THE REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

WATER FOR PRODUCTION REGIONAL CENTRE- NORTH

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED REHABILITATION OF ONYAMA VALLEY DAM IN LAPYEM PARISH, ADILANG SUB COUNTY, AGAGO DISTRICT, UGANDA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

Prepared for:

THE REPUBLIC OF UGANDA

Ministry of Water and Environment,
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ACRONYMS

ACAO	Assistant Chief Administrative Officer
ADLG	Agago District Local Government
AGI	Agro- Industrialization
AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
CAO	Chief Administrative Officer
CBMS+	Community Based Management System Plus
CDO	Community Development Officer
DEO	District Environment Officer
DNRO	District Natural Resources Officer
DWO	District Water Officer
EHS	Environment, Health and Safety
EIA	Environment Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
FGDs	Focus Group Discussions
GBV	Gender Based Violence
GO	Grievance officer
GoU	Government of Uganda
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HH	Household
HIV	Human Immuno deficiency Virus
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
JTR	Joint Technical Review
Km	Kilometre
LC	Local Council
MoGLSD	Ministry of Gender, Labour and Social Development
MWE	Ministry of Water and Environment
NEA	National Environment Act
NEMA	National Environment Management Authority
NES	National Environment Statute
NGO	Non-Government Organizations
NPHC	National Population Housing Census
NWSC	National Water and Sewerage Corporation
OHS	Occupational Safety and Health
Ops	Operational Procedures
PCDP	Public Consultation and Disclosure plan
PH	Public Health
PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
RGC	Rural Growth Centre
SDG	Sustainable Development Goal
SEA	Sexual Exploitation and Abuse
SGBV	Sexual and Gender Based Violence

SO	System Operator
SSIP	Strategic Sector Investment Plan
STDs	Sexually Transmitted Diseases
ToR	Terms of Reference
UBOS	Uganda Bureau of Statistics
UWSS	Urban Water Supply and Sewerage
VAC	Violence Against Children
WfPRC-N	Water for Production Regional Centre- North
WHO	World Health Organization
WSS	Water Supply System
WUC	Water User Committee

ACKNOWLEDGEMENT

We, the undersigned, hereby declare that this ESIA Report represents the facts pertaining to the Proposed Onyama Earth Dam in Agago District "

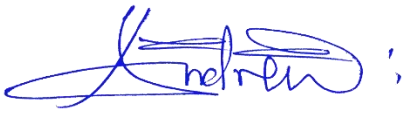
ON BEHALF OF MINISTRY OF WATER AND ENVIRONMENT

Sign:

Dated: _____

DETAILS OF EXPERTS WHO CONDUCTED THE ESIA

Name of Consultant: ANDREW NKAMBO (*CC/EIA/273/23)*

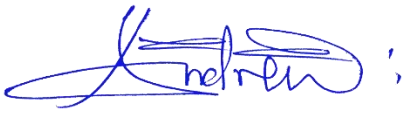
Sign: 

Dated: _____ _____

ESIA TEAM COMPOSITION

Table 1 presents the composition of the Environmental and Social Impact Assessment (ESIA) team that undertook the ESIA for the proposed Onyama Earth Dam in Agago District in accordance with the provisions of the *National Environmental Act No. 5 of 2019* of the Laws of Uganda, the *Environmental and Social Impact Assessment Regulations (2020)* and the *National Environment (Conduct and Certification of Environmental Practitioners) Regulations (2003).*

Table 1: Proposed ESIA Team Composition

Name of Key Specialists	Assigned Position	Signature
Mr. Andrew Nkambo, BSc. *Certified Environmental Impact Assessor* ***(CC/EIA/273/22) – Team Member***	ESIA and Ecologist/Natural Resources Management Specialist/Lead Consultant	
Dr. Denis Byamukama, PhD *Certified Environmental Impact Assessor* ***(CC/EIA/073/22) – Team Leader / Member***	Team Leader Water Resources Management / Water Quality Specialist	
Mr. Pius Kahangirwe, MSc. *Certified Environmental Impact Assessor* ***(CC/EIA/159/22) – Team Leader / Member***	ESIA and Environmental / Occupational Health & Safety Specialist	
Contributing Specialists		
Mr. Anthony Begumisa	Sociologist	
Ms. Jackline Abitegeka,	Faunal Studies	
Mr. Vincent Birungi	Biodiversity Specialist	
Mr. Abdu Magidu Menya	Sociologist	
Mr. Roy Ongeyuru	Health, Safety and Environment	
Mr. Michael Sseku	Socio-Economist	
Mr. Simon Njuki	Irrigation Engineer	
Mr. Eric Isabirye	Environmentalist	

EXECUTIVE SUMMARY

ES01: Project Background and Objectives

The government of Uganda through Water for Production department of the Ministry of Water and Environment is making considerable efforts in raising the water for production coverage and availability across the country through construction of multi-purpose reservoirs (Valley dams and valley tanks) for domestic water supply, irrigation, livestock watering, rural industries, wild life, fisheries and aquaculture with the objective of increasing agricultural production and productivity, and regulate dependency on rain fed agriculture which is heavily affected by prolonged droughts. Water for production is key to the successful implementation of the GoU's plan for poverty eradication and climate change mitigation through provision of dams and valley tanks for storing excess flood water during heavy rains for use during the dry seasons.

As part of the initiative, the Water for Production Regional Center Central (WfPRC-N) has prioritized rehabilitation of Onyama Valley Dam to increase water storage for domestic water supply, aquaculture, livestock watering and irrigation especially during the dry season in the dry cattle corridor district of Agago. Agago is one of the Cattle Districts of Uganda characterized by livestock production with scarce water and pasture and are one of the most affected regions in the country. While it is not currently classified as semi-arid, this corridor has many semi-arid characteristics which include high rainfall variability, periodic late onset rains/droughts, historical reliance on mobile pastoralism as an important strategy to cope with resource variability. Onyama Valley Dam will address the water crisis and provide adequate water which is a pre-requisite for provision of water for production beside the many other accruing benefits. Availability of water makes it feasible for the majority of the population to engage in meaningful agricultural and socio-economic activities that would increase household income and thereby reduce poverty.

National Environmental Act (NO.5 of 2019) mandates an Environmental Impact Assessment for all projects that are likely to have significant impacts on the environment so that adverse impacts can be identified, avoided, reduced, mitigated or compensated for, based on the mitigation hierarchy (i.e., Water storage and Irrigation). The proposed project falls under Schedule 5 of the National Environment Act specifically under Utilization of water resources and water supply (No. 4) and Construction of valley dams and valley tanks where the threshold is 1,000,000 m3 or more (h) and support facilities (k) which lists projects to be considered for ESIA. The proposed Onyama Earth Dam is in the category of projects requiring mandatory Environmental and Social Impact Assessment (ESIA) before implementation. Similarly, the African Development Bank's (AfDB) integrated safeguards system through the Operational Safeguard 1 on the Environment and Social Assessment categorised the project as category 2; medium risk requiring the preparation of an ESIA with an embedded ESMP as the implementable piece.

WfPRC-N therefore, proposed to carry out an Environment and Social Impact Assessment (ESIA) for the proposed Rehabilitation of the Onyama earth dam in Adilang Sub County in Agago District in accordance with the requirements of the National Environment Management Authority (NEMA) and AfDB ISS for approval before implementation.

ES02: Project Design and Location

Onyama dam is located in Ajwa central village, Lapyem parish, Adilang sub county in Agago district on GPS location 36N 553494E 310672N. It boarded by vallages of Ajwaa- lela-pura, Ajwaa-wipolo, Anyami Akuuri and Biwang who are earmarked to benefit from the dam. Onyama dam is located 300m off Adilang – Alwala road. The dam which is located in a government owned land was established around 1952 and is currently silted and having acquatic weeds. The proposed dam has a height of 4m with storage capacity of 199,692m^3 (with a potential increase up to 17,077,352m^3), embarkment length of 130m and would provide water for livestock watering, irrigation, domestic use, reservoir fisheries, flood control, etc. The dam is currently being used for fishing and animal watering by the surrounding community, cattle keepers from Lira Kato Subcounty and Karimojong pastoralists who came around January to March. The dam is recharged by Onyama seasonal stream, existing natural spring and groundwater whose water table is high. The place experiences severe flooding of about 50m from the visible dam extents during the dry season. Using the ArcGIS 10.4 software and the digital elevation model (DEM) of 30m, a catchment area of Onyama dam was delineated and found to be 66.93 sq. km.

The dam shall provide water storage for multi-purpose uses through irrigation, livestock watering, domestic water supply, aquaculture and fisheries production. The project shall consist of the components;

i. Dam
ii. Reservoir
iii. Irrigation system of 72Ha and above
iv. Pipe network
v. 4no. tap stands
vi. Solar abstraction system (hybrid system to run on both solar and hydroelectricity)
vii. Pump house
viii. 3no. 2 stance VIP latrines
ix. Office and store building

The main activities to be carried out will include;

i. De-silting of the reservoir
ii. Construction of the dam
iii. Construction of water abstraction system
iv. Laying of the transmission and distribution lines, and laterals for irrigation of 72Ha of land
v. Construction of project structures which include pump control room, 2 stance VIP latrines, project office and store for the produce
vi. Construction of 6no. cattle troughs
vii. Construction of night storage reservoir
viii. Construction of 5no. tap stands
ix. Installation of hydrant system on 72Ha
x. Socio-economic activities i.e. stakeholder engagements and mobilization
xi. Agronomy activities i.e. training farmers on the good agronomy practices

The project is being implemented by Ