manage wetland resources and its goal is to sustain the biophysical and socio-economic values of the wetlands in Uganda for present and future generations. Wetlands are a source of livelihood to the majority of Ugandans and hence directly contribute to National Development plan, vision 2040 and attainment of the Millennium Development Goals.	WMD will ensure that any alterations of the wetland resources follow conditions of the wetland permit issued.
The National Environment Management Authority (NEMA)	NEMA responsible for the regulatory functions and activities that focus on compliance and enforcement of the existing legal and institutional frameworks on environmental management in Uganda. NEMA's mandate covers both green and brown issues of environmental management. It oversees the implementation of all environment conservation programmes and activities of the relevant agencies both at the national and local Government level.	NEMA will be responsible for review, comment and overall approval of the ESIA/ESMPs reports for the respective irrigation schemes. Once approved, NEMA will issue Conditional Approval Certificates for the ESIA for the proposed construction and operation of the irrigation scheme.
Ministry of Agriculture Animal Industry and Fisheries(MAAIF)	MAAIF is responsible for managing and coordinating agricultural policies and interventions. It does so through the Ministry's autonomous and semi-autonomous agencies, local governments, farmers and farmers' organizations, other ministries, departments and agencies (MDAs), the private agribusiness and agro-processing sector, civil society, development partners and academia.	MAAIF will ensure that project implementation activities including use of agro chemicals are procured, stored and applied as per manufacturer's recommendations.

Institution	Responsibility/Mandate	Application in ESIA
The National Agricultural Advisory Services (NAADS)	As provided for under the NAADS Act, 2001, the mandate of NAADS is to contribute to the modernisation of the agricultural sector in order to increase total factor productivity of both the land and labour for the benefit of the farmers. Its objectives and functions are to: Promote food security, nutrition and household incomes though increased productivity and market oriented farming; Empower farmers to access and utilise contracted agricultural advisory services; Develop private sector agricultural advisory delivery capacity and systems and assure quality of advice. NAADS is one of the seven components under the Plan for Modernization of Agriculture (PMA), the planning framework of the government for the transformation of subsistence agriculture to market oriented for commercial production.	Empower farmers to access and utilise contracted agricultural advisory services; Value chain addition and develop private sector agricultural advisory delivery capacity and systems and assure quality.
Plan For Modernisation of Agriculture Secretariat (PMA)	Provides technical support and cross-Sectoral coordination for implementation of Agriculture policy. The PMA Secretariat was established as the administrative arm of the Plan for Modernisation of Agriculture (PMA) and its current mandate and functions were derived from the PMA framework which envisaged a strong cross-sectoral approach to agriculture policy discourse. The emphasis of PMA was on coordination of cross	Provide technical support and cross-sectoral coordination for implementation of the irrigation scheme.
	sectoral activities based on seven identified pillars. Over time, however, its role has evolved to a more agriculture-sector focus. A functional and institutional analysis of the PMA Secretariat was conducted earlier this year by a member of the consultancy team and arising from that exercise it was proposed to rename the institution as the National Agriculture Sector Secretariat (NASSEC).	

Institution	Responsibility/Mandate	Application in ESIA
The Ministry of Gender, Labour and Social Development (MGLSD)	The Mandate of the ministry is to evaluate and Control the Physical, Chemical, Physiological, Social, and Technical factors that affect a person at Work and the Working Environment. The objectives of the MGLSD are to minimize Occupational Accidents, Diseases and Injuries. promote good Health of the Worker at the Workplace promote good Working Conditions, promote construction of Safe and Healthy workplaces, promote awareness of Occupational Safety and Health among Workers, Employers and the General Public through Training. The ministry, through its department of Occupational Health and Safety (OHS) will be responsible for registering the workplace and monitoring of conditions under which employees on the project are subjected.	The OHS Department in this Ministry will be responsible for undertaking inspections of construction sites to ensure safe working conditions.
The Ministry of Health (MoH)	MoH has a mandate of policy formulation and policy dialogue with Health Development Partners, resource mobilization and budgeting, strategic planning, regulation, advising other ministries on health matters, setting standards and quality assurance, capacity development and technical support, provision of nationally coordinated services such as epidemic control, coordination of health research and monitoring and evaluation of the overall sector performance.	Monitoring and evaluation of irrigation activities to ensure zero disease incidences by farmers in coordination with the Ministry of Water and Environment.

Institution	Responsibility/Mandate	Application in ESIA
District Local Governments	District Water Officers (DWOs) in the Local Governments are key stakeholders and are tasked to: Participate actively in the development and implementation of catchment management plans for the river/lake basins; Promote integrated planning in management of land, water, and environmental resources; promote and facilitate the mainstreaming of IWRM into district and town development plans, district environmental action plans, investment plans, and other relevant plans; Carry out monitoring and evaluation of IWRM activities in their respective areas and Raise public awareness within their jurisdictions on water and environmental issues.	Participate in the monitoring and enforcement of the environmental regulations, provision of extension services, mobilization of communities, sensitization and capacity building activities. The District will designate a Project Support Officer (PSO) among its staff, who will support the implementation and technical supervision of the Project, including sensitization of farmers, training, and monitoring and evaluation in the respective local governments. An identified district environment officer will be responsible for ensuring the compliance of all the projects components in line with relevant regulations and conditions during construction and the operation of the irrigaton schemes. The district environment officer will relay environmental and/or social concerns on the project to NEMA for technical guidance. The district officers will report periodically to the MWE/PCU on all issues related to the irrigation scheme activites including environmental and social safeguards.
The Ministry of Finance, Planning and Economic	MFPED is the key Ministry for economic development/macroeconomic development and it is responsible for mobilizing and financing investments in water resources	
Development (MFPED)	Development and management. It is responsible for the development of the National Development Plan and Vision 2040.	Ensure that the project is implemented as planned and provide financial support in time for timely execution of the project.

Institution	Responsibility/Mandate	Application in ESIA
The National Planning Authority (NPA)	NPA was established by the NPA Act 15 of 2002. It is mandated to produce comprehensive and integrated development plans for the country elaborated in terms of the perspective vision, and long- and medium-term plans. It is also responsible for overseeing the implementation of the five-year National Development Plan (NDP) and Uganda's new development blueprint dubbed Vision2040. Thus there is need for coordination with NPA to implement the Water Resources Strategy.	Ensure that the project is implemented in line with the NDP and Vision 2040 specifically the requirements for water resources management and strategies.
Contractor	In accordance with the Contract provisions, the Contractor(s) will be accountable for the implementation of the mitigation measures during the construction and initial operation phases.	The Contractor(s) must include in their schedule of works, all proposed mitigation measures. The Contractor(s) must have designated personnel (Supervising Consultants) to monitor environmental, safety and health matters during construction works, and report regularly to MWE. It is recommended that the Supervising Consultant Team include an Environment Management Specialists, who will be responsible for the day-today guidance of the project activities on environment and social compliance to the requirements of the Contract and the Bank's policies. Under this arrangement, the Contractor(s) will have the obligation to ensure that the mitigation measures as well as project Conditions of Approvals are included in the Bidding documents. The Bills of Quantities (BoQs) will specify budget needs for the implementation of the mitigation measures in line with the ESIA and the ESMPs for the Project.

4.4 AFRICAN DEVELOPMENT BANK AND ITS RELEVANT POLICIES

The African Development Bank Group (AfDB) policy on environmentally sustainable development in Africa is described in the 2004 Bank Group Policy on the Environment. The policy acknowledges the need to preserve and enhance ecological capital to sustain and enrich economic growth in Africa. The main goals of the new policy are to:

i. Promote a long-term view and perspective of economic and social development;

ii. Reverse, where possible, and halt the impoverishment process in Africa by enhancing the access of the poor to environmental resources;

iii. Help Regional Member Countries to build their human capacity and sensitize policymakers on environmental issues and bring about institutional changes to achieve sustainable development; and,

iv. Reinforce the existing partnerships with international institutions and network also with regional and sub-regional organizations to coordinate interventions in environmental sustainable development.

v. Two procedural guidelines central to the new Policy on the Environment were completed in 2004, namely the Strategic Impact Assessment Guidelines (SIA) and the Integrated Environmental and Social Assessment Guidelines (IESA). The SIA is a systematic process of evaluating the environmental consequences of any proposed policy or programme, as well as a tool for assessing social and environmental sustainability of policy-based lending, structural adjustment, and sector investment lending. The IESA Guidelines are designed to ensure the inclusion of environmental and social issues in Bank projects throughout the project cycle. These provide guidelines for sector-specific issues and impacts that should be taken into account during the preparation and assessment phases of a project.

vi. The companion documents to the IESA Guidelines are the Environmental and Social Assessment Procedures for African Development Bank's Public Sector Operations (2001) of the
African Development Bank and the AfDB's Policies on Environment and Involuntary Resettlement (2003). These documents provide the procedural process by which public sector sponsored projects are categorized and assessed.

vii. AfDB presents its Integrated Safeguards System (ISS) of 2013, a cornerstone of its strategy to promote growth that is socially inclusive and environmentally sustainable. Safeguards are a powerful tool for identifying risks, reducing development costs and improving project sustainability, thus benefiting affected communities and helping to preserve the environment. The ISS builds on the two previous safeguard policies i.e. Involuntary Resettlement (2003) and Environment (2004) and on three cross-cutting policies and strategies: Gender (2001), the Climate Risk Management and Adaptation Strategy (2009) and the Civil Society Engagement Framework (2012). It also builds on the Bank's sector policies: Health (1996), Integrated Water Resources Management (2000), Agriculture and Rural Development (2000, 2010), and Poverty Reduction (2004). It brings these policies and strategies into a consolidated framework that is intended to enhance the effectiveness and relevance of the Bank's work. A summary of safeguard operational policies to be triggered by the project are as described below.

Table 8: AfDB Operational Safeguards

Operational Safeguard (OS)	Trigger	Requirements	Remarks
OS 1: Environmental and Social Assessment	√	This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements: the scope of application; categorization; use of a SESA and ESIA, where appropriate; Environmental and Social Management Plans; climate change vulnerability assessment; public consultation; community impacts; appraisal and treatment of vulnerable groups; and grievance procedures. It updates and consolidates the policy commitments set out in the Bank's policy on the environment.	The developer has undertaken an ESIA given category 1projects of the AfDB which require a full Environmental and Social Impact Assessment (ESIA), including the preparation of an Environmental and Social Management Plan (ESMP).
OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation	X	In particular, it embraces comprehensive and forward-looking notions of livelihood and assets, accounting for their social, cultural, and economic dimensions. It also adopts a definition of community and common property that emphasizes the need to maintain social cohesion, community structures, and the social inter-linkages that common property provides.	The developer should undertake a comprehensive Resettlement action plan given that the land which is communal and used for grazing is to be converted to agricultural land
OS 3: Biodiversity and Ecosystem Services	√	The overarching objective of this safeguard is to conserve biological diversity and promote the sustainable use of natural resources. It translates into OS requirements the Bank's Commitments in its policy on integrated water resources management and the UN Convention on Biological Diversity.	Biodiversity surveyes were undertaken and an impact assessment has been asseed in the event the project has negative effects on natural environment.
OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency	√	This safeguard covers the range of impacts of pollution, waste, and hazardous materials for which there are agreed international conventions and comprehensive industry-specific standards that other multilateral development banks follow. It also introduces vulnerability analysis and monitoring of greenhouse gas emissions levels and provides a detailed analysis of the possible reduction or compensatory measures framework.	The developer is required to comply with all national standards especially those on water and soil quality during construction and operation

OS 5: Labour Conditions, Health and Safety	√	This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It covers working conditions, workers' organizations, occupational health and safety, and avoidance of child or forced labour.	The developer will be required to implement this safeguard integrated with the occupational health and safety act of Uganda

4.5 MULTILATERAL DEVELOPMENT BANK'S SAFEGUARDS

Also take note that the IFC adopted its Performance Standards on Environmental and Social Sustainability in 2006 and revised them in 2011. Since 2006, the IADB, EBRD, EIB and AsDB have all upgraded their safeguard systems, and the World Bank and the Islamic Development Bank have upgraded theirs. In addition, major private banks providing international project finance and bilateral development finance institutions (such as the Dutch FMO or German DEG), with which the Bank often co-finances projects, have adopted the Equator Principles, which are based on the IFC's Performance Standards on Environmental and Social Sustainability. The multilateral development banks' safeguards include the following key common features.

Table 9: Multilateral Development Bank's Safeguards

Area	WB	IFC	EBRD	EIB	IADB	AsDB	AfDB	MFIWGE
Environmental and social assessment(ESA)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Involuntary resettlement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pollution prevention	Yes	Yes	Yes	Yes	Yes	(in ESA)	Yes	Yes
Biodiversity	Yes[c]	Yes	Yes	Yes	Yes	(in ESA)	Yes	Yes[d]
Community impacts	No	Yes	Yes	Yes	No	(in ESA)	(in ESA)	Yes
Labour conditions	No	Yes	Yes	Yes	No	(in ESA)	Yes	Yes
Indigenous peoples	Yes	Yes	Yes	Yes	Yes	Yes	(in ESA)	Yes
Cultural heritage	Yes	Yes	Yes	Yes	Yes	(in ESA)	(in ESA)	No[e]
Environmental flows	Yes[f]	No	No	No	No	No	(in ESA)	Yes

a As proposed in the ISS.
b As contained in the Common Framework for Environmental and Social Assessment.
c World Bank has safeguards on natural habitats and forests.
d Split into pollution and toxic and hazardous substances.
e Proposes safeguard on vulnerable groups, which includes indigenous peoples.
f Safeguard is on water resource management.

4.6 CONVENTIONS AND PROTOCOLS

Table 10: Conventions and Protocols to which Uganda is a Signatory Relevant to the Project

Conventions and Protocols	Provision
The Treaty for the Establishment of the East African Community 1999	The East African Community (EAC) treaty covers five partner States of Kenya, Uganda and Tanzania, Burundi and Rwanda. One of the objectives of the treaty is promotion of a sustainable growth and equitable development of partner States including rational utilization of the region's natural resources and protection of the environment. The treaty provides that States agree take measures to control trans-boundary water pollution arising from developmental activities adopt common environmental standards for the control of water pollution arising from urban and industrial development activities and exchange information on water and harmonize their policies and regulations for the sustainable and integrated management of shared natural resources and ecosystems. This implies that Uganda as a party state is required to control pollution of shared water resources.
EAC Protocol on Environment and Natural Resources Management 2006	The Protocol is designed to govern the Partner States in their cooperation in the management of environment and natural resources over areas within their jurisdiction including trans-boundary environment and natural resources. For water management, it requires the Partner States to cooperate in the management of shared water resources.
The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal	This was adopted in 1989, came into force in 1992 and Uganda acceded to it on 11th March 1999. The overall goal of the Basel Convention is to protect, by strictly control, human health and the environment against the adverse effects which may result from the generation, trans-boundary movement and management of hazardous and other wastes. The implications of this Convention for control pollution is that Uganda as a party is required ensure that hazardous and other wastes are managed and disposed of in an Environmentally Sound Manner.

Conventions and Protocols	Provision
Bamako Convention 1991	The Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement of Hazardous Wastes within Africa was adopted in Bamako, Mali, on 30 January 1991 and came into force on 10 March 1999. The objectives of the Convention are to protect human health and the environment from dangers posed by hazardous wastes by reducing their generation to a minimum in terms of quantity and/or hazard potential. The implications of this Convention for control pollution is that Uganda as a party is required to prohibit dumping of hazardous wastes and take appropriate measures to implement the precautionary principle to pollution prevention through the application of clean production methods, rather than the pursuit of a permissible emissions approach based on assimilative capacity assumptions. These hazardous chemicals can be in form of fertilizers, pesticides, etc
The Stockholm Convention on	The Stockholm Convention was adopted in May 2001 and entered into force in May 2004. It deals specifically with
Persistent Organic Pollutants (POPs)	chemical management and in particular with POPs, PCBs and dioxides. The objective of this convention is to protect human health and the environment. Parties are required to take action on an initial group of 12 specified chemicals. The implications of this Convention for control pollution is that Uganda as a party is required to reduce or eliminate release from stockpiles and waste and develop and implement strategies to identify stockpiles and wastes containing POPs and to manage these in an environmentally-sound manner. This is relevant since the operation of the irrigation schemes may demand the use of pesticides, inorganic fertilizers and herbicides.
The Rotterdam Convention (1998)	The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was adopted in 1998 in response to gaps within international law related to trade in hazardous chemicals and entered into force in 2004. The implications of this Convention for control pollution is that Uganda as a party is required to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm.
The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972	The main objective of the London Convention is to prevent indiscriminate disposal at sea of wastes that could be liable for creating hazards to human health; harming living resources and marine life; damaging amenities; or interfering with other legitimate uses of the sea. The implications of this Convention for control pollution is that Uganda as a party is required prohibits the marine dumping of certain hazardous materials, requires a prior special permit for the dumping of a number of other identified materials and a prior general permit for other wastes or matter.

5. BIOPHYSICAL AND SOCIAL ECONOMIC BASELINE

5.1 BIOLOGICAL ENVIRONMENT

Both the terrestrial and aquatic ecosystems, harbor biological life whose diversity and richness was vital to investigate the flora and fauna presence, assess and evaluate their conservation value, prior to the implementation of the Tochi Irrigation Scheme development. In this regard a biological assessment study was conducted to assess the biodiversity status within the project area with focus on avifauna, mammals and herpetiles, aquatic fauna and flora species within the project command area, areas for the irrigation infrastructure and the project area boundaries.

5.1.1 Vegetation

Plants are used as a bench mark for monitoring changes/ modifications in ecosystems (Tushabe et al., 2006), since animals all depend, directly or indirectly on plants. Species diversity has greatly changed in many areas, mainly because of alterations in the environment, for which some are naturally influenced while others are triggered by developmental activities. Principle threats to biodiversity in Uganda continue to exist, including habitat loss, modification and alteration along with unsustainable harvesting, pollution and introduction of alien species (NEMA 2006/7).

The assessments aimed at identifying potential impacts to vegetation & flora and propose mitigation measures, and also lead to the development of an Environmental Management & Monitoring Plan to guide project implementation.

i. Species Diversity and Richness

A total of 81 species were recorded from 30 families and 60 genera (Annex 1). Among all the species recorded Tree species were the highest in plant life forms, with a representation of 22 species, followed by Shrubs (21 species), Herbs (18 species), while Grasses constituted of 14 species with a record of six (06) species for Climbers (Fig 6). The woody species altogether contributed 53% by species richness as compared to 47% of the non-woody species. The woody species constituted of small trees and shrubs while the non-woody species were composed of herbs and grasses.

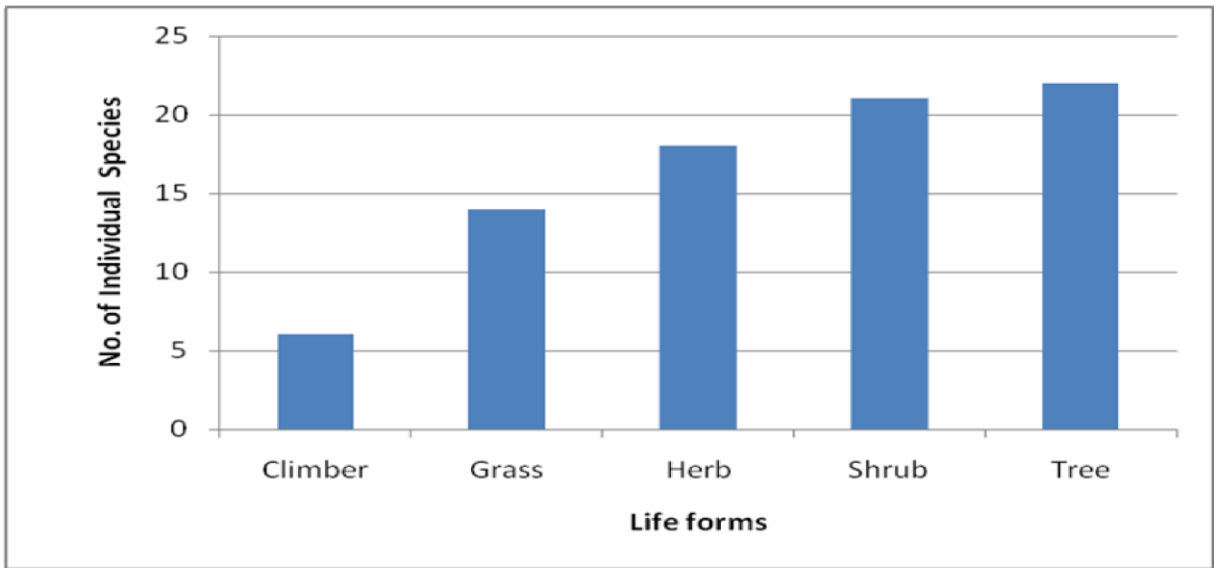

Figure 5. Plant life form distribution within the project area

The low diversity and species distribution recorded within the project area was attributed to limited variations in habitat types such as bushy vegetations that are homogenous in nature, hence limited in species diversity and richness.

Dense scrublands dominated with Mimosa pigra, which is a known and common invasive species to the marshy, wetland and swampy habitats within Uganda. Because of its thorny and entangling nature, yet very aggressive in habitat colonization, Mimosa pigra out-competes other plant species, rendering the habitats to be of low biodiversity value, in terms of species diversity and richness. Mimosa pigra covers all project components including the Water spread reservoir and both Canals but exists as small isolated pockets. While in the project command areas-southwards of the project boundaries Mimosa is very dominant and abundantly distributed.

Plate 1: Dense scrubland of Mimosa pigra southwards of the project command area

Plate 2: Impenetrable infestations of Mimosa pigra within the command area (front is the left canal & across the river is the right canal).

Other attributes to the low diversity in flora species included seasonal fires as depicted in photographic illustrations below. Fire is also a limiting factor to natural plant regeneration processes-permitting a few plant species that are fire tolerant to co-exist. Fire severely damages seeds and vegetative parts of

certain plants impairing their ability to reproduce and manifest into new plants (while is some few plants, fire is instead a stimulant to the reproductive processes, particularly in the breaking of seed dormancy).

Plate 3: Earlier bush burnings within the water spread reservoir

Over-grazing by livestock and charcoal burning that were observed also exerted pressures on the habitats causing degradations and rendering sections of the project area to be of low biodiversity value.

Plate 4: Previously burnt bushes regenerating with new and tender grass to support livestock grazing within water spread reservoir

Plate 5: Evidence of cut trees for charcoal burning amidst bushy vegetation within the command area

The existence of the flood plains within the project area, also limits species diversity and richness, given that such areas get saturated with surface water flow, during the rainy season. Not many terrestrial plants are able to thrive in highly water saturated habitats. Most of the woody species succumb to rot and deaths, and eventually suffer subsequent loss locally in such habitats. As a result, only short-lived herbaceous-weedy annual or perennial species that are resilient to such recurring micro-climatic conditions are able to survive in the floodplains, limiting the vegetation cover to grasses, herbs and a few shrubs.Generally occurrences of all the descriptions above contribute to the low levels of species diversity and richness in the project area.

ii. Vegetation/ habitat descriptions in the project area

Tochi riverine ecosystem is characterized by bushy vegetation for which Vossia cuspidata, Phragmites mauritianum, Alchornea laxiflorus, Vernonia amygdalina and Pennisetum purpereum dominated the riverine vegetation. While the non-riverine bushy vegetation dominated with grasses were interspersed with very light distribution of shrubs and trees. Common of the trees were Albizia grandibracteacta, Borassus aethiopum, Vitex doniana, Albizia coriaria, Raphia farinifera, Piliostigma thoningii, Ficus sycomorus, Acacia gerrardii, Ficus sur, Crateva adansonia and Ficus natalensis mixed with variably dense to open mixtures of herbaceous-weedy species such as the sedges (Cyperus spp), Polygonum setosulum, Triumfetta rhomboidea, Lepstemon owariensis, Senna hirsuta, Imperata cylindrica, Amaranthus spp and Commelina benghalensis among others. The non riverine bushy vegetation, occur within seasonally flooded plains on both the left and right canal, covering the command area from the dam locations-southwards but the floodplains continue and blend with Mimosa dominated scrubland on the right canal southwards.

Other habitats classified within the project area were Scrublands, characterized by thickets of Lantana camara, Flueggea virosa, Erythrococa bongensis, Rubus steudneri, Mimosa pigra, Dalbergia sp and Ziziphus pubscens. According to (Langdale-Brown et al. 1964), thickets are communities dominated by shrubs of mainly low to medium height, much branching species of plants, either forming dense clumps or continuous shrubby and tree tangles sometimes approaching 100% cover often armed with spines or thorns.

Table 11. Distribution of Vegetation/ Habitat types within Project Components

Project Component	Vegetation/ Habitat types
Water Spread Reservoir	
	 Riverine bushy vegetation
	 Non-riverine bushy vegetation along right canal
	 Non-riverine bushy vegetation along left canal
	 Non-riverine bushy vegetation in the far westwards along right canal
Dam area	

Riverine bushy vegetation across the dam area

Non-riverine bushy vegetation in the far westwards along right canal

Pennisetum purpereum dominated bushy vegetation far eastwards along the left canal

Project command area: along the river

Vossia-Phragmites Riverine bushy vegetation with Borassus aethiopum in background along left canal

Phragmites Riverine bushy vegetation with trees in the far background

Mimosa dominated Riverine bushy vegetation southwards of the command area

	 Mimosa dominated Riverine bushy vegetation southwards of the command area

	 Mimosa dominated Riverine bushy vegetation southwards of the command area	
Vegetation in the far ends away from the river:	Right canal	Left canal
		




iii. Species of conservation concern

With regard to biodiversity /genetic loss, the project area does not have species of conservation concern both regionally and nationally, as well as internationally as per the IUCN red list (IUCN, 2016).

But on the National Forestry Authority list of reserved species Albizia coriaria was widely observed within the project areas, occurring as both mature trees and saplings, and NFA obliges the critical importance of protecting their habitats. However, Albizia coriaria is widely distributed in the country-it does not have a restricted habitat range. Thus there will be minimal impact by the project activities to the survival of the species.

iv. Invasive Plant Species recorded

There were two records of invasive plant species within the project area namely; Lantana camara and Mimosa pigra. Dominant of all the invasives in the project area was Mimosa pigra whose distribution and abundance was highest among the species records. Lantana camara was encountered in very small sub-populations, but also with high chances of spreading further in case disturbances prevail (Cronk & Fuller, 1995).

Invasive plants can be a potential threat to biodiversity conservation. The spread of invasive plants is often triggered by disturbances in the ecological systems. Invasive plants are potential threats to conservation, and may cause economic or environmental damage (NARO, 2007). They displace native species through aggressive and altered recruitments in natural ecosystems. Therefore their

management is critical. The International Finance Corporation (IFC, 2012) Perfomance Standard 6; on biodiversity conservation and sustainable management of living resources, provides that any project that wishes to be in compliance with the provisions therein in the standard, endeavors to address concerns related to invasive aliens.

5.1.2 Avian Fauna

Conservation value of birds

The survey recorded sixteen (16) bird species within the project area. The yellow-vented bulbul was the most common bird species, followed by blue-naped mousebird and the rest were almost equally distributed although Rosy-patched shrike was least abundant. Birds were more abundant in the riverine and least distributed within fallow land. See below for the list of bird species recorded.

Table 12: Bird Species within the project area

Scientific name	Common name	Species occurrence in habitats			Conservation status
		b	s	fp	
Acciptes minullus	Little sparrowhawk	x	-	x	LC
Alcedo cristata	Malachite kingfisher	x	-	-	LC
Alseonax adustus	Dusky flycatcher	x	x	-	LC
Andropadus tephrolaemus	Yellow-vented bulbul	x	x	x	LC
Apalis jacksoni	Black throated apalis	-	-	-	LC
Aplopelia larvata	Lemon dove	x	-	x	LC
Apus affinis	Little swift	-	x	-	LC
Apus caffer	White rumped swift	x	x	-	LC
Centropus superciliosus	White -browed coucal	-	x	x	LC
Corythaxiodes leucogaster	White-bellied Go-away-bird	x	-	-	LC
Guttera edouardi	Crested guineafowl	x	-	x	LC
Indicator indicator	Greater honey- guide	x	-	x	LC
Milvus migrans	Black kite	x	x	x	LC
Nectarinia hunter	Hunter's sunbird	x	-	x	LC
Oriolus larvattus	Black headed oriole	x		x	LC
Plegadis falcinellus	Glossy ibis	x	-	-	LC

b- Bushy vegetation; s- Scrubland; fp- flood Plains
X = present, - = absent in the habitat
LC- Least concern

Bird species were distributed in three different habitat types i.e. bushy vegetation, and this had the highest abundances of bird species, a factor that can be attributed to the presence of fairly dense vegetation, which offer good camflouge to the bird species. The other habitats included the scrubland and flood plains. These harbored mostly the edge and the ground dwelling species whose abundance

was low and unevenly distributed. From the global reference of IUCN redlist (IUCN 2015), the bird species recorded were of least conservation concern. No habitat specialists were recorded.

However, the species are being threatened by a number of factors that include hunting especially of the crested guinea fowls. Other threatening factors to avian fauna include; farming which has reduced on suitable habitat areas for the birds; charcoal burning where mature trees suitable for bird roosting and breeding are cut down; and bush burning.

Establishment of the irrigation scheme involves a number of activities which obviously will impact on the habitat. Clearing of vegetation during the construction phase reduces the cover especially for the ground dwelling species of which the most dominant in the area are guinea fowls. Direct mortality to birds due to collision with moving machinery is anticipated especially ground dwelling species; establishment of furrows or flowing canals will create aquatic microhabitats that may not favor the native species that cannot flourish in such habitats. However, the project developments may instead attract abundances and distribution of waterfowls along the tail flows and flow canals. During the operation phase, increase in acreage of land under cultivation is expected to reduce the habitat and increase concentration of pesticides that may be dangerous to ground foragers such as the dove species and guinea fowls among others.

5.1.3 Mammalian Fauna

Mammals are of very significant importance to any terrestrial ecosystem given the ecological roles the species play. Impacts on the dynamics of their populations, species composition and preferred habitats may have gross and irreversible impacts on the ecosystem for the larger species of mammals.

The survey identified nine species of mammals, four of which were primates, one antelope, three rodent species, and a wild pig (Table 14). However, the primates were the most common species of mammals noted within the study area. Animals were observed in riverine, open woodland, savannah grassland, fallow land and scrubland.

Table 13: Mammal species within the project area

Species	Common name	Species occurrence in habitats b	s	fp	Conservation status
Paraxerus cepapi	African bush Squirrel	x	x	-	LC
Rattus rattus	Black rat	x	x	-	
Lemniscomys stratus	Common stripped grass mouse	x	x	-	LC
Crocidura fuscomurina	Tiny musk shrew	x	x	x	LC
Aethomys kaiser	Kaiser's bush rat	-	x	-	LC
Crocidura hildegardeae	Jackson's musk shrew	x	-	-	LC

Leporidae lepus	Wild rabbits	x	-	x	LC
Felis silvestris	Wildcats	x	x	-	LC
Arvicanthis niloticus	Nile grass rat	-	x	-	LC

b- Bushy vegetation; s- Scrubland; fp- flood plains
LC- Least concern (according to IUCN RedList of Threatened Species)
X = observed, - not observed

From the study findings, the bushy vegetation and scrubland had the highest mammal species distributions and abundances, particularly for the rodents. This is justified by earlier studies by Baranga (1992) that the bushy vegetation and scubland are typical habitats for the rodent species. Shrew species recorded were more dominant in scrubland mainly in adjacent anthills and thickets, while scrubland hosted few rodent species but a considerable population of wild rabbits and some wild cats. This is because of the anthills and some thickets which provide adequate shelter and hiding grounds. (Delany, 1975) confirms that rodents are typical of savannah bush and grassland. However, all species are known to be widely distributed in the moister parts of East Africa (Kingdon, 1974). From the global reference of IUCN redlist (IUCN 2015), the mammalian species recorded were of least conservation concern. However threats to habitat and animals were observed in the area which if not attended to may cause serious impacts on biodiversity. These included; hunting especially of wild rabbits and African bush squirrel; farming which has led to reductions in habitat and conflict between farmers and the rodent species that destroy crops. Bush burning was also evident, plus charcoal burning as threats to mammalian fauna through their direct influence on habitat loss.

5.1.4 Hepetofauna

A total of eight species of reptiles and three species of amphibians were recorded. Of the reptiles three species were snakes, two geckos, one tortoise, one skink and the other a monitor lizard. While for amphibians; two species were frogs and one toad as indicated in Table 16. Amphibians were observed along the riverside and nearby savannah vegetation. But generally the herptiles were found in different habitats as per their preferences, and habitat types included riverine, open grassland, savannah, rocks and fallow land.

Table 14: Reptile species within the project area

Scientific name	Common name	Species habitats b	occurrence in s	fp	Conservation status
Agama atricollis	Common tree agama	-	x	-	LC
Causus resimus	Green night adder	x	-	-	LC
Hemidactylus sp.	House gecko sp.	-	x	-	LC
Leptotyphlops sp.	Worm snake sp.	x	-	x	LC

Mabuya sp.	Skink sp.	x	x	-	LC
Typhlops sp.	Blind snake	x	-	x	LC
Varanus niloticus	Nile monitor lizard	x	x	-	LC
Stigmochelys paradalis	Leopard tortoise	x	x	-	LC

b- Bushy vegetation; s- Scrubland; fp- flood plains
LC- Least Concern according to IUCN RedList of Threatened species
X = observed, - = not observed

Table 15: Amphibian species within the project area

Scientific name	Common name	Species occurrence in habitats	Conservation status
Bufo regularis	Square marked toad	Savannah & marshy	LC
Phrynobatrachus natelensis	Snoring paddle frog	Riverine & marshy areas	LC
Ptychaedena achietae	Savannah ridged frog	marshy & savannah vegetation	NE

NE - Not Evaluated, LC-Least concern

The fallow land and riverine habitats consisted of the majority of reptile species. But none of the species was of conservation value locally, or nationally though this is still a challenge since herptiles are least studied in Uganda. At a global level (IUCN, 2015), still none of the species is referenced in the redlist category. A number of reptiles especially ghekos and skinks were observed in refugia like logs of trees and rocks and very few reptiles were found in the flood plains. Therefore in terms of habitat value visa-viz biodiversity richness, Tochi project area was considered of very low conservation significance.

Amphibians inhabited bush land and scrubland at riverbanks and marshy habitats. Lamotte (1992) suggested that areas with both a high diversity and abundance of amphibians are moist areas. Existence of amphibians in these areas is threatened by the severe drought prevalent in the region. This was demonstrated by the vegetation scorched by the sun, which under ideal conditions forms shade or suitable niches for the species. This of course affects the breeding of amphibians and their possibilities to camouflage from predators. Overgrazing by cattle causes trampling of vegetation especially at the banks where amphibians live and breed. This may not only impact on the breeding grounds but may cause loss of tadpoles and eggs.

Therefore development of an irrigation scheme will in addition to the existing threats to biodiversity species as highlighted in this report, compromise the survival of herptiles by impacting on them negatively.

5.1.5 Aquatic fauna

Fish Species

Three fish species namely;Aethiomastacembelus frenatus, Bagrus docmac and Oreonchromis niloticuswere observed at different sampling sites within the project area along river Tochi Photographic illustrations of the identified fish species are shown in below.

Table 16: Distribution of fish species within the project area.

Fish species	Occurences of species at sampling sites					Conservation status
	1	2	3	4	5	
Aethiomastacembelus frenatus	√	X	√	X	√	Least Concern
Bagrus docmac	√	√	X	√	X	Least Concern
Oreonchromis niloticus	√	√	√	√	X	Not assessed

Aethiomastacembelus frenatus

Bagrus docmac

Oreonchromis niloticus

Figure 6: Illustration of fish species in the project area

The identified fish species at different sampling sites within the project area were moderately abundant and well distributed. Their richnessdid not significantly vary among the five fish sampling sites.
Aethiomastacembelus frenatusis known to occur in swamps, marginal wetlands and shallow waters (Eccles, 1992; IUCN, 2015) which were characteristic of the stretch of Tochi River within the project area. This species is known to be threatened by predation by Nile perch, illegal fishing, pollution of the inshore environment and wetland loss due to agriculture expansion (Bayona et al., 2010). However, none of these threats were ascertained during the assessment. It's wide spread within the project area which makes it ofless conservation concern as also listed by the IUCN red list (2015) following regional assessment conducted regarding its population.

Bagrus docmac was widespread within the project area along Tochi River and no potential threats to this species were identified during the assessment. It is also reported elsewhere to have a wide distribution with no major threats impacting on its population (Azeroual et al., 2010). Thus, it is currently registered as a species of least conservation Concern by the IUCN (2015) following its regional assessments (Azeroual et al., 2010).

Oreonchromis niloticus was well distributed within the project area along Tochi River and no threats were identified to it population. It is the most important tilapiine constituting the third most important commercial fishery in Uganda, after Nile perch and Rastrineobola argentea (MAAIF, 2012) hence necessary to protect its populations. It prefers plant material and algae (also found in Tochi River) in

its diet which defines its ecological role in the aquatic food chain (Lowe-McConnell, 1958; Moriarty & Moriarty, 1973; Getabu, 1994; Balirwa, 1998). Therefore, the proposed project needs to be implemented with minimal disturbance to the aquatic environment to avoid any disruptions in ecological roles and functions of this fish species within the project area.

Algae Species

Three major taxonomic groups namely; Blue-green algae, Green algae) and Flagellates constituted the algal community within the project area at selected sampling sites. Green algae dominated the species richness and abundance compared to Blue-green algae and flagellates at all sites sampled. Widely recorded genera were Oscillatoria, Microcystis and Calothrix among the Blue-greens, Spirogyra and Cladophora among the Greens and Uroglena for the case of flagellates.

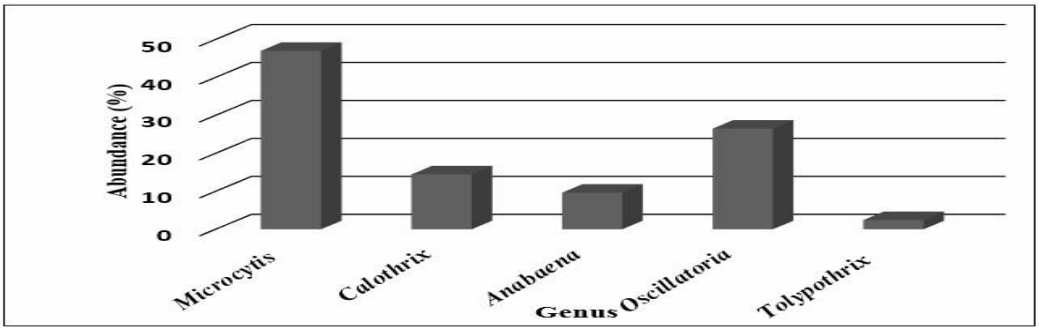

Figure 7: Relative abundance of Blue green algae within the project area.

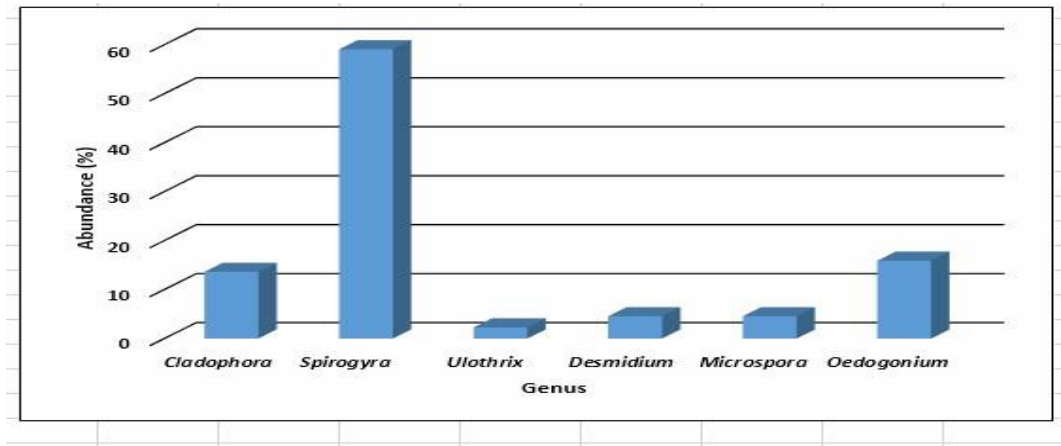

Figure 8: Relative abundance of Green algae within the project area.

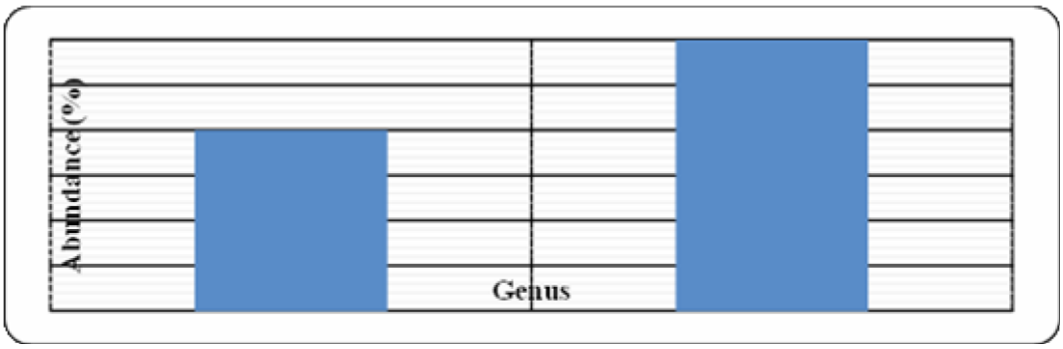

Figure 9: Relative abundance of flagellates within the project area.

The observed dominance of green algae compared to the blue green algae is an indication that river Tochi in not eutrophic. Phytoplanktons play a significant role in the aquatic food chain by acting as a food sources for the grazers (Zooplanktons) and herbivorous fishes like Oreonchromis niloticusfound in river Tochi. However, excessive growth of algae, especially the blue-greens, can be disastrous as certain species like the Microcystis are capable of producing toxins (Basu, 1997) that are deleterious to fish.Perturbations following development projects e.g the proposed Tochi river irrigation scheme can cause a shiftin phytoplankton composition and productivity leading to structural changes in the aquatic food chains (Mwebaza-Ndawula 1994; Cottingham 1999; Tallberg et al. 1999; Dodson et al. 2000; Mugidde 2004). This has got a negative impact to other aquatic organisms like zooplanktons and fish that feed on phytoplankton by altering their size structure (Gowen et al. 1992; Gosselain et al. 1998). Therefore we recommend that the proposed project activities be implemented following the recommended practices as further outlined in this report so as not to affect the ecological integrity of riverine system within the project area.

Zooplankton

Six genera were recorded from the samples collected along Tochi River within the project area. Two crustaceans namely; Cyclops and Bosmina and four Rotifera i.e. Branchionus, Proales, Eucalanus and Lecane were recorded. The keystone species were Proales and Eucalanus found in all samples collected at different sampling sites within the project area.

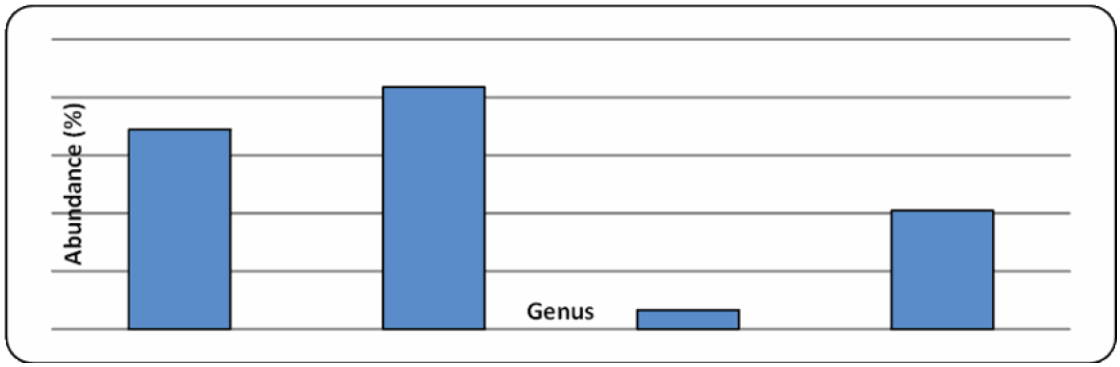

Figure 10: Relative abundance of Rotifers along Tochi River within the project area.

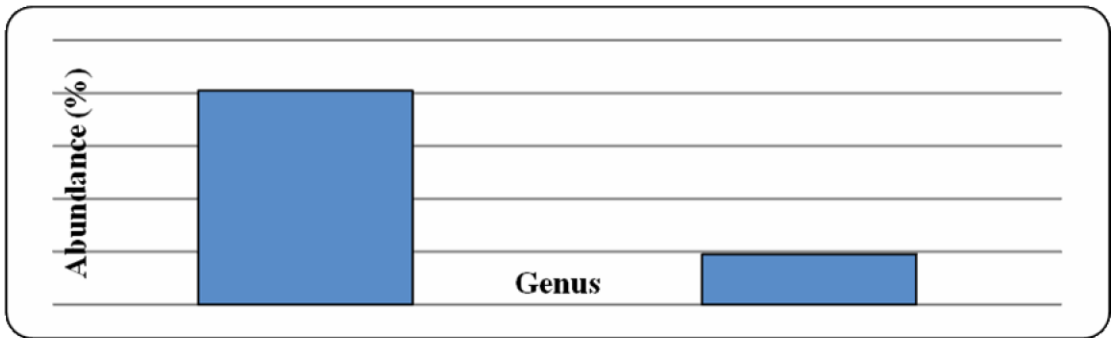

Figure 11: Relative abundance of Crustaceans along Tochi River within the project area.

The observed aquatic diversity and abundance patterns for zooplankton in Tochi River is a trend typical for riverine communities (Mwebaza-Ndawula et al., 2005, Baranyi et al., 2002). The ecological significance of the identified zooplanktons especially rotifers lies in their function as a food base for the various fishes (Mwebaza-Ndawula and Schiemer, 1997; Mwebaza-Ndawula, 1998) identified in Tochi River within the project area. Therefore, zooplanktons occupy an important position in aquatic food webs (Mwebaza-Ndawula, 1998) as they feed on aquatic algae, detrital particles and parts of aquatic macrophytes converting them to animal protein for use further up in the food chain and ultimately for fish production. Therefore, the proposed project should be implemented with minimal disturbance to the aquatic environment within the project area so as not to affect the ecological roles of zooplankton communities.

No benthic macro-invertebrates were identified at established sampling sites along Tochi River within the project area. The absence of macro-invertebrates is perhaps explained by the nature of soils where sampling was done. The soils were characterized of soft clay and sand which offer limited establishment and attachment surfaces for the macro-invertebrates.

5.1.6 Ecological sensitivity of Tochi ecosystem

Tochi ecosystem in its current state provides the surrounding local communities with fisheries from the river, water for domestic and livestock use, while the terrestrial environment serve as grazing land for livestock as well as hunting grounds for wild game. Also among other benefit to humans is the fuelwood, from the tree stands that are scattered within the project area, whose distribution and abundances has been rendered low possibly because of over-exploitation.

Ecologically sensitive habitats

The ecologically sensitive habitats were;;

- Grass lands with dense patches of thickets with variable tree species standing amidst them,
- Mimosa pigra (invasive) infested areas,
- Cyperus papyrifera dominated wetland
- Flood zone

a) **Grass lands with dense patches of thickets**

The dense patches of thickets with variable tree species were predominated by Phoenix reclinata, Piliostigma thoningii, Spathodea campanulata, Borassus aethiopum, Stereospermum kunthianum,

Ficus spp, Albizia spp, Bridelia scleronuera, Combretum spp, Raphia farinifera, Grewia similis, with shrubby species of Alchornea laxiflora, Senencio angulatus, Flueggea virosa, Monanthotaxix buchananii, Triumfetta spp, Erythrococa bongensis and Grewia mollis among others, mixed with herbaceous- weedy species of either erect or creeping growth forms to give dense vegetation coverages. The dense thickets were characteristic within the reservoir and dam areas and within the command area and appear like belts when viewed on google map. The dense patches are located along geographical coordinates.

Geographical coordinates for the sensitive habitats within (UTM)

Reservoir area		Left Canal within the command area		Dam area	
435462	270442	437049	262226	437796	266713
435810	270932	436692	262524	438002	266454
436346	270574	436504	262933	438149	266280
436695	270489	436010	263261	437144	267470
437048	270218			436945	267689
437453	269877				
438167	269397				
438707	269070				
440487	267831				
437611	268382				
437592	268236				
437564	268092				
437527	267939				
437460	267824				

These dense patches are perceived sensitive because they are supportive to the few recorded fauna species as they present a variety of fruit plants, camouflaging, roasting and breeding habitats compared to the grasslands. The dense patches are amidst large expanses of bushy grasslands that serve as ranging habitats for the recorded fauna species.

b) **Mimosa pigra (invasive) infested areas**

Invasive plants can be a potential threat to biodiversity conservation. The spread of invasive plants is often triggered by disturbances in the ecological systems. Invasive plants are potential threats to conservation, and may cause economic or environmental damage (NARO, 2007). They displace native species through aggressive and altered recruitments in natural ecosystems. These are cited as ecologically sensitive because of the negative role they play in biodiversity conservation. Hence due attention must be given to such areas and the species itself to ensure its control and elimination from the project area.

Geographical coordinates for the sensitive Mimosa pigra infested habitats (UTM)	
Along the Riverine within the reservoir, dam and the command area	
436142	264898
436950	265204
437477	267338
435712	263261
436710	261759

c) Cyperus papyrifera dominated wetland

The wetland stretches to about 100 metres either sides, southwards and northwards at location 437847/ 265944 (UTM). Being a wetland area, it is definitely sensitive because of the flood control role and its associated impacts, and the role it plays in filtration of pollutants that would result into eutrophication and sedimentation into the river. The wetland location is estimated at less than 70 metres eastwards from Tochi river.

d) Flood zones

Located at 437977/ 267380 (UTM), these were considered sensitive because their proximity to settlements (subsistence farmland & homestead), in a range of 300 metres. The map below shows the ecologically sensitive areas in Tochi project area.

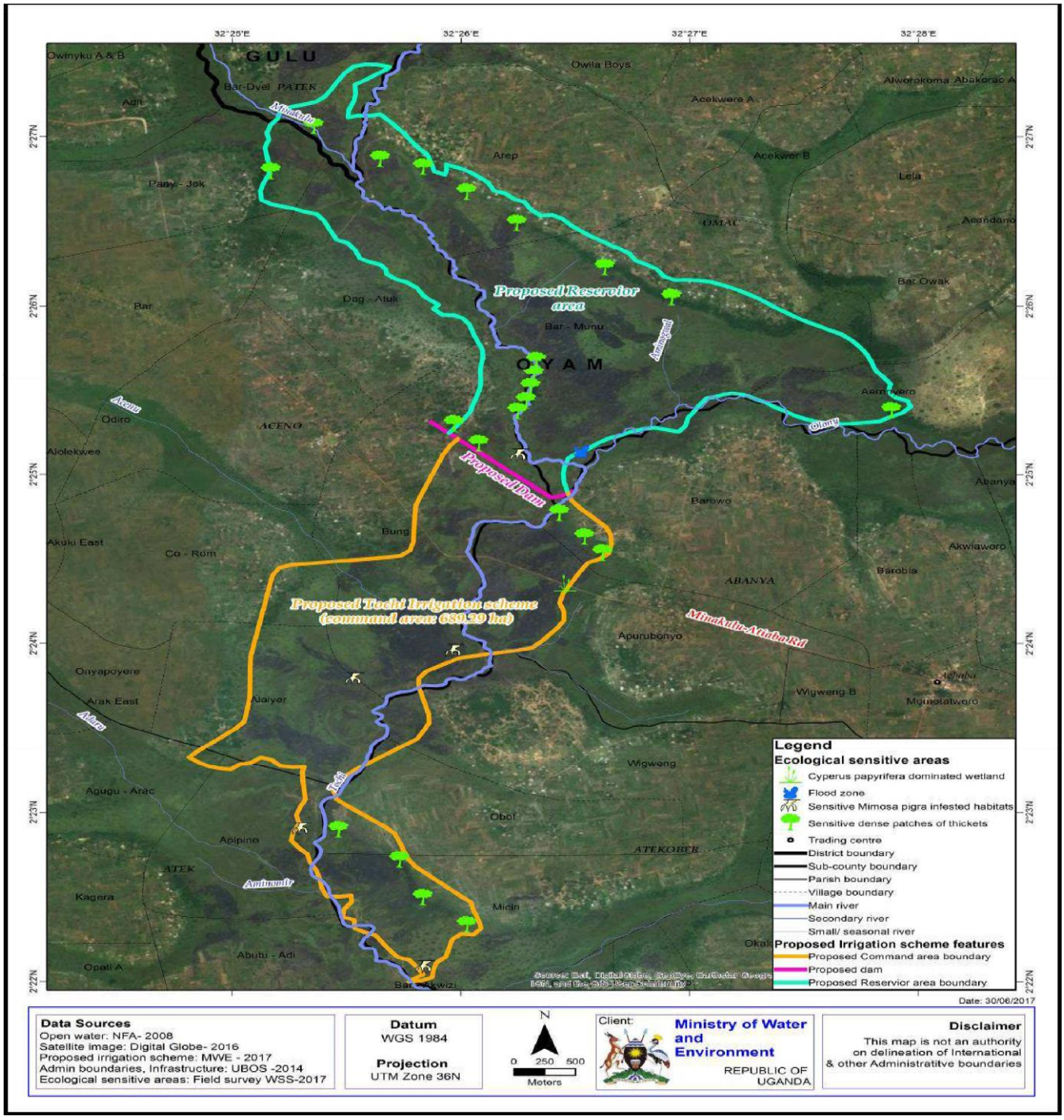

Figure 12: Map showing some ecologically sensitive areas

Besides what has been mentioned above, Tochi ecosystem serves as a flood control area for surface run-offs during the wet seasons. Part of the water spread reservoir and the dam; including the command area with both canals are flood plains that serve as water containment areas to safeguard against environmental damages to the surroundings.

Generally the fauna and flora within the Tochi river ecosystem are not of any conservation concern, since none is IUCN redlisted. Consequently no local or national species of conservation value exists. With the overall vegetation type that is of low biodiversity value, the site is considered an appropriate location for the development an irrigation scheme.

5.2 SOCIAL SURVEY

5.2.1 Introduction

The project design is hinged on community-based participation with the districts and sub-counties as focus of implementation, and the private sector as main technical service providers. The project's objectives and expectations cannot be realized unless farmers' considerations on benefits and costs, feasibility and desirability and their priorities in life match that which the project requires of them. At times, smallholders' priorities differ from the project's priorities. Hence the need to assess the acceptability and desirability of the farmers to participate in the development of the irrigation schemes. The nature of the population must be understood in order to match the rate of development with the absorptive capacity. Elements such as the level of literacy, farming knowledge and skills, past experience with irrigation, gender issues and attitudes to change shall be among the several parameters to be considered by the Consultant when analyzing the social aspects of the project.

In this regard, the consultant carried out a baseline, socio – economic survey that fully addresses socio – economic status, gender, sanitation of the beneficiaries. This is intended to assess their ability to operate and manage the irrigation facilities. To understand the nature of population and match the rate of development with the farmers' absorptive capacity, the consultant shall assess farmers on the level of literacy, farming knowledge and skills, past experience with irrigation, gender issues and attitudes or their ability to embrace change.

Irrigation development brings cultural shock to a smallholder community. With monomodal rainfall conditions, smallholders work for a few months in a year under rainfed conditions and in a sense they are underemployed and have ample time to attend to their social aspects of the society. In contrast to this, irrigated crop production requires almost daily attention throughout the year if it is to be profitable. How able the community is to adjust to these and other changes becomes critically important and should be thoroughly discussed with the farmers by the Consultant. With the introduction of irrigation, the farmers' social time shall be encroached on. The consultant will thus assess the acceptability and desirability of the farmers to participate in the development of the irrigation schemes.

Irrigated crop production is a high input high output system and therefore farmers need to procure seeds, fertilizers and chemicals in order to optimize their production system. The consultant reviews potential options and makes recommendations under the prevailing land tenure system. The consultant shall assess the existing markets and transport system as well as their potential for development. Market prices, transport costs and farm prices will be predicted as related to the expected increased volume of production. Processing / storage facilities will be considered as part of a marketing strategy.

5.2.2 Demographic Characteristics

In order to understand the socio-economic conditions in the project areas in Acaba Sub-County, Minakulu Sub-County and Ngai Sub-County and the respective parishes and villages affected by the project, a random household survey was undertaken using a sample size of 460. The questionnaires were administered by research assistants within the project area having received one day training on the tool and sampling strategy.The demographic characteristics given an indication of how populations behave within their landscapes and this case, whether they will be able to adopt irrigated agriculture and sustain the responsibility that comes with operating and maintaining the infrastructure.

- **Household Data**

Most of the questionnaires were administer to household heads (67%), which implies that most information collected in this survey is representative of decision making persons within the project area.

Table 17: Status of Respondent

Status in the household of respondent		Frequency	Percentage
01	Head	306	67%
02	Spouse	122	27%
03	Other (specify)	9	2%
Missing		23	5%
TOTAL		460	100%

The FIEFOC programme targets households and therefore understanding the characteristics of the household head aids in determining how feasible the proposal to irrigate along the Tochi area will be. In terms of access to household heads, presence of the households within the project area implies that most homes have their household heads living and working within the community of the project and therefore full time farmers.

- **Gender of Household Head**

In terms of gender, of those interviewed, majority were found to be females which seems to suggest that most households interviewed were female headed as shown in the graph below.

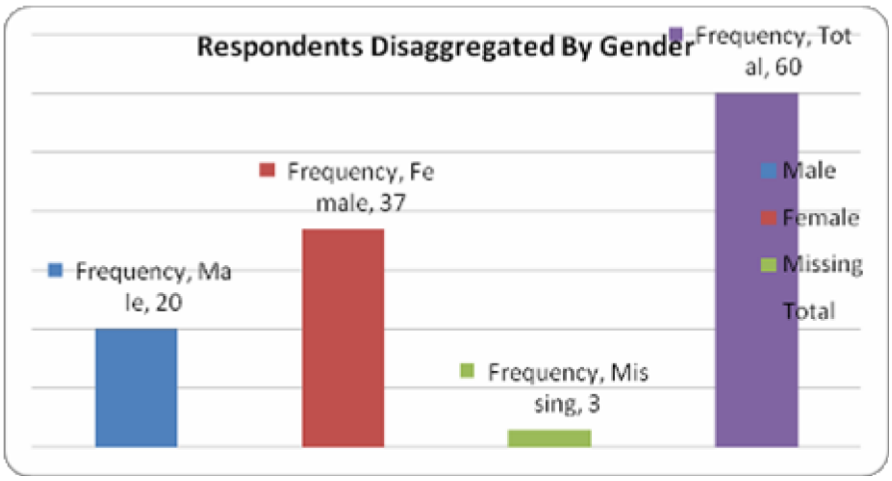

Figure 13: Respondents Disaggregated By Gender

The overall objective of this project is to contribute towards improvement of farm incomes, rural livelihood and food security. Females are normally charged with food production at household level while men normally engage in commercial aspects, requiring an input of men and women, but more importantly the women because they provide a lot of the farm labor from planting to harvesting.

- **Age**

Regarding the age, 73% of those interviewed fall within the 26 – 49 years age group, this is an economically active age group which is the main target for the proposed project.

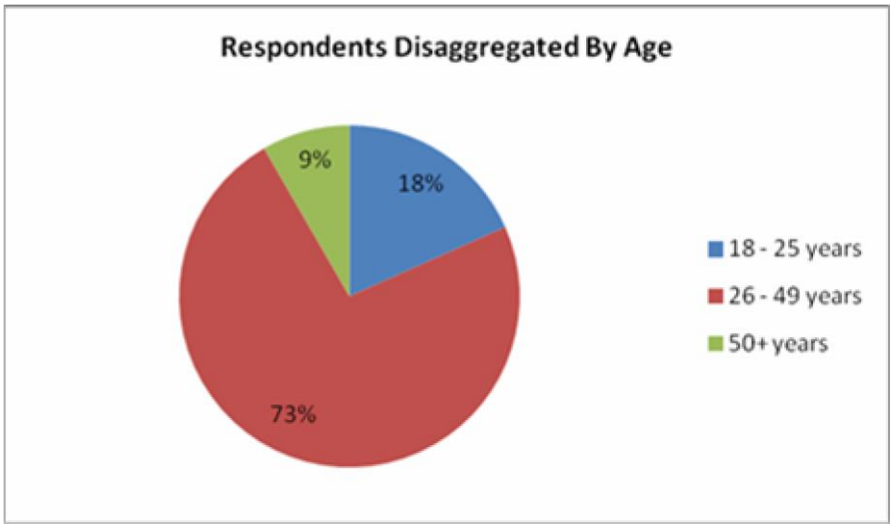

Figure 14: Respondents Disaggregated By Age

Age can influence the production and productivity of irrigated crop production and might create production difference among the irrigation areas. Given that the most are economically active they can easily adopt better farming practices and related activities that come with irrigation agriculture given that their overall goal is to increase productivity and be able to sustain the household expenditures including school fees, medical fees, transport amongst others.

5.2.3 Household Characteristics

- **Household Composition**

Results suggest as shown in the table below that most households have more people below the age of eighteen years living within their households which implies that majority of household members are school going and can only be available for farming during the holidays.

Table 18: Distribution of Household Members Disaggregated By Age Group

Age group	0-5 yrs	6 -14 yrs	16-25 yrs	26-45 yrs	46-65 yrs	Over 65 yrs
Household members	92	113	95	76	7	5
Average distribution per household	1.56	1.92	1.61	1.29	0.12	0.08

It also implies that most household heads, still have children for whom they are catering for in terms of school fees, medical and other needs and are hence more motivated to improve their yields in order to meet these needs.

- **Construction Materials of Dwelling Units**

The different materials used for the construction of a house are usually viewed as a proxy measure of the quality of housing as well as an indicator of health risk. Respondents were asked to give a description of the houses their living conditions.

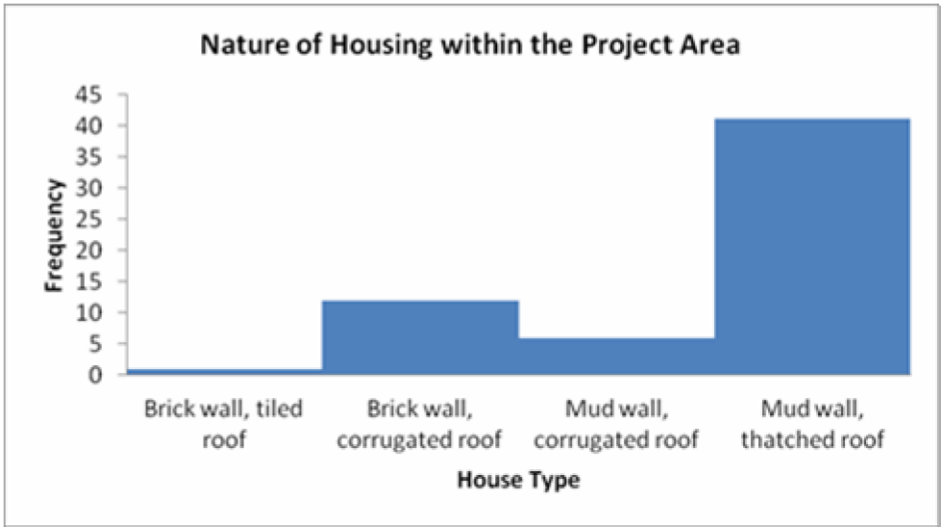

Figure 15: Nature of Construction of Dwelling Units in the Project Area

Results suggest that majority of respondents have mud wall and thatched houses which implies higher health risk as is characteristic of rural areas unlike in urban areas.

- **Household Occupation**

The number of rooms used for sleeping gives an indication of the extent of crowding in households. Crowding in one sleeping room increases the risks of infectious diseases.

Table 19: Number of Rooms in Houses

Number of rooms	Frequency	Percentage
1	55	12%
2	32	7%
3	101	22%
4	14	3%
5	37	8%
Over 5	37	8%
Missing	184	40%
Total	460	100%

Results from the survey seem to suggest that 22% of households have three rooms which implies that health risk is not as high as in the case when household members reside in one room. Considering that most household depend on family labor, having health family that are not susceptible diseases does not have an implication of labor availability especially in planting and harvesting periods.

❖ Occupancy Tenure

Occupation tenure identifies a basic feature of the housing inventory, whether a unit is owner or renter occupied. It refers to the arrangements under which the household resides in a dwelling and these include renting, owner occupancy and dwelling supplied free. Ownership of a dwelling unit represents security of tenure of a household and tenure type is important for planning housing assistance and is also used in national data collections as a key housing variable.

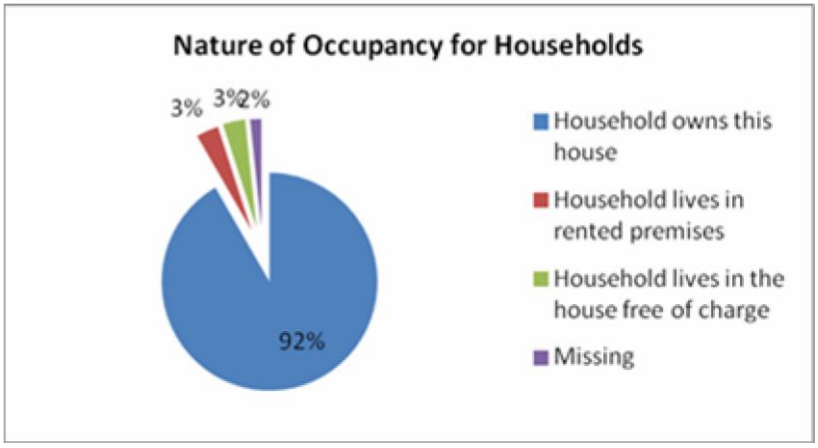

Figure 16: Nature of Occupancy for Dwelling Units

Results suggest as shown in the figure below that 92% of household heads own the houses that they live which imply the following:

- That they are permanently residing within the project area and are therefore more likely to actively participate in the operation and maintenance of the irrigation infrastructure
- That the land they have for agriculture is only available for profit making other than for provision of housing.

5.2.4 Land Tenure Arrangements

Land is vital resource for production of crops for farmers who rely their livelihood on it. Besides the holding size, land arrangement is crucial to cultivate, manage and produce agricultural products and also it has influence on net income gain from each plot of land. Land arrangement is a kind of consensus made between the land owner and the renter either in cash or as share cropping. The land arrangement is made when the farmer; who owns the land face short of labour or lack of oxen used to plough; rent to his fellow farmer who faces shortage of land to cultivate.

Security of tenure normally determines whether a household activity is willing to engage in income generating activities or not. Proposals for growing of rice and cotton are being made and there is need to understand whether land tenure arrangements will permit farmers to venture into these crops.

Results suggest as is the case with the Northern Region most land is communal or customary. 75% of those interviewed have communal land, while 12 percent have inherited land from a relative implying that transfer rights. Under communal tenure, exclusive rights are assigned to a group.

Individual or family rights are also assigned under most traditional tenure systems. This implies that the households who have user rights which include rights to grow crops, trees, make permanent improvement, harvest trees and fruits, and so on can actively participate in this project.

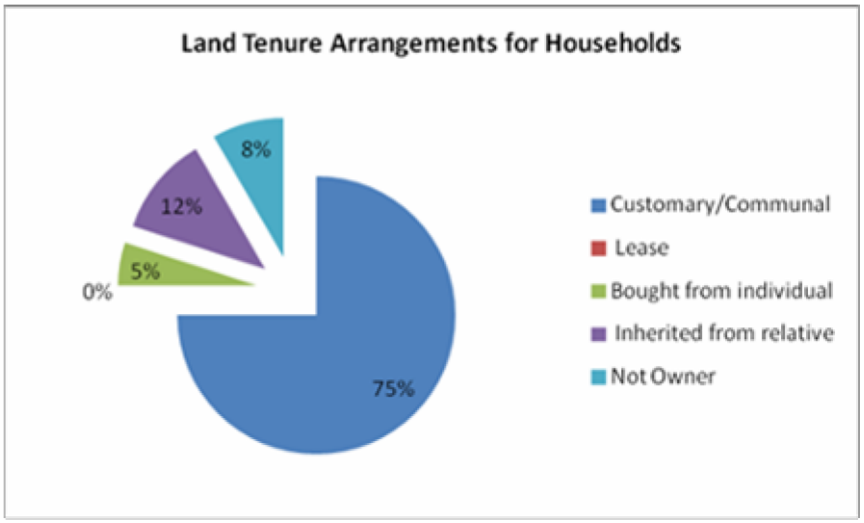

Figure 17: Land Tenure Arrangements for Household Heads

Therefore, for the proposed project, farmers targeted are able to engage in the proposed crops and cannot sell. It means that community members when consulted can provide land for the farm infrastructure if their traditional institutions including clans are adequately engaged. Emerging from this tenure arrangement that requires further discussion are the following:

- **Size of land**

Results from the survey suggest that most farmers have on average 1-2 acres that is available for farming as shown in the figure below.

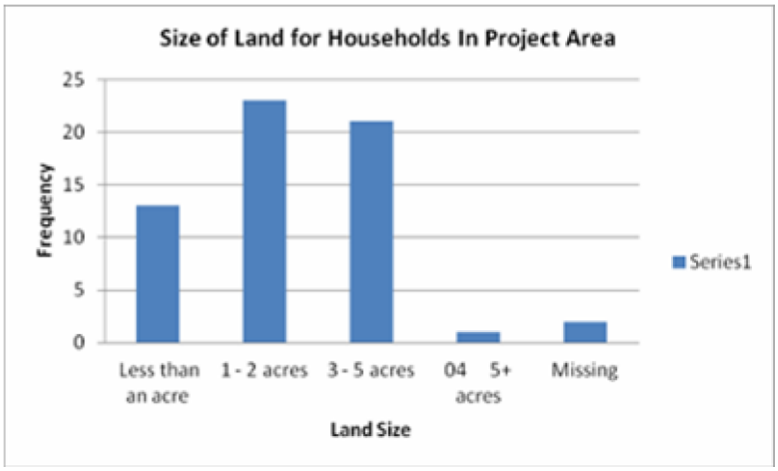

Figure 18: Land Holding Size in the Project Area

Yet most engage in subsistence agriculture, with limited improved technology, including the use of fertilizers and improved seeds. With the aspect of water being addressed, coupled with improved management practices, farmers will be presented with the opportunity to improve their productivity even on small pieces of land. In fact, there is ample international evidence that small holdings are often more productive that larger units, i.e. in terms of yield per hectare and profit per hectare.

- **Percentage of land covered by Houses**

Results that suggest that for most household heads, about 75% of their land is available for income generating activities including agriculture, storage and post-harvest handling of their produce as shown in the figure below.

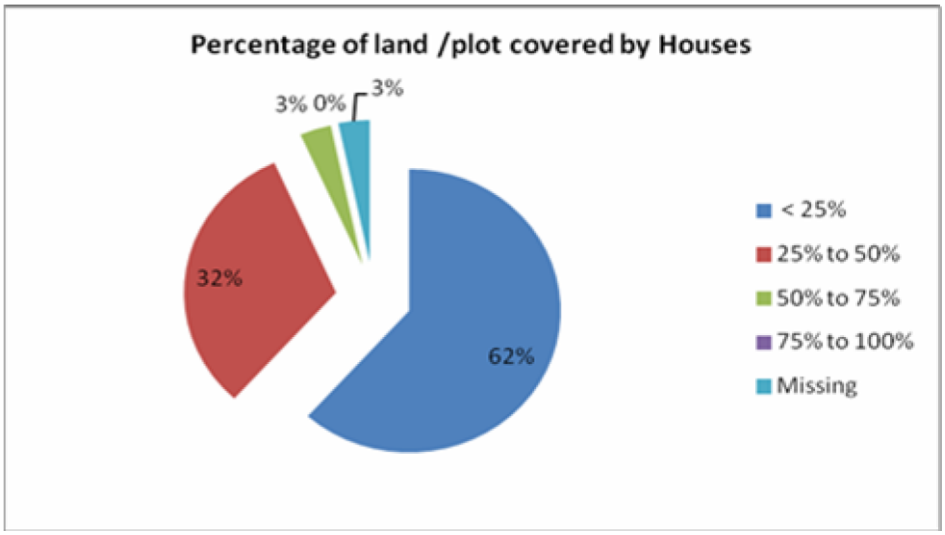

Figure 19: Percentage Land Covered by Houses

Sixty two percent of respondents said that the land on which their houses are located is less than 25% of their total land size.

5.2.5 Characteristics of Household Head

- **Highest Level of Educational Attainment**

Basic education is a fundamental human right and a component of wellbeing. Education is also a key determinant of the lifestyle and status an individual enjoys in a society. Studies have consistently shown that educational attainment has a strong effect on the behavior and attitude of individuals. In general, the higher the level of education an individual has attained, the more knowledgeable they are about the need and use of available facilities in their communities.

Results suggest that the majority of household heads have attained primary education.
Regarding farming experience, it is an informal education on agricultural practices and production patterns from their surrounding environment, that is, households and community. On average when farmers complete their education at primary level then they are about 13 years and by the time they are between the ages of 26 and 49, they have attained informal education on farming that would benefit the project.

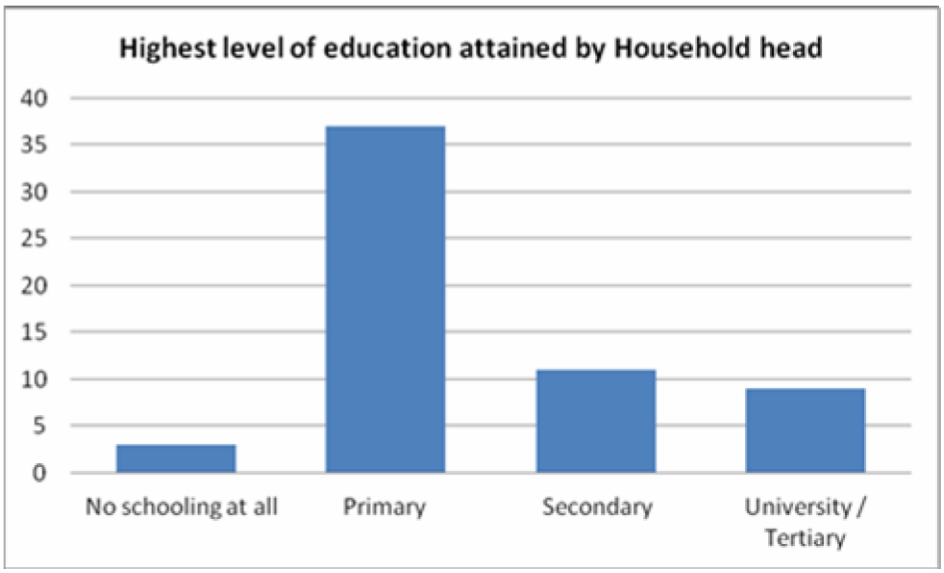

Figure 20: Highest Level of Educational Attainment for Household Head

Although farmers will have experiential knowledge on agricultural production, they may not have knowledge on irrigation management which implies that many of the farmers do not have the basic know how of practicing irrigation agriculture and would require their capacity built in the following:

- Crop water needs
- Water application method
- Irrigation intervals

Knowledge of irrigation water management aspects will help reduce wastage of irrigation water, deterioration of some structures and water logging problems on some farms.

❖ **Occupation of Household Head**

Results suggest that 77% of the household heads are farmers which imply that most of the household heads have farming experience.

Table 20: Occupation of Household Head in the Project Area

Occupation of the household head	Frequency	Percentage
Technical / Professional / Managerial	32	7%
Formal trader (with a shop)	0	0%
Informal trader (stall at the roadside or at home)	0	0%
Casual laborer	37	8%
Fishing	0	0%
Farmer	350	76%
Sales / administrator (private)	9	2%

Civil servant (working at the district or sub county)	23	5%
Transport / boda boda	9	2%
Other (	0	0%
TOTAL	460	100%

In terms of livelihood strategies, most farmers depend on farming as their primary source of income, very few engage in retail trade or any other activities. Therefore, farmers have an opportunity for irrigation agriculture in order to enable them increase their productivity and hence incomes.

- **Income of Household Head**

The major income source is agriculture which includes livestock and crop production. Crop production in the study areas is the major income source. As shown in the table below most farmers interviewed earn less than 100,000 Uganda Shillings.

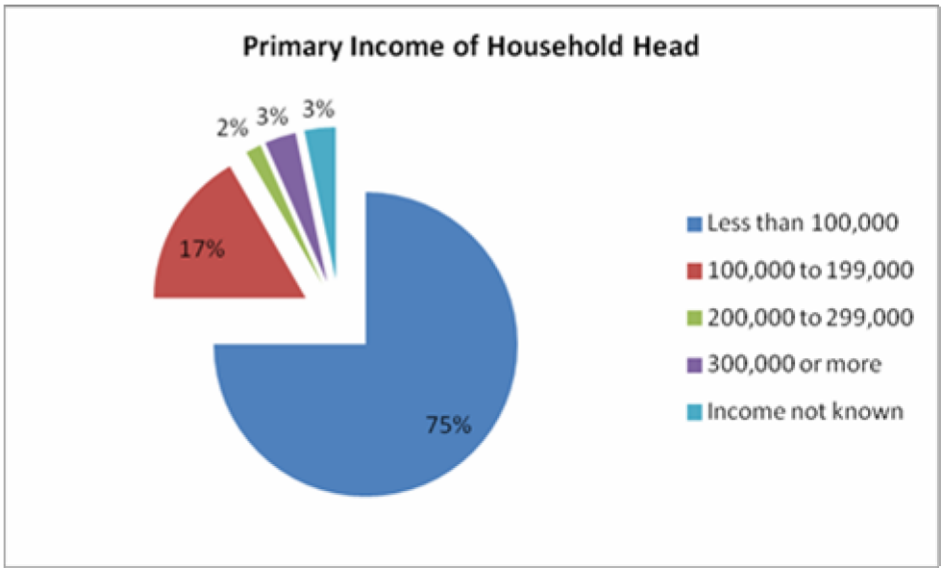

Figure 21: Primary Income Sources for Household Heads

Farmers complained that their low incomes were attributed to reducing soil fertility and unreliable rains which presents opportunity for irrigation agriculture because there is motivation to increase agricultural productivity.

❖ **Expenditure of Household Head**

Results suggest that they spend less than 50,000 on their household needs but definitely spend more on medical, school, transportation and clothing. This means that most household heads have to depend on informal debt financing to support their expenditures.

Table 21: Expenditure on Household Needs

Expenditure on household needs	Frequency	Percentage
Less than 5,000	106	23%
5,000 - 10,000	138	30%
11,000 - 20,000	106	23%
21,000 - 30,000	83	18%
31,000 - 50,000	23	5%
51,000 - 100,000	0	0%
over 100,000	0	0%
Missing	0	0%
TOTAL	**460**	**100%**

❖ **Goods and Assets Owned**

Access to credit for financing investment and farm operations is crucial for the commercialization of small holder agriculture. In line with this, it provides the facility of accessing inputs to the farmers and produce good and sufficient production without constrain by shortage of money. Because most lending institutions require collateral to borrow money, respondents were asked what assets they have at household level.

Table 22: Goods and Assets Owned at Household Level

Household Assets	Frequency	Percentage
TV	0	0%
Bicycle	331	72%
Car	0	0%
Motorcycle	14	3%
Foam mattress	83	18%
Furniture	23	5%
Radio	0	0%
Mobile Phone	0	0%
Missing	9	2%
TOTAL	**460**	**100%**

As shown in the table above, most household heads have bicycles as assets, additionally, as shown in the figure below for those who have livestock, most have cows, goats and poultry.

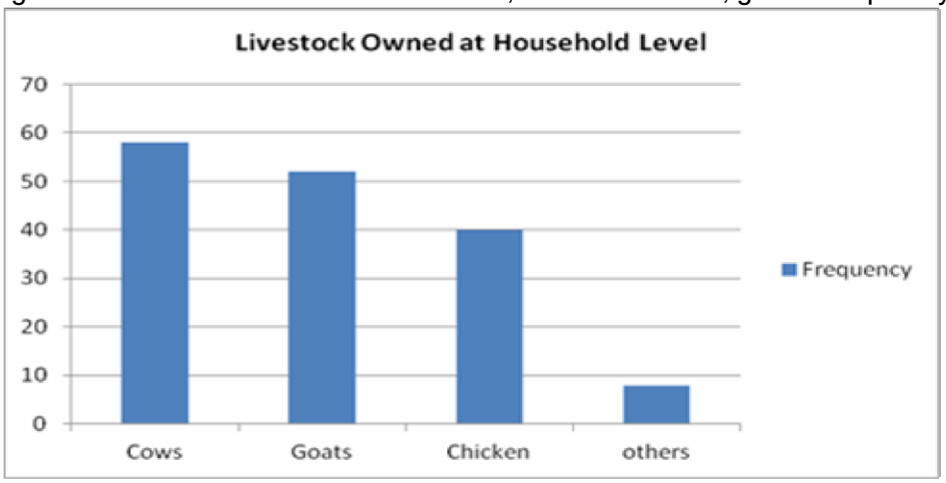

Figure 22: Livestock Owned By Household Heads

This implies that some household head can access financing but in order to ensure that all farmers have access, village savings schemes should be considered by the project. In this regard, supporting farmers to get credit access should include the following:

- Training each group in commercial, marketing and financial matters – including through the creation of a 'marketing committee' in each group and the building of contacts with all the commercial buyers in the area.
- Helping these groups to set up Village Savings and Loans Associations (VSLAs) to pool and lend funds to each other.
- Supporting the famers to get organized into registered Farmers' Cooperative Societies, large enough to have real negotiating power with companies. This will ensure collective buying and marketing of produce.

- **Social Cohesion**

Respondents were asked whether they had recently moved into the project area or were born there and as shown in the figure below, majority were born there. Forming of groups and associations require trust from fellow group members which is best attained when community members live together for a considerable period of time.

In Northern Uganda, community members live with family or clan members based on their land tenure system that is clan based. When forming water user associations and enforcing water use requirements, there is an opportunity to utilize the traditional systems to sustain the system because most community members appreciate these systems.

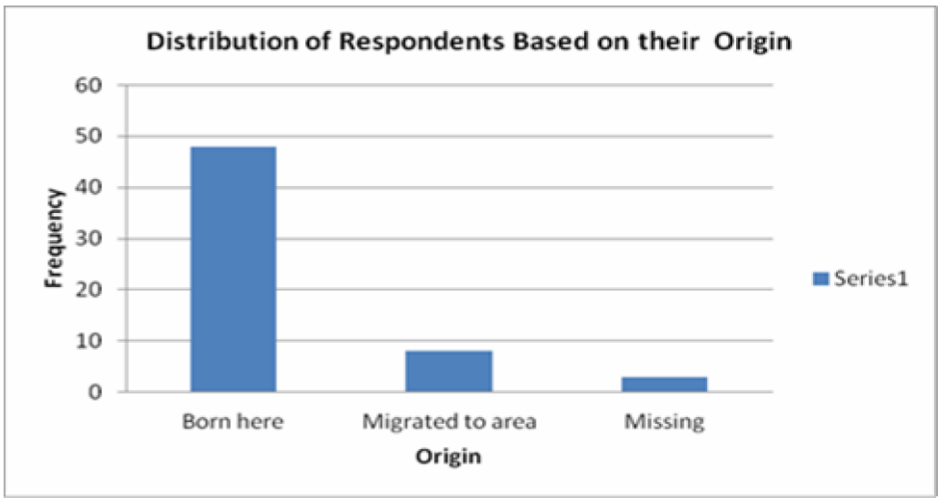

Figure 23: Distribution of respondents based on their origin

5.2.6 Agricultural Production and Constraint Analysis

Agricultural production is the mainstay of most communities in Oyam district and therefore understanding the current farming systems and their constraints would best inform the feasibility of the proposed irrigation scheme in the Tochi area.

- **Current Farming Systems**

Consultations with farmers and Local Government officials revealed that most of farmers are practicing subsistence crop farming alongside livestock. Most grown crops include cassava, beans, maize, simsim, sweet potatoes, sunflower, soya beans, sorghum, and ground nuts. Mostly grown in the first season are soya, maize, beans, cassava, ground nuts, sweet potatoes, sunflower and millet as shown in the table below.

Table 23: Crops Grown By Households in the Project Area in the First Season

Crops	Frequency	Percentage
Maize	290	63%
Millet	14	3%
Cassava	129	28%
Beans	14	3%
Cotton	0	0%
Rice	0	0%
Groundnuts	9	2%
Sweet potatoes	0	0%
Others…	0	0%
Total	**460**	**100%**

According to the sub county chief, in the second season sim sim is the most crop grown, the other crops are not grown a lot this season due to the much rains in the second season (so farmers fear to grow this season as the rains normally destroy their crop). However the rest of other crops can be grown in both seasons. According to the household survey, most farmers interviewed planted maize, beans and sim sim in the second season as shown in the table below. Crop rotation is a common practice.

Table 24: Crops Grown By Households in the Second Season

Crops Grown	Frequency	Percentage
Maize	184	40%
Millet	32	7%
Cassava	37	8%
Beans	78	17%
Cotton	14	3%
Rice	0	0%
Groundnuts	37	8%
Sweet potatoes	0	0%
Sim sim	55	12%
Missing	23	5%
TOTAL	**460**	**100%**

Table 25: Animals Reared at Household Level in Project Area

Animals reared	Frequency	Percentage
Cows	207	45%
Goats	124	27%
Sheep	0	0%
Poultry	78	17%
Pigs	14	3%
Apiary	0	0%
Missing	37	8%
TOTAL	**460**	**100%**

About farming practices, farmers mainly use ox -plough which helps in organizing the soil. He said that fertilizer use is rare because the land is fertile. Very few people in the district use tractors. The majority of the people use hand hoes for crop production.

The farmers are mainly subsistence that is they grow food for home consumption and they sell the remaining. Poverty and lack of modern technologies of farming has made the majority of the people persistently engage in subsistence agriculture. *"I can tell you that this region has the potential to*

provide food the whole Langi and Acholi regions but unfortunately poor methods of farming, lack of proper skills have let us down, Community Development Officer, Oyam District.

5.2.7 Constraints

Given that majority of Uganda depend on agriculture; increasing agricultural production is key to the primary source of poverty reduction. It has already been observed that farmers in the Tochi are subsistence farmers, not utilizing modern farming methods, depending on rainfall for their water and growing crops on small pieces of land. In order to understand the performance of their production systems, farmers were asked how they felt their units were performing.

77% of the farmers said that their production units were low yielding. According to participants in focused group discussions for men, prolonged drought which affects their yields as well as decreased soil fertility and shortage of land for cultivation were cited as major constraints to production. Further, they felt that there is very limited market for what they produce and so they are forced to sell to middle men at very low rates, yet with the absence of stores where to keep their produce is a big problem to farmers.

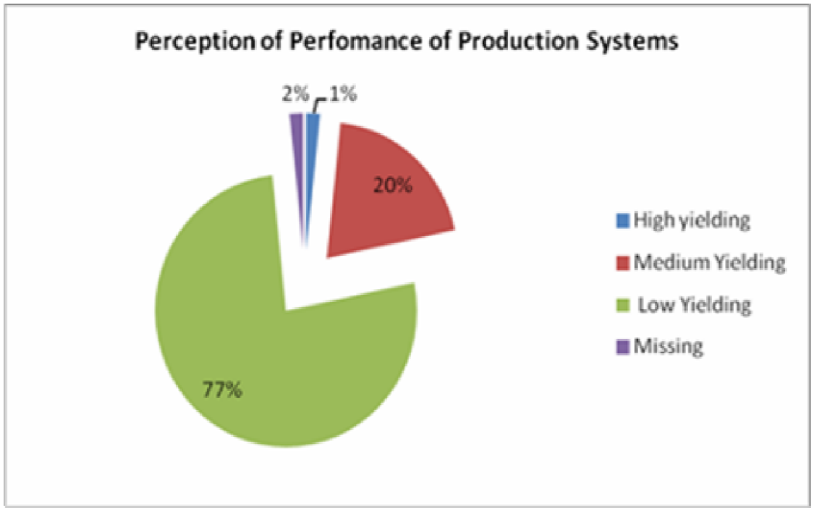

Figure 24: Performance of Production Systems in the Tochi Area

According to the household survey, 80% felt that their biggest challenge was land; however, it was not related to tenure of security or access which implies that in terms of rights to utilize the land, the proposed project may not encounter challenges.

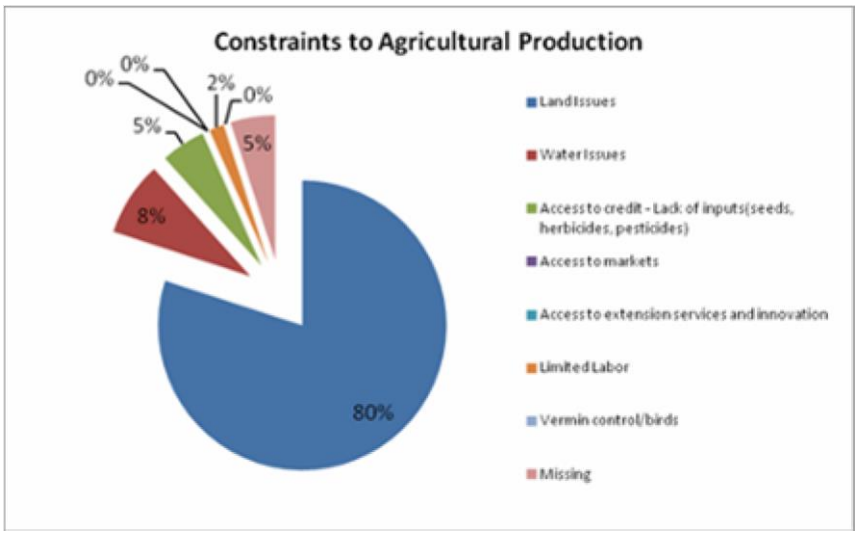

Figure 25: Constraints to agricultural production

Most of the respondents felt that their land had lost fertility which makes it the reason for the problem with the land. In addition to this, land is customary and there is a lot of land fragmentation leading to difficulties in commercial farming. Acaba is one of the most densely populated sub counties; some people who donate land to school are claiming it back. There is an NGO called land and equity in Uganda trying to solve the problem. *"Land access is a very big problem in this area due to the 20 year insurgency that displaced many land owners and also the land tenure system and this makes it difficult for investors to access land. "Production Officer, Oyam District.* Shortage of land also means that there is limited space for rearing animals which forces the residents to keep small numbers of animals. A male participant in the focused group discussion observed that *"if the irrigation starts, it can also help reduce the impact of lack of land because it will improve productivity within the small pieces of land. Also those with small pieces of land can hire from those who have large pieces so that they can also benefit from irrigation"*

In addition there are diseases and pests that affect the animals. They claim that they have veterinary officers but when they come, they ask for money. This implies that there is limited access to extension services which is required for irrigation agriculture. Other issues raised by stakeholders include the following:

- The first rains come late for example now people have prepared their gardens for planting but rains are nowhere.
- Pests and diseases which mostly affect cassava and groundnuts; this is as a result of lack of extension workers.
- Lack of market for the farmers produce, as produce is kept in houses or stores with no markets. As a result middlemen come and buy cheaply from rthe farmers.
- Farmers plant a single crop on a big piece of land and are only able to maintain only a small part of it which leads to low yields.
- In some areas wild animals are a problem as they raid farmers' gardens, monkeys are a problem (participant in female's focused group discussion)

- Soils are getting exhausted due to over cultivation-this can be attributed to the growing population.
- The growing population is making land very limited not enough for agriculture. People are selling land on an alarming rate which has also fueled land conflicts.

Key issues relate to poor farm management, access to extension services, and land conversions due to population growth that affect the ecosystem health of land in the project area.

❖ **Constraints related to Climate related**

When asked about water as a potential challenge in relation to agricultural production in the project area, the Oyam District Community Development officer said that the District has had a problem of water shortage mainly due to prolonged drought. This has meant that there is reduced production and water being a strategic resource is essential for both animals and crops. Some people have lost their livestock due to the persistent drought. Many farmers are redundant because of drought.

Results from the household survey suggest that majority of respondents felt that in the case of climate change impacts, the challenges were related to unpredictable rains and weather fluctuations as shown in the figure below.

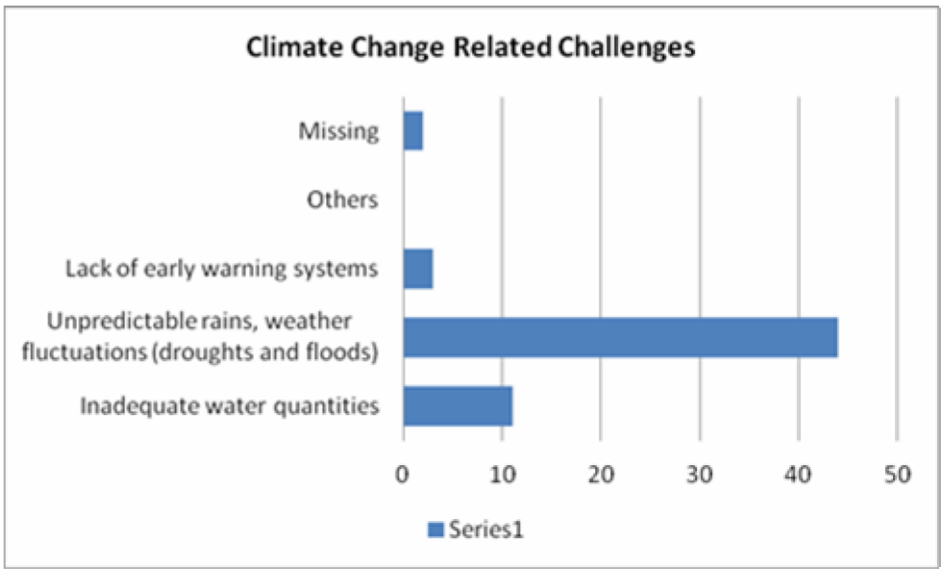

Figure 26: Climate change related challenges

There is growing evidence that climate change, specifically higher temperatures, altered patterns of precipitation and increased frequency of extreme events such as drought and floods, is likely to depress crop yields and increase production risks. Participants in a focused group discussion for males in Tochi observe that the irrigation will be timely intervention in helping the people reduce on the effects of drought on productivity. Furthermore, if fertilizers are provided for free, it would help them to stem the problem of low soil fertility. Availability of quick maturing drought-resistant seeds would also help

increase yield. The female focused group discussion also raised the same concern, *"We would want chemicals and pesticides so as to improve productivity at farm level. We should also be provided with seedlings that are quick maturing and drought resistant" Female Participant in focused group discussion, Tochi, Oyam*

In addition to this, it emerged that community member who own livestock are also faced with water scarcity to the point that some people have lost their livestock due to drought. This presents a case of serious competing needs for water. The water that is used for growing crops on the shores is the same water that is used for livestock survival, it is the same water that is used for fishing and it is the same water used for domestic purposes. For livestock they mainly use the river because it is the only one which is permanent since the swamps are dried up. People on the shores of the river are growing cabbage, tomatoes, sugar cane, and vegetables because of the river water which helps in dry season. Fishing is done in very few circumstances. He further said that the community will welcome the idea of the irrigation scheme and find a way of using the river equitably.

In relation to crop production, the problem of climate change is compounded by poor soils caused by poor production techniques, limited access to inputs and access to credit. In order to address this vulnerability there is need for farmers to adopt adaptation strategies that would also help them cope with climate change impacts in addition to irrigating crops including the following:

- change in crop varieties and species;
- change in timing of activities;
- change in
- production techniques;
- change in location and
- Changes in resources and/or life styles in the case of emergency situations such as droughts. In relation to irrigation, farmers will need training on the following aspects in order to ensure that they obtain sustainable benefits:
- minimizing of water losses and irrigation efficiency
- building strong institutions to manage, operate and maintain the irrigation infrastructure
- developing of by-laws to enforce management measures
- general environment management

When the aspects of efficiency are addressed then the competing water needs will be addressed. However, in order to ensure that all actors are involved in managing the River Tochi Resource, it is recommended that:

- A stakeholder analysis be undertaken to determine who are the different water users
- Form a water user association and related institutional and governance measures to ensure that management systems are in place.

❖ **Credit Related Constraints**

Increasing agricultural production may require more capital meaning that some members of the community might require gaining access to credit. Results from the household survey suggest that majority of respondents feel that the problem of credit is related to limited access to financial institutions as shown in the figure below.

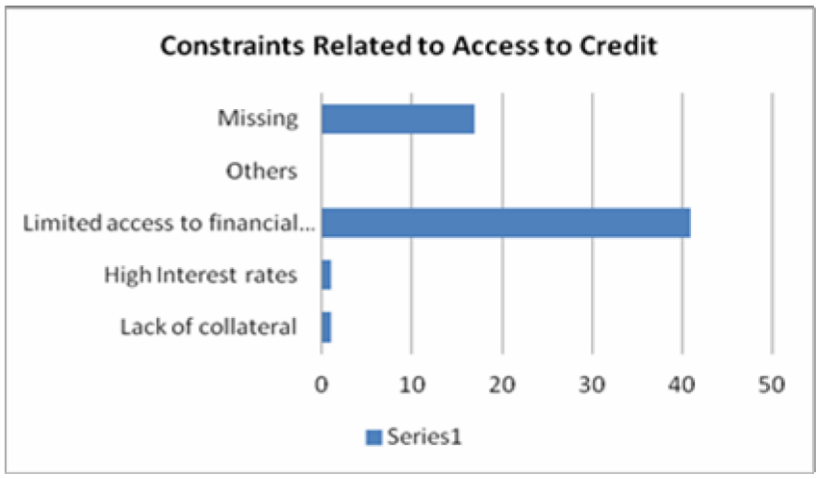

Figure 27: Credit Related Constraints in the Tochi Area

During the focused group discussions male participants were asked what credits services were available to small scale farmers and women's access to and control over credit as well as the barriers that limit their access to such services. It emerged from the male participants that there are no financial institutions in Tochi apart from the SACCO called Vision Fund, but there is no farmer who gets money from them. This implies that community males in the community are not members of this SACCO and that there is need to ensure that farmers are organized to access credit amongst themselves.

On their part, it emerged from the women's focused group discussion *"As women we save locally amongst ourselves and later can borrow this money when there is an emergency, this village saving group is called Bedabea group. SACCOs are far away from us, people just come and sensitize us but we are not members." Participant female focused group discussion, Tochi, Oyam*.

General observation is that women have organized themselves into a group in order to access credit while the men have not. However, there are likely to informal services gain from neighbors and relatives that is also heavily relied upon by community members although these are not adequate for commercialization of agriculture. Yet, access to credit for financing investment and farm operations is crucial for the commercialization of small holder agriculture. In line with this, it provides the facility of accessing inputs to the farmers and produce good and sufficient production without constrain by shortage of money. It can be provided in kind or cash based on the type of institutions and their rules and regulations. Therefore, helping these groups to set up Village Savings and Loans Associations (VSLAs) to pool and lend funds to each other would benefit the project better, or better still strengthen the existing ones.

- **Market Related Constraints**

Market place is the vital socio-economic factor for marketing agricultural products and to buy inputs for agriculture. On markets, community members said that the nearest markets are located in Ngai Market, Oyam town and at Minakulu Market. Ngai market is approximately 5Km from the beneficiary communities, Minakulu Market is about 8 Kilometers from the beneficiary communities while Oyam town is approximately Six Kilometers. As far as transporting agricultural products is concerned, there is a road network that exists but the roads are very narrow and murram. These roads can be impassable

sometimes during the rainy season as they flood for example the Minakulu to Oyam road. Other markers include Machodwogo which is 10 miles.

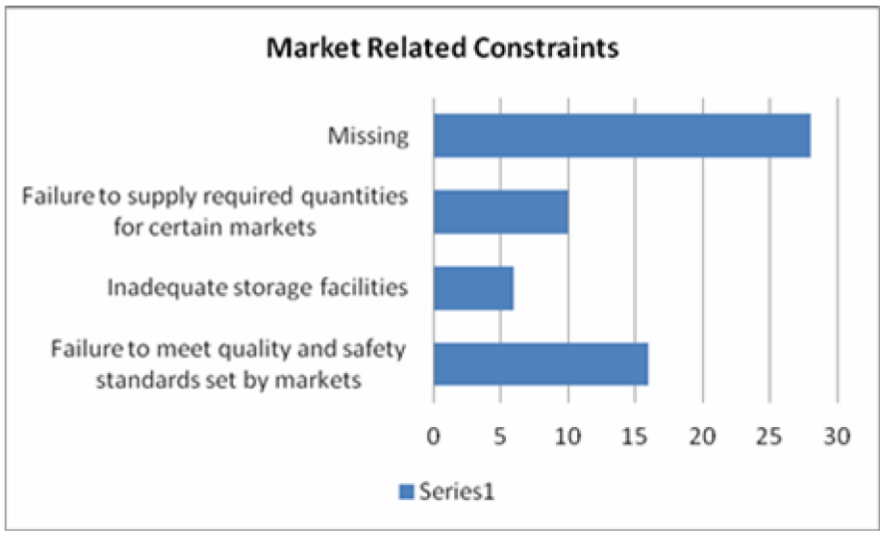

Figure 28: Market Related Constraints in the Tochi Area

Results from the household survey revealed that their major challenge was failure to meet market standards and required quantities for the market. In order to transport their produce farmers use cars, bicycles or human loading.

Improved access to input and output markets is a key precondition for the transformation of the agricultural sector from subsistence to commercial production. Smallholder farmers must be able to benefit more from efficient markets and local-level value-addition, and be more exposed to competition.

"In order to overcome the challenge of markets, (Government should help us to identify markets for our produce. In addition, working in groups could solve the problem but we don't have stores for keeping what is produced.Government should then help us to construct for us the stores for which we will store the produce" Male participant in a focused group discussion, at Aceno Parish, Minakulu Sub-County, Oyam District.

The beneficiaries also suggested that in order to further resolve the marketing problem, road networks within the community should be put right. The beneficiaries further suggested that government should help and repair an old deep (treatment centre) which was constructed by the past government. This they argue would help reduce on the problem of diseases for the animals. And finally they suggested that veterinary doctors should not always demand for money from them treating animals

Therefore, in order to address issues related to market, farmers can be supported to form a Farmers' Cooperative Societies, large enough to have real negotiating power to ensure collective buying and marketing of produce. Additionally, there is need to put up a store so that farmers stop storing their produce in their houses where they easily get mold.

- **Constraints Relating to Access of Extension Services and Innovation**

According to the household survey, farmers felt that the biggest challenge that most extension services focus on increasing agricultural production only and that even then the training is inadequate as shown in the figure below.

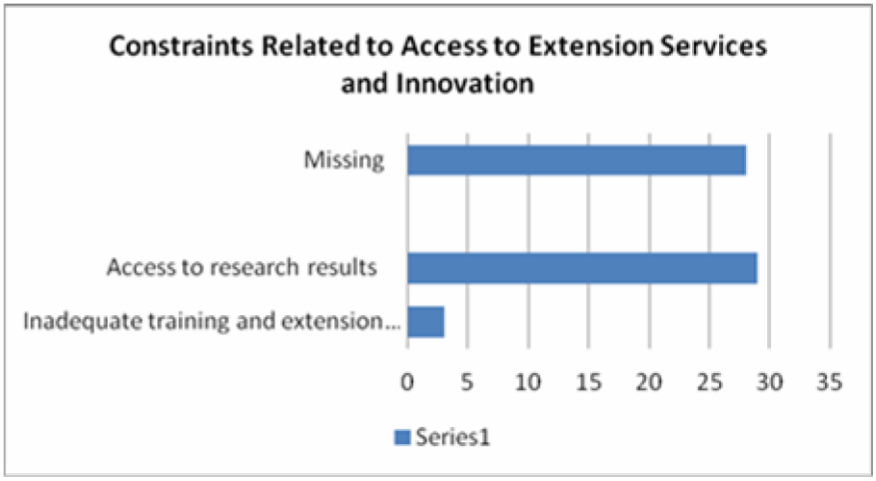

Figure 29: Constraints Related to Access to Extension Services and Innovation

Farmers need to be supported to form partnerships with the district production department so that they get more information on addressing other constraints for examples access to inputs, training in production, research and innovation. In this way they will be able to get any information that would help them improve their yields.

5.2.8 Labor Issues

In a focused group discussions for males, it emerged that all the members of the household participate in clearing the garden, sowing, weeding harvesting and marketing.

On the farm most of the production is done by women while men are mainly involved in opening the land. Tilting, planting, weeding and harvesting are all done by women. Men are usually key decision makers on what needs to be sold to the market. Women are expected to do a lot of work even when the project starts as compared to men. Furthermore, it emerged that regarding crop farming, women who do most of the work in the garden; men engage in productivity but at low rate as men don't take it seriously. They are more involved in commercial agriculture especially growing rice, sugar cane and tobacco. Women are more inclined to grow food crops as a form of security for the family against hunger and other risks. According to the community development officer Oyam district, there is no need for hired labor, the labor is available but women might get more involved than the men.

As shown in the figure below, most household heads (67%) depend on family labor to work on their farms.

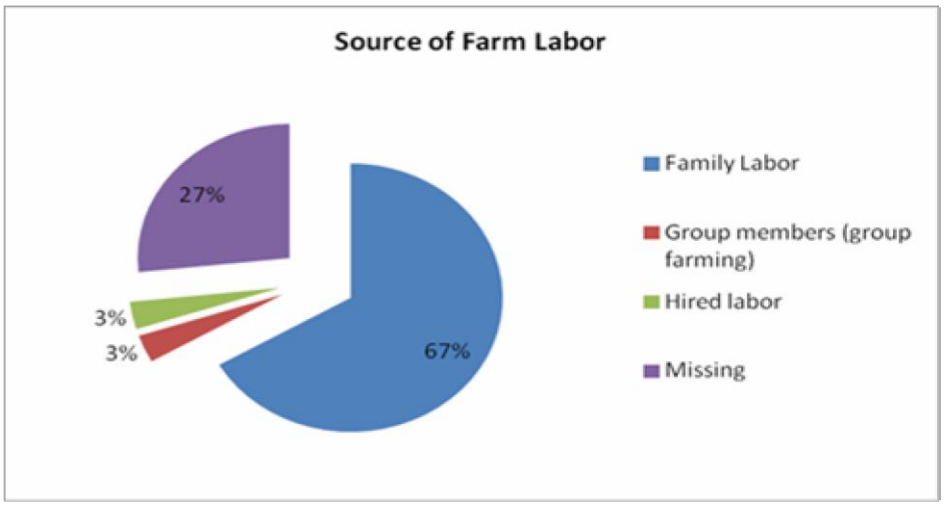

Figure 30: Source of Labor on Farms in the Tochi Area

Both men and women participate in rearing and selling animal products as well as in income generating activities. Women participate in activities that are mainly carried out domestically like feeding the animals at home and when it comes to marketing then the men are more involved. "Some of the activities we are involved in include; fishing and brick making. *All proceeds from these activities are shared among the men and the women" Male Participant in a focused group discussion, Tochi, Oyam*

According to them women actively participate in public and social affairs and their voices are heard, however for leisure it is not easy for the women to participate because they have to look after the children.

It emerges that sometimes there is no joint planning for income at household level as observed by the Sub County Chief, Acaba Sub County "Cultivation is mostly done together, weeding is mostly done by women, harvesting is done as a family. Sim sim and millet is usually harvested by women. Selling in some families is done together or after agreeing on who should go and sell while some families disagree when it comes to selling either on who should sell or on how to spend the money." More training on gender roles and joint planning should be emphasized during project implementation.

- **Availability of Labor for Irrigation Activities**

In the case of labor for irrigation labor is likely to be available given that both men and women will be highly interested. The reason for the likely involvement of both men and women in irrigation agriculture is due to the expectation of increased income. Standards of living are likely to be achieved in the project area. *"..as long as locals know what they are going to get from the project will be beneficial, they will overwhelmingly be involved" Water officer, Oyam District.* Moreso, in the event that labor is not enough at household level, hiring labor is now common, however this is practiced in groups for example a group of farmers help one today and another day someone else.

In the event that labor requirements for irrigation management, community members highlighted some of the issues that they feel would increase the cost of managing the scheme which include the following:

- Poor scheme management
- Poor maintenance of scheme infrastructure
- Poor enforcement of monthly contributions from members
- Poor solid waste management leading to blockage of scheme infrastructure
- Vandalizing of scheme infrastructure

Some of the recommendations including the following as some of the ways to minimize the need for labor:

- Sensitizing the community on the need for proper maintenance of the infrastructure
- Let the community manage the scheme so as to increase ownership and participation
- Charges should not be too costly
- Capacity building on proper handling of contributions.

5.2.9 Beliefs and Value Systems

Beliefs and value systems also determine the productivity of crop and livestock systems. Participants were asked how people in the Tochi community view the existing challenges as irrigation systems require a lot of community participation. According to the participants, some community members who don't have interest in the scheme may try to frustrate the project. They fear that the project may hinder them from using the water for fishing, watering animals and they also fear that they may be arrested for swimming in the river. *"We are worried that the public may not participate in the construction and management of the irrigation scheme. When the irrigation breaks down, no one will repair it" Male Participant in focused group discussion, Tochi, Oyam*.

Furthermore, they cited management measures may limit the participation of locals and attract other actors who will then benefit from the project as one participant narrates, "We are worried that government may introduce a tax and also outsiders may come in and benefit from the project at the expense of local" Male Participant in focused group discussion, Tochi, Oyam. The recommendations that would enhance the success of the project included the following:

- local people who are able should be given priority in the project in terms of employment
- if the intention is to increase the production of rice and cotton, then government should provide insecticides and herbicides

"Government should facilitate us and we can be in position to develop ourselves. When the irrigation scheme is completed, we will need implements that we can use for farming and also for maintaining the scheme itself"Male Participant in focused group discussion, Tochi, Oyam

On the other hand, observations from the water officer reveal that people will be willing to participate because; culturally people are adapted to contributing towards community projects. An example are the contributions from the community members towards clean water extension which have been used to construct boreholes, therefore no cultural barriers are expected.

Regarding contributions for managing the scheme, community members noted that it is difficult for farmers to contribute money, but rather labor as one narrates, *"We the people of Tochi are very poor and we think that contributing to such a project will not be possible except labor. If the government wants to help us let them build the dam an maintain it, they can employ people who can work to maintain the dam, but not collecting money from us" Male Participant in focused group discussion, at Abanya Parish, Acaba Sub-County, Oyam*.

5.3.1 Domestic Water Supply Facilities

In order to understand nature of access for water for domestic respondents were asked where they get their water.

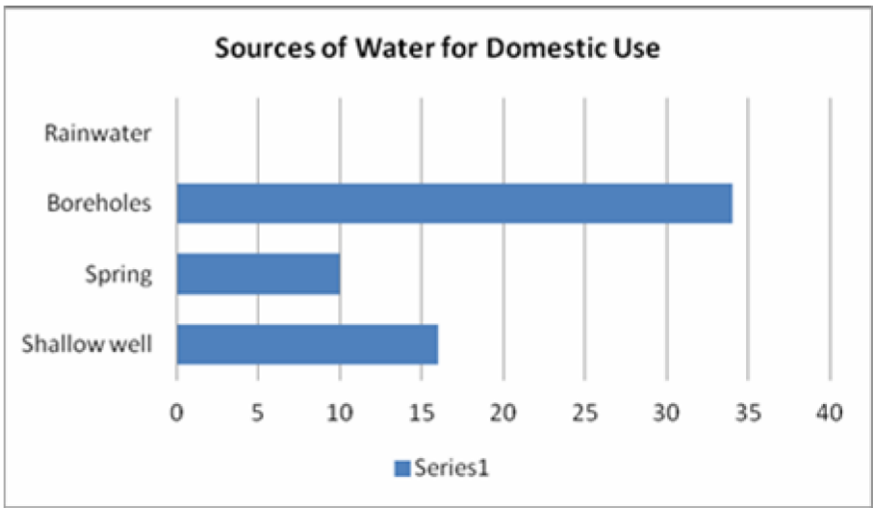

Figure 31: Sources of Water for Domestic Use

The majority get their water from boreholes as shown in the figure above. 68% of the respondents said they were satisfied with the water and for those that were not satisfied with the water that they use attributed the dissatisfaction to the poor quality of water. In terms of access, they have 24 hours' access to water to water. However, according to Sub County Chief, Acaba Sub County, one challenge is that water is not enough, boreholes are not enough and the water is not very clean for domestic use. World Vision is trying to help out by extending water to different communities. Due to water scarcity maintaining livestock has become difficult as there is no clean water and end up drinking from swamps. In township there is selling and buying of water but this is not the case in villages. Because there other NGO's working on access of water for domestic use it is not expected that water from the proposed irrigation scheme will be utilized for domestic use.

5.2.10 Sanitation Facilities

Considering that irrigation schemes come with spread of diseases, it was important to find out whether there is general awareness about poor sanitation and health hazards.

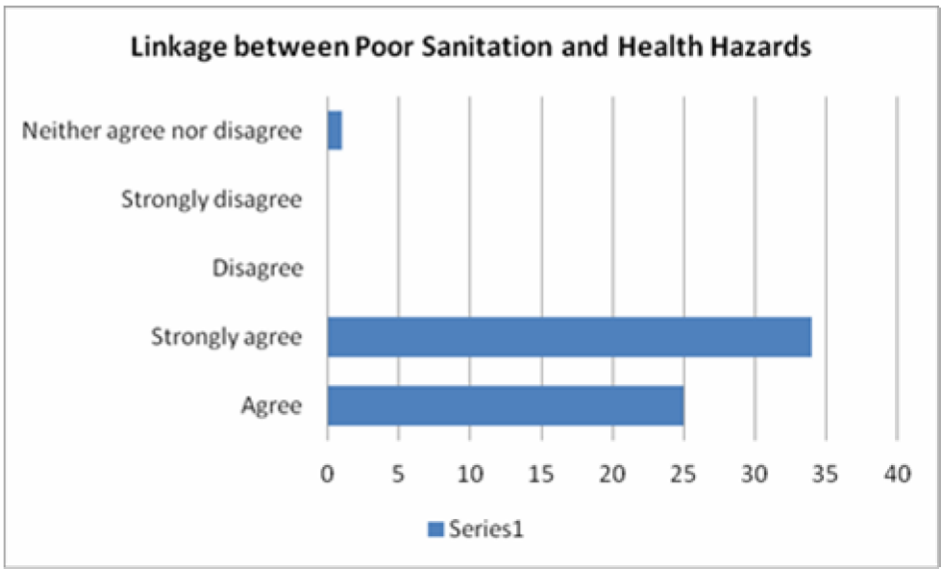

Figure 32: Linkage between poor sanitation and health hazards

As shown in the figure above majority of the respondents strongly agree that poor sanitation is linked with health hazards.

As shown in the table below for most predominant diseases, affect the children below 15 years of age

Table 26: Predominant Diseases per Age Group

	0 - 5 yrs	6 - 15 yrs	16 - 25 yrs	26 - 45 yrs	46 - 65 yrs	over 65 yrs
Malaria	1.16	1.2	1	1	0	0
Typhoid	0	1	1	1	0	0
Respiratory Infections	1.7	1.3	1.25	1.2	1	0
Diarrhea	1.2	1	0	0	1	0
Typhoid	0	0	1	0	0	0

- **Latrine facilities**

For Latrine facilities, 92% of those interviewed have latrine facilities, for the 8% that do not have they are planning to put up one. 88% of those that have latrines have ordinary pit latrines; only three percent have VIP latrines, while 8% did not respond. As shown in the figure below, most of the structures are mud and wattle with grass thatched roofs.

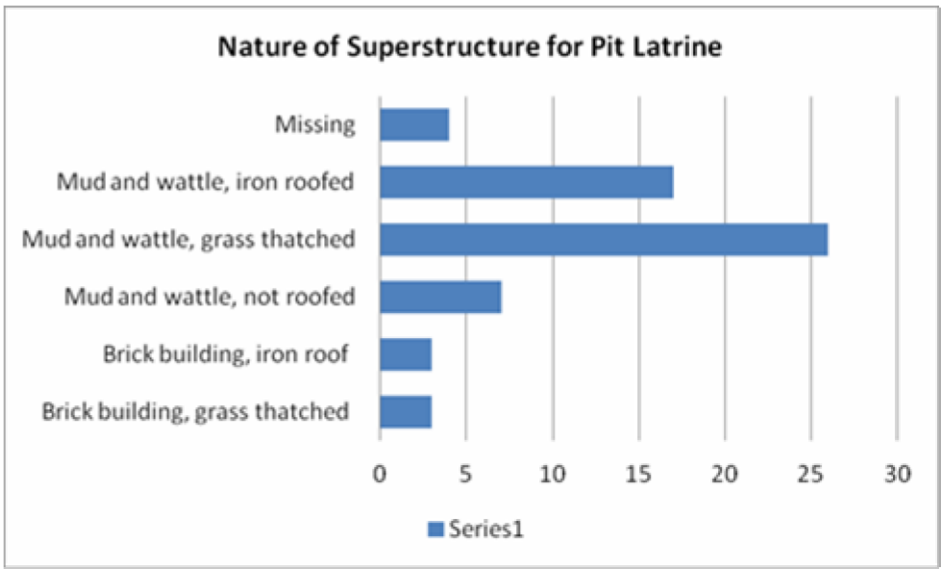

Figure 33: Nature of superstructure for pit latrines

For the sub structure, 55% have sub structures that are at ground level, while 38% have sub structures that are raised.

- **Hygiene Practices**

48% of the respondents have hand washing facilities while 47% do not have one, when asked how often they use this facility, 38% said that they use it often, 5% said they never use and 57% were none responsive.

On bathing facilities, 85% said that they have a facility for bathing while15% said they did not have such a facility, like the pit latrines, most bathing facilities are temporary in nature.

When asked where respondents dispose their dirty water, majority dispose in the compound as shown in the figure below.

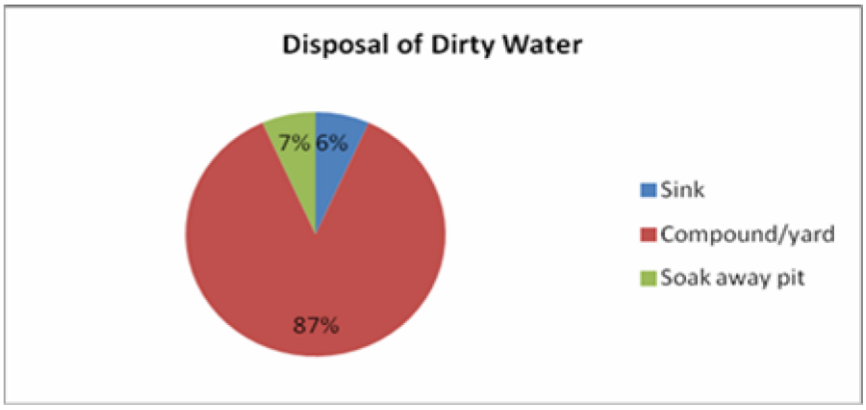

Figure 34: Methods used by Households to dispose of dirty water

In the case of rubbish, most households burn their rubbish as shown in the figure below.

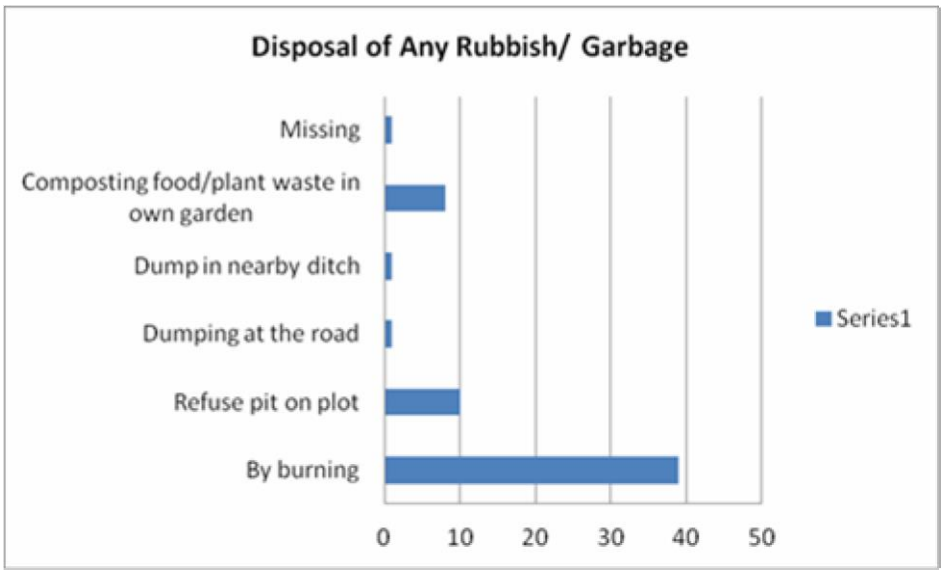

Figure 35: Disposal of Rubbish at Household Level

5.2.11 Desire and Willingness to Pay

Willingness to pay for water is a product of four factors: (i) the profit that can be gained from using the water; this factor should be reflected in the fluctuations in prices for the main commodities produced within the region in which water can be traded; (ii) supply of water; this is measured by the allocation level announced at the beginning of the season and then revised during the season depending on availability of water within the reservoirs supplying the region. The allocation level is announced as the proportion of their entitlements that irrigators can use during that season; (iii) demand for water; this would be influenced by the level of the seasonal allocation and commodity prices as discussed above, but also by the level of natural precipitation and evaporation. Finally demand for water could be determined by the price of substitute goods, within the study region (iv) the potential loss irrigators would suffer if insufficient water is applied during periods of water scarcity.

Farmers were asked whether they needed the irrigation scheme in order to increase their yields and all people that were interviewed expressed the need for the irrigation scheme.

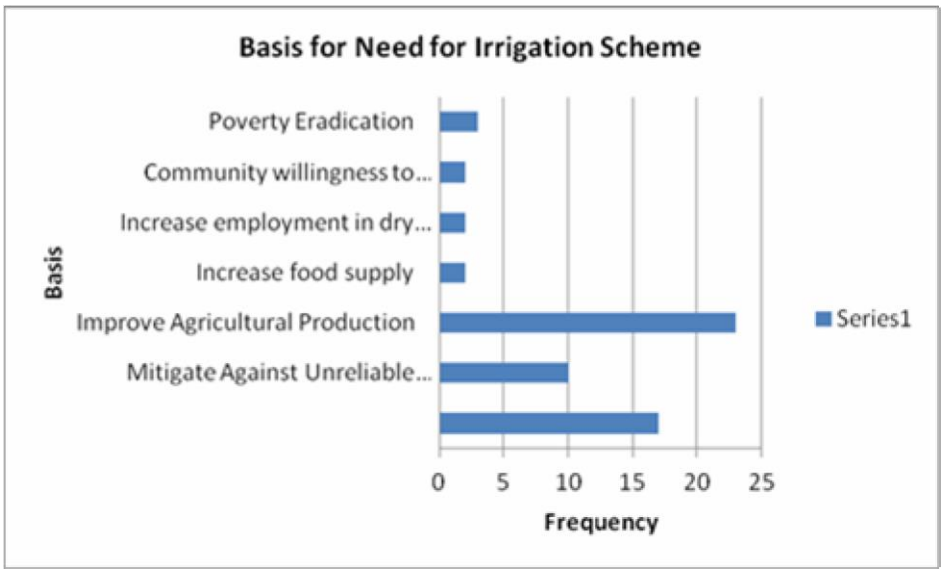

Figure 36: Basis for the Need for the Irrigation Scheme

On the reason why they expressed the need for the irrigation scheme, majority said that it would improve agricultural production while other said that that it would mitigate against unreliable rainfall.

On willingness to pay 72% said that they are willing to pay and participate, 10% said that they were not willing to pay while 18% were non responsive. According to the production officer, Oyam District, on the issue of payment he said that the local people may not be willing to contribute money and might look at it as a free government program but they are willing to contribute labor.

5.2.12 Proposed Management Structure for Tochi Irrigation Scheme

Literature shows that the performance of irrigation schemes depend on four major factors including the following:

a. Planning: Those schemes, which were planned and implemented with full farmer participation, normally perform well. Schemes which were planned by consultants without Participatory Rural Appraisal (PRA) experience may not perform as well.

b. Group Cohesion is important for successful irrigation management. Cooperative action is important when undertaking activities like marketing, transport hiring, operation and maintenance

c. Type of Management is important, schemes that are farmer managed given the farmers a sense of ownership and belonging and as such they will invest in them, those that are Government managed make farmers feel that they have no sense of ownership

d. Type of technology, whether sprinkler or surface affects the labor inputs and leisure time for farmers. Surface systems are more labor intensive that limit the time available for weeding, spraying and organizing markets for produce.

During the household survey, farmers were asked what management structure should be adopted and as shown below, majority said that the structure should comprise of the local community and Government.

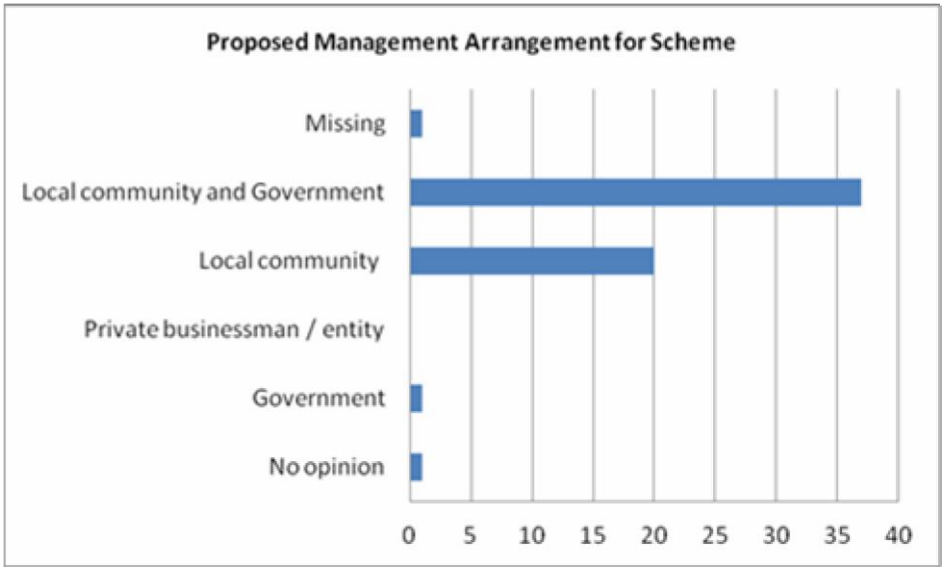

Figure 37: Proposals for Management of the Scheme

Further, there are opportunities observed that could explain the need for the scheme and indication of community participation as highlighted below:

- People are willing to change to different approaches to doing things for example people will be willing to change from practices like informal fishing
- Many are already inquiring on how new machinery is going to work, they are interested in what they are likely to experience.
- There is the expectation that standards of living are likely to considerably improve as a result of improved productivity. The only worry right now is that no one is sure of how such projects exactly work and so there is a bit of apprehension. What should be done is to pick a few beneficiaries and show them what has been done elsewhere before, so that they act as ambassadors
- Institutionally the current institutions to implement the project, the local institutions like subcounty or district are going to generate more local revenue as a result of the likely improved agriculture
- Communities around the project area should be sensitized about the project plan and the benefits. *"They should be involved in the project implementation and feel part of the project and*

indirectly own it. If there are any materials to be provided for the project, the community should be the one to provide." Sub County Chief, Acaba Sub County

According to the district water officer, after the facility if put in place there should be people who are charged with managing the benefits so that both women and men are able to benefit and people should be sensitized in order to curb vandalism. As far as maintenance is concerned the whole district hierarchy and the local beneficiaries should come together in a collective effort to ensure that the benefits of the irrigation system are maintained. The responsible departments within the district should specifically train particular individuals and groups to come together in a collective effort to ensure that the benefits of the irrigation system are maintained. The responsible departments within the district should specifically train particular individuals and groups to monitor the usage and maintenance, *"the agriculture office and water office and community being key stakeholders should keep consulting each other" Water Officer, Oyam District.*

- **Stakeholders in Operation and Maintenance**

According to the sub county leadership, both implementers and beneficiaries should come together and put by-laws binding the two parties. There should be committees to manage the project from the community level, supervised by the sub-county and the district. Some issues came out clearly:

a) There are farmers organized in groups cultivating from the project area and some of them are even registered.
b) Training people on the usage of the usage of the irrigation scheme.
c) People should be sensitized and there should be a responsive team in place to tackle and outbreak of diseases.
d) Bring on board both men and women. Sensitive the management team and train them to manage it well.
e) Train the farmers on all the aspects farming like harvesting and how to well manage the irrigation scheme.
f) Change the attitudes of the people through education and mobilization.
g) Bring on board both men and women. Sensitive the management team and train them to manage it well. Although power struggles may arise, some members could refuse to come to meetings because they expect an allowance.
h) Train the farmers on all the aspects farming like harvesting and how to well manage the irrigation scheme.
i) Change the attitudes of the people through education and mobilization.
j) There is need for increased labour at the household and the community through mobilization
k) Many people who are engaged in farming need to be sensitized on better farming methods.
l) There is need for increased labour at the household and the community through mobilization
m) Many people who are engaged in farming need to be sensitized on better farming methods.
n) Farmers should manage pricing and payment other than private persons or government
o) Poor performance of leadership of water associations is likely to be a problem so institutional strengthening is needed.
p) There is none (agreements) at the moment but this need to be put in place for this particular project.

q) The most important capacity need is community awareness, community should be made aware of the benefits that will come a long with this project and be trained as well.
r) Socio-cultural concerns in that people are resettling and the clan claims that the project land is theirs. He said that middle ground should be sought to solve or avert the problems. There could be a need to cleanse the land before the construction starts.

In addition to the above issues, communities should be sensitized on how to increase production, and an association is key so that training farmers on how to use irrigation is given high priority. Management of water needs for different enterprise is key as communities rely on livestock as well.

5.3 PHYSICAL ENVIRONMENT

5.3.1 Water Quality Assessment

Tochi River is one the major right bank tributaries of Kyoga Nile. It originates as a stream which drains Gulu city at the northern fringe of the catchment at approximate location of 20 46' 56" N and 310 12' 20"E and traverses towards in south east direction throughout its length. River flows in a relatively flat ground throughout its remaining length. Many small streams joins the river from both the banks enriching its runoff. Length of the River upto the diversion site is about 69 km. It further traverses south west to join with Kyoga Nile U/s of Karuma falls near Jaber.

Water quality analysis was carried out to determine the base line condition for future monitoring of the impact of agro-chemicals. Water samples were picked at both upstream and downstream of River Tochi within the project command area. Water samples were analysed at the Department of Chemistry Makerere University for Physical chemical, nutrients, pesticides and bacteriological parameters.

Results and Discussion

Results of physico-chemical analysis as indicated on the certificate of analysis (Annex 3) show normal River Tochi water quality characteristics. The level of fertilizer residues in the river water is low. There are no pesticide residues. The coliform count is characteristic of normal river waters

5.3.2 Catchment characteristics

Using the topographic sheets, Google Earth (SRTM DEM) data and Google Imagery, the catchment area of Tochi River contributing to the flows up to the project site is estimated as 1629 km^2, and shown in Figure 38.

More than 75 % of the catchment is covered by natural vegetation and agricultural fields. Dense reserve forests like Opok forest reserve, Ngai forests reserve etc. occupies some parts of catchment. Less than 15% of the areas are villages or urban areas and the remaining land are barren. Gulu city falls within the catchment boundary and occupies Northern fringes of the catchment. The maximum and minimum elevations within the catchment are 1211 m and 1041.61 m respectively. The catchment is relatively flat. Catchment is completely rainfed. The data collection included the following: Topographic survey sheets of the catchment, Rainfall data from nearby Rain Gauges for from 1943-1963, 1965-1975, 1991-2014 and 1975-1984. Stream flow measurement data on Tochi River from Nov 1963 -1978 and 1994-2014

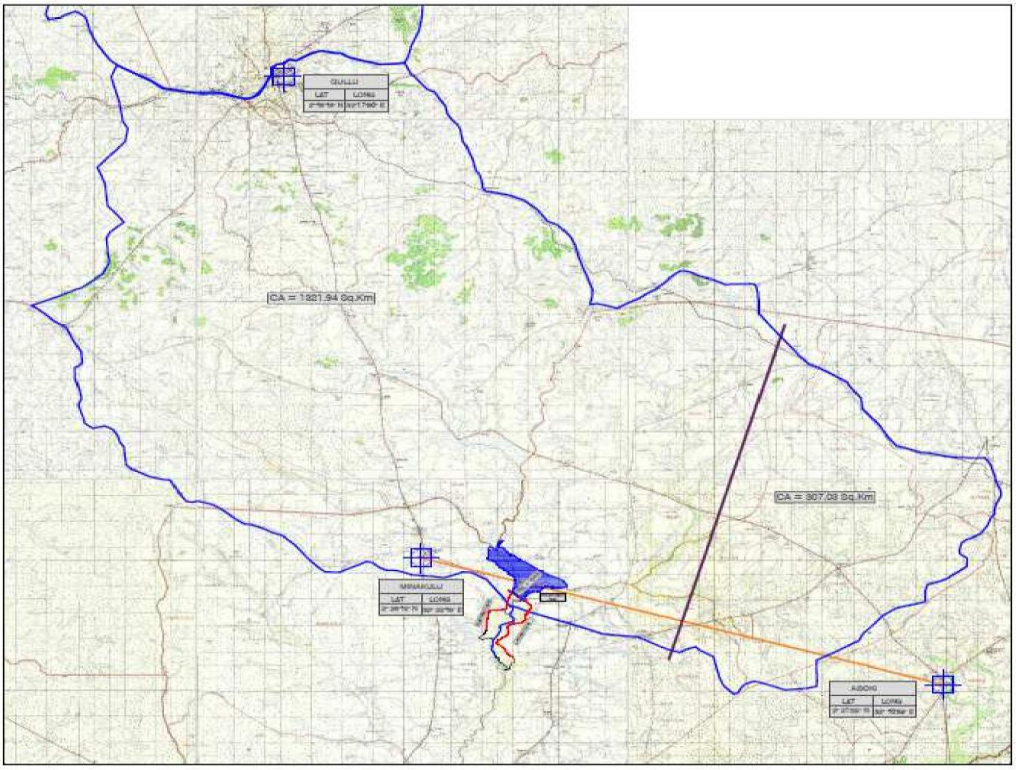

Figure 38: Catchment Delineation for Tochi Site

5.3.3 Hydrological analysis

Rainfall pattern at the project site is studied using a mean annual rainfall. Mean annual rainfall is shown if Figure 39 and Table 32. It can be seen from this data that at Minakulu Station, the mean monthly rain fall varies from 87mm to 158mm from March to June. There are two peaks of 158mm and 204mm respectively in May and August. This clearly shows a Bi-modal rainfall pattern for this station. However, mean monthly rainfall in September is 190mm and next highest to the August month peak of 204mm. During Dec, Jan and Feb mean monthly rainfall is between 13 mm to 38 mm.

Table 27: Mean Rainfall (mm) at Minakulu Rain Gauge Station

Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	TOTAL
12.8	26.5	86.5	152	157.8	110.7	147.1	204.3	190.2	142.3	91.1	37.6	1358.8

Plenty of surface water is envisaged to be contained around the project area, due to heavy rainfall distributed throughout the year. In order to confirm this, two methods are used: Analysis of stream flow data; and Analysis of rainfall data.

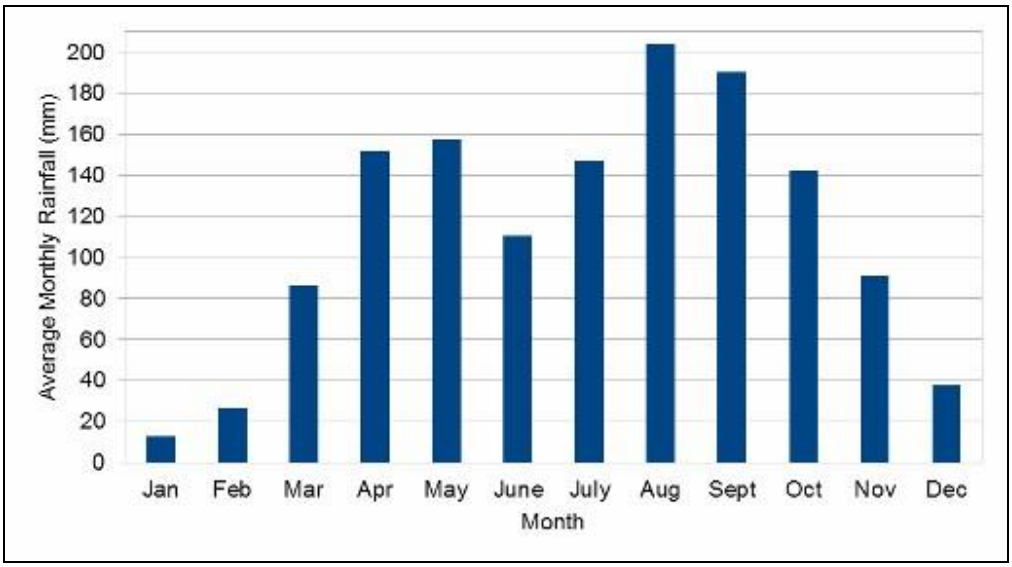

Figure 39: Mean Monthly Rain Fall at Minakulu Rain Gauge Station

Stream flow data analysis

The gauge-discharge data collected, is utilised to estimate the annual water availability of the Tochi river. The salient features of the data are presented in Table below.

Table 28: Gauge-Discharge Site at the Project Area

Project Location	G-D Station over River/ ID	No. of Years of Data Availability	Catchment Area at G&D Station (sq.km)	Catchment Area at Project Site (sq.km)	Latitude	Longitude
Tochi	Tochi/ 83212	37 (1963-1978/19942014)	2,188.0	1,629.0	2°13' 38" N	32°20'30" E

The above data corresponds to discharge rates measured daily at a point of time. On filling the few missing data assuming linear variation in flow rates, and discarding those years with large gaps, time series have been constructed and the annual volumes of water flowing downstream of the above sites are analysed.

Rainfall data analysis

Rainfall over the catchment areas of project site is monitored through multiple rain-gauge stations in the project area. The data so available is presented in Table below.

Table 29: Rain-Gauge Stations around the Project Area

Project Location	Rain-Gauge Station	Latitude	Longitude	Years of Data Availability
Tochi	Aboki	2° 21' 22" N	32° 40' 59" E	1965-1984
	Minakulu	2° 26' 42" N	32° 22' 48" E	1943-1963 1975-1984
	Gulu	2° 46' 48" N	32° 17' 60" E	1991-2014

The rainfall data is used to build rainfall-runoff relationships for the catchment. It can be seen from the above table that multiple rain-gauge stations have been used to estimate the surface-water at the project site. This is done so that maximum utilisation of the available data is made for the project purposes. From the analysis, the average runoff coefficients for the different catchments have been estimated. This information is utilised to validate the rainfall-runoff relationships, which are built to estimate the yields.

Before using the data for estimation, however, it is necessary that it be checked for consistency. Where gaps in the data are present, a study is made to check if important data is missing, in which case a part of the data has been discarded. In cases where the duration of a gap is small, gap filling has been performed. These methods are discussed in the subsequent sections of the report. The average monthly rainfall occurring at the rain-gauge stations is presented in Figure 40. It can be seen from the Figure 40 that the rainfall distribution around this project area is Bi-Modal with first peak occurring between March to June and second occurring between July to November.

5.3.4 Agronomy/Soils

- **Crop production**

Agriculture is the backbone of the economy of Oyam district. Over 90% of the people depend on subsistence farming as their principal source of livelihood. The sector provides employment to over 80% of the active rural population. The district has a high potential for a wide range of agricultural products, both crops and animals. There is 97 percent area suitable for agriculture and human settlements. According to records available in the Agricultural department, only 64185 ha of area is currently under cultivation.

Agricultural production is the main enterprise in the project area therefore gaining an understanding of the current production systems and constraints will help inform the feasibility of the proposed irrigation scheme. Most of farmers are practicing subsistence crop farming alongside livestock. Most grown crops include cassava, beans, maize, sim sim, sweet potatoes, sunflower, soya beans, sorghum, and ground nuts. Mostly grown in the first season are soya, maize, beans, cassava, ground nuts, sweet potatoes, sunflower and millet. In the project area, about 20% of the area is occupied by the crops among them maize occupies major area about 45% to 64%, followed by cassava, beans and Sesamum. The existing crop area is around 100 Ha out of 500 Ha of the proposed area and 200 Ha of the 1800 Ha total area available for cultivation under irrigation. Cotton used to be grown, but due to

marketing problems, it has long been abandoned although vigorous efforts are being made to revive it. Crop rotation is common in Tochi area.

- **Land holdings**

In the parishes of Abanya, Aceno and Ngai, majority of the farmers are currently using only rain-fed agriculture with average land holding of 1-2 acres that is available for farming. With the advent of irrigation, improved management practices the farmers will have an opportunity to improve the productivity of land.

- **Land Use**

The proposed Irrigation scheme site is located in Oyam district of Northen Uganda. The farm land occupies more than 90 percent area, and remaining is commercial farm land. Arable land, which makes up about 90% of the total land area in the district is very fertile.

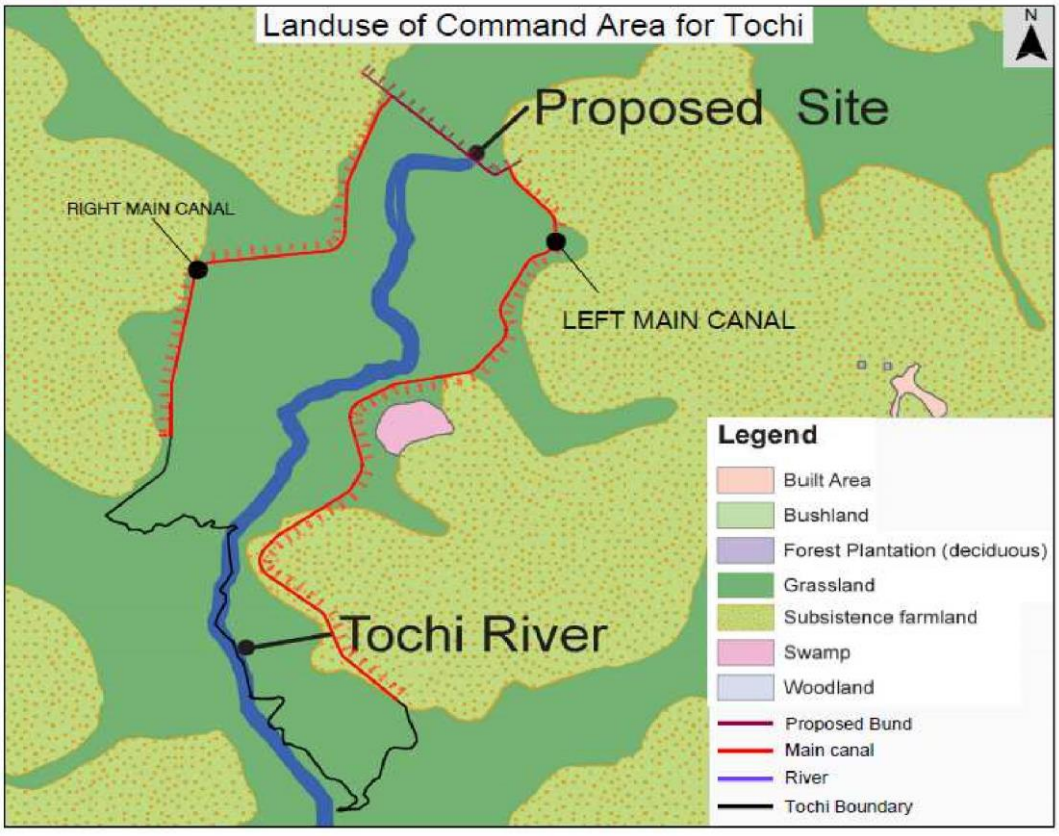

Figure 40: Landuse of command area for Tochi

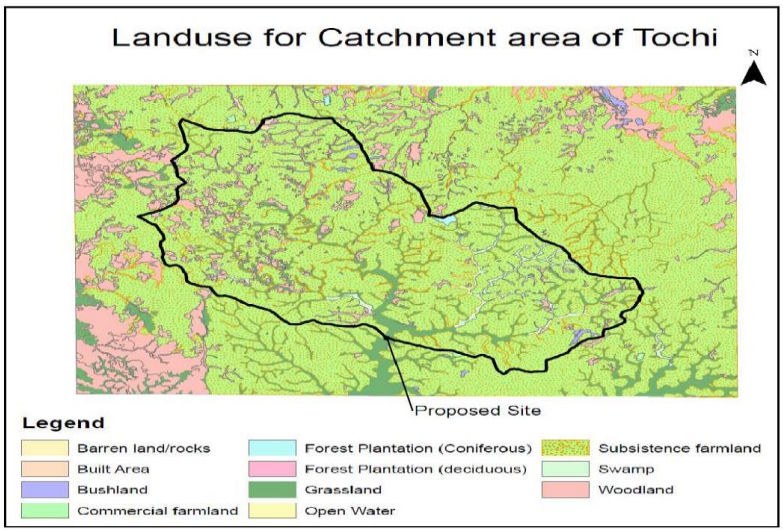

Figure 41: Landuse of catchment area for Tochi

5.3.5 Major Crop Production Constraints and Potentials

- **Major Crop Production Constraints**

The crop production in Tochi area is affected by several technical and non technical constraints, hindering full exploitation of available resources. It has already observed, farmers in the Tochi are subsistence farmers, they do not use modern farming methods, and they depend on rainfall for their water and also grow crops on small pieces of land. The prolonged droughts as the main constraints to production. Poor and low Farming Technology

Lack of working capital coupled with a low educational level, and narrow understanding, or lack, of technical knowledge, the majority of farmers have not been able to take the opportunity so far to change/ improve their own farming system. The iron hoe is the basic farming tool, together with the harrowing stick and the slasher or 'panga'. Even these elementary implements are in short supply among the poor farmers. Other farm implements like axes, spades and the wheel barrows are not common. Spray pumps and pruning saws are even scarcer. The use of tractors is negligible. Ox ploughing recently introduced by NGO's is only practiced by very few farmers. Farmers should be assisted to adopt appropriate technology.

- **Poor Post-harvest Technology and Facility**

The greater part of the agricultural production in the study area is being consumed domestically in the farm household. Only a limited produce is being commercialized. Further, no post-harvest technology has been developed in the study area. Use of traditional farming implements leads to field losses to a significant extent during harvesting and post-harvest stage as a result the poor quality crop produce is produced which fetch low price.

- **Lack of Capital**

The small landholders/peasants have no working fund. Therefore, they use their own seeds and continue their farming with application of less farm inputs. Accordingly, the crop yield is so low and is subsistence level. To get out from such circumstances, farmers need seed money fund for procurement of an appropriate farming technology and then to tackle the most urgent problems for increasing crop production.

Increasing agricultural production may require more capital meaning that some members of the community might require gaining access to credit in order to acquire inputs like fertilizers among others.

There are no financial institutions in Tochi apart from the SACCO called Vision Fund, but there is no farmer who gets money from them. Majority of the farmers feel that in Tochi area problem of credit is related to high interest rates. At the village level there are no formal credit facilities. Women are involved in informal Village Savings and Credit Associations. However, men do not participate in this informal arrangement. Further, there are problems in difficulty in paying back what is borrowed as a result of unpredictable climatic conditions which affects farm output, high interest rates, lack of collateral, culture that does not support borrowing. Therefore, the farmers need to be helped through setting up of financial institutions or strengthen the existing ones.

- **Poor Farm Input Supply System**

The farm inputs, e.g., chemical fertilizers, agro-chemicals, farming tools/equipment, etc. are sold by authorized dealers, so-called "stockiest" in the district. The stockiest are located at the district centre or major trading (marketing) centers within the district. The long distance from farmer to stockiest inhibits most farmers from utilizing farm inputs. Besides, each stockiest does not always stock varieties as well as the quantity of inputs to meet the demand of the beneficiaries. In addition, the stockiest's package of inputs is in most cases larger than that of the farmer demand. Since the farmers have limited working capital, they hesitate to purchase chemical fertilizers. No quality control mechanisms are in place to check poor quality of material.

- **High dependence on climatic factors**

The farmers rely heavily on natural rainfall and in case of drought, famine strikes hard. Further, the droughts led to food shortages.

- **Marketing**

Market place is the vital socio-economic factor for marketing agricultural products and to buy inputs for agriculture. The nearest markets are located in Oyam district headquarters and in Minakulu. Minakulu is about 15 kilometers from the beneficiary community and Oyam is approximately six kilometers. As far as transporting goods is possible as a network exists but the road is very narrow. Other markets include Machodwogo which is 10 miles, Oyam which is 6 miles and Ngai market which is 20 miles.

Most of the crops produced are sold in the local markets. Produce dealers buy and carry away produce such as groundnuts, simsim, finger millet, beans and others. The remoteness of the area from the capital city, lack of competitors among the population, poor road network and insecurity makes the

middlemen exploit the farmers with very low prices. This discourages production by lowering farmer's morale.

The major challenge was failure to meet market standard and required quantities for the market. In order to transport their produce farmers use cars, bicycles or human loading. In order to address issues related to market, farmers can be supported to form a Farmers' Cooperative Societies, large enough to have real negotiating power to ensure collective buying and marketing of produce.

- **Weak Agricultural Extension Services**

The number of agricultural officers and extension staff in the Study area is far short of desirable if directly compared with the total numbers of farm households. Further, district and/or sub-county offices do not have sufficient working funds or tools/equipment and transportation facilities. Farmers need to be supported to form partnerships with the district production department so that they get more information on addressing other constraints for examples access to inputs, training in production, research and innovation. In this way they will be able to get any information that would help them improve their yields.

- **Production Potential**

Agricultural production at Tochi can be improved through adoption of improved crop husbandry practices instead of following the long established traditional farming practices. The existing traditional farming practice is not in harmony with the needs and requirement of developing a productive and sustainable agricultural productivity and also with the potential of the area.

The climatic condition of the Tochi area remains favorable practically throughout the year for growing several types of crops provided that water supply is available. Based on the information obtained from the beneficiaries and review of related literatures potential crops that can effectively be cultivated in the area under irrigation are from cereals like rice.

5.3.6 Possible Interventions

The agricultural production can be substantially increased through provision of irrigation, use of fertilizer, improved seeds and cultural practices, and use of agro-chemicals. The provision of credit system, to pay for inputs and that will increase the use of all possible agricultural inputs.

Investigation, identification, consultation and advice should be given on the appropriate control measures on pests and diseases to the farmers. There is an urgent need to improve soil fertility by manuring, mulching, bund construction, rotational cropping, optimum plant population etc. Farmers should also be trained to adopt soil water management techniques.

The Production department has to rectify the above problems through training of farmers to acquire the necessary skills in crop and livestock management practices through on farm trials, demonstrations on farmer's fields, discussions, field days, group meetings, farm visits and tours.

❖ Crop Selection Criteria

Since the the Tochi Irrigation Scheme is located within the tropical climate, temperature is not limiting factor for most types of crops to be cultivated. The crop recommended for production is selected based on suitability to the area, marketing condition and market value of the crop, diversification of crop and fulfilling the dietary need of the farmers. Growing of rice has a better virtue of prompt for implementation than others owing to: availability of enough water, agro-climatic suitability, food demand by the people and commercial value and further to meet the food security in the project area there by for the region and country.

❖ Proposed Cropping Pattern

The cropping pattern is worked out in two seasons (first season and second season) and considers the present practice of the beneficiaries. The beneficiaries are practicing mono cropping system at intensity of 200% in limited area. This cropping intensity is used with the project condition at full utilization of the command area.

Based upon the proven performance of crops under different agro climatic conditions in Uganda, and the Govt. policy in poverty eradication and importance given to rice cultivation the Rice – Rice cropping system has been identified for the command area, which suits the soils, socio economic conditions and other factors.

Though the cotton crop can also be grown under irrigation, the farmers are of the opinion that the profit is less and prefer to grow rice. Further, the Agriculture officials and irrigation engineers are also of the opinion that rice crop will be better choice with provision of irrigation. Besides this, the Govt policy also supports rice cultivation, hence rice –rice cropping system has been suggested and study of other options are not required for this scheme. Accordingly, the crop water requirements and other water aspects have discussed.

❖ Agricultural Support services

Extension Services

Extension service plays a major role in the dissemination of information and will focus on research and development on the problems that farmers encounter locally. Similarly the farmers of Tochi irrigation scheme requires guidance on the effective use of farm inputs, irrigation water management, new crops varieties and their cultural requirements.

Under the current decentralization policy, agricultural extension officers have been transferred from MAAIF to Local Governments for improvement and reinforcement of the extension service systems. In the respective district areas, the District Agricultural Officer (DAO) has an initiative for operation and management of the agricultural extension services. The same working functions are being constituted in the sub-county office. The agricultural officers in sub-county offices in collaboration with the leading farmers undertake practical operation of the agricultural extension services.

The on-farm working staffs (extension officers and assistants) have been assigned in the respective technical sections under the supervision of the agricultural officer. At present, extension officers are

assigned in the section of "farmers association" or "agriculture (crop production)" as the main field officers. Thus, building capacities of professionals will help in the successful implementation of the project.

Credit Services

To assist the smallholder farmers and peasants, an institutional credit system is essential. The GoU has been promoting micro-finance in 2003/04 and establishment of savings and credit societies (SACCOS) in 2005/06. The Northern Uganda Social Action Fund (NUSAF) of the World Bank has supported communities' initiatives for developmentt. The financial interventions by different agencies in the Tochi command area are very limited. It is desirable to expand the service of financial institutions as they are helpful in improving small- holder farmers and rural livelihoods.

Crop Research Activities

To promote the agricultural modernization programme, MAAIF has organized 7 national agricultural research institutes into the National Agricultural Research Organization (NARO), and launched the NARO programme. Each center has its own area of specialization based on agro ecology. The proposed project command area comes under the jurisdiction of Ngetta zonal agricultural research and development institute which is a semi-autonomous public agricultural research institute of Uganda to conduct and manage applied and adaptive agricultural research and facilitate the development and dissemination of appropriate technologies that address specific needs of the agro-ecological zone. As the the Ngetta ZARDI mandate and acivities are to carryout applied and adoptive research for mid northern and Northern Agro ecological Zones; on station and on farm adoptive trials, technology demonstrations and foundation seed multiplication which will fulfil requirement of research needs of the irrigation scheme crops.

Training

Training is important at the level of both extension agent (DA) and the beneficiaries. The training of the extension worker is necessary for acquiring and updating his knowledge on irrigated crop production techniques and methods on irrigation development plus teaching principles to the farmers. The extension agent could be trained at the training and research centers or at any institutions which have a course on irrigated rice crop production and related issues and through visits to government and/or private irrigated farms in the country.

The training of farmers is also pre-requisite for the success of the project.The main focus of training of farmers on cultural management practices including the use of agricultural inputs and irrigation water management, post-harvest handling of rice. Further, training curricula at farmers and officers level has to be developed and training has to be imparted. Simple information materials are to be developed and to popularize the technologies sufficient extension personnel are to be employed. The training content should contain:

- Introduction to irrigation development
- Irrigation and its uses
- Irrigation scheme care and management by beneficiaries farmers (participation and responsibilities)
- Irrigation agronomy (paddy crop production)
- Input utilization

- Crop protection and post-harvest handling
- The relation of irrigated agriculture and animal husbandry etc.
- The selection criteria for farmers could be:
- Should be active participant in irrigation development (considered as a model farmer)
- Should have his own farmland in the command area and not hired or leased
- Shall be between the age of 18 and 45
- Shall be able to read and write
- Use of improved agronomic practices
- Improved agronomic management of irrigated transplanted rice

Agricultural production in Irrigation schemes can be developed and implemented through adoption of improved crop husbandry practices instead of following the long established traditional farming practices. The existing traditional farming practice is not in harmony with the needs and requirement of developing a productive and sustainable agricultural productivity. Thus agricultural production can be substantially increased through primarily construction of the irrigation thereby bringing large area under irrigation with the use of fertilizer, improved seeds, and agro-chemicals.

In general, there are potentials for land and water resources development, thereby increased cropping intensity, increasing yield, for agro-based industry development, and other related development activities. By following specific modern paddy rice cultivation will also contribute to increasing productivity in the area. The improved agronomic management practices are given below.

The transplanting of rice has advantage of reducing weeds, and mechanical weeding can be followed (rotary weeder). Further, transplanting reduces lodging.

❖ **Land preparation**

A well-prepared field controls weeds and recycles nutrients through the decomposition of rice stubble and weeds which are incorporated into the soil. It provides soft soil mass for transplanting and makes a impervious soil layer below a certain depth from soil surface which reduces the percolation of water and minimizes the fertilizer loss through leaching. Follow the following steps for land preparation:

- First, repair bund to impound water in the fields.
- After repairing the bund, irrigate the fields 3-5 days before tilling.
- Irrigate the field and cut the bund to increase planting area.
- Bund should narrow and small to avoid making nest of rats.
- Irrigate the field again after tilling. This hastens the decomposition of organic materials that were incorporated with soil.
- Keep the field flooded to minimize the loss of nitrogen.
- One week after 1st tilling, puddle the fields. Pudding minimizes the loss of water and increases nutrient retention and availability.
- Drain standing water in the field, apply basal fertilizer before final tilling to incorporate it with the soil. This minimizes the loss of nitrogen into the air.
- Basal fertilizer application: DAP 25kg / acre + Urea 25kg / acre • Level the field.
- Seed Preparation

- It is advisable to carry out seed selection using the floating method. Soak seeds for 24 hours in clean water. Incubate the seeds for 30-36 hours by placing in a sack filled to half its capacity. Warm temperature is needed to increase the enzymatic activities inside the seed. Incubation keeps the seeds warm, increases growth of the embryo, and results in uniform germination.
- Seedbed Preparation and Seeding Management (Wet Seedbed)
- Prepare seedbed plots of 1m wide and any convenient length 1 day before sowing. A plot area of about 100-150 sqm is needed to sow 15 kg of seeds for one acre. Level and smooth the seedbed surface and sow evenly about 100g of seeds/sqm.
- Once seeds have sprouted, about 3-4 cm high, irrigate and keep shallow water level. Sixteen days after sowing, seedlings are ready to transplant. Seedlings should be transplanted at the age of 25 to 30 days after sowing.

The implementation of the proposed irrigation project as commercial entity involving the local community through farmer participation is technically sound and economically feasible. The project will contribute greatly to the National target of poverty eradication through stabilization and improvement of the smallholders' commercial crop production sub-sector.

In Tochi irrigation scheme, the rainfall is more and sufficient water is available to irrigate more than 1800 ha of area. Through provision of improved agricultural inputs like improved seed, fertilizer, pesticides etc, agricultural mechanization and extension service, the production can be improved.

5.3.7 Geology and Soils Characteristics

The district's topography is characterized by low plains and flat topped hills along the shores of River Nile, standing at 900 metres above sea level. Oyam district lies at an average altitude of 1150mm above sea level. River Nile, Tochi, and Okole swamps provide the main drainage within the district.

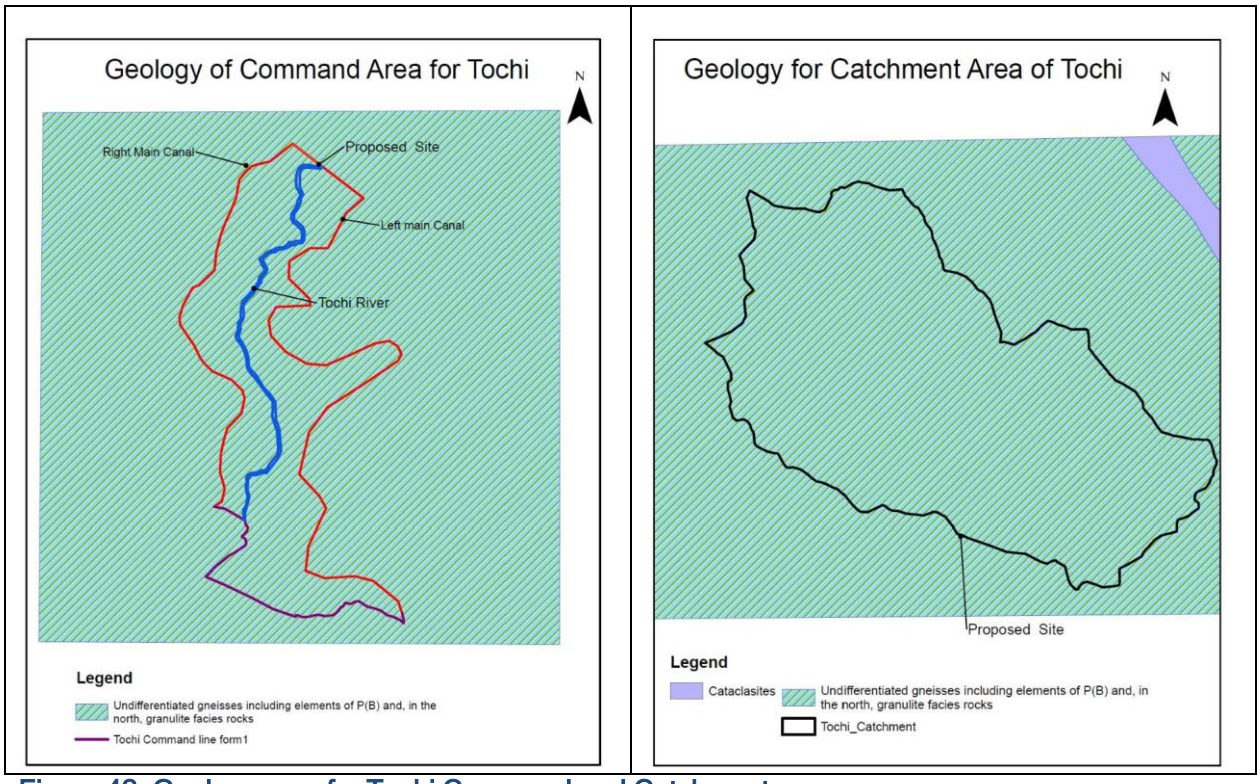

Figure 42: Geology map for Tochi Command and Catchment area

- **Soil Erosion Hazard**

In the project area in some places slight soil erosion has been noticed due to intense rainstorm, bush burning, soil type and steep landform.

- **Surface Stoniness**

The cover of surface in the proposed command area is having few to none coarse fragments and it may not be a problem for irrigated development particularly rice crop.

- **Soil Drainage**

The depth of ground water of the survey area is very deep and the drainage is not a problem in the proposed project area.

- **Soil Texture**

Soil texture implies a relative proportion of sand, silt and clay in the fine earth fraction (the soil material smaller than 2mm in diameter). It was described by hydrometer method in the laboratory. The particle size analysis using USDA standards showed that the texture of soils in the study area is sandy clay

loams. The soil contains 56% sand, 28% silt contentand 16% of clay (Table 31). On the other hand, the information generated from the maps obtained from Ministry of Survey and lands, Govt of Uganda indicate that in command area, the majority of the soils are shallow brown sandy loams over old alluvial followed by shallow brown sandy loams over laterites (Fig 43). Major soil types under Tochi proposed command is black and grey clays often calcarious followed by reddish brown sandy loams and shallow grey brown sandy loams. The reddish brown sandy loams and loams on laterite and shallow brown sandy loams over rock or laterite occupy major area in catchment followed by black and grey clays often calcareous and shallow grey brown sandy loams over laterite.

Table 30: Soil textural class of Tochi soils

%Sand	%Clay	%Silt	Textural class
56.0	28.0	16.0	SCL

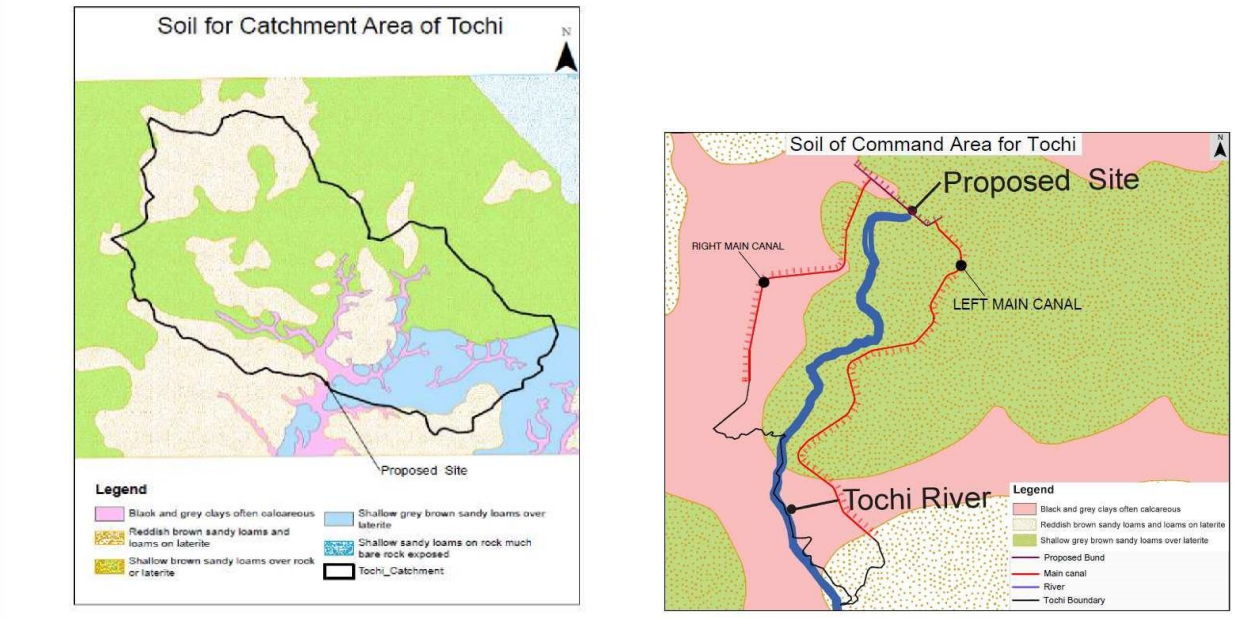

Figure 43: Soil map for Tochi Command and Catchment area

- **Bulk Density**

Bulk-density of a soil is the weight of a known soil volume compared to the weight of an equal volume of water, or weight per unit volume. To measure bulk density of the soils undisturbed soil samples were taken by using pF core sampling cylinder, were sent to Soil Laboratory. If the value of soil bulk density exceeding than 1.65 g/cm3 is expecting compaction. Concerning the bulk density of the soils of Tochi irrigation project area is 1.35 g/cm3. Hence, any soil compaction will not be expected.

- **Hydraulic Conductivity**

Permeability of a soil is the volume of water which will pass through unit cross sectional area of a soil unit time, given a unit difference in water potential. It is expressed in cm h-1 or m day-1. The tests were

carried out according to inverse auger hole method, near to representative soil profile. Animals create the presence of cracks and holes or roots influence on permeability. the saturated hydraulic conductivity was 0.30 cm /hr for the study area. Therefore the result shows that the water movement is moderately slow in the soils.

- **Chemical Characteristics of Soil**

Soil chemical properties have a great influence on planning soil and agronomic programs best suited to the proposed irrigation projects, and evaluation and monitoring of the schemes. The soil chemical characteristics of each soil had been analyzed and discussed based on laboratory analytical results of soil samples collected from the field.

One of the physiological characteristics of the soil solution is its reaction. The soil reaction is expressed through pH value. The pH value of soil is an important indicator, which describes acidity and alkalinity of the soil and the availability and toxicity of macro and micronutrients. Moreover, it is used to appraise correctable soil deficiencies relating to economic correlation such as lime for acid soil and gypsum for sodic soils. pH value is determined by pH-meter in a 1: 2.5 soil-water suspensions. The reaction of the soils in the present work is slightly acidic and the range of pH value that was 5.0. However, the acidity of these soils not a constraint for rice crop grwoth.

Table 31: The exchangeable cations of Tochi soils, Cmoles/kg of soil

	pH	EC	OM	N	p
		µScm-1	%age		PPM
TOCHI	5.0	110	2.11	0.11	19.3

Electrical Conductivity (ECe)

The electrical conductivity (ECe) is measured in a saturation of an extract of the soil water suspension using a conductivity meter. The electrical conductivity measurements are used as an indicator of total soluble salts in the soil. If the value of EC is below 2mS/cm then the soils are not saline. Regarding to the studied soil, the range of EC value was 110 µScm-1 and the soil salinity rated as minimum.

- **Organic Carbon**

Organic carbon contains an acid that can make plant roots more permeable, improving their uptake of water and nutrients, and can dissolve minerals within the soil, leaving them available for plant roots. It also helps make a good environment for all the soil microbes and organisms that work with and enhance a plant's health and growth. And organic matter can improve the texture of all types of soils, from gritty sand to heavy clay. Sequestration of carbon in agricultural soils through appropriate management actions has been recognized as an important tool to mitigate climate change.

Carbon is the main element present in soil organic matter, on average making up 58% by weight. Organic carbon is the principal storehouse for nutrient influencing soil structure and biological activity. It has been determined by using Walkly and Black method in the laboratory and has been expressed in percentage (%). The critical level of organic carbon is 1.2%. The rate of organic matter of the soil is 2.11% in the top soil and the organic carbon is 1.22 indicating that the level of organic carbon is high.

- **Total Nitrogen**

Nitrogen is an essential nutrient element, which highly influences the plant growth. It is a constituent of chlorophyll, plant proteins and nucleic acid. The total nitrogen content of the project area has been determined by using Kjeldahl method in the laboratory. The threshold value of TNT is 0.125%. The total nitrogen status of Tochi irrigation scheme soils is 0.11% near to threshold value.

Available Phosphorus

4

Available phosphorus is the amount of phosphorus readily available for absorption by plant roots. Three different phosphorus ions are formed by ionization of one, two, or all of the three hydrogenfrom phosphoric acid (H2PO4) to form HPO 2- The predominance of one or another of or PO4 is the one most readily absorbed by the concentration of the HPO4 ion increases at high pH value because it becomes the dominant ion in solution above pH 7.2 The PO43- ion occurs at pH value too high for it to be significant in plant nutrition.

The overall available phosphorus content of the soil of the study 19.3 ppm which indicates that P content is high.

- **Cation Exchange Capacity (CEC)**

Cation Exchange Capacity (CEC) is the ability of the soil to hold onto nutrients and prevent them from leaching beyond the roots. The more cation exchange capacity a soil has, the more likely the soil will have a higher fertility level. When combined with other measures of soil fertility, CEC is a good indicator of soil quality and productivity. The cation exchange capacity of a soil is simply a measure of the quantity of sites on soil surfaces that can retain positively charged ions by electrostatic forces. Cations retained electrostatically are easily exchangeable with other cations in the soil solution and are thus readily available for plant uptake. Thus, CEC is important for maintaining adequate quantities of plant available calcium (Ca++), magnesium (Mg++) and potassium (K+) in soils. The CEC value is obtained by using ammonium acetate method at pH value 7 and is expressed in milli equivalents per 100 grams (meq/100g) of soil. CEC values that fall below 15 meq/ 100g are low; poor in organic matter may have high leaching problems because of poor capacity to retain cations, and they may require careful management of the fertilization process. The CEC value between 15 and 25 meq/100g soil considered as medium level and the value ranges from 25 to 40 meq/100 g soil categorized as high level.

The range of CEC values observed was 26 meq/100 g soil. Therefore, the CEC value of the studied area falls into very high level, which means that the mineral soils have a high plant nutrient storage and water holding capacity. The CEC can also prevent the soil nutrient from leaching beyond the roots.

- **Exchandeable cations**

The level of the exchangeable cations in soil indicates the existing nutrient status and can be used to assess balance among the cations. Many effects on soil structure and nutrient uptake by crops are influenced by the relative concentration of cations as well as by their absolute levels. Sodium, potassium and calcium ions were determined by flame emission spectrophotometer, while magnesium ions were measured by calorimetricates.

Table 32 :The exchangeable cations of Tochi soils, Cmoles/kg of soil

K	Na	Ca	Mg
0.35	0.07	2.4	3.8

- **Exchandeable Sodium**

The value of exchangeable sodium content from 0.07cmoles/kg soil and in general rated as low.

- **Exchangeable Potassium**

Potassium has a counter balancing effect on the result of nitrogen excess. It enhances the synthesis and translocation of carbohydrates, thereby encouraging cell wall thickness and stalk strength. The overall content of potassium considers as very high category, which ranged from 0.35 cmoles/kg soil.

- **Exchangeable Calcium(Ca2+)**

Calcium is an essential element for the growth and functioning of root tips. It helps movement of carbohydrates from one part of the plant to the other and for helping to regulate sap acidity. The exchangeable calcium of the soils ranged from 2.4 cmol/kg soil.

- **Exchangeable Magnesium (Mg2+)**

The exchangeable calcium of the soils ranged from 3.8 cmol/kg soil.

NB: See soil test results certificate in annex 3

6. ALTERNATIVES ANALYSIS

The study of alternatives focused on information derived from the assessment of other Irrigation development in Uganda and the feasibility study for the Tochi Irrigation Scheme (2015). Among the alternatives, different irrigation schemes were analysed, technology options, location.

6.1 NO PROJECT ALTERNATIVE

In the area proposed for the Tochi irrigation scheme, the farmers are growing different crops including maize, millet, sesame, beans, cotton, ground nut and cassava under rain fed conditions. The proposed irrigation area is under the customery and communal land tenure systems. The farmers are using family labor and practicing subsistence farming under rain fed agriculture. Discussion made with the target community showed that productivity of crops is lower due to lack of improved farm practices and lack of water for irrigation. They also explained that limited intensity of farming and erratic rainfall as contributing factors for low production and productivity.

The development of the irrigation scheme will benefit the local community in two forms; an increase in productivity due to an introduction of improving agricultural practices and an increase in cropping intensity. As mentioned in the feasibility study report, without the project, benefits of an additional ≥2000kg rice/acre would be lost as currently the area doesn't produce rice. Tocchi area would therefore miss out on annual farm return upwards of ≥9million Uganda shillings over a 5 year period if the project is not implemented.

6.2 MULTI-CRITERIA ANALYSIS

The findings of different aspects – technical, social, environmental and economic criteria have been analyzed using multi-criteria analysis model based on the proposal during the feasibility study phase in order to select the best two most viable projects for further study. The evaluation of the different criteria was made for four schemes namely Pabbo, Rhino camp Wadelai, Tochi and Biiso. This evaluation was carried out to be able to select two viable and feasible irrigation schemes of which Tochi was among them. The model used for Multi-Criteria analysis is given in Table 63.

Table 33: The Model used for Multi-Criteria Analysis

Technical Criteria	Economic Criteria	Environmental Criteria	Social Criteria
Water availability	Benefit -Cost	+ve impacts	Social desirability
Land Suitability & availability	Market Potential & Access	-ve impacts	Social benefits
Crop production & potential	Unit Investment cost	Mitigation & Management costs	Adverse Social Impacts
O & M Maintenance & Management	Financial & Economic Viability		Socio mitigation costs
Engineering Feasibility			

Each of the above technical, social, environmental and economic criteria was given weightages and the aggregate score indicates the most feasible scheme. The following weightages were utilized for each discipline.

Table 34: The Model used for Multi-Criteria Analysis

S.No		% of Weightage
1	Technical Criteria	35
2	Economic Criteria	30
3	Environmental Criteria	15
4	Social Criteria	20

Multi-criteria Analysis

The evaluation of the different criteria for the four schemes was done taking into consideration of various outputs from the sectorial studies.

Table 35: The Model used for Multi-Criteria Analysis

		% weightage	Pabbo	Wadelai	Tochi	Biiso
I	**TECHNICAL**	**35**	**24.45**	**29.43**	**26.67**	**21.80**
1	Water availability	15	5.9	12.1	12.2	6.3
2	Land Suitability & availability	15	12.0	14.0	12.0	11.0
3	Crop production & potential	30	20.0	27.0	21.0	12.0
4	O & M Maintenance & Management	10	7.0	7.0	7.0	7.0
5	Engineering Feasibility	30	25.0	24.0	24.0	26.0
		100	69.9	84.1	76.2	62.3
II	**ECONOMIC**	**30**	**16.38**	**22.61**	**11.44**	**21.57**
1	Benefit -Cost	20	11.48	16.2	7.06	17.08
2	Market Potential & Access	20	15.00	18.00	16.00	11.00
3	Unit Investment cost	10	3.06	4.93	3.07	6.29
4	Financial & Economic Viability	50	25.07	36.23	12.01	37.53
		100	54.61	75.36	38.14	71.91

		% weightage	Pabbo	Wadelai	Tochi	Biiso
III	**Environmental**	**15**	**14.1**	**10.5**	**14.1**	**7.5**
1	+ve impacts	25	25	25	25	20
2	-ve impacts	45	45	27	45	18
3	Mitigation & Management costs	30	24	18	24	12
		100	94	70	94	50
IV	**Social**	**20**	**13.5**	**20**	**20**	**7.45**
1	Social desirability	20	20	20	20	8
2	Social benefits	30	22.5	30	30	18
3	Adverse Social Impacts	25	12.5	25	25	6.25
4	Socio mitigation costs	25	12.5	25	25	5
			67.5	100	100	37.25
	TOTAL		**68.43**	**82.54**	**72.21**	**58.32**

Based on the sectorial criteria analysis the aggregate for the four projects was prepared (table 36).

Table 36: Aggregate of multi criteria analysis of four irrigation schemes (%)

		% weightage	Pabbo	Wadelai	Tochi	Biiso
I	Technical	35	24.45	29.43	26.67	21.80
II	Economic	30	16.38	22.61	11.44	21.57
III	Environmental	15	14.1	10.5	14.1	7.5
IV	Social	20	13.5	20	20	7.45
	Total	100	68.43	82.54	72.21	58.32

Conclusions

Based on the multi-criteria analysis and Financial and Economic findings, Tochi irrigation scheme was the most feasible.

Table 37: Result of financial and economic analysis of irrigation projects

	Irrigation Schemes			
	Pabbo	Tochi- Wadelai	Tochi	Biiso
Financial Analysis				
FIRR	47.58 %	57.86 %	26.21 %	63.92 %
NPV	58,599,830,330	129,456,200,448	42,570,775,021	66,674,232,461
B-C ratio	3.24	3.81	1.84	4.19
Economic Analysis				
EIRR	40.47 %	49.94 %	22.06 %	56.03 %
NPV	46,709,705,758	106,191,923,540	30,984,054,473	56,024,471,246
B-CRatio	2.84	3.34	1.61	3.67

7. STAKEHOLDER ENGAGEMENT AND PARTICIPATION

7.1 INTRODUCTION

This chapter provides details of the public consultation and participation activities undertaken during the ESIA for the proposed Tochi Irrigation Scheme. The project area includes mainly three Sub-Counties of Acaba, Minakulu and Ngai with parishes in the Sub-Counties of Abanya, Aceno and Omac respectively (see table 1) for Sub-Counties, Parishes where consultations were carried out). Emphasis was placed on a fully-inclusive, open and transparent public participation process in the transfer of information regarding the Tochi Irrigation Scheme project. A number of stakeholders are involved in this project ranging from the Lead Agencies, district officials, Sub-County officials, the community and other stakeholders. Public consultation process started in 2015 during preparation of the scoping report through to the preparation of the Environmental and Social Impact Statement.

7.2 Classification of Relevant Stakeholder

Stakeholders can be divided into two very broad groups: those ultimately affected, primary stakeholders (who expect to benefit from or will be adversely affected by development of proposed Tochi Irrigation Scheme and related interventions) - and those with some intermediary role - secondary stakeholders.

Primary stakeholders include; Oyam District Local Government, Sub-Counties of Oyam, Minakulu and Ngai and the local communities whose activities directly rely on or impact on natural resources available where the proposed project and its supporting infrastructure is expected to be developed. The Ministry of Water and Environment together with the Ministry of Agriculture Animal Industry and Fisheries are themselves primary stakeholder

Secondary Stakeholders include the Funders, public sector agencies (ministries, regional/provincial or local governments, government mandated agencies, etc.), private sector, and NGOs.
Stakeholders can further be classified by the scope of geographical coverage to identify four categories of key stakeholders:

a) **Key Nationwide stakeholders** comprise basically of national institutions within Uganda in charge of providing and enforcement of regulatory framework, planning, implementation and monitoring in relation to the proposed project. They comprise basically institutions with nationwide scope of operation and influence in Uganda. Their activities often have significant nationwide effect on the direction of the Agriculture sector, water usage and irrigation activities. Many public sector institutions MWE, MAAIF (and other line ministries), NEMA and Parliamentary committee on Natural Resources fall within this category. Their activities may affect resource use and activities. An analysis of these stakeholders is presented in Table below.

b) **Key International Stakeholders:** likely to have stake in the Agriculture sector like regional institutions, these comprise major Technical Support organizations with a global perspective such as the African Development Bank and NFT (the project funders), They stress coordination and compliance with international environmental and Climate change related obligations and are very influential in project planning and implementation processes as they provide financial and technical support based on internationally applied regulations and guidelines (often have strict terms under which they provide their financial and technical support to guard against environmental and social damage and mismanagement of funds).

c) **Local Stakeholders** The majority of local stakeholders likely to be directly affected include the Indigenous people and Community (Men, women, youth) actively utilizing resources within the area and eking out a living from exploiting natural resources or whose source of livelihood is affected by the establishment and development of irrigation scheme activities. Most notable in this category are; the communities and Local Governments within and surrounding the proposed project site. Based on their individual mandates, consensus needs to be arrived regarding their interests as they influence in the decision-making and planning processes. They also include the cultural leaders who stand out so prominently in Uganda. An analysis of these stakeholders is presented in Table 38.

d) **Education and Research Based stakeholders** undertaking studies related to Environment, ecology such as:
   - Makerere College of Agriculture and Environmental Sciences- The college offers graduate level training courses in Agriculture, Environmental Management and Wetlands Conservation.
   - National Meteorological Training Centre – Offers certificate and diploma level technical and practical training to meteorology observers, technicians and officers.

e) **Private Sector and Civil Society Organizations (CSO)** The private sector is not very influential in the decision- making and planning processes since their main interest is to do business and make a profit. Their most noticeable influence is in lobbying for contracts and for policies and laws that enhance their participation. However, the CSO form an important advocacy front with strong capacity to disseminate and mobilize local community support.

7.3 Mobilization

In order to plan for the stakeholder engagement exercise, stakeholder analysis and mapping was undertaken. Based on the different interest of the stakeholders, the table below outlines the stakeholders groups that were consulted by the members of the ESIA team summary of the information requirement.

Table 38: Description of stakeholders, consultation purpose and the information required for the proposed Tochi Irrigation Scheme

Stakeholder	Project Interest	Information Requirements	Engagement Mechanism
MWE	Need for Irrigation scheme, water resource utilization and sustainable project implementation	Irrigation Potential of the country, growing demand for water resources, climate challenges	Formal/Periodic Meetings

MAAIF	Implementation of the project at the operational phase	Policy guidance in the development and operation of the irrigation project	Formal/Periodic Meetings and Site visit
Directorate of Water Resources Management	Access to water resources	Tochi river water level and their uses, Likely indicators of water pollution and recommendations for mitigation.	Meeting and site visits
Ministry of Gender, Labor and Social Development	Protection of women, orphans, elderly and physically challenged	Aspects related to equity and equal access to water sources, How the project will address social injustices in access to irrigation services and current guidelines for gender mainstreaming and budgeting.	Meeting
Local Governments	Project benefits to the local community, Improvement in local community infrastructure, resolution of disputes on land holding	Basic infrastructure facilities in the affected project area.	Periodic Meetings and Site visit
Private Sector	Valuable resource for design, construction, operation and maintenance of water and sanitation facilities. Conduct training and capacity building for both central and local government staff. Provision of other commercial services including mobilization of financial resources for irrigation development activities.	Current capacity development needs, Existing financial services for the water user groups.	Meetings and Informal discussions
Non Governmental Organizations	Supplement the public sector efforts and ensure that concerns of the underprivileged/poor are catered for. Provision of financial and planning support to communities and local governments.	Current interests of the local Non-Governmental organizations in participating in social development and environmental restoration activities with the project	Meetings and Informal discussions

The mechanisms used for this assignment included information sharing meetings with the national and district officials of the government organizations, communities and local government staff and local leaders and Non-Governmental Organizations. The concerns and issues raised during consultation are discussed as below:

7.4 Consultation Activities

Consultation was undertaken with local, regional, national and international interests and stakeholders. The purpose of these consultative meetings was to introduce the project with the stakeholders and to identify their comments and expectations with respect to the proposed Tochi Irrigation Scheme and ESIA process.

Annex 5 provides the details of the issues captured during consultative meetings.

7.4.1 Summary of Major Concerns Raised by Stakeholders

The views of the national and district official are discussed in line with negative and positive impacts that the project would have on their sectors. These include impact on local communities, watershed and catchment management, water flow management in River Tochi and irrigation scheme management issues as well. The major concerns raised by the officials are discussed as follows:

i. Impacts on Local Communities

The main concern of stakeholders from the local communities was mainly about how they will benefit from the project and how they will be involved right from construction stage to operation phase of the Tochi Irrigation Project. The community members emphasized the need to provide local youth with jobs during construction of the irrigation scheme. The community members also want the contractor to source raw materials locally

The ESIA team Consultations with the Local Leaders in the project area revealed that the community should benefit from contractor social responsibility by for example providing safe water for drinking, rehabilitating some village feeder road, etc

ii. Natural Resource Management and Catchment Management Concerns

Consultations with National Environment Management Authority focused on compliance of the project plan to the existing environmental legislation. NEMA will review the ESIA and they are also concerned that aspects of the River Tochi banks would be adequately addressed in the ESIA process. The agency would also be interested in knowing whether there is degradation at the moment and whether then 100 meters buffer zone is observed by community members since the current trend is that people living or cultivating up to the river bank do not respect it. National Environment Management Authority (NEMA) was also concerned about the impacts on other water users downstream the proposed irrigation scheme. As regards to the protection of catchment areas of River Tochi, consultations with NEMA revealed that there should be a comprehensive plan to protect and manage the catchments of river Tochi and the Wadelai Irrigation Scheme for sustainability.

iii. Vulnerability, Equity, Responsiveness and Rights Concerns

During the field visits and the consultation process, it was noticed that communities within the proposed Wadelai Irrigation Scheme area already experience different forms of vulnerabilities given that they are in an area which is drought prone and flood prone whenever it rains. Consultations with the Ministry of Gender Labor and Social Development focused on exploring the options to include local communities in the establishment of the Tochi irrigation scheme. The ministry recommended that staff (Community Development Officers-CDOs) to be established within the project area. These staff will be responsible for community mobilization, sensitization etc. These CDOs have to be oriented and trained in social mobilization, and should become part of the project management team. The people at the management level should make sure that they will include a CDO, who will take care of gender responsiveness and inclusion. In terms of gender responsiveness, the ministry has policy guidelines which require that gender impact analysis should be undertaken as part of the project appraisal. It was recommended that a consultant, who can do gender analysis and include the specific heads of people, should also be brought on board. Additionally, occupational safety and health should be assessed and addressed in the project design and implementation

Consultations with the Equity and Rights Department of the Ministry of Gender, Labor and Social Development suggested that the local people need to be consulted and sensitized about the project. The people should be kept updated about the progress of the project right from construction to operation. Incase of displacement, they need to address the economic activities of the people, and the project should support income generating activities as well as provision of social services like construction of farmer schools, etc. The local people in the project area depend on Tochi as a source of their water for domestic use, water for watering animals and fishing and these uses should be put into consideration in ESIA. Safety measures should also be taken into consideration, as the project authority will use fertilizers and pesticides during operation of the Wadelai Irrigation Scheme. Finally, the project implementation unit of FIEFOC under MWE should liaise liaise with the equal opportunities commission on issues of complaints and alternative disputes resolutions and mandated institutions should also be involved in the project implementation process.

iv. Water Abstraction and Diversion of River Tochi

Consultations with the Ministry of Water and Environment (MWE) raised concerns regarding the construction processes of the proposed Wadelai Irrigation Scheme that could be diverted flow of water in River Tochi. The team recommended that unnecessary/ diversions of River Tochi be avoided such that water flow continues normally having no or limited effects on water ecosystem and access for community members and downstream water users.

v. Irrigation Scheme Operational Concerns

Consultations with the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) focused on the impact of the irrigation scheme when it is operational. MAAIF will have a duty to make sure the Tochi Irrigation Scheme is productive and is operational and well maintained. It will have a duty to empower farmers and farmer groups and avail extension services to the farmers.

vi. Other Socio-economic Issues

Concerns raised by Non-Governmental Organizations involved in the project area recommended that the design execution of the project should have adequate considerations for environmental like social, cultural and minority groups. Furthermore, there should be clear and sound interests and political interests should also be put into consideration because of the nature of the community. The community should be given a chance to access and appraise the project. There should be EIA and there should be participatory mechanisms of implementing the project at the communities so that people's views/stakeholders are taken into account. In terms of site specific concerns, staff at Future Dialogues international noted that project approaches should be multidimensional given their site specific conditions.

There were issues raisedrelating to potential population increase as a result of the project especially during construction phase of the irrigation scheme. He recommended that a plan be put in place to ensure that local communities are able to cope with the sudden surge in population in the area with its associated impacts. Issues of defilement, HIV/AIDS should be seriously addressed at the initial stages of the project through sensitization of all workers.

7.5 Community Meetings

At the community meetings, information on the socio-economic studies, environment impact studies and other engineering related to the Tochi irrigation scheme were discussed. The stakeholders and community members were then given an opportunity to raise their concerns regarding the proposed project. The key issues raised by the local community are presented in Table 39. The details are presented under Annex 5.

Table 39: Major issues raised by the local community during consultative meetings

Issue	Community concern
Employment opportunities	• Will the youth within neighboring project area be given first priority during the recruitment exercise and how many workers will be required? • There is need for entrepreneurship training and provision of loans to the youth so that they can engage in the project during its operations
Utilities and Social Services	• There is need for the communities to benefit from the project for example improve access to safe water through establishment of boreholes • Need for health services within communities especially in Abanya Parish, Atekober Parish, Dogapio Parish (Acaba Sub-County), Aceno Parish, Atek Parsh, Amwa (Minakulu Sub-County) and Omac Parish(Ngai Sub-County) • Will accessing the irrigation facilities be free or for payment?

Issue	Community concern
Grievances on Compensation	• Some individuals staying close to the proposed project area especially close to the River Banks and near the proposed reservoir area fear of displacement and thus worried on whether they will be compensated • When water overflows the reservoir during operation of the irrigation scheme, who will be responsible for compensation of property destroyed • Concerns over destruction of people's gardens especially along access routes since they are not well established and whether compensations will be made for destroyed crops
Concerns over Management of Irrigation Scheme	• Concerns over who will get land in the project area and what criteria will be used to allocate land to farmers and farmer groups • Whether there will be available markets for the farmers' produce • The established dam and the reservoir will have fish, will the fish be available for the community members free of charge
Concerns over water related disease outbreaks	• Water related diseases are most likely to affect the locals in the area for example malaria, bilharzia and diseases may become prominent due to the establishment of the dam and reservoir

Plate 6: Meeting with Abanya Parish Local Leaders, Acaba Sub-County

Plate 7: Meeting with Local Leaders in, Minakulu Sub-County

Plate 8: Consultations in Aceno Parish.

Plate 9: Study team meeting with the Production Officer of Oyam District at Oyam District Headquarters

Plate 10: Some of study team members carrying out assessents and consulting local personnel along the Tochi area

8. IMPACT ASSESSMENT AND MITIGATION MEASURES

8.1 INRODUCTION

This section presents the discussion of impacts, the identification and the mitigation that are likely to affect the environment is based on the period of

- Pre-construction and construction of project facilities, and
- Operation of the Irrigation Scheme

The environmental impacts are analyzed for three major elements,

- the social environment (including the positive impacts)
- the physical environment
- the biological environment

8.2 IMPACT ASSESSMENT

This is the process of identifying the anticipated or actual impacts of a development intervention, on those social, economic and environmental factors which the intervention is designed to affect or may inadvertently affect. Potential impacts have been identified based on proposed activities to be undertaken, through specialist studies and through a consultative process with key stakeholders. To establish impact significance, the following key concepts will be utilized as follows:

The identification of all the possible impacts of the Project followed a systematic approach, which included consideration of the following:

- Project Description- an analysis of the Project design, Project phases and activities and the processes involved, which has resulted in a clear understanding of the Project activities that have the potential to give rise to impacts;
- Project Scope of Assessment – the scope of assessment has highlighted the potential environmental and social/socioeconomic components that may be impacted upon during a certain timeframe and over a certain distance;
- Stakeholder Input – the input of key stakeholders was considered in identifying the potential impacts that are of concern to those parties that may be impacted by the Project;
- Expert knowledge – expert knowledge from scientists and regulators familiar with the project as well as prior experience of EIA specialists with experience gained from similar projects has contributed to the preliminary identification of impacts;
- Project/Environment Interactions - A Project activity/environment interaction matrix was developed, which summarized the possible interactions between Project activities and the main resource/receptor types during the phases of the Project.
- Cumulative impacts: are those arising from a large number of activities that are for the most part individually insignificant, but together have had regional or even global repercussions.

Discussion of these impacts will be done qualitatively and possible mitigations suggested banking on similar projects, in the absence of the national framework for identifying/addressing cumulative impacts.

Two different forms of impact are assessed within this ESIA:

- Planned impacts; those impacts that result from a planned event. Such impacts are expected to occur during the course of the Project (e.g. an increase in turbidity levels in the water column due to a disruption of seabed sediments);
- Unplanned impacts; those impacts that result from an unplanned or non-routine event. Such impacts are not expected during the Project but nevertheless the probability of the impact occurring is assessed (e.g. occupational hazards).

8.3 ANTICIPATED POSITIVE IMPACTS

These are the positive impacts anticipated at the onset of project activities;-

- **Increased Job Opportunities for Local Populations**

The project will provide substantive employment opportunities to local populations especially in Acaba, Miinakulu and Ngai Sub-Counties, particularly during the construction phase of the irrigation scheme. An influx of labourers and construction workers will characterize the construction phase, which will drive the demand for basic services including housing, transport, food and healthcare. The local communities will meet these needs; local women will provide food-vending services, homes can be rented out for the new population and small enterprises will benefit from increased sales of products and/or services. It is anticipated that the project will provide up to 500 direct and indirect employment opportunities over the entire construction cycle to ensure its completion, with a sizable locally contracted workforce of between 150-300 persons at any one time.

- **Improved Rural Livelihoods and food security**

During operation of the proposed Tochi irrigation scheme, increased agricultural employment and non-farm activities in the three Sub-Counties of Acaba, Minakulu and Ngai as well as Oyam District at large is also expected to occur as a result of increased agricultural acreage. Entrepreneurial activities in supplying inputs and other support services to the production activity will generate multiplier effects on the targeted communities through increased income and creation of job opportunities especially to 50% of the targeted youth and women.

- **Increased Agricultural Production and Acreage**

The construction of the irrigation infrastructure and proper management of the Tochi Irrigation Scheme (through efficient water application and sustainable irrigation practices) is expected to yield considerable increase in the agricultural output e.g. rice, maize, fruits. The irrigation scheme will particularly encourage the rise of out growers within the project area and beyond that can support the supply of agricultural crops to the regional markets and will contribute to local revenue to the communities, district and the overall economy of the regions and country as a whole.

- **Restoration and Protection of Catchment**

The proposed Tochi Irrigation Scheme implementation will also be based on a catchment protection approach which will not only improve the livelihood of people living in the catchment area specifically in the especially in the three project Sub-Counties, but also promote sustainable development of the watershed to address environmental challenges i.e. land degradation in the project area and beyond. Tree planting and other watershed management activities planned as part of the project will contribute to restoration of forest cover and ecosystems, thus reducing soil erosion, water pollution, combat desertification and deforestation as well as enhance water catchment functions. These activities will mitigate climate risks and contribute to reduced vulnerability to extreme weather events and provide a more secure social environment for targeted populations.

- **Improved Water for Productive Uses**

Improved water for production through the construction of irrigation infrastructure will be one of the major benefits. With the development of the proposed Tochi irrigation scheme, smallholder farmers will have access to water for agricultural production, which will help them counter the problems of frequent dry periods, thereby smoothening the cyclical impacts of droughts. In addition, the rehabilitation measures are expected to improve the efficiency of water diversion, conveyance and application and thus reduce water wasting. Apart from improving agricultural production this will avail additional water that would have been wasted to downstream users and thereby reduces water pressure and conflicts. There will also be improved flood water utilization in the area and flood control especially in Acaba and Minakulu Sub-Counties.

It should be noted that the above mentioned positive impacts will be enhanced during the onset of project activities to offset some of the negative impacts.

8.4 POTENTIAL NEGATIVE IMPACTS

This section presents the potential negative impacts anticipated to occur at the onset of project activities including pre-construction, which includes (land acquisition, clearing, excavation planning). This section further discusses the potential impacts that would arise out of the construction phase and eventual operation and decommission activities. Mitigations are also proposed in this section basing on preferred state by the lead agencies, communities, and international best practice standards.

8.4.1 Pre-Construction Phase Impacts

These are anticipated impacts that are likely to occur in the period preceding construction activities.

A. Loss of land

The area proposed for set up of the rice paddies is utilized for grazing. According to the biodiversity & Social survey, the area scheduled for flooding is dominated by shrubbery of which the common species is Mimosa pigra, an aggressive invasive species. However, there is negativity towards converting this land into agricultural fields with a large portion of it being flooded to create a reservoir, as cattle keepers will have no pasture for their animals and access to water will be limited. Tochi ecosystem in its current

state provides the surrounding local communities with fisheries from the river, water for domestic and livestock use, while the terrestrial environment serve as grazing land for livestock as well as hunting grounds for wild game. Also among other benefit to humans is the fuel-wood, from the tree stands that are scattered within the project area, whose distribution and abundances has been rendered low possibly because of over-exploitation. The impact intensity is high as already there are tensions between farmers and grazers for the flood plain and access to water. The receptor sensitivity is high also because the area has known some volatile tribal clashes in the past over land and given that 75% of the land is communally owned therefore sharing between farmers and grazers may present challenges.

Mitigations

- Siting of the road and support facilities (Construction Camps) to avoid critical terrestrial and aquatic habitat (e.g. thick wooded grassland the riverine forests, wetlands, and fish spawning habitat in the wetlands);
- Conflicting interests in the flood plain will be settled at Village level to allow for farmers be able to access this area for rice growing and grazers opportunity for pastures in areas adjacent the Tocchi scheme;
- Provide alternative grazing grounds for the cattle keepers which should have access to water and doesn't prolong the distance originally covered by the herders
- Farmers should be given protection so that in case of clashes, these are not harmed, nor agriculture impacted
- Government security forces should be on call at all times in the event of a clash between local groups
- Sensitization should be undertaken to inform stakeholders of the benefits of agriculture and demonstrations given on integrated agricultural practices (farming and cattle keeping) existing in the same place at the same time
- Provide watering grounds for cattle on the outskirts of the scheme. Access to the water for domestic animals should be ensured at all times to reduce conflict over water resources
- Cattle keepers should be given alternative grazing grounds to make way for rice paddies in the areas.
- In keeping with the Resettlement action plan, any land with dense population infrastructure will be excluded from the command area of the scheme.

B. Noise and vibration generation from mobilization of equipment

Heavy trucks moving equipment and materials in preparation for the construction will generate a considerable amount of noise and vibration within the area. The existing noise levels are typical of undisturbed environments except at busy road junctions therefore any increment from the norm will inevitably lead to varying degrees of disturbance to the area. The receptor sensitivity in this case low and impact intensity is low because already there is other vehicles on the road transporting community members to and fro the site. Also, because of the heavy use of the area for grazing and other activities, no sensitive animal habitats will be impacted.

Mitigations

- Noise should be kept to a minimum by selecting fewer vehicles access to the site at any given time

- Intense construction activities involving various noisy equipment will be located away from neighbouring communities

The proponent will develop a mechanism to record and respond to complaints especially from communities to check on effectiveness of the applied mitigations and to get insight on how to address these concerns in due time.

8.4.2 Construction Phase Impacts

Typical activities during the construction phase of the irrigation project include effects caused by civil works, which would include ground clearing and removal of vegetative cover, channeling, installation of measuring devices and monitoring stations, land levelling, some concrete works, wastewater collection, onfarm irrigation system improvements, land leveling, changes in agriculture practices, groundwater recharge, wells, wastewater collection and treatment, and environmental restoration during the period of infrastructure construction, during the second phase implementation of. The impacts and mitigation measures are proposed to reduce the impact magnitudes to minor/negligible levels.

A. Landuse change

The project will change land use from grassland and farming land to irrigated farmland. A total of 500ha will be converted from present use to irrigated farmlands. This is a permanent impact that will reduce the area under conventional agriculture and/or grazing land use. Present land use can revert back to its status after decommissioning of the project but it will take a long period of time before the rejuvenation of the current habitat/vegetation. Impact intensity is high given large tracts of land will be converted and the receptor sensitivity is low given over exploitation observed in the area durng studies.

Mitigation

- This impact is unavoidable and can be compensated through allocating those who will be displaced from their grazing gorunds other areas to feed their animals. There is a need also for the conservation of natural habitats downstream.
- To enable sustainable land use in the project areas, an integrated land use plan should be developed within the catchments based on the three tier approach that considers wider Tochi catchment, middle grounds and the lower areas (project area)

B. Air quality (emissions)

Potential emissions generated during the construction phase include vehicle fumes; impact intensity in this case is low because the project will be more human labour intensive than machine. Few or no Sections of the areas where particulate material was observed included those with vehicles on murram roads however the rest of the areas had either grass or shubbery. This presents a good quality environment and a high dilution potential for any pollutants produced. The receptor sensitivity is therefore medium, with a moderate impact severity before mitigation.

Mitigation

- All vehicles will be instructed to switch off engines on arrival at site. More pollutants are released during idling as compared to a vehicle in active movement;

- All trucks delivering materials to the site will be maintained in good working order as inefficient fuel combustion is key in the release of NO2, SOx CO, and NO from vehicle exhausts;
- Vehicle drivers will be encouraged switch engines off when not in use because an idling truck releases more emissions than one in active movement;
- The project will employ community members using hand held tools to reduce on the need for excavators or heavy equipment that release fumes.

C. Conflict over resources

Livelihood in the project area is mainly centred on subsistence agriculture and livestock keeping. Conversion of land into predominantly irrigated land will reduce available pasture grounds for families keeping livestock. The impact intensity in this case is high given tribal clashes have been reported in the area between farmers and grazers.

Mitigation

- To prevent conflict between irrigation farming and livestock keeping, extension services on improved livestock keeping that is more intensive than extensive should be promoted. Practises such as keeping fewer but better breeds that are of more economic benefit should be promoted. In addition, practices such as zero grazing should be introduced to reduce land requirement for livestock keeping.
- Water resources should be extended to livestock keepers that want to maintain the freerange grazers. Troughs extending water on the outskirts of the irrigated section should be constantly flooded with water to provide for watering animals.

D. Air quality (Dust Emissions)

Dust emissions are expected during transportation of materials and project workers to and fro the site, burning of waste material, and construction during the dry season. This impact intensity is very low since most activities will be undertaken in the floodplain and the receptor sensitivity is low as the area doesn't harbor any wildlife that is nationally important for conservation.

Mitigation Measures

- No bonfires for waste will be encouraged in the project area, as this causes dust raising situations;
- Dust generating activities will be minimized especially on windy days to prevent dust raising in the area;
- Water will be used as dust suppressant where applicable to subdue any dry particles from becoming airborne during windy days in the dry period;
- Cover excavated soils especially on windy days to reduce dust exposure to workers and neighboring areas;
- All loads/materials entering and leaving site to be covered to prevent windblown dust along the route to and fro the site;

- Land clearing, removal of topsoil and excess materials, tips and stock piles, will be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) as well as the locations of sensitive receptors;
- Workers engaged in activities likely to raise dust will wear dust masks at all times during this phase;
- Areas near exposed surfaces of stockpiled materials should be vegetated.

E. Destruction of Cultural Resources

During the implementation of small civil works it is unlikely that culturally important sites will be uncovered. While no cultural properties to be affected by Project activities have been identified, an appropriate clause will be included in all works contracts regarding the procedures to be followed in the event of chance find of culturally significant sites during Project activities.

Recommendation

- Where the proponent has encountered tangible cultural heritage that is replicable and not critical, the personnel will apply mitigation measures that favor avoidance;
- Minimize adverse impacts and implement restoration measures, in situ, that ensure maintenance of the value and functionality of the cultural heritage, including maintaining or restoring any ecosystem processes needed to support it;
- Where restoration in situ is not possible, restore the functionality of the cultural heritage, in a different location, including the ecosystem processes needed to support it;
- Where the project site contains cultural heritage or prevents access to previously accessible cultural heritage sites being used by, or that have been used by, Affected Communities within living memory for long-standing cultural purposes, the developer will, based on consultations allow continued access to the cultural site or will provide an alternative access route, subject to overriding health, safety, and security considerations;
- Where an encounter has been made with artefacts, the developer will ensure that the project personnel doesnot disturb any chance find until further assessment by competent professionals has been made and the find has been rendered replicable in another area or be preserved in its current state;
- The developer/contractor will work in close collaboration with the Uganda Museum officials on any find and develop a procedure for addressing chance finds especially during excavations.

F. Soil erosion

Digging ditches and construction of canals will cause soil erosion and lead siltation downgradient. It also damages the soil (strips top organic matter) and plants (suffocate seeds, roots, denies nutrients to plant); causes loss of water and soil and destroys the natural sight in some parts of the places for soil collection and quarry. Meanwhile, the flux from road drainage washes the soil below the roadbed and leads to increase in suspended solids in rivers. Particles can be contributed also by encroachment in digging area, leading to a decrease in water quality.

Mitigations

- Project activities will be scheduled to avoid heavy rainfall periods (i.e. more activities during the dry season) to the extent practical;

- Protect canal/ditches' slope by use of stones or other heavy material that will not easily weather away;
- The developer will encourage contouring and minimizing length and steepness of slopes to reduce erodibility;
- Mulching using vegetation previously cleared from the areas will be used to stabilize exposed places;
- Any spoils (Boulders) in the reservoir area will be used for the backfilling of the weir

G. Contamination of surface waters

Accidental spills from vehicles and equipment with diesel engines may contaminate the water, lowering the quality. Erosion leading to deposition of sediments in aquatic resources also introduces contamination into the water, increasing turbidity, suspended solids and lowering the overall water quality. Poor construction and domestic waste management may also release contaminants into the water ways. The impact intensity will be medium, because much as the main river has highly sensitive fish species like the tilapines, all activities will be a distance from the water course, except at the reservoir and diversion. The receptor sensitivity is medium, because the Tochi river pours into the Nile, which is an internationally shared system therefore any negative impact will affect not only a regional area, but may travel across international boundaries.

Communities will mainly carry out project construction with little mechanical works, so little amount of wastewater and waste gases is expected to be produced almost has no effects on the environment. The possible solid wastes are sands, stone blocks, bricks and soil. Since the little demand on sands and stones, there will be no much solid waste left by rational purchase on such stuffs. The main solid wastes are the loose soils in field projects.

Mitigations

- Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season to reduce sediment/contaminant delivery to the river which could end eventually to the Nile;
- Application of appropriate construction practices and creating awareness among the community of the need to maintain high water quality;
- All project vehicles scheduled to work near water resources will be cleaned prior to use (during the dredging activities);
- Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;
- When water quality criteria allow, storm water should be managed as a resource in holing lagoons, either for groundwater recharge or for meeting water needs at the site;
- Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of aquatic ecology and public health;
- Maintenance of vegetative buffer between the water and construction works to help trap loose sediments and or materials will be considered

H. Contamination of ground waters

Waste storage areas for the construction crew may leak nutrients and biological pollutants into ground water resources. Other sources of pollution maybe spoil storage areas on site for contaminated soils. The impact magnitude in this case is low, because no waste materials will be stored on site therefore any leachates will not have reached ground aquifers before the camps are removed and restoration commences. The Receptor sensitivity is low.

Mitigations

- Waste collection points for workers at the construction site will be located out of the high water table sections of the area;
- All waste areas will be bunded during temporary storage to prevent pollutant leaching to below ground water resources

I. Loss of vegetation

Sections scheduled for the construction of the reservoir will inevitably be stripped of vegetation and lateron be flooded. National Forestry Authority list of reserved species Albizia coriaria was widely observed within the project areas, occurring as both mature trees and saplings, and NFA obliges the critical importance of protecting their habitats. However, Albizia coriaria is widely distributed in the country-it does not have a restricted habitat range. Therefore the impact magnitude is rated as medium, and the receptor is low because the study observed that the area was heavily infested with Lantana camara and Mimosa pigra.

Mitigations

- Areas of important Albizia coriaria will be left intact in as far as is practical. Where necessary, community members will be encouraged to translocate the saplings and vegetate areas where trees are scares.
- Vegetation translocation and relocation techniques will be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement;
- During extraction, ecological niches should be preserved and protected as far as possible

J. Construction traffic

The construction phase will entail materials haulage that will put varying number of heavy trucks on the main roads to the project site. The impact intensity is medium, because the construction is to take place in phases, which will necessitate the usage of only a small number of vehicles at a particular time. The receptor sensitivity is low on producing a combined receptor sensitivity of medium ranking. The impact severity is moderate before mitigations.

Mitigations

- In the case that there is an overlap of public and project vehicles, the developer will be charged with controlling vehicle traffic through the use of one -way traffic routes if needed, and on- site trained flag- people wearing high- visibility vests or outer clothing covering to direct traffic;

- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle;
- Ensuring moving equipment is outfitted with audible back-up alarms;
- Using inspected and well-maintained lifting devices that are appropriate for the load, such that there are no breakdowns in the middle of the road;
- Contractor shall provide temporary road signage during construction and ensure drivers observe speed limits and for safety of other road users.

K. Noise

Most water conservancy projects, like enforcement of the construction of agriculture irrigation project and integrated protection and management for small rivers, areearthwork, most of which are far away from residential areas. Thus there is almost nonoise pollution. For the projects that are located near to residential areas, noisymechanics should be avoided for use.Noise impact from one vehicle will be low, given the vegetative barriers and remoteness of the construction site from receptors and the receptor sensitivity is low given there are no neighbouring houses in the vicinity.

Mitigations

- Night time activities will be avoided at all costs in as far as is practical, because sound travels further during night than during the day;
- In order to limit noise due to haulage traffic, the construction fleet will be kept in good condition well fitted with efficient silencers;
- Hand held tools will mostly be used therefore incidences of noise increment will be avoided.

L. Occupational Health and Safety Risks

Construction and operation activities at the project that involve handling of heavy equipment, working in an area that is prone to flooding, being exposed to the sun for long hours. Workers will be exposed to diseases arising from sanitation inefficiency which may lead to a loss of valuable work-days due to ill health. During construction of the irrigation infrastructure there is risk of injury to employees undertaking the work as well as community members around the construction activity especially small children and animals. Injury or death could result from falling into excavated areas, drowning in flooded pit holes and canals as well as injury or death from vehicles, heavy machinery and equipment. The second risk to human safety is during the operational phase. This entails falling into canals leading to injury or death due to drowning. This is an impact more prone to small children and to community members travelling during dark periods (at night) particularly when drunk. The probability of occurrence is high, due to the remoteness of the site, which may present a variety of challenges sanitation and safety-wise. The significance of consequence is moderate given that most workers will be locally sourced so the negative impacts arising out of exposure of foreign people to the local climate, food and area, are reduced. The overall significance is major, therefore necessitating stringent mitigations as proposed below.

Mitigations

- Because of the remoteness of the site location, any human fecal material waste produced will be contained in temporary sealed septic tanks before collection by licensed waste collection agency and disposed at NEMA approved facilities;
- Only highly skilled workers will be allowed to operate heavy machinery (cranes, excavators, graders) and heavy trucks (Tipper trucks);
- Any large excavated pits will be guarded to prevent falling into the pit by community members/Children/animals;
- Worksites especially those posing a greater danger to humans/animals will have limited access (i.e. excavation areas, worksites with heavy vehicular movement);
- Planning work site layout to minimize the need for manual transfer of heavy loads. This reduces over exertion of project workers;
- It will be necessary for the project team to ensure that proper working equipment and attire are provided during the construction phase to minimize chances and incidences of death or injury. Similarly, proper warning signage should be appropriately erected especially where there are heavy machines and equipment moving or around excavated areas so as to forewarn any nearby persons of the dangers eminent. Intensive awareness programmes before and during the construction periods on public safety should be undertaken to reduce the chances of this impact manifesting
- Job rotations and rest or stretch breaks;
- Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths

M. Animal behavior alteration

Disturbance in the area would change animal behaviour in the instance that sediments are released into the river. This may destabilize normal ecosystem function, which may lead to a low fish yield from the river and eventual loss of income for many downstream community members that depend primarily on fishing. From the global reference of IUCN redlist (IUCN 2015), the mammalian species recorded in the site were of least conservation concern. However threats to habitat and animals were observed in the area which if not attended to may cause serious impacts on biodiversity.The impact intensity on fauna species will be medium, because most activities will be a distance from the main river, therefore the aquatic organisms will have the riverine wetland plant shielding most of the nightlights however the terrestrial mammals may move from their habitats into neighbouring gardens or residences and the receptor sensitivity is low, since none of these species are of conservation concern.

Mitigations

- Barriers between sensitive habitats and worksites will be maintained to enable the separation of project activities from habitats within the river/wetlands;
- All facilities will be located outside of known/established animal corridors to prevent animal disorientation;
- Known animal foraging areas should be left intact to enable grazing at the same time construction of the irrigation scheme;
- Sediment traps should be placed at the end of the drainage channel before runoff is re-directed into the river

N. Injury to fauna

Construction of the reservoir and associated infrastructure could harm animals in the sense that channels would be left open to allow water flow to the scheme. Grazing animals moving towards the river for watering risk falling into open channels or drowning in the reservoir. Fish could be injured or killed due to increased sedimentation downstream. The impact magnitude is low, since the construction will be phased that any structures nearest the river will be constructed last, to prevent water inflow into incomplete structures and associated consequences. The receptor sensitivity is low, since the areas proposed for the development have lowest diversity of fishes and or other animals.

Mitigations

- The construction will be timed during the dry period so that runoff doesnot flood the excavated sections to transport sediments downstream into the main river;
- Incase any fish are caught in the excavated sections for the reservoir facilities, they will be removed and placed in the main river to prevent injury;
- Grazers will have alternative areas to find pasture for their animals and water

O. Hydrology

The scheme aims to use flood waters stored in a reservoir over the whole year to grow rice. As a result flood patterns and seasonal flows may change; the flood level which was expected during the wetperiod will be lower and the dry period may present shallower situations in the river section between the reservoir and the flow-back. The impact intensity is low, because the water will be maintained within the naturally existing flood plain; however the receptor sensitivity is low as there are no communities living within the flood zone.

Mitigations

- The distance between reservoir and flow-back should be limited to areas of low animal interaction in as far as is practical, without compromising the integrity of the environment or project effort;
- Normal hydrological functions like transportation of sediments downstream will be maintained to sustain the downstream ecological functions like siltation in the wetlands, that are areas for breeding/feeding for various birds and fauna; this is so because the water will not be dammed at anytime during scheme operation;
- Optimization of the use of flood waters will be undertaken to prevent flooding downstream and slow release of waters during the dry season

P. Increase in employment and household income

Direct impacts would include the temporary creation of jobs for construction workers and the associated income and taxes generated by the irrigation project. Indirect impacts would occur as a result of the new economic development, and would include new jobs at businesses that support the expanded workforce or provide project materials, and associated income and taxes. The project will employ community members mostly from Tochi area and some from Gulu district. The employment will increase overall household income through salaries offered to the workers during construction. This

will be due to employment of labourers, both technical and casual. The impact magnitude will not be discussed in this case because employment is beneficial to communities and therefore no mitigations are required, rather some recommendations will be suggested.

Recommendations

- Priority should be given to residents of the communities within close proximity of the development;
- Women should be considered equally as men during the employment process, with due consideration to community structures and norms;
- No children will be hired on the project for any work in keeping with the International Labor Organization, (ILO) Convention No. 138, (1973), that defines the minimum age of employment

Q. Influx of migrants

Construction of the scheme could, with the anticipated promise of employment draw residents from the neighbouring areas into the Tochi area in search of temporary work. The resulting influx could result in secondary effects such as increased spread of diseases like HIV/AIDS and other STDs. The impact magnitude is high, because a large number of people is expected to be engaged in the construction process. Along with the expected workforce, associated developments complementary to the project will be set up, like airtime booths, along the route to the worksite, restaurants, among others.

Mitigations

- The developer will continuously sensitize workers and community members alike on HIV/AIDS and the dangers of unsafe relations;
- Workers will be encouraged to be disciplined when on company assignments in the villages and prevent risky interactions with community members.
- Another measure to manage influx is through provision of social infrastructure including water and sanitation facilities. Sanitation facilities are particularly critical in the paddy areas as lack of them will result in deteriorated water quality. During construction phase of the project, the contractors should have employment policy which gives preference to the local people. By employing the locals, this would discourage population influx to the area
- The developer will keep in close communication with women and youth groups to monitor any changes in social structure and communication with local leaders to monitor any changes in population.

R. Disruption of cultural norms and practices

There is also a possibility of disruption of cultural norms of the residents in Tochi area. The impact intensity is low, because priority is to be given to residents in the communities within the project area and any neighboring districts. The receptor sensitivity is medium because the residents are moderately modernized and positively responsive to development changes.

Mitigations

- Any foreign project workers will be informed on cultural norms of the local communities before encounter, to avoid conflicts with communities;
- Local authorities shall need to be strengthened in order to deal with the increased cases of indiscipline brought about by the increased population influx, and any disputes that are likely to ensue;
- Gender issues will be considered during the hiring process to ensure equality in income provisions; Continous provision of water from the river will also be considered as it is culturally disproportionate that women and children be responsible for water collection.
- Existing community members will be prioritized for employment so that cultural norms are not drastically altered to maintain social cohesion

S. Loss of Aesthetic Quality

Changes in aesthetics (landscape/visual beauty) are another potential direct effect from the development. The current landuse practice is grassland, however with the scheme installation, the landuse will change to commercial rice production. Ground disturbance and vegetation removal may produce contrasts of water color, form and soil texture. Such disturbances could occur as a result of excavation for channels and ancillary structures; clearing and levelling staging areas; stockpiling soil and spoils (if not removed); resulting from excavation, levelling, and equipment movement. It is anticipated that the project will change the visual quality of the Tochi river in the proposed area significantly by introducing structure and channels. The change in landuse may also bring about conflict as the area is used for grazing; therefore turning to farmland may cause grievances among the cattle keepers. The alteration will therefore have a negative impact on the activities in the area. The receptor sensitivity is high since land wrangles in most areas of the country have resulted in death or civil war.

Mitigations

- The entire process will take into consideration the preferred land-use proposed by communities and government initiative;
- Access to excavation areas will be closed off to all but construction crew to prevent accidents like falls, or exposure to unsightly conditions within the area;
- Conflicting landuse should be integrated in the overall management of the flood plain so that grazers and rice farmers' views are given due respect;

8.4.3 Operation Phase Impacts

These are impacts anticipated during the operation of the Tochi Irrigation Scheme, including impacts on aquatic flora and fauna, river ecology, and hydrology.

A. Loss of livelihoods

Current livelihood sources in the area are subsistence farming, livestock keeping and small scale fishing. Increased acreage of irrigation will reduce opportunity for the other existing sources of livelihood in one way or another. Irrigation of large tracts of land (500Ha) in the Tochi area, will reduce acreage available for livestock grazing thus endangering alternatives means of livelihood of the locals. This loss could be through reduced amounts of pasture land or negative impacts on fisheries.

Mitigation

Where it occurs, displaced people should be compensated and given alternative areas for cultivation to cushion them against shocks such as hunger. The new areas should be developed for them or they should be integrated into the projects associations as they become projects beneficiaries and not losers. Proper management of resources (soil and water) will ensure that aspects such as fisheries will not be adversely affected therefore reducing impact on that source of livelihood. This is important as fish is the key source of protein for not only the area but also as general region. It is critical therefore that this impact is adequately mitigated to safeguard this protein source.

B. Encroachment on sensitive habitats

The project is located within the Tochi river flood plain. The proximity of the project close to this ecosystem could lead to indirect impact through encroachment of the area by community members who are not going to benefit from the project. Also, Bird & fish poisoning through application of pesticides in the farms might occur as an indirect impact of the project. Indiscriminate use of agrochemicals might have adverse impacts of the birdlife and other animals in the area.

Mitigation

- To prevent encroachment of the wetland areas, a buffer zone should be created around the the project boundary. The management of the project should also control unplanned outgowers that might develop when the project is in operation.
- However, this project does not anticipate use of aerial spraying which is more dangerous to bird life than localised application. The impact will be cumulative in nature as the region has other irrigation activities that use aerial spraying in the rice paddies grown.
- Farming technologies to be adopted during the operational phase of the project should be environmentally friendly.
- IPM technology should be applied in pest management instead of inorganic chemicals.
- No aerial spraying should be undertaken to control pests

C. Emergence of pests and diseases

Increased acreage of irrigated land will create a more humid environment that may result in an increase of agricultural pests and plant diseases. Change to a more uniform environment on the project areas will favour vigorous species adapted to a wide variety of conditions. Diseases and weeds may spread quickly via the re-use of waste-water and drainage water.

Mitigation

- To mitigate against emergence of pests and diseases an incorporation of integrated pest management approaches are proposed. These measures should involve rotational/mixed cropping practices which preserve greater diversity in habitat thus reducing impact of pest and diseases. At the farm level, the agronomist should discourage monocropping. Rice varieties used in this project should be selected from the ones already allowed in Uganda

D. Food security

The presences of Tochi Irrigation Scheme within the project area will attract potential project beneficiaries to want to grow rice. With higher income as compared to other subsistence crops, subsistence farming might be abandoned in favour for cash flow rice. This trend might affect the production of food crops leading to food insecurity in the project area. While the country agricultural strategy and poverty reduction strategy promote high value crops, subsistence crops still play important role in ensuring food security for the majority of the rural poor. This is an indirect impact that might affect the whole region (Acholi & Langi region), as has been felt in regions in Uganda (Recent food crisis in Karamoja, Teso, Lango, Acholi, Bukedi, West Nile, and Cattle Corridor districts of Nakasongala, Isingiro, Luweero, Apac and parts of Busoga – Nov 2016).

Mitigation

This impact can be mitigated by good land use planning that incorporates rice production and other food crops. Agricultural extension officers should be mobilized to advice farmers on the importance of diversifying crop production and good farm practices such as intercropping, rotational cropping and agro forestry. The project proponents should also embark on encouraging communities to diversify their staple diet so that they do not only rely on traditional food crops as their most important crop even when it has little economic returns. When rice is out of season, irrigation blocks can be cultivated with fast growing seasonal crops which would provide alternative foods for the communities in the area. This will ensure that within the project area there is food available for local consumption.

E. Aquatic fauna

Diversion of a section of the river will change flow characteristics from free-flow to static waters at the reservoir. At the reservoir, it is anticipated that stratification will occur, resulting in formation of oxygen limited hypolimnion. This reduces the vertical space available for fisheries habitation, which may lead to incidences of over predation if the fish are limited to living only in the Epi & Metalimnion. Fish such as catfish and some tilapine eggs which are buried in sediment may be flow into the channels and be lost in the fields. Additional negative impacts on fish could occur as a result of (i) changed hydrology of the wetlands, (ii) reduced flooded area, and (iii) pesticide runoff in drainage waters. The impact intensity is medium, and receptor sensitivity will be low, since the Tochi river has for over along time been turbid, and of low fish diversity.

Mitigations

- The reservoir will have an overhead flow, allowing for continuous flow of water, except at a reduced speed, though not slow enough to induce stratification;
- The scheme will maximize utilization of flood waters therefore drawing water from the main river will be minimized;

F. Movement obstruction due to canals

The creation of canals and feeder canals within the project area will obstruct movement within and without villages and homesteads and make it difficult for movement of people and goods as well as livestock. Impact intensity will be high given that most community members use the proposed area as access to the river and connection to other places. The receptor sensitivity is low however as alternative access is available.

Mitigation

The project design should ensure that existing transportation and communication routes as well as new appropriate ones are adequately covered using culvert. This will ensure that communities and families are not cut off from their friends and relatives. It is also ensure that populations in the area can access social amenities without difficulty. In public areas, culverts should be provided to ease access by people and livestock. In areas where canals and drains will pass near homesteads, culverts should be used.

G. Child labour

Females are normally charged with food production at household level while men normally engage in commercial aspects. Rice cultivation is a labour intensive activity most of the members of the households engage in rice cultivation. Results of the social survey suggest that most households have more people below the age of eighteen years living within their households which implies that majority of household members available for labour are school going and this could result in drop in school attendance as children may be required to provide labour in the scheme. This impact will be more so in poor households that cannot afford to employ additional labour.

Mitigation

- Application and strict enforcement of the compulsory primary education will help to reduce the impact. Also through creating awareness of the importance of education, the beneficiaries should help prevent the impact from occurring.
- The Ministry should educate the Irrigation Water Users to avoid use of children labour during school days, however this condition can be lifted during school holidays.
- The local administration (chiefs) should enforce of the policy on use of child labour at the project level.

H. Water Quality

Paddies store nutrients over long periods of time especially from the remnant grasses of rice after harvesting. These biodegrade and release nutrients into the water that eventually flows out of the scheme back to the Tochi river. There will be incidences therefore of water contamination from the paddies to the river which drains later into River Nile. The impact magnitude is high as there will be constant activities in the paddies year out and the receptor sensitivity is medium.

Mitigations

- Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season to reduce sediment/contaminant delivery to the river and eventually to the Nile;
- Desilting drainage channels supplying water to the paddies occasionally will remove nutrient rich sediments from the main water ways and returned back to the gardens.
- Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;
- When water quality criteria allow, storm water should be managed as a resource in holing lagoons, either for groundwater recharge or for meeting water needs at the site;
- Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory

requirements, in the absence of which disposal has to be consistent with protection of wildlife, aquatic ecology and public health;
- Water from the paddies should be channelled through a maintained section of wetland to remove impurities before discharge to the river;

I. Water Borne Diseases

Water retained in the field and canals will create a breeding environment for mosquitoes and snails. This situation will lead to increase in malaria cases and bilharzias. As shown in the figure 32, majority of the respondents involved in the study strongly agreed that poor sanitation is linked with health hazards. Predominance of malaria in the Tochi area is highest in children aged 0-5yrs therefore these are more likely to be susceptible from infection by mosquitoes breeding in the canals.

Mitigation

The control of the water-related diseases will be conducted in a number of ways, some of which are mutually reinforcing. The following measures are proposed to mitigate this impact.
- Measures aimed at the pathogens: immunization, prophylactic or curative drugs;
- Introduction of fish in the canals to destroy vector larvae;
- Undertaking health education, personal protection measures including mosquito nets and mosquito proofing of houses;
- Management of the irrigation infrastructure;
- Indoor Residual Spraying
- Only 8% of households in the Tochi area did not have toilet facilities at the time of survey. Therefore provision of farm toilets in the blocks will be crucial to alleviating water borne diseases.

J. Soil Erosion

During the operation phase there will not be significant impact on soil. However, proper and continuous maintenance is called for to prevent erosion from the steep areas or areas cultivated in the flood plain. The impact magnitude will be very low and the receptor sensitivity will be low, giving a minor impact severity.

Mitigations
- All the drainage paths that have been constructed will be maintained and de-silted on a regular basis;
- Native herb and grasses species will be encouraged to re-grow in previously cleared areas to help trap loose soils and prevent their progression downstream into the waterway or the river;
- Maintaining flood zones within the cultivated area helps with reduction of erosion.

K. Flooding

Constructed irrigation drainage and networks will increase the flow of water in the lowlands. This effect compounded by reduced vegetation will reduce holding capacities of the area, thus increasing flooding potential downstream. This is cumulative impact as the area experiences flooding occasionally. The construction of the weir will flood a large surface area upstream of the weir. During the high flows of

Tochi River in the second rainy season, floods will occur upstream of the weir and might submerge arable land on the banks of the River.

Mitigation

Most of the rivers and streams within the Nile River Basin catchment are prone to flooding. Flooding can only be controlled through reforestation of catchments, protection of river banks, and manmade structures such as dykes that will reduce the flow of water. There will also be need to strengthen Tochi river banks so as to minimize chances of the river breaking and spilling water into the project zone. The component on catchment and hillside management should promote catchment management especially upstream to control the intensity of the floods. The river banks of the channels leading the irrigated area should be protected to prevent water breaking the banks and flooding the fields. Flooding of the surface area of reservoir upstream should only be along the river course to avoid land inundation upstream. To avoid this, the weir should have overflow spillway.

L. Alteration of river flow

River diversion will reduce the water in the main river channel. This may lead to collapse of bank slopes due to decreased flow especially during the dry season. The effect is local and can be overcome to some extent by releasing compensation flow downstream.

Mitigations

- During the operational phase, technical staff will continuously monitor the slopes especially those at the banks of the river;
- Flood water will be maximized (stored) for usage to reduce stress on river water during the dry season
- Land clearing and slope stabilization activities should be conducted in their proper sequence and disturbed areas are to be suitably protected and maintained until permanent protection is established

M. Reduced flow downstream

Off-take of water for irrigation will result in reduced stream flows especially during the dry season. At Tochi, the Irrigation requirement (IR) for 1st season rice crop was 437 mm and it was 531 mm for 2nd season rice. For a project of 500 Ha therefore, the net irrigation requirement for irrigation of 500 ha at Tochi was found to be 4.84 MCM with the water availability taken in to consideration. These are the amounts of water that will be abstracted from R. Tochi to undertake growing of rice.

In calculation of Total water requirement 10 and 5% of Gross Irrigation Requirement was considered for drinking water and Industrial purposes besides Irrigation. The total water requirement for irrigation of an area of 500 ha was found to be 15.9MCMr. It is possible that in the dry season this water is only available to the scheme and not downstream communities that may have a challenge accessing water. The impact intensity is high given most communities depend directly on river waters and the receptor is high.

Mitigation

Two gates are proposed for head regulation (one for service, the other for emergency release) as part of the infrastructure to be developed. The gates will be used to control the amounts of water abstracted from the river thus allowing for management of water flow downstream. Introduction of water abstraction fee for the project beneficiaries will also discourage wastage and conserve water use.

N. Microclimate Modification

Loss of vegetation cover in those areas to be irrigated will lead to modification of the microclimate in the project area. The vegetation of phragmites and typha, for instance, favours water retention and regulates the temperature, thus creating a micro-climate favourable to the formation of organic soils. Therefore the loss of this vegetation will lead to loss of organic soils in the project areas. This impact is cumulative in nature as the project areas are already under intense grazing and exploitation with activities not directly related to activities of this project.

Mitigation

This impact is unavoidable and therefore a compensation strategy that enhances similar habitat is proposed. The parts of the project area downstream that will be remain after development of the irrigation infrastructure should be protected and conserved to provide the services. Also to recover the services of the microclimate, planting of trees should be undertaken to create that ambient climate similar to what was in existence before.

O. Siltation downstream

The source of water for this project is the River Tochi. It feeds into the Victorian Nile and in extension the Nile Basin hydrology. Already, siltation is of major concern among all major rivers feeding into the River. The main source of such siltation has been catchment activities that have resulted in poor soil management, deforestation and apparent soil loss. Irrigation on the Tochi River will contribute to siltation of the river mouth into River Nile, which may lead to increased flooding downstream.

Mitigation

To reduce siltation in the River, a catchment rehabilitation process should be up scaled to protect the soil from water runoff. There is need for integration of the Tochi scheme into a wider River Basin Catchment Management Plan to ensure protection of the catchment areas. This measure should be supported by creating buffer zones downstream of the area to trap the silt. Wider consultations and engagements should be sought by MWE to improve catchment management in the entire basin.

P. Climate change impacts to the scheme

Climate change effects especially extreme droughts may compromise the ability of the River to function as a system including social support services like irrigation and water supply. During extreme drought the availability of water for ensuring environmental flows and supporting the irrigation scheme may be a problem and a cause of concern.

Mitigation

As discussed in the environmental flow section, in times of low flows as a result of drought, the maintenance of the Rivers ecological balance remains paramount and as such restrictions on water usage especially for irrigation will be imposed i.e. irrigation will be halted an issue that may cause tension with the local communities who are beneficiaries and for that matter rigorous awareness creation will be required.

Q. Water and Sanitation impacts

The return flow from the irrigation paddies will have impact on human health for those villages downstream that use the flood water for domestic uses. This is because the return flows will likely to have significant quantities of pollutants from agrochemicals. This is a cumulative impact as the water from the River is already contaminated upstream and may be unfit for human consumption. This impact is low given the existing water quality currently and the receptor sensitivity is high since communities downstream may depend on this return water for domestic purposes.

Mitigation

MWE in consultation with the local community should provide domestic sources of water during the planning phase of the project. Within every block, there should be provision of safe water supply. The return water flow should pass through buffer zones to enable filtration of agrochemical pollutants to a degree that is fit for domestic use (according to UNBS Standards 2008) or near the level as required by World Health Organization (WHO) standards.

R. Noise & Vibration

Sound from the project operations could include the chatter of farmers as they go about planting, harvesting, maintenance, and the noise from the occasional vehicle from the funders and consultants during monitoring and auditing. The Impact intensity will be very low and the receptor sensitivity is low.

Mitigations

- No vibration is expected at this stage, therefore no mitigation has been offered,

S. Traffic

It is not anticipated that traffic will increase or be a nuisance during the operation of the rice scheme. The vehicle requirement in and out of the area may be high during harvesting as trucks will be required to ferry rice to the market areas, however this is not expected to be high or significant.

Mitigations

- Developer will reduce the required number of trips to and fro the site to only necessary incidences requiring transportation of project staff and the occasional maintenance workers;
- The Project drivers will abide by the speed limits set forth by the UNRA for all vehicle access to the area;
- The developer will orient visitors to the Irrigation scheme so that safety road rules are followed in close coordination by project staff

T. Occupational Health and Safety

Accidents arising from working in soggy areas may arise. There is a high likely hood of emergence of vector borne diseases like malaria and other water related illnesses. Workers scheduled to work within the paddies or those engaged in maintenance on the exterior will be exposed to flooded areas. There is a likely hood of children/animals falling into the flooded area of the paddy. The impact intensity in this case will be evaluated using a probability of occurrence as accidents are a result of unplanned activities.

Mitigations

- Workers in the paddies will be instructed on how to respond to emergencies and situations of near drowning or drowning.
- Workers will be trained on the recognition and prevention of hazards specifically applicable to work in remote areas, and in areas with dangerous wild animals like snakes; Working in groups gives safety in numbers, since the area harbors known dangerous wild animals
- Swimming as a pre-requisite for working across river/stream sections will be needed and where lack of the skill is observed, training will be undertaken;
- For the case of diseases like malaria, the project will put in place strategies to control the disease through issuance of mosquito nets and education on their usage. The developer will have a clinic stationed at the worksite to address any illness. There will also be an emergency evacuation plan to remove any injured worker from the field for urgent treatment;
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites.
- Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs.

All components of the workers' camps, including accommodations, sanitation facilities, water supply and other infrastructure, recreation facilities, kitchens and dining areas, and medical facilities, will need to adhere to and be maintained at internationally accepted health and safety standards.

8.5 DE-COMMISSIONING PHASE

On completion of construction, the reservoir, channels, paddies will need to be safely and securely removed and the areas stabilized to minimize risks of release to the environment of toxic or polluting materials, All disturbed sites which are no longer being used will need to be rehabilitated and revegetated.
During the removal of debris, there will be adverse impacts if the materials such as scrap iron, glass, polythene materials, planks, The concrete layers (cemented/concreted floors/areas of temporary structures and access roads) should be removed; the materials should be safely disposed off at sites previously agreed upon with NEMA. Transport of both salvaged materials and disposable materials will increase vehicular traffic, noise and disturbances to the communities along the main access roads. The impacts are of very temporary in nature and precautions or mitigations suggested earlier in the impacts discussion should be enforced to minimize such disturbance further.

The following are the foreseeable impacts, who management should take a precautionary term, referring to the mitigations/recommendations suggested in this section:

- Soil, erosion impacts caused by demolition of reservoir structures and debris removal.
- Noise and vibration on structure demolition
- Flooding of downstream areas due to reservoir removal • Damages to access roads from vehicles with heavy loading.
- Aesthetic impacts on debris amassing and denudation of the structure environment

A summary of anticipated impacts and mitigation measures are presented in Table 40

8.6 POTENTIAL CUMULATIVE IMPACTS

The proposed irrigation scheme and other interventions planned do not have significant irreversible impacts. Hence, the project interventions are unlikely to contribute to cumulative impacts in the project area. However, to avoid/mitigate possible cumulative impacts (particularly likely for deforestation, and surface water depletion), all negative impacts will be addressed in the site-specific EIAs and ESMPs to be developed during the design and implementation stages of the project. The project will contribute to long-term environmental positive impacts in the project areas including:

- Improved land conditions due to improved land management from sustainable land management activities promoted through the project to reduce land degradation and improve soil fertility; and
- Enhanced soil and water conservation measures and activities as well as improved watershed management programmes whose net impact will be improved soil and water conditions.

8.7 CLIMATE CHANGE RISKS, MITIGATION AND ADAPTATION

According to the Bank's Climate Safeguard Screening System, the project was assessed as Category 2 indicating that the project may be vulnerable to climate risk and will require the integration of practical risk management and adaptation options into the project design and implementation plans in order to increase the resilience of the project infrastructure and beneficiaries to withstand the impacts of climate change. Uganda's agriculture based economy makes it highly vulnerable to the risks of climate variability and change, particularly given the high proportion of the country's population dependent on rain-fed agriculture. Climatic impacts in Uganda have been linked with more frequent and longer lasting droughts and flood events, which prevent farmers from engaging in all year round farming activities. In the last century, the frequency and intensity of extreme climatic events has been on the rise. The Uganda's National Adaptation Programme of Action (NAPA) noted an average temperature increase of 0.28°C per decade in the country, with the months of January and February most affected by this warming trend, averaging an increase of 0.37°C per decade.

Any future climate change may have relatively strong impacts on the hydrology of the region and agricultural/irrigation activities. Rainfall has also decreased and become more unreliable and less evenly distributed. Recent years have seen erratic arrivals and endings of rainfall seasons, and individual rainfalls have been heavier and more violent. Floods and landslides are on the rise and are increasing in intensity.

This proposed initiative by design is a strategic response to the impact of climate change in the vulnerable project area evidenced by land degradation, dry spells and floods. Under Component 2 of the project, catchment management activities including integrated soil and water conservation and

sustainable forest management activities will be implemented to control land degradation and flood impacts, and thereby contribute to reduced climate change vulnerability of the community and the irrigation infrastructures. Specifically, the proposed activities under this component will seek to improve and restore vegetation cover in the catchment area to sustain water quality and quantity for agriculture irrigation and other uses.

Table 40: Summary of anticipated impacts and Mitigation Measures

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
Pre-Construction											
Land	Loss of Land	Reservoir construction and farm set up	Flood plain				• Siting of the road and support facilities (Construction Camps) to avoid critical terrestrial and aquatic habitat (e.g. thick wooded grassland the riverine forests, wetlands, and fish spawning habitat in the wetlands); • Conflicting interests in the flood plain will be settled at Village level to allow for farmers be able to access this area for rice growing and grazers opportunity for pastures in areas adjacent the Tocchi scheme; • Provide alternative grazing grounds for the cattle keepers which should have access to water and doesn't prolong the distance originally covered by the herders • Farmers should be given protection so that in case of clashes, these are not harmed, nor agriculture impacted • Government security forces should be on call at all times in the event of a clash between local groups • Sensitization should be undertaken to inform stakeholders of the benefits of agriculture and demonstrations given on integrated agricultural practices (farming and cattle keeping) existing in the same place at the same time • Provide watering grounds for cattle on the outskirts of the scheme. Access to the water for domestic animals should be ensured at all times to reduce conflict over water resources • Cattle keepers should be given alternative grazing grounds to make way for rice paddies in the areas. • In keeping with the Resettlement action plan, any land with dense population infrastructure will be excluded from the command area of the scheme				Mitigations will reduce impact to moderate levels. Precaution is to be taken to ensure any unforeseen issues are addressed as and when they arise. Impact intensity is reduced to moderate ranking, therefore post-assessment monitoring as prescribed in the EMMP is essential to ensure that mitigations achieve the desired results.
Ambient environment	Noise of activities involving heavy machinery use during clearing, grading	• Cutting and land excavation • Equipment mobilization	• Neighbouring communities • Route communities • Workers camps				• Undertake a comprehensive resettlement action plan detailing how many cattle keepers are dependant on that parcel; how many farmers stand to benefit and carry out a cost-benefit analysis;				Impact intensity is reduced to minor ranking, therefore post-assessment monitoring as prescribed in the EMMP is essential to ensure that mitigations achieve the desired results.

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
Pre-Construction											
			•				• Access to the water for domestic animals should be ensured at all times to reduce conflict over water resources • Cattle keepers should be given alternative grazing grounds to make way for rice paddies in the area				

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)		Impact Area	Impact Significance			Proposed Mitigation Measures		Imp Signif
					Minor	Moderate	Major			Minor
Construction Phase Biophysical Impacts										
Landuse Change	Change of landuse from grassland & farming to Irrigated farmland	• Start up of the scheme	•	The Tochi irrigation area				•	This impact is unavoidable and can be compensated through allocating those who will be displaced from their grazing gorunds other areas to feed their animals. There is a need also for the conservation of natural habitats downstream.	
								•	To enable sustainable land use in the project areas, an integrated land use plan should be developed within the catchments based on the three tier approach that considers wider Tochi catchment, middle grounds and the lower areas (project area)	
Air quality	Increased emissions from vehicles	• Mobile vehicle engines (emissions)	•	Construction area				•	All vehicles will be instructed to switch off engines on arrival at site. More pollutants are released during idling as compared to a vehicle in active movement;	
			•	Neighboring communities to access route						
								•	All trucks delivering materials to the site will be maintained in good working order as inefficient fuel combustion is key in the release of NO2, SOx CO, and NO from vehicle exhausts;	
								•	Vehicle drivers will be encouraged switch engines off when not in use because an idling truck releases more emissions than one in active movement;	
								•	The project will employ community members using hand held tools to reduce on the need for excavators or heavy equipment that release fumes	

Conflict over resources	Conversion of grazing areas to farmland	• Limiting grazers from access to pasture	•	Tochi reservoir and command area				•	To prevent conflict between irrigation farming and livestock keeping, extension services on improved livestock keeping that is more intensive than extensive should be promoted. Practises such as keeping fewer but better breeds that are of more economic benefit should be promoted. In addition, practices such as zero grazing should be introduced to reduce land requirement for livestock keeping.		
								•	Water resources should be extended to livestock		

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Imp Signif
				Minor	Moderate	Major		Minor
							areas; • All loads/materials entering and leaving site to be covered to prevent windblown dust along the route to and fro the site; • Land clearing, removal of topsoil and excess materials, tips and stock piles, will be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) as well as the locations of sensitive receptors; • Workers engaged in activities likely to raise dust will wear dust masks at all times during this phase; • Areas near exposed surfaces of stockpiled materials should be vegetated.	
Archeology	Destruction of archeological/ cultural sites	• Excavations forConstruction of reservoir drainage channels and access road	• Excavation sites around the flood plain				• Where the proponent has encountered tangible cultural heritage that is replicable and not critical, the personnel will apply mitigation measures that favor avoidance; • Minimize adverse impacts and implement restoration measures, in situ, that ensure maintenance of the value and functionality of the cultural heritage, including maintaining or restoring any ecosystem processes needed to support it; • Where restoration in situ is not possible, restore the functionality of the cultural heritage, in a different location, including the ecosystem processes needed to support it; • Where the project site contains cultural heritage or prevents access to previously accessible cultural heritage sites being used by, or that have been used by, Affected Communities within living memory for long-standing cultural purposes, the developer will, based on consultations allow continued access to the cultural site or will provide an alternative access route, subject to overriding health, safety, and security considerations; • Where an encounter has been made with artefacts, the developer will ensure that the project	

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Imp Signif
				Minor	Moderate	Major		Minor
							• Mulching using vegetation previously cleared from the areas will be used to stabilize exposed places; • Any spoils (Boulders) in the reservoir area will be used for the backfilling of the weir	

Water	Surface Water contamination	• Accidental petrol/diesel spills • Soil erosion • Domestic waste from workers	River Wadelai Streams Neighboring the construction or transit site				• Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season to reduce sediment/contaminant delivery to the river which could end eventually to the Nile; • Application of appropriate construction practices and creating awareness among the community of the need to maintain high water quality; • All project vehicles scheduled to work near water resources will be cleaned prior to use (during the dredging activities); • Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination; • When water quality criteria allow, storm water should be managed as a resource in holing lagoons, either for groundwater recharge or for meeting water needs at the site; • Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of aquatic ecology and public health; • Maintenance of vegetative buffer between the water and construction works to help trap loose sediments and or materials will be considered		
	Groundwater contamination	• Leaching from waste storage areas •	Below ground aquifers				• Waste collection points for workers at the construction site will be located out of the high water table sections of the area; • All waste areas will be bunded during temporary storage to prevent pollutant leaching to below ground water resources	-	
Hydrology	Flow alteration	• Reservoir •	Tochi river				• The distance between reservoir and flow-back •		

Environmental Component	Nature of Impact	Concerned Activities (that would cause Signifi impacts)	Impact Area Significance	Impact			Proposed Mitigation Measures	Imp
				Minor	Moderate	Major		Minor
	vegetation/flora loss due to earth works during land clearances. Hence subsequent loss of carbon sinks-being that vegetation is vital for carbon absorption	excavations along the water spread reeservoir, drainage channels, dam area	surroundings of the water spread reeservoir, drainage channels, dam area, and along the River banks,				in as far as is practical. Where necessary, community members will be encouraged to translocate the saplings and vegetate areas where trees are scares. • Vegetation translocation and relocation techniques will be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement; • During extraction, ecological niches should be preserved and protected as far as possible	

	Submerging of vegetation results into deaths of plants with subsequent decomposition and eutrophication of the rivers, particularly with Phosphorus & Nitrogen which accelerate growths of photo autographicorganisms (cynobacteria). The cynobacteria synthezise a wide range of odours & noxious compounds such as hepatotoxins, microcystin, cylindrospermopsin, nodularins. Occurrence of such toxins is harmful to both aquatic & human life through use of contaminated water.	• As a result of floodings due to construction works along the water spread reservoir, drainage channels & dam area	Vegetation at the peripheral of the water spread reservoir, drainage channels, dam area and river banks				• Avoid occurrences of eutrophication through routine evacuation of submerged vegetations/ clearances of such vegetations where submerging is envisaged to happen in the course of dam construction and its operations. Also a monitoring programme to check any occurrences of cynobacteria and their levels and subsequent impacts should be devised.	
	Eutrophication can impact negatively on oxygen concentrations in the river as a result of	• Decomposition of submerged vegetation Sedimentation	• Vegetation at the peripheral of the water spread reservoir, drainage				• Avoid occurrences of eutrophication in the rivers through routine evacuation of submerged vegetations. Also avoid occurrences of erosion/ siltation into	

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Imp Signif
				Minor	Moderate	Major		Minor
		of submerged vegetation • Sedimentation as a result of localized erosion/ siltation that may arise from vegetation clearances	spread reservoir, dam and along canal sections adjacent to the latter				• river/wetlands; All facilities will be located outside of known/established animal corridors to prevent • animal disorientation; Known animal foraging areas should be left intact to enable grazing at the same time construction of • the irrigation scheme; Sediment traps should be placed at the end of the drainage channel before runoff is re-directed into the river	
	Involuntary migration of small mammals	• Disturbance due to noise as a result of human presence and vegetation clearances	• Southwards of the project command area that had presence of mammals				• Restrict vegetation clearances within project footprint • Awareness creation on wildlife value among adjacent communities •	
	Injury to fauna	• During construction of the Water spread reservoir and dam	Reservoir area, driainage channels & the dam				• The construction will be timed during the dry period so that runoff doesnot flood the excavated sections to transport sediments downstream into the main river; • Incase any fish are caught in the excavated sections for the reservoir facilities, they will be removed and put back into the main river to prevent injury	

Traffic	Increased vehicular traffic enroute to site	• Material, equipment haulage, • Workers transportation	Access route				• In the case that there is an overlap of public and project vehicles, the developer will be charged with controlling vehicle traffic through the use of one - way traffic routes if needed, and on- site trained flag- people wearing high- visibility vests or outer clothing covering to direct traffic; • Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle;	

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Imp Signif
				Minor	Moderate	Major		Minor
							incidences of noise increment will be avoided.	
Occupational Health and Safety	Injuries from accidents	• Heavy machinery handling • Slips and falls • Drowning, • Hazardous materials	• Workers • Community members				• Because of the remoteness of the site location, any human fecal material waste produced will be contained in temporary sealed septic tanks before collection by licensed waste collection agency and disposed at NEMA approved facilities; • Only highly skilled workers will be allowed to operate heavy machinery (cranes, excavators, graders) and heavy trucks (Tipper trucks); • Any large excavated pits will be guarded to prevent falling into the pit by community members/Children/animals; • Worksites especially those posing a greater danger to humans/animals will have limited access (i.e. excavation areas, worksites with heavy vehicular movement); • Planning work site layout to minimize the need for manual transfer of heavy loads. This reduces over exertion of project workers; • It will be necessary for the project team to ensure that proper working equipment and attire are provided during the construction phase to minimize chances and incidences of death or injury. Similarly, proper warning signage should be appropriately erected especially where there are heavy machines and equipment moving or around excavated areas so as to forewarn any nearby persons of the dangers eminent. Intensive awareness programmes before and during the construction periods on public safety should be undertaken to reduce the chances of this impact manifesting • Job rotations and rest or stretch breaks; • Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths •	

Environmental Component	Nature of Impact	Concerned Activities (that would cause	Impact Area Significance	Signifi impacts)	Minor	Moderate	Major	Proposed Mitigation Measures	Imp Minor
		neighboring areas						• when on company assignments in the villages and prevent risky interactions with community members. • There are no measures for preventing population influx into the project areas. However MoWE and community leaders in these respective areas should control settlement in fragile areas including wetlands and steep hills through existing legislations such as the The National Environment (Wetlands, River Banks And Lake Shores Management) Regulations, No. 3/2000. • Another measure to manage influx is through provision of social infrastructure including water and sanitation facilities. Sanitation facilities are particularly critical in the paddy areas as lack of them will result in deteriorated water quality. During construction phase of the project, the contractors should have employment policy which gives preference to the local people. By employing the locals, this would discourage population influx to the area • The developer will keep in close communication with women and youth groups to monitor any changes in social structure and communication with local leaders to monitor any changes in population. • also be considered as it is culturally	

Culture	Disruption of cultural norms and practice	Disrespecting cultural practices, Disregard of cultural norms by project	Project area (Tochi area, Gulu District)				• Any foreign project workers will be informed on cultural norms of the local communities before encounter, to avoid conflicts with communities; • Local authorities shall need to be strengthened in order to deal with the increased cases of indiscipline brought about by the increased population influx, and any disputes that are likely to ensue; • Gender issues will be considered during the hiring process to ensure equality in income provisions; Continous provision of water from the river will	

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Imp Signif
				Minor	Moderate	Major		Minor
Aesthetics	Loss of aesthetic quality	Change in landuse from grazing to rice paddy Ground disturbance and vegetation removal	River Wadelai				• The entire process will take into consideration the preferred land-use proposed by communities and government initiative; • Access to excavation areas will be closed off to all but construction crew to prevent accidents like falls, or exposure to unsightly conditions within the area; • Conflicting landuse should be integrated in the overall management of the flood plain so that grazers and rice farmers' views are given due respect;	

Table 41: Summary of Potential impacts and mitigations arising from Operation Phase

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			
				Minor	Moderate	Major		Minor	Moderate	Major	
Operations											
Livelihood	Loss of livelihood	Increased acreage of irrigated land Vs Grazing pastures	Entire Tochi Scheme				• Where it occurs, displaced people should be compensated and given alternative areas for cultivation to cushion them against shocks such as hunger. • The new areas should be developed for them or they should be integrated into the projects associations as they become projects beneficiaries and not losers. • Proper management of resources (soil and water) will ensure that aspects such as fisheries will not be adversely affected therefore reducing impact on that source of livelihood.				Pe
											do ori e
							• Maintaining flood zones within the cultivated area protection of the catchment areas. This measure imp				
Disease	Pests and	environment due to									

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance		
								Minor	Moderate	Major
Sensitive habitats	Encroachment of sensitive habitats	Settlments/farming activities	Margins along the river/wetlands				• To prevent encroachment of the wetland areas, a buffer zone should be created around the the project boundary. The management of the project should also control unplanned outgowers that might develop when the project is in operation. • However, this project does not anticipate use of aerial spraying which is more dangerous to bird life than localised application. The impact will be cumulative in nature as the region has other irrigation activities that use aerial spraying in the rice paddies grown. • Farming technologies to be adopted during the operational phase of the project should be environmentally friendly. • IPM technology should be applied in pest management instead of inorganic chemicals. No aerial spraying should be undertaken to control pests			
Pests and	Emergence of	Creation of humid	Irrigated areas				• To mitigate against emergence of pests and			

Minor	Moderate	Major	Co
			Co
			Co

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance	Minor	Moderate	Major	Proposed Mitigation Measures	Impact Significance	Minor	Moderate	Major
								collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements in the absence of which disposal has to be consistent with protection of wildlife, aquatic ecology and public health; • Water from the paddies should be channeled through a constructed wetland to remove impurities before discharge to the environment. such as intercropping, rotational cropping ... forestry. The project should also ... encourage communities to diversify their diet so that they do not rely only on traditional crops as their most important crop even when ... little economic returns. When rice is out of season, irrigation blocks can be cultivated with fast ... seasonal crops which would provide alternative ... for the communities in the area. This will ensure that within the project area there is food available for local consumption				
Water Borne Diseases	Water Borne diseases	• Stagnant water	• Canals • Reservoir					The control of the water-related diseases will be conducted in a number of ways, some of which are mutually reinforcing. The following measures are proposed to mitigate this impact. • Measures aimed at the pathogens: immunization, prophylactic or curative drugs; • Introduction of fish in the canals to destroy vector larvae; • Undertaking health education, personal protection measures including mosquito nets and mosquito proofing of houses; • Management of the irrigation infrastructure; • Indoor Residual Spraying • Only 8% of households in the Tochi area did not have toilet facilities at the time of survey. Therefore provision of farm toilets in the blocks will be crucial to alleviating water borne diseases.				
Aquatic fauna	Impact on fisheries	Temporary damming of the river at the reservoir	Reservoir					• The reservoir will have an overhead flow, allowing for continuous flow of water, except at a reduced speed, though not slow enough to induce stratification; • The scheme will maximize utilization of flood waters therefore drawing water from the main river will be minimized ;				Pe

Environmental Component	Nature of Impact	Concerned Activities (that would cause Significance impacts)	Impact Area	Impact			Proposed Mitigation Measures	Impact			
				Minor	Moderate	Major		Minor	Moderate	Major	
Soil	Movement in the area	Erosion • Obstruction due to canals • Loss of soil from paddies /drainage channels	• Dredging and having Irrigated a • Irrigated area open canals				• All the drainage paths that have been constructed will be maintained and desilted on a regular basis; • Native herb and grass species will be encouraged to re-grow in previously cleared areas to help trap loose soils and prevent their progression downstream into the waterway or the river; • The project design should ensure that existing transportation and communication routes as well as new appropriate ones are adequately covered using culvert. This will ensure that communities and families are not cut off from their friends and relatives. It is also ensure that populations in the area can access social amenities without difficulty. In public areas, culverts	-	-	-	Co loc
							impact from building area should be protected to prevent water breaking the banks and flooding the fields. Flooding of the surface area of reservoir upstream should only be along the river course to avoid land inundation upstream. To avoid this, the weir should have overflow spillway • The Ministry should educate the Irrigation W to avoid use of children labour during schoo	ers			
Hydrology	Alteration of river flow	• River diversion	• Upstream and midstream from the intake				• During the operational phase, technical staff will continuously monitor the slopes especially those at the banks of the river; • Flood water will be maximized (stored) for usage to reduce stress on river water during the dry season • Land clearing and slope stabilization activities should be conducted in their proper sequence and disturbed areas are to be suitably protected and maintained until permanent protection is established;	-	-	-	

	Reduced flow downstream	• Off take of water for irrigation	• River Tochi				• Two gates are proposed for head regulation (one for service, the other for emergency release) as part of the infrastructure to be developed. The gates will be used to control the amounts of water abstracted from the river thus allowing for management of water flow downstream. Introduction of water abstraction fee for the project beneficiaries will also discourage wastage and conserve water use	-	-	-	
Micro Climate	Climate modification	• Vegetation loss	Reservoir & irrigated plots				• This impact is unavoidable and therefore a compensation strategy that enhances similar habitat is proposed. The parts of the project area downstream that will be remain after development of the irrigation infrastructure should be protected and conserved to provide the services. Also to recover the services of the microclimate, planting of trees should be undertaken to create that ambient climate similar to what was in existence before	-	-	-	
Siltation downstream	Siltation downstream	• Soil disturbance	Downstream the irrigated area				• To reduce siltation in the River, a catchment rehabilitation process should be up scaled to protect the soil from water runoff. There is need for integration of the Tochi scheme into a wider River Basin Catchment Management Plan to ensure				
Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			
				Minor	Moderate	Major		Minor	Moderate	Major	

sanitation	health	the paddies	downstream					should provide domestic sources of water during the planning phase of the project. Within every block, there should be provision of safe water supply. The return water flow should pass through buffer zones to enable filtration of agrochemical pollutants to a degree that is fit for domestic use (according to UNBS Standards 2008) or near the level as required by World Health Organization (WHO) standards				
Traffic	Vehicle access to the site	• Farming in the paddies	Flood plain					• Developer will reduce the required number of trips to and fro the site to only necessary incidences requiring transportation of project staff and the occasional maintenance workers; • The Project drivers will abide by the speed limits set forth by the UNRA for all vehicle access to the area; • The developer will orient visitors to the scheme so that safety road rules are followed in close coordination by project staff;	-	-	-	

Occupational health and safety	Injuries from accidents on site,	• Farming in the paddies	Flood plain				• Workers in the paddies will be instructed on how to respond to emergencies and situations of near drowning or drowning. • Workers will be trained on the recognition and prevention of hazards specifically applicable to work in remote areas, and in areas with dangerous wild animals like snakes; Working in groups gives safety in numbers, since the area harbors known dangerous wild animals • Swimming as a pre-requisite for working across river/stream sections will be needed and where lack of the skill is observed, training will be undertaken; • For the case of diseases like malaria, the project will put in place strategies to control the disease through issuance of mosquito nets and education on their usage. The developer will have a clinic stationed at the worksite to address any illness. There will also be an emergency evacuation plan to remove any injured worker from the field for urgent treatment;				P

8.8 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

Environmental monitoring will be carried out at three levels.

1. Daily or regular monitoring of activities and conditions in construction and operation by the project developer. For all preconstruction activities and during construction and operations, the Developer, Contractor, and Subcontractors will monitor their activities on a regular basis. For all their work, the Developer, Contractor, and Subcontractors are to monitor for potential adverse impacts, including but not limited to those that have been identified by the EIA of this project, and they are to comply fully with all standards and safeguards. This may necessitate a full time environmental and health and safety personnel engaged and funded by the developer to oversee the activities of the developer and propose adequate mitigations in line with.
2. Periodic (sometimes unscheduled) monitoring of impacts and of compliance by government organizations established for the MWE/Department of Water Resource Management (DWRM), MAAIF, NEMA and the Environmental Management Office under the Developer's Environmental and Social Department.
3. Occasional monitoring of impacts and of compliance by a third party external monitor.An external monitor will be engaged and funded by the Developer, to conduct annual reviews of the effectiveness of the environmental measures carried out by the project. The external monitor should have international experience in environmental auditing and monitoring. The external monitor should be engaged throughout the construction phase and for the first years of operations phase (at a much reduced level reflecting the significantly fewer environmental impacts during this phase), until the hydrological and water quality have stabilized.

A monitoring plan is presented below:

Table 42: Monitoring Activities and Criteria

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Pre-construction							
Land Loss	Siting of the road and support facilities (Construction Camps) to avoid critical terrestrial and aquatic habitat (e.g. thick wooded grassland the riverine forests, wetlands, and fish spawning habitat in the wetlands);	ESIA Document, this report, Land Act Cap 227, 1998	Visual observation Design documentation Stakeholder engagement	√	√	√	Before onset of construction activities
	Conflicting interests in the flood plain will be settled at Village level to allow for farmers be able to access this area for rice growing and grazers opportunity for pastures in areas adjacent the Tocchi scheme						
	Provide alternative grazing grounds for the cattle keepers which should have access to water and doesn't prolong the distance originally covered by the herders						
	Farmers should be given protection so that in case of clashes, these are not harmed, nor agriculture impacted	ESIA Document, this report, Land Act Cap 227, 1998	Periodic monitoring of security				

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Pre-construction							
	Government security forces should be on call at all times in the event of a clash between local groups		Periodical monitoring of security in the area	√	√	√	
	Sensitization should be undertaken to inform stakeholders of the benefits of agriculture and demonstrations given on integrated agricultural practices (farming and cattle keeping) existing in the same place at the same time	ESIA Document, this report, Land Act Cap 227, 1998	Visual observation	√	√	√	
	Provide watering grounds for cattle on the outskirts of the scheme. Access to the water for domestic animals should be ensured at all times to reduce conflict over water resources		How many cattle keepers are resettled and where	√			
	Access to the water for domestic animals should be ensured at all times to reduce conflict over water resources		Visual observation	√	√		
	Cattle keepers should be given alternative grazing grounds to make way for rice paddies in the area		Visual observation		√		

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	In keeping with the Resettlement action plan, any land with dense population infrastructure will be excluded from the command area of the scheme		Stakeholder engagement	√	√		Before onset of construction activities
Noise & Vibration	Undertake a comprehensive resettlement action plan detailing how many cattle keepers are dependant on that parcel; how many farmers stand to benefit and carry out a costbenefit analysis;	The National Environment (Noise Standards and Control) Regulations, 2003, EMMP, this report	Report on the land rights in the area	√	√		Monthly
	Access to the water for domestic animals should be ensured at all times to reduce conflict over water resources		Visual Observation, Reports on wrangles due to access to water	√	√		Monthly
	Cattle keepers should be given alternative grazing grounds to make way for rice paddies in the area		Alternative site for grazing	√		√	Monthly checks

Construction Phase

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Change of landuse from grassland & farming to Irrigated farmland	This impact is unavoidable and can be compensated through allocating those who will be displaced from their grazing grounds other areas to feed their animals. There is a need also for the conservation of natural habitats downstream. To enable sustainable land use in the project areas, an integrated land use plan should be developed within the catchments based on the three tier approach that considers wider Tochi catchment, middle grounds and the lower areas (project area)	ESIA Document, this report, Land Act Cap 227, 1998	Periodic monitoring of security		√	√	Biannual monitoring
Air Quality (Gaseous Emissions)	All vehicles will be instructed to switch off engines on arrival at site. More pollutants are released during idling as compared to a vehicle in active movement;	EMMP, this report,	Visual observation,	√	√		Bi Monthly reports to be audited monthly
	All trucks delivering materials to the site will be maintained in good working order as inefficient fuel combustion is key in the release of NO2, SOx CO, and NO from vehicle exhausts;	EMMP, this report	Observation and vehicle maintenance reports	√	√	√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Air Quality (Gaseous Emissions	Vehicle drivers will be encouraged switch engines off when not in use because an idling truck releases more emissions than one in active movement;		Regular inspections and checks on service lists Visual observation of community activity in the project area	√	√		
	The project will employ community members using hand held tools to reduce on the need for excavators or heavy equipment that release fumes			√	√		
Conflict over resources	To prevent conflict between irrigation farming and livestock keeping, extension services on improved livestock keeping that is more intensive than extensive should be promoted. Practises such as keeping fewer but better breeds that are of more economic benefit should be promoted. In addition, practices such as zero grazing should be introduced to reduce land requirement for livestock keeping.	ESIA Document, this report, Land Act Cap 227, 1998	Periodic monitoring of security		√	√	Biannual monitoring
	Water resources should be extended to livestock keepers that want to maintain the freerange grazers. Troughs extending water on the outskirts of the irrigated section should be constantly flooded with water to provide for watering animals						

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Air quality (dust)	No bonfires for waste will be encouraged in the project area, as this causes dust raising situations;	EMMP, this report	Daily Visual inspections, by staff EHS supervisor, Environmental documentation Daily visual observations by Staff EHS personnel	√	√	√	As required
	Dust generating activities will be minimized especially on windy days to prevent dust raising in the area;			√		√	
	Water will be used as dust suppressant where applicable to subdue any dry particles from becoming airborne during windy days in the dry period;			√	√	√	Daily throughout construction phase
	Cover excavated soils especially on windy days to reduce dust exposure to workers and neighboring areas;			√	√		Daily
	All loads/materials entering and leaving site to be covered to prevent windblown dust along the route to and fro the site;			√	√	√	Daily
	Land clearing, removal of topsoil and excess materials, tips and stock piles, will be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) as well as the locations of sensitive receptors;			√	√		Daily. As required during windy dry days

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Workers engaged in activities likely to raise dust will wear dust masks at all times during this phase				√		During excavations
	Areas near exposed surfaces of stockpiled materials should be vegetated.			√	√		After construction
Archeology	Where the proponent has encountered tangible cultural heritage that is replicable and not critical, the personnel will apply mitigation measures that favor avoidance; Minimize adverse impacts and implement restoration measures, in situ, that ensure maintenance of the value and functionality of the cultural heritage, including maintaining or restoring any ecosystem processes needed to support it;	EMMP this report	Visual observation, Collection of artefacts	√		√	As required
	Where restoration in situ is not possible, restore the functionality of the cultural heritage, in a different location, including the ecosystem processes needed to support it;		Visual observation		√	√	As required

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Archaeology	Where an encounter has been made with artefacts, the developer will ensure that the project personnel doesnot disturb any chance find until further assessment by competent professionals has been made and the find has been rendered replicable in another area or be preserved in its current state;	EMMP this report	Visual observation		√	√	As required
Soil erosion	Project activities will be scheduled to avoid heavy rainfall periods (i.e. more activities during the dry season) to the extent practical;	EMMP, this report	Visual observation, design documentation	√	√		Monthly
	The developer will encourage contouring and minimizing length and steepness of slopes to reduce erodibility;		Design documentation		√		
	Mulching using vegetation previously cleared from the areas will be used to stabilize exposed places;		Visual observation		√		Weekly
	Any spoils (Boulders) in the reservoir area will be used for the backfilling of the weir		Visual Observation	√	√		As required

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Surface water contamination	Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season to reduce sediment/contaminant delivery to the river and eventually to the Nile;	EMMP, this report	Visual check of activity schedule		√		Dry season
	Application of appropriate construction practices and creating awareness among the community of the need to maintain high water quality;	EMMP, this report	Vehicle service sheet checks	√	√		As required
	All project vehicles scheduled to work near water resources will be cleaned prior to use (during the dredging activities);	EMMP, this report	Visual observation, Species used are suitable		√		As required
	Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;	EMMP, this report	Absence of pollution indicators in dredged areas		√		As needed
	When water quality criteria allow, storm water should be managed as a resource in holing	EMMP, this report	Presence of Pollution indicators				Rainy season
	lagoons, either for groundwater recharge or for meeting water needs at the site;				√		
	Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which						

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	disposal has to be consistent with protection of wildlife, aquatic ecology and public health;						
Surface water contamination	Maintenance of vegetative buffer between the water and construction works to help trap loose sediments and or materials;			√	√		
Ground water contamination	Waste collection points for workers at the construction site will be located out of the high water table sections of the area;	EMMP, this report	Pollution indicators in monitoring wells at site	√	√	√	Monthly or during rainy season when ground water table rises
	All waste areas will be bunded during temporary storage to prevent pollutant leaching to below ground water resources	EMMP, this report	Visual inspection of the bunding material	√	√		
Loss of vegetation	Areas of important Albizia coriaria will be left intact in as far as is practical. Where necessary, community members will be encouraged to translocate the saplings and vegetate areas where trees are scares	EMMP, this report,	Visual inspection of excavation sites	√	√		As required
	Establishment of buffer zones from the edge of extraction areas, considering the characteristics of the natural habitats and the type of extraction activities;		Visual observation		√		Weekly/Monthly

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Vegetation translocation and relocation techniques will be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement;	EMMP, this report	Numbers of native plants remaining on site after construction	√	√		Annually
	During extraction, ecological niches should be preserved and protected as far as possible;	EMMP, this report, IFC guidelines for Materials Extraction	Visual observation		√		Weekly
Traffic	In the case that there is an overlap of public and project vehicles, the developer will be charged with controlling vehicle traffic through the use of one -way traffic routes if needed, and on- site trained flag- people wearing high-visibility vests or outer clothing covering to direct traffic;	EMMP, this report	Flag men on road during activities	√	√	√	As required during vehicle transit
	Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle;	EMMP, this report	Visual observation	√	√		Daily, or as required during heavy traffic requirements on site

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Ensuring moving equipment is outfitted with audible back-up alarms;	EMMP, this report	Site observation,		√	√	
	Using inspected and well-maintained lifting devices that are appropriate for the load, such that there are no breakdowns in the middle of the road;	EMMP, this report	Audio measurements of equipment on site		√	√	
	Contractor shall provide temporary road signage during construction and ensure drivers observe speed limits and for safety of other road users.	EMMP, this report,	Visual obersvations		√	√	
Noise	Night time activities will be avoided at all costs in as far as is practical, because sound travels further during night than during the day;	EMMP, this report, The National Environment (Noise Standards and Control) Regulations, 2003 Occupational Health and Safety Act 2006	Audio measurements at receptors near site			√	As required
	In order to limit noise due to haulage traffic, the construction fleet will be kept in good condition well fitted with efficient silencers;		Visual inspections and Observation	√	√		As needed
	Hand held tools will mostly be used therefore incidences of noise increment will be avoided.		Audio measurements at sources and receptors	√		√	Annually

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Waste	Because of the remoteness of the site location, any human fecal material waste produced will be contained in temporary sealed septic tanks before collection by licensed waste collection agency and disposed at NEMA approved facilities; There is need to consider set-up of a waste treatment plant for the project human fecal material treatment before discharge to the environment;	EMMP, this report	Presence of organic pollution indicators in surface waters	√	√		As required
	Toxic, non-biodegradable waste such as spent machine oil and batteries will be stored in sealed drums, which in turn will be stored within a bund having 110% storage capacity volume, until they can be removed for safe long term disposal at the nearest designated District/Sub county solid waste storage site	EMMP, this report, Waste transfer forms, Waste receipt forms at disposal site Waste management Regulations, 1999	Presence of empty oil cans	√	√		Weekly
	Biodegradable, and Non-toxic nonbiodegradable waste, including glass, plastic and metal cans, bottle tops, foil wraps, etc. will be bundled and transported to the nearest designated District/Sub county Solid Waste dump site.		Visual observation of waste collection areas	√	√		Weekly, or as required

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	All domestic solid waste (i.e. trash and garbage) will be source separated into organic, paper and non-biodegradable fractions.		Visual observation at site	√		√	Weekly
	The proposed development will be responsible for the handling and transporting of its entire production of solid waste.		Periodic monitoring of site waste transfer notes	√		√	Annually
Occupational health and safety	Because of the remoteness of the site location, any human faecal material waste produced will be contained in temporary sealed septic tanks before collection by licensed waste collection agency and disposed at NEMA approved facilities; It will be necessary for the project team to ensure that proper working equipment and attire are provided during the construction phase to minimize chances and incidences of death or injury. Similarly, proper warning signage should be appropriately erected especially where there are heavy machines and equipment moving or around excavated areas so as to forewarn any nearby persons of the dangers eminent. Intensive awareness	EMMP, this report, IFC EHS guidelines, 2007	Visual observation, absence of houseflies and other pests, incidence of disease among workers	√	√		Daily

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	programmes before and during the construction periods on public safety should be undertaken to reduce the chances of this impact manifesting						
	Only highly skilled workers will be allowed to operate heavy machinery (cranes, excavators, graders) and heavy trucks (Tipper trucks);	IFC, EHS guidelines 2007, EMMP of this report	Visual inspection of work place	√	√		Monthly
	Any large excavated pits will be guarded to prevent falling into the pit by community members/animals;	IFC EHS guidelines 2007, EMMP of this report	Visual observation, checks on workers skills		√		Monthly
	Worksites especially those posing a greater danger to humans/animals will have limited access (i.e. excavation areas, worksites with heavy vehicular movement);	EMMP, this report	Visual observation, Employee knowledge	√	√		Monthly
	Job rotations and rest or stretch breaks; Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths	EMMP, of this report	Visual observation,	√	√	√	Monthly
Alteration of animal behavior	Barriers between sensitive habitats and worksites will be maintained to enable the	EMMP of this report	Visual observation				Throughout construction

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	separation of project activities from habitats within the river/wetlands;			√	√	√	phase
	All facilities will be located outside of known/established animal corridors to prevent animal disorientation;	EMMP of this report, Uganda Wildlife Act CAP 200, 1996	Visual observation and barrier integrity		√		
	Known animal foraging areas should be left intact to enable grazing at the same time construction of the irrigation scheme;		Visual observation		√		
	Sediment traps should be placed at the end of the drainage channel before runoff is redirected into the river			√	√		
Injury to fauna	The construction will be timed during the dry period so that runoff doesnot flood the excavated sections to transport sediments downstream into the main river;		Frequency of fish encounters recorded with LC1	√	√		
	Incase any fish are caught in the excavated sections for the reservoir facilities, they will be removed and put back into the main river to prevent injury			√	√	√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Fauna	The construction will be timed during the dry period so that runoff doesnot flood the excavated sections to transport sediments downstream into the main river;	EMMP of this report	Design documentation	√	√		Project onset
	In case any fish are caught in the excavated sections for the reservoir facilities, they will be removed and placed in the main river to prevent injury;	EMMP of this report Uganda Wildlife Act CAP 200, 1996	Design documentation	√	√		Whenever necessary
	Grazers will have alternative areas to find pasture for their animals and water		Visual inspection,	√	√		Monthly
Hydrology	The distance between reservoir and flow-back should be limited to areas of low animal interaction in as far as is practical, without compromising the integrity of the environment or project effort;	EMMP of this report	Visual inspections, design documentation	√	√		Rainy and Dry season
	Normal hydrological functions like transportation of sediments downstream will be maintained to sustain the downstream ecological functions like siltation in the wetlands, that are areas for breeding/feeding for various birds and wildlife; this is so because the water will not be dammed at any time during scheme operation;	DWRM requirement	Flow measurements up and downstream the river at the proposed site	√	√	√	Peak and low peak flow measurements

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Optimization of the use of flood waters will be undertaken to prevent flooding downstream and slow release of waters during the dry season	EMMP of this report					
Social Impacts							
Employment opportunities	Priority should be given to residents of the communities within close proximity of the development;	EMMP of this report	Project Documentation	√	√		Project onset
	Women should be considered equally as men during the employment process, with due consideration to community structures and norms;	National Child Labour Policy, 2006/2010, Children's Act Cap	Employee documentation	√	√		Throughout project implementation
	No children will be hired on the project for any work in keeping with the International Labor Organization, (ILO) Convention No. 138, (1973), that defines the minimum age of employment;	59, 2000	Employee documentation	√	√	√	
Influx of migrants	The developer will continuously sensitize workers and community members alike on HIV/AIDS and the dangers of unsafe relations;	EMMP, of this report	Documentation of Minutes of awareness meetings/campaigns	√		√	Throughout project implementation

Project Component or Impact	Mitigation measures / Action	Reference	Monitoring Criteria Document	Responsibility			Timing
				Developer	Contractor	External monitor	
	Workers will be encouraged to be disciplined when on company assignments in the villages and prevent risky interactions with community members.	EMMP, of this report	Documentation on discipline requirement at worksite	√	√		
	There are no measures for preventing population influx into the project areas. However MWE and community leaders in these respective areas should control settlement in fragile areas including wetlands and steep hills through existing legislations such as the The National Environment (Wetlands, River Banks And Lake Shores Management) Regulations, No. 3/2000	EMMP, of this report	Visual inspection of fragile ecosystems	√	√	√	
	Another measure to manage influx is through provision of social infrastructure including water and sanitation facilities. Sanitation facilities are particularly critical in the paddy areas as lack of them will result in deteriorated water quality. During construction phase of the project, the contractors should have employment policy which gives preference to the local people. By employing the locals, this would discourage population influx to the area	EMMP, of this report	Visual inspection of social infrastructure	√	√	√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	The developer will keep in close communication with women and youth groups to monitor any changes in social structure and communication with local leaders to monitor any changes in population.	EMMP, of this report	Documentation	√	√	√	
Disruption of Cultural norms and practice	Any foreign project workers will be informed on cultural norms of the local communities before encounter, to avoid conflicts with communities;	EMMP of this report Environmental and Social Policy, June, 2013	Documentation of minutes from awareness rising within workers Number of women/men employed at the site	√	√	√	Project Onset
	Gender issues will be considered during the hiring process to ensure equality in income provisions; Continous provision of water from the river will also be considered as it is culturally disproportionate that women and children be responsible for water collection Local authorities shall need to be strengthened in order to deal with the increased cases of indiscipline brought about by the increased population influx, and any disputes that are likely to ensue; hiring process to ensure equality in income		Security personnel stationed at work site	√	√	√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Gender issues will be considered during the provisions;	Environmental and Social Policy, June, 2013	Number of women/men employed at the site	√	√	√	
	Existing community members will be prioritized for employment so that cultural norms are not drastically altered to maintain social cohesion	EMMP of this report	Number of foreigners at worksite				During construction
Loss of Aesthetic Quality	The entire process will take into consideration the preferred land-use proposed by communities and government initiative;	EMMP of this report,	Visual inspections of site		√		Throughout project construction
	Access to excavation areas will be closed off to all but construction crew to prevent accidents like falls, or exposure to unsightly conditions within the area;		Visual observation of barriers to site		√		
	Conflicting landuse should be integrated in the overall management of the flood plain so that grazers and rice farmers' views are given due respect;		Visual inspections on site		√		
Operation phase							
Loss of livelihood	Where it occurs, displaced people should be compensated and given alternative areas for cultivation to cushion them against shocks such as hunger.	EMMP of this report,	Records of compensated individuals		√	√	Throughout project Operation

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	The new areas should be developed for them or they should be integrated into the projects associations as they become projects beneficiaries and not losers.	EMMP of this report,	Visual observation of newly developed site		√	√	Throughout project Operation
	Proper management of resources (soil and water) will ensure that aspects such as fisheries will not be adversely affected therefore reducing impact on that source of livelihood.	EMMP of this report,	Visual inspections on site		√	√	
Encroachment on sensitive habitats	To prevent encroachment of the wetland areas, a buffer zone should be created around the the project boundary. The management of the project should also control unplanned outgowers that might develop when the project is in operation.	EMMP of this report,	Visual inspections of fragile ecosystems	√		√	Throughout project Operation
	However, this project does not anticipate use of aerial spraying which is more dangerous to bird life than localised application. The impact will be cumulative in nature as the region has other irrigation activities that use aerial spraying in the rice paddies grown.	EMMP of this report,	Biodiversity surveys of bird survival in the irrigated sections	√		√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Farming technologies to be adopted during the operational phase of the project should be environmentally friendly.	EMMP of this report,	Observation and testing of technologies	√		√	Throughout operation period
	IPM technology should be applied in pest management instead of inorganic chemicals.	EMMP of this report,	Water quality tests of discharged waters	√		√	
	No aerial spraying should be undertaken to control pests	EMMP of this report,	Biodiversity surveys of bird survival in the irrigated sections	√		√	
Pests and Diseases	To mitigate against emergence of pests and diseases an incorporation of integrated pest management approaches are proposed. These measures should involve rotational/mixed cropping practices which preserve greater diversity in habitat thus reducing impact of pest and diseases.	EMMP of this report	Site survey and documentation of pests	√		√	Throughout operation period
	At the farm level, the agronomist should discourage monocropping. Rice varieties used in this project should be selected from the ones already allowed in Uganda	This report, Feasibility study for the scheme	Visual observation and records of planted crops	√	√	√	Annual audits
Food Security	This impact can be mitigated by good land use planning that incorporates rice production and other food crops	This report, Feasibility study for the scheme	Visual observation and records of planted crops	√	√	√	Annual audits

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Impact on Aquatic organisms	The reservoir will have an overhead flow, allowing for continuous flow of water, except at a reduced speed, though not slow enough to induce stratification;		Visual observation	√	√		At commissioning stage
	The scheme will maximize utilization of flood waters therefore drawing water from the main river will be minimized ;	This report, Feasibility study for the scheme	Design documentation	√			N/A
Obstruction due to canals	The project design should ensure that existing transportation and communication routes as well as new appropriate ones are adequately covered using culvert.	This report, Feasibility study for the scheme	Design documentation	√		√	Annual audits
Child labour	Application and strict enforcement of the compulsory primary education will help to reduce the impact. Also through creating awareness of the importance of education, the beneficiaries should help prevent the impact from occurring.	This report, IFC Child labour 1998, Employment act of Uganda	Visual inspections during school days	√		√	Random site visits
	The Ministry should educate the Irrigation Water Users to avoid use of children labour during school days, however this condition can be lifted during school holidays.	This report, IFC Child labour 1998, Employment act of Uganda		√		√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Child labour	The local administration (chiefs) should enforce the policy on use of child labour at the project level						
Water quality	Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season to reduce sediment/contaminant delivery to the river and eventually to the Nile;	EMMP, this report	Presence of spawning grounds for fish and benthos	√		√	Through out operation period
	Desilting drainage channels supplying water to the paddies occasionally will remove nutrient rich sediments from the main water ways and returned back to the gardens.		Presence of silts in drainage channels	√		√	
	Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;		Water quality downstream of paddy area	√		√	
	When water quality criteria allow, storm water should be managed as a resource in holing lagoons, either for groundwater recharge or for meeting water needs at the site;		Water quality downstream of paddy area	√		√	
	Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which		Water quality downstream of paddy area	√		√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	disposal has to be consistent with protection of wildlife, aquatic ecology and public health;						
	Water from the paddies should be channelled through a constructed wetland to remove impurities before discharge to the environment	EMMP, this report	Water quality downstream of paddy area	√		√	
Water Borne Diseases	Measures aimed at the pathogens: immunization, prophylactic or curative drugs;	EMMP, this report	Hospital records showing disease incidence in area	√		√	Periodic audits as required by NEMA
	Introduction of fish in the canals to destroy vector larvae;		Observation of stagnant waters in canal	√		√	
	Undertaking health education, personal protection measures including mosquito nets and mosquito proofing of houses;		Interaction with communities	√		√	
	Management of the irrigation infrastructure;		Site observation	√		√	
	Indoor Residual Spraying		Site inspection, interaction with households	√		√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Only 8% of households in the Tochi area did not have toilet facilities at the time of survey. Therefore provision of farm toilets in the blocks will be crucial to alleviating water borne diseases		Follow up on sanitation issues in the area	√		√	
Soil Contamination	All the drainage paths that have been constructed will be maintained and de-silted on a regular basis;	EMMP, this report	Visual observation, slope angle measurement	√		√	Operation phase, especially flood events
	Native herb and grasses species will be encouraged to re-grow in previously cleared areas to help trap loose soils and prevent their progression downstream into the waterway or the river;		Visual inspections	√		√	
	Maintaining flood zones within the cultivated area helps with reduction of erosion.		Visual observation,	√		√	
Alteration of river flow	During the operational phase, technical staff will continuously monitor the slopes especially those at the banks of the river;	Feasibility study report, EMMP of this report	Visual observation	√			Seasonal flood events
	Flood water will be maximized (stored) for usage to reduce stress on river water during the dry season	EMMP of this report	Field monitoring activities	√			Monthly checks

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Land clearing and slope stabilization activities should be conducted in their proper sequence and disturbed areas are to be suitably protected and maintained until permanent protection is established;	EMMP of this report		√			As required
Reduced flow downstream	Two gates are proposed for head regulation (one for service, the other for emergency release) as part of the infrastructure to be developed.	EMMP of this report	Field monitoring activities	√			Monthly checks
Microclimate modification	The parts of the project area downstream that will be remain after development of the irrigation infrastructure should be protected and conserved to provide the services	EMMP of this report	Field monitoring activities	√			Monthly checks with annual audits
Siltation downstream	To reduce siltation in the River, a catchment rehabilitation process should be up scaled to protect the soil from water runoff	EMMP of this report	Field monitoring activities	√			Monthly checks with annual audits
Impact from climate change	the maintenance of the Rivers ecological balance remains paramount and as such restrictions on water usage especially for irrigation will be imposed	Feasibility study report, EMMP of this report	Numbers of registered complaints from communities downstream	√		√	Annually or as advised by Lead agency
Water and sanitation	MWE in consultation with the local community should provide domestic sources of water during the planning phase of the project	EMMP of this report	Visual inspection of water sources	√		√	Annually or as advised by Lead agency

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Traffic Noise from Vehicles accessing the site	Developer will reduce the required number of trips to and fro the site to only necessary incidences requiring transportation of project staff and the occasional maintenance workers;	EMMP of this report	Noise measurements at source and nearest receptor	√		√	Annually or as advised by Lead agency
	The Project drivers will abide by the speed limits set forth by the UNRA for all vehicle access to the area;	EMMP of this report	Visual observation	√		√	Before project commences
	The developer will orient visitors to the Scheme so that safety road rules are followed in close coordination by project staff						
Occupational Health and Safety	Workers in the paddies will be instructed on how to respond to emergencies and situations of near drowning or drowning.	Visual observation	Training records of workers	√	√	√	Throughout project life cycle
	Workers will be trained on the recognition and prevention of hazards specifically applicable to work in remote areas, and in areas with dangerous wild animals like snakes; Working in groups gives safety in numbers, since the area harbors known dangerous wild animals	This report	Training records of workers	√	√		Throughout project life cycle

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Swimming as a pre-requisite for working across river/stream sections will be needed and where lack of the skill is observed, training will be undertaken;	EMMP of this report	Training records of workers for swimming	√	√		
	For the case of diseases like malaria, the project will put in place strategies to control the disease through issuance of mosquito nets and education on their usage. The developer will have a clinic stationed at the worksite to address any illness. There will also be an emergency evacuation plan to remove any injured worker from the field for urgent treatment;	Emergency evacuation plan, EMMP of this report	Mosquito net usage in the area Emergency evacuation plan documentation	√	√		
	Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites.	Employee records, EMMP of this report	Training records for employees	√	√	√	
	Use of chemoprophylaxis drugs by nonimmune workers and collaborating with public health officials to help eradicate disease reservoirs	EMMP of this report, Developer's Environmental safety policy	Visual inspection of first aid kits on site	√	√	√	
*External Monitor is a lead Agency/stakeholder like NEMA, DWRM, DEO or a private consultant whom the developer will engage on matters arising like noise, biodiversity, air and water quality monitoring. Lead Agencies will make their own arrangements on inspections on site to ensure compliance with set guidelines and standards.							

8.9 ENVIRONMENTAL AND SOCIAL MITIGATION BUDGET

The provision under this section covers the cost for biodiversity conservation & management, catchment area management, fishery conservation & management, public health delivery system, solid waste and sewage management, fuel and energy conservation measures, muck disposal, landscaping and restoration of construction areas & quarry sites, environmental monitoring programme etc. The various budgeted provisions for mitigation activities and related costs are outlined in Table below. These budget estimates have been made with adequate provisions for contingencies and is an integral part of the financial requirement of the project.

The developer (MWE) with support from Farm Income Enhancement and Forest Conservation (FIEFOC) Project will be responsible for ensuring that the budgeted resources for implementing the environmental and social components of the project are provided. The budgeted funds are indicative and part of the overall cost for the project and should be accessible to the contractor who should prepare actual budgets according to the implementation schedules of the different proposed Management and Monitoring plans, which will also have to be adjusted and put in place.

The day today (local level) management and monitoring will be done by the contractor, while the National level, developer with support from FIEFOC will liaise with NEMA to form a joint monitoring team. MWE will pay to NEMA the certificate/ approval fees that form part of their monitoring budget, but in addition the MWE will provide the budget for the facilitation of the monitoring activities of the committee. Other/individual central government and local government agencies and institutions that will not be part of the committee shall retain their monitoring roles and mandates and will cover their costs from their annual budgets.

Table 43: Summary of costs in implementing the Environmental and Social Management activities

No.	Activity	USD
1	Soil and water conservation measures	25,000.00
2	Soil and water quality monitoring	12,000.00
3	Atmosphere environment protection and monitoring	9,000.00
4	Sound environment protection and monitoring	9,000.00
5	Solid waste management	7,500.00
6	Public Safety including signage	55,000.00
7	Restoration of material sourcing sites	15,000.00
8	Monitoring of Aquatic and Terrestrial Resources	12,000.00
9	Aesthetics and Landscape Rehabilitation	6,500.00
10	Social environment including community sensitization	20,000.00
	Sub Total	**171,000.00**
	Contingency (10%)	**16,100.00**
	Total Budget	**187,100.00**

9. CONCLUSION

The proposed Tochi Irrigation Scheme is part of the government's plan to establish new irrigation schemes distributed over the country. The source of the fund for the project was received from the African Development Bank (AfDB). Several beneficial impacts envisaged will include: Employment of local communities during the pre-construction/mobilization and the construction phase; The project will contribute towards improvement of farm incomes, rural livelihood and food security; Local revenue to the communities, District; Improved flood water utilization in the area; Income generation; water will be availed throughout the year to ensure productivity even in dry season; Increased of Agricultural Production; Minimize Soil Deterioration; Crop diversification; Provision of Livestock Feed and; Restoration and Protection of Catchments.

However, the ESIA findings indicate that direct impacts will be fairly benign and limited to the project area where construction works will be undertaken. Direct negative impacts will include:

- The physical construction of irrigation systems. This involves issues such as human resettlement; watershed degradation; encroachment of unique ecosystems and historical and cultural sites; biodiversity loss and change (including wildlife and fishery resources); proliferation of invertebrate and vertebrate pests and disease carriers; soil erosion and sedimentation), Noise during construction.
- The management of irrigation systems. This depends on the nature of the water source (surface or ground water or both), quality of the water, and its delivery to the irrigated land. The withdrawal of ground water can lead to land subsidence, salinization, and increased pollution by other chemical contaminants. Withdrawal of surface water leads to changes in river hydrology (e.g., water quantity, flow regime and quality) that can affect these and other associated aquatic ecosystems. Water delivery to the irrigated land and agricultural run-off can lead to soil erosion, impacts on aquifers, waterlogging, and salinization of soil and water.
- Agricultural management practices. These may contribute to the pollution of groundwater and downstream surface water through inputs of salts, agrochemicals, and toxic leachates.
- Increased sediment loads into the river especially during construction phase
- Improper disposal of cut out spoil and other construction wastes.
- Other concerns include occupational safety hazards, and HIV/AIDS risk associated with construction labour.

During this ESIA study, thorough consultations were conducted with relevant stakeholders and MWE will liaise with them to ensure effective implementation of the proposed mitigation measures for the anticipated negative impacts. MWE should work closely with the local leaders and government agencies to ensure smooth implementation of the Environmental Management and Monitoring Plan and if impacts not contemplated during this ESIA arise, the developer should immediately address them in consultation with NEMA.

The project is environmentally and socially feasible for implementation provided the recommended mitigation and monitoring measures are implemented, and the proposed implementation arrangements are upheld.

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ANNEXES

ANNEX1: FLORA SPECIES RECORDED WITHIN THE PROJECT AREA

Family	Species	
Mimosaceae	Acacia gerrardii	Tree
Mimosaceae	Albizia grandibracteata	Tree
Mimosaceae	Albizia coriaria	Tree
Amaranthaceae	Amaranthus sp	Herb
Palmae	Borassus aethiopum	Tree
Commelinaceae	Commelina benghalensis	Herb
Capparaceae	Crateva adansonia	Tree
Cyperaceae	Cyperus esculentus	Herb
Papilionaceae	Desmodium salicifolium	Herb
Euphorbiaceae	Erythrococa bongensis	Shrub
Moraceae	Ficus natalensis	Tree
Moraceae	Ficus sur	Tree
Moraceae	Ficus sycomorus	Tree
Euphorbiaceae	Flueggea virosa	Shrub
Poaceae	Imperata cylindrica	Grass
Verbenaceae	Lantana camara	Shrub
Convolvulaceae	Lepstemon owariensis	Climber
Mimosaceae	Mimosa pigra	Shrub
Poaceae	Miscanthus violaceus	Grass
Poaceae	Phragmites mauritianum	Grass
Caesalpiniaceae	Piliostigma thoningii	Tree
Polgonaceae	Polygonum setosulum	Herb
Palmae	Raphia farinifera	Tree
Rubiaceae	Rubus steudneri	Shrub
Polgonaceae	Rumex bequaertii	Herb
Tiliaceae	Triumfetta rhomboidea	Shrub
Verbenaceae	Vitex doniana	Tree
Poaceae	Vossia cuspidata	Grass

ANNEX 2:APPROVAL OF TERMS OF REFERENCE FOR EIA BY NEMA

Plant life form

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

NEMA House
Plot 17, 19 & 21, Jinja Road
P.O.Box 22255, Kampala. UGANDA.
Tel: 256–414–251064, 251065, 251068
342758, 342759, 342717
Fax: 256–414–257521 /232680
Email: info@nemaug.org
Website: www.nemaug.org

NEMA/4.5

3rd September, 2015

The Permanent Secretary,
Ministry of Water and Environment,
KAMPALA.
Tel: +256 (0)414 505945 / 221198

RE: REVIEW OF TERMS OF REFERENCE PERTAINING TO THE PROPOSED REHABILITATION/RECONSTRUCTION OF FIVE SELECTED IRRIGATION SCHEMES, UNDER THE FARM INCOME ENHANCEMENT AND FOREST CONSERVATION PROJECT – PHASE-II

This is in reference to the Terms of Reference (TOR) for carrying out an environmental and social impact assessments (ESIAs) for proposed rehabilitation/reconstruction of **five selected irrigation schemes,** which you submitted to this Authority for review and consideration for approval. This Authority has finalised the review and grants formal **APPROVAL** of the said TOR, relating to the project sites listed in the table below.

Irrigation Scheme	Project / Location	District
1. Doho–II	Doho Parish, Nazimasa Sub-county, Bunyole East County.	Butaleja
2. Mubuku–II	Sebwe Parish, Nyamwamba Division, Kasese Municipal Council	Kasese
3. Wadelai	Regem and Pakwinyo Parishes, Wadelai Sub-county, Jonam County	Nebbi
4. Ngenge	Kapkwat, Sikwo, Sosho and Cheptarre Parishes, Ngenge Sub-county, Kween County.	Kween
5. Tochi	Abanya Parish, Acaba, Oyam Sub-county, Oyam County.	Oyam

In addition, you are advised to consider the key aspects outlined below, during the conduct of the ESIAs and preparation of the ESIA reports.

(i) Note that the ESIA reports for the five proposed project areas **should be submitted separately for review.**

(ii) Carry out comprehensive stakeholder consultations involving, among others, the respective District Local Government Authorities, the concerned local communities in the targeted project areas that will accommodate the projects, and other Authorities responsible for provision and management of public utilities *(road network, among others)*, respectively; and, ensure that the concerns/views of the stakeholders **are well-documented and appended to the ESIA reports.**

1 of 2

(iii) Provide **correct citation of details of the location of the project areas** that will accommodate the project components / infrastructure, preferably in tabulated format – *by names of **villages**, zones, wards, parishes, sub-counties, division, county – whichever is applicable.*

(iv) Present the narratives on **any identified project-affected communities/entities** and the related compensation aspects, land-take aspects, shared resources, respectively, in a comprehensive manner.

(v) Provide comprehensive **baseline information/data** relating to the project areas and their environs, public utilities, regulated and sensitive/fragile areas, settlements, **water source** (supplying water for irrigation); and, **a set of coloured photographs** showing the current state of some of the critical sections of the targeted project area, respectively.

(vi) Include in the ESIA reports **coloured location/google maps** *(preferably covering A-4 or A-3 paper size)* that are clear, well-labelled and legible and showing the alignment of the project infrastructure, as well as sets of **GPS coordinates.**

(vii) Provide comprehensive narratives on all the **proposed project components, activities,** and the size of the workforce.

(viii) Include in the ESIA reports comprehensive **analyses of alternatives** in terms of project design, type of technologies, among other aspects.

(ix) Provide **detailed evaluation of the identified potential environmental impacts, residual impacts and risks** associated with the project components and activities.

(x) Ensure that **comprehensive mitigation and environmental management and monitoring plans** are well presented, respectively, that relate to the identified potential environmental impacts.

(xi) Consider any other critical environmental aspects/concerns not initially foreseen during the preparation of the TOR, and **include evaluations of such aspects/concerns** in the respective ESIA reports.

(xii) Indicate the **total project (investment) cost** covering all the project components and activities.

This is, therefore, to recommend that you proceed with carrying out the ESIAs for the proposed projects. We look forward to receipt of five sets of copies of comprehensive environmental and social impact statements, for our further action.

Margaret Aanyu
FOR: EXECUTIVE DIRECTOR

c.c The Director,
Directorate of Water Resources Management,
ENTEBBE.

2 of 2

ANNEX 3: SOIL ANALYSIS REPORT

MAKERERE UNIVERSITY
P. O .Box 7062 Kampala- Uganda
Cables: "MAKUNIKA"
E-mail:ap@caes.mak.ac.ug
Fax: +256-414-531641
Phone: +256-414-533580

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
SCHOOL OF AGRICULTURAL SCIENCES
Department of Agricultural Production

SOIL ANALYSIS RESULTS

PROJECT NAME: Feasibility Study and Detailed Engineering Design of Irrigation Schemes Under the FIEFCO Project
LOCATION: Toṭhi(Oyam), Pabbo(Gulu), Biiso(Bullisa) Wadelai(Nebbi)

Laboratory Analysis

The air-dried soil samples were pounded, sieved through 2 mm to remove any debris then subjected to physical and chemical analysis following standard methods described by Okalebo *et al.* (2002)'. Soil pH was measured in a soil water solution ratio of 1:2.5; Organic matter by potassium dichromate wet acid oxidation method; total N determined by Kjeldhal digestion; Extractable P by Bray P1 method; exchangeable bases from an ammonium acetate extract by flame photometry (K^+, Na^+) and atomic absorption spectrophotometer (Ca^{2+}, Mg^{2+}); and particle size distribution (texture) using the Bouyoucos (hydrometer) method. Heavy Metals and trace elements by AAS from an EDTA extract

TRACE ELEMENTS AND HEAVY METALS

Lab No	Fe	Cu	Mn	Zn	Cr	Ni	Pb	Cd
	ppm(mg/kg)							
1	130.6	2.81	49.6	2.49	1 00	0.00	000	0.02
2	110.5	2.98	33.9	5.24	2.02	0.00	0.00	0.00
3	120.7	2.66	28.2	2.50	1.01	0.00	0.00	0.01
4	156.9	2.47	25.4	4.54	2.12	0.00	0.00	0.00
5	161.2	2.53	22.2	2.87	1.14	0.00	0.00	0.01
6	105.2	1.35	32.0	3.25	0.96	0.00	0.00	0.00

ROUTINE ANALYSIS

	pH	OM	N	P	K	Na	Ca	Mg	CEC
		%age		ppm	Cmoles/kg				
1	6.0	0.88	0.01	16.9	0.77	0.08	5.6	6.10	15
2	6.0	1.49	0.08	17.8	0.65	0.10	6.5	4.20	32
3	6.2	8.46	0.34	14.6	0.54	0.09	5.3	2.90	49
4	6.1	2.06	0.15	13.5	0.27	0.05	4.5	4.10	29
5	5.0	2.11	0.11	19.3	0.35	0.07	2.4	3.80	26
6	6.0	6.94	0.21	11	0.85	0.12	3.2	1.22	21

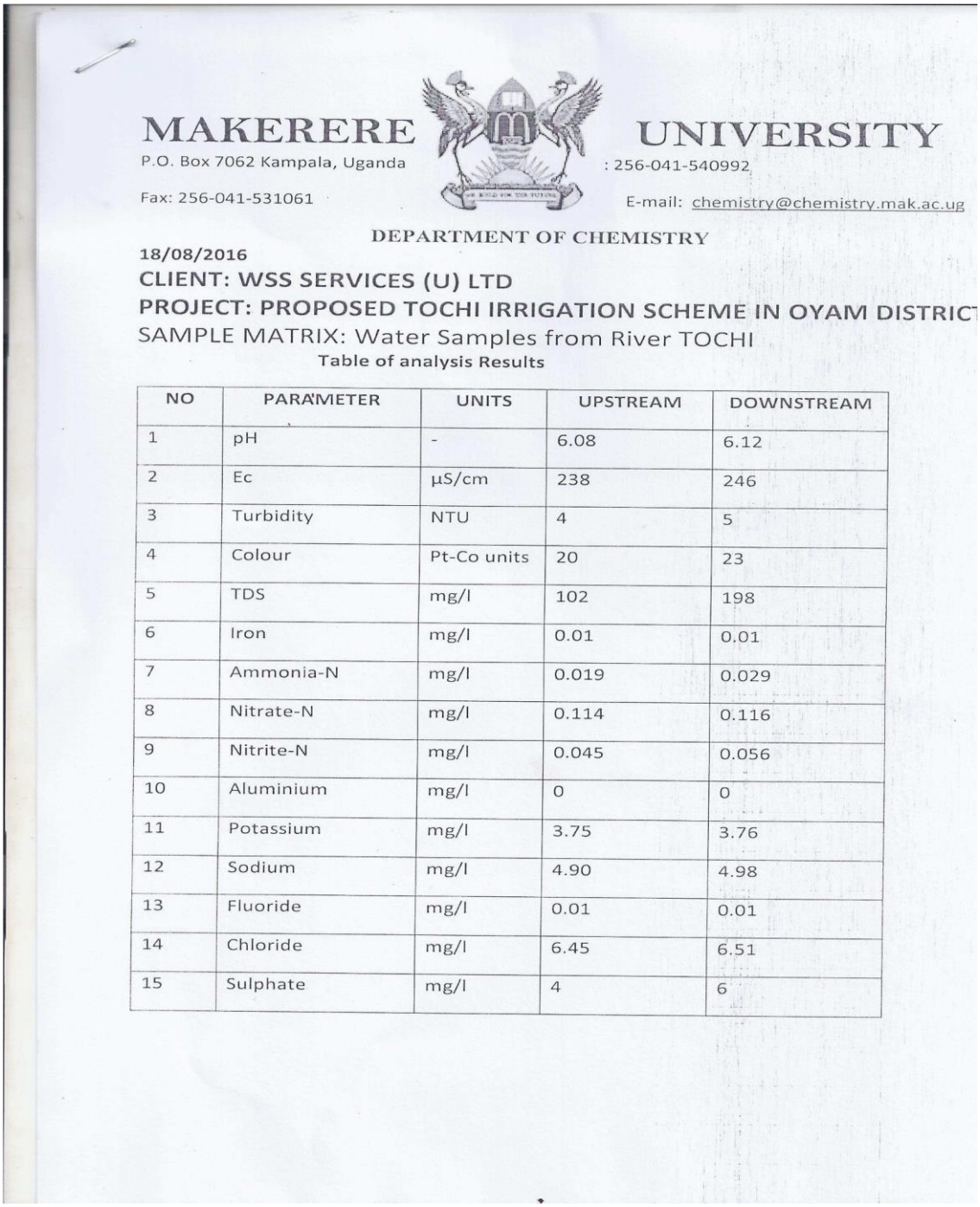
PHYSICAL PROPERTIES

	%sand	%Clay	%Silt	TEXTURE CLASS	BD	K_{SAT}	EC	WP	Water holding capacity
					g/cm^3	Cm/hr	μScm^{-1}	cm^3 water/cm^3soil	
1	76.0	10.0	14.0	SCL	1.59	2.91	140	0.10	0.20
2	48.0	28.0	24.0	SCL	1.38	0.41	210	0.19	0.31
3	34.0	56.0	10.0	C	1.20	0.19	136	0.36	0.62
4	66.0	24.0	10.0	SCL	1.46	0.45	124	0.19	0.26
5	56.0	28.0	16.0	SCL	1.35	0.30	110	0.20	0.29
6	58.0	24.0	18.0	SCL	1.40	0.48	120	0.18	0.26

1	WADELAI COMMAND AREA
2	BIISO COMMANDA AREA
3	PABBO COMMAND AREA
4	WADELAI COMMAND AREA
5	TOCHI COMMAND AREA
6	PABBO COMMAND AREA

Bonny Balikuddembe
Senior Laboratory Technician
Soil, Water and Plant Analytical Laboratory

ANNEX 4: WATER QUALITY ASSESSMENT CERTIFICATE



MAKERERE UNIVERSITY

P.O. Box 7062 Kampala, Uganda
: 256-041-540992
Fax: 256-041-531061
E-mail: chemistry@chemistry.mak.ac.ug

DEPARTMENT OF CHEMISTRY

18/08/2016

CLIENT: WSS SERVICES (U) LTD

PROJECT: PROPOSED TOCHI IRRIGATION SCHEME IN OYAM DISTRICT

SAMPLE MATRIX: Water Samples from River TOCHI

Table of analysis Results

NO	PARAMETER	UNITS	UPSTREAM	DOWNSTREAM
1	pH	-	6.08	6.12
2	Ec	µS/cm	238	246
3	Turbidity	NTU	4	5
4	Colour	Pt-Co units	20	23
5	TDS	mg/l	102	198
6	Iron	mg/l	0.01	0.01
7	Ammonia-N	mg/l	0.019	0.029
8	Nitrate-N	mg/l	0.114	0.116
9	Nitrite-N	mg/l	0.045	0.056
10	Aluminium	mg/l	0	0
11	Potassium	mg/l	3.75	3.76
12	Sodium	mg/l	4.90	4.98
13	Fluoride	mg/l	0.01	0.01
14	Chloride	mg/l	6.45	6.51
15	Sulphate	mg/l	4	6

16	Magnesium	mg/l	3.44	3.26
17	Calcium	mg/l	8.69	9.22
18	Chromium	mg/l	0.01	0.01
19	Manganese	mg/l	0.01	0.01
20	Copper	mg/l	0.01	0.01
21	Arsenic	mg/l	0	0
22	Lead	mg/l	0	0

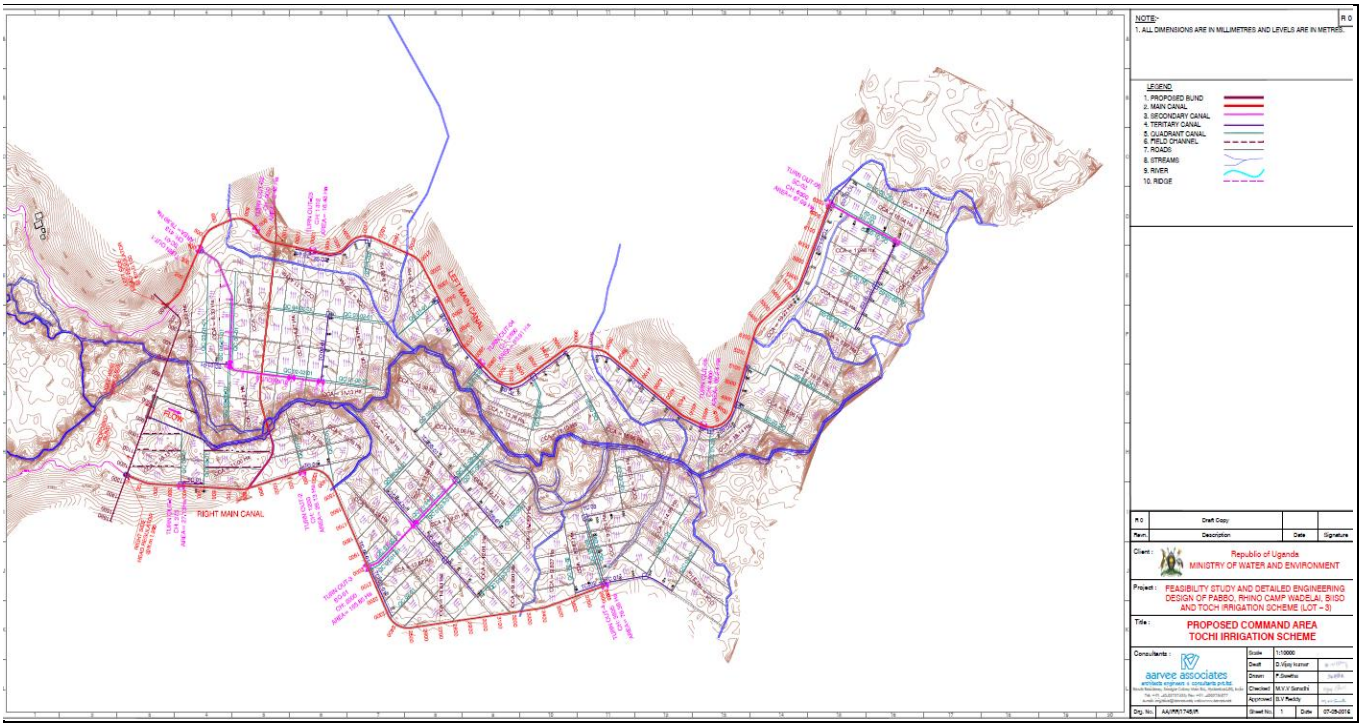
ANALYSIS BY

Ruharara Budigi
Chief Technician
Email: rbudigi@gmail.com

RBRuharara

CHEMISTRY DEPARTMENT
KAMPALA UGANDA
MAKERERE UNIVERSITY

ANNEX 5: PROJECT LAYOUT PLAN



ANNEX 6: RECORDS OF STAKEHOLDER CONSULTATIONS

Focused Group Discussion Guide

Focused Group Discussion Guide for ESIA for Irrigation Schemes in ACABA, NGAI AND MINAKULU Sub-Counties for the Proposed Tochi Irrigation Scheme

Background

The Farm Income Enhancement and Forestry Conservation Project was established in 2005 with the aim of contributing to poverty reduction and livelihood improvement for the people of Uganda. Its overall objective is to improve farm incomes, rural livelihood and food security through sustainable natural resources management and agricultural enterprises development. The project intends to develop the identified sites like this one into modern irrigation schemes with farmer based sustainable institutional management arrangements. It required that relevant technical investigations and studies (comprising of but not limited to hydrological and hydraulic studies, topographical surveys, geotechnical investigations, socio-economic assessment), and prepare engineering designs and tender documents to facilitate the construction of civil and hydraulic structures. The aim of this engagement is to establish the current situation regarding farming in these areas of interest, production constraints, agricultural markets, gender and social aspects that could present barriers or opportunities for the sustainability of the proposed irrigation systems.

Total Participant time required: 1 hour + 10 minutes – 1 hour + 50 minutes

Total focus group time: 1 hour + 10 minutes - 1 hour + 50 minutes

Break: 0 minutes

1.1 Introduction (10 m)

This session will include the following procedures:

- Introductions (including the interviewers observers and FGD participants)
- Explanation of the purpose of the study is to conduct baseline study as a means to provide baseline for evaluating the outcomes and impacts of the programme.
- Explanation of the presence and purpose of recording equipment and introduce observers. Additionally, the need for the discussion to be informal, so there's no need to wait for us to call on you to respond. Information on the identity of participants, participation and remarks that are to be private. Finally introduction of assistants to take notes

Current Production Systems

- What are the current production systems in this area? Probe for both crop and animal production systems
- What are the current production constraints? Probe for water, soil productivity, land access, access to markets.
- How best can each of the challenges identified above be addressed at farm level and community level? Probe for constraint specific recommendations Agricultural Markets
- Describe the location of agro-produce markets in each district, county where the project sites are located.
- How far is the agri-produce markets from the project sites & mode of transport /roads available
- Any challenges that communities face in accessing these markets (Probe for storage facilities, transport facilities that limit them to selling their produce at farm gate)

- Are there any domestic animals available in farm households for cultivation / transporting farm products to market in the event that productivity increases?

Gender Roles and Responsibilities
Let us discuss the gender roles associated with agricultural production. What activities are associated with the different genders at household level? Probe for:

- Current activities for both men and women activities related to land clearing: sowing, weeding, harvesting and marketing
- Activities related to livestock management and marketing of livestock products
- income generating activities
- participation in public and social affairs, leisure for women
- other

Beliefs and Value Systems
Beliefs and value systems also determine the productivity of crop and livestock systems. In your view, how do people in this community view the existing challenges and solutions? (Irrigation systems require a lot of community participation). What is the general perception towards group dynamics, probe for recent observations in different groups while focusing on intended outcomes vis-à-vis value systems of the members. When the scheme is fully functional, beneficiaries might be required to contribute towards the cost of maintenance. In your view what do you think would the social, economic and cultural challenges that may come with this requirement? How best can these be addressed.

Credit Access
Increasing agricultural production may require more capital meaning that some members of the community might require to gain access to credit. What credits services are available to small scale farmers and women's access to and control over credit? Probe for credit scheme barriers, collateral, loan amounts and repayment time, cultural, social and legal barriers. What alternative sources of financial services are available within this community? Probe for grants, SACCOs, money lenders etc.

Impacts of the Irrigation Schemes
Generally, what is your view regarding the proposed irrigation scheme. Probe for the specific benefits in terms of production, income diversification, access to markets, amongst others. Any homesteads that are likely to be affected during construction, operation and maintenance. Probe for upstream and downstream communities and activities engaged in. In your view, what would be the best option for managing constraints to production at farm level? Probe for the need for increased labor input, adoption of more productive technologies, shifts in value systems, behavior modification or farmers redefining their attitudes and perceptions towards farming.

Closing (10 m)

- Closing remarks
- Thank the participants

Key Informant Interview Guide at National Level for ESIA for Feasibility Study and Detailed Design for the proposed Tochi and Wadelai Irrigation Schemes in Oyam and Nebbi Districts Respectively General Information: *As appropriate, complete this information prior to interview.*

Institution/Agency:_____

Name of person being interviewed: _____

Occupation _____Phone number:_____

Date of interview: _____

Interview conducted: (tick one) In person _____ By phone _____

Interviewer: _____

Interview start time: _____ Interview end time: _____ Total time for

interview: _____

(Total number of minutes)

Introduction

Good morning / Good Afternoon / Good evening Sir/Madam, My name is ……and I am part of a team conducting a detailed environmental and social impact study for the Tochi and Wadelai Irrigation Schemes. During the feasibility study a number of issues were raised by stakeholders regarding the environmental and social aspects that need to be managed during the implementation phase and require your input as follows:

a. The physical construction of irrigation systems. This involves issues such as human resettlement; watershed degradation; encroachment of unique ecosystems and historical and cultural sites; biodiversity loss and change (including wildlife and fishery resources); proliferation of invertebrate and vertebrate pests and disease carriers; soil erosion and sedimentation)

   Based on your area of expertise how do and the current practice within the region, how do you thing the relevant aspect to you can be managed……
   ……
   ……
   ……
   ……
   …

b. The management of irrigation systems proposed is based on the nature of the water source (surface or ground water or both), quality of the water, and its delivery to the irrigated land. The withdrawal of ground water can lead to land subsidence, salinization, and increased pollution by other chemical contaminants. This implies the need for a versatile structure that responds to the changes in the water quality and quantity of water. Whereas a community managed structure would promote ownership and control of the system and hence the resource, the lack of capacity on technical aspects would limit its capacity to sustainably manage the system. In your view, how best would this gap be

addressed……
……
……
……

c. Withdrawal of surface water leads to changes in river hydrology (e.g., water quantity, flow regime and quality) that can affect these and other associated aquatic ecosystems. Water delivery to the irrigated land and agricultural run-off can lead to soil erosion, impacts on aquifers, waterlogging, and salinization of soil and water. The EIA proposes measures to minimize soil erosion during construction phase and the technology selected will take into account the sustainability of the systems in your view what emergency response measures should be in place to ensure that communities respond to any accidental
spillages:……
……
……
……
……

d. Agricultural management practices. These may contribute to the pollution of groundwater and downstream surface water through inputs of salts, agrochemicals, and toxic leachates. It is generally known that the practice of controlling pollution at source is not generally practiced within the Uganda context, in your view, what measures should be adopted to minimize pollution for downstream users……
……
……
……
……
…

e. Noise pollution from construction equipment was raised as an issue and ESIA has proposed that contractor should not exceed permissible noise levels as per the national standard and proposes works to only be undertaken during the day, in your view do you consider this as an adequate measure if not why?.....
.....
.....
.....
.....

f. Poor waste management practices at construction site is the responsibility of the contractor, the project site is located in remote area and in most cases contractors take this as an opportunity to indiscriminately dump waste which is not in compliance with general housekeeping contractual obligations. Based on your experience how can the compliance of contractors to contract obligations in relation to environmental and social safeguards be enhanced.
……
……
……
……
……

g. Any comments to enhance sustainable construction and operation of the irrigation system……
……
……
……
……

CHAIRMAN L/C.1 BUNG IPINY
ACENO PARISH
MINAKULU - OYAM DISTRICT
DATE 9/6/2017 SIGN

OFFICE OF THE LCI,
BUNG IPINY,
MINAKULU SUB|CTY,
OYAM DIST,
ACENO PARISH,
9/6/2017.

MISTRY OF WATER AND
ENWORMENT LUZIRA KAMPALA

RE: PROPOSED TOCHI IRRGATION PROJECT

On the abowed date we have seen one of the team of the project above and we the Community accept and welcome the project in our area we expect to benefit from the project through provision of employement, improved Agricultural production and food securty in our area. We therefore have no objection to the project.

Thank's yours in Serves LCI
BUNG IPINY.

CHAIRMAN L/C.1 BUNG IPINY
ACENO PARISH
MINAKULU - OYAM DISTRICT
DATE 9/6/2017 SIGN

TEL 0784625547=

OFFICE OF THE L.C.1
APUROBONYO-CELL
ABANYA-PARISH
ACABA-SUB/CTY
OYAM-DIST.
9/06/2017

MINSTRY OF WATER AND
ENVIROMENT LUZIRA KAMPALA

RE: PROPOSED TOCHI IRRGATION PROJECT

On the abored date we have seen one of the team of the Project above and we the Community accept and welcom the project in our Area we expect to benefit from the project through provison of employement, improved Agricultural production and food security in our area. we therefore have on objection to the project above.

Thank's yours in Serves L.C.1
APUROBUNYO
TEL: 0781221026. OKELLO SIMON PETER

L.C. APUROBONYO DATE 9/6/2017 SIGN ACABA OYAM

LIST OF STAKEHOLDERS CONSULTED

REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

FARM INCOME ENHANCEMENT AND FORESTRY CONSERVATION PROJECT

FEASIBILITY STUDY AND DETAILED DESIGN OF IRRIGATION SCHEMES (TOCHI, PABBO, WADELAI AND BIISO)

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER CONSULTATION SHEET

Village .... Parish.................Sub-County ACABA ...District OYAM

Date:

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1	OKENO FRANCIS	P/CHIEF	0774587104	[signature]
2	OKELLO S.P	L.C.1	078	[signature]
3	ONRORO SAM	BMT (WATER ODLG)	0775253733	[signature]
4	Ayella Jimmy	DWO - Oyam	0782902877	[signature]
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

FARM INCOME ENHANCEMENT AND FORESTRY CONSERVATION PROJECT

FEASIBILITY STUDY AND DETAILED DESIGN OF IRRIGATION SCHEMES (TOCHI, AND WADELAI)

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER CONSULTATION SHEET

Village: Apuru-Bonyo Parish: Abanya Sub-County: Acaba District: Oyam

Date: 10/06/2017

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1	Hassan Lubega	Consultant	0782741000	[signature]
2	ANYURU RICHARD	Councillor Abanya	0789179466	[signature]
3	OKELLO SIMON PETER	L.C.1 Apurubonyo	0781221026	SP
4	OKELLO RICHARD	L.C1 OBOT	0780452844	[signature]
5	OGOH LAWRENCE	LC1 WIGWENG 'B'	—	[signature]
6	SOPHIA ARUAI	L.C.1 Wigweng A'	0777457990	[signature]
7	Alfred Otim	L.C1 Barowo	—	[signature]
8	OPEI VINCENT	L.C1 BAROWO B.	0789626458	[signature]
9				

REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

FARM INCOME ENHANCEMENT AND FORESTRY CONSERVATION PROJECT

FEASIBILITY STUDY AND DETAILED DESIGN OF IRRIGATION SCHEMES (TOCHI, AND WADELAI)

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER CONSULTATION SHEET

Village: Bung Ipiny Parish: Aceno Sub-County: Minakulu District: Oyam

Date: 10/06/2017

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1	Hassan Lubega	Consultant	0782741000	[signature]
2	Odongo Geoffrey	Odiro 'B'	0774209573	[illegible] [signature]
3	Opio Paul	Bung Ipiny V/Chman	0784175612	[signature]
4	Okello Ray	Bung Ipiny LC I	0784625547	[signature]
5	Otim Richard	Odiro 'B' LC I	0771927370	[signature]
6	EMUNA GEOFFREY	Alaiye LC I	0779886158	[signature]
7	[illegible]	Elder Odiro 'B' LC I	0788948601	[signature]
8	OTTO PATRICK	ODIRO A.	0783929486	[signature]
9	OLWII GEOFFREY	Bung Ipiny Secretary LC I	078417562	[signature]

10	ATIME ALFRED	Comite LCI Bung Mollo	0782179620	
11	ONGOM RICHARD	C/M. LCI BUNGIMALO	0775215063	
12	OGOA TOMMY	BUNGIDING DEFENCE LCI	-	
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STAKEHOLDER CONSULTATION SHEET

Village Apuro Bonyo Parish Abanya Sub-County Acaba District Oyam

Date:

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1	OBOCH BOSCO	Farmer	–	[illegible]
2	ARLIA Emmanuel	Farmer	0786031754	[illegible]
3	TILE PATRICK	farmer	–	[illegible]
4	Tile Helen	farmer	–	[illegible]
5	OKELLO JUSTINE	Farmer	0778055301	[illegible]
6	OWETA MOSES	farmer	0781425794	[illegible]
7	OKAKA RONALD	[illegible]	[illegible]	[illegible]
8	OPIO DANIEL	Survey	0777857751	[illegible]
9	ORONGO DAVID	Farmer	–	[illegible]
10	OKELLO CYPRANO	Farmer	0775031195	[illegible]

LC I APURO BONYO DATE 9/6/2017 SIGN OYAM

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
10	OWETA DENIS	Famer	—	[illegible]
11	ALENY Geoffrey	Famer	—	[illegible]
12	OCARA ALE	Famer	—	[illegible]
13	OKELLO SAM	Fame	—	[illegible]
14				
15	OPIO PAUL.	V/CMAN LC.I BUNG IPINY	—	[illegible]
16	OPIO KENNETH	FAMER	0775039951	[illegible]
17	OGOA TOMMY	FAMER Bung ipiny	0788396292	[illegible]
18	OMODO ALFRED	A TEACHER	0789111998	[illegible]
19	OGUTA FRANCIS	Famer	0780338648	[illegible]
20	OLWII GEOFFREY	Sectary LCI Bung ipiny	0784175612	[illegible]
21	Atim Lawrence	Famer	—	[illegible]
22	OBONG RICHARD	Famer	—	[illegible]
23	JASPHER OKWIR	RWOT WANG TIC	0774210511	[illegible]
24	OKELLO RAY	LCI Bung ipiny	0784625547	[illegible]
25	OGWANG MORISH	FAMER		[illegible]
26	ODONGO KALVIN	Famer	0780187602	[illegible]

CHAIRMAN L/C.1 BUNG IPINY
ACENO PARISH
MINAKULU – OYAM DISTRIC
DATE 9/6/2017 SIGN [illegible]

DATE 9/6/2017
SIGN [illegible]
OYAM

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
27	Ojur Bonny	Farmer	0774723072	
28	Atim Sean	Sec		
29	ENGOLA LOBS	Farmer	—	
30	OLA Ambrose	Chairman	0784625574	
31				
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CHAIRMAN L/C.1 BUNG IPINY
ACENO PARISH
MINAKULU - OYAM DISTRICT
DATE 9/6/2017 SIGN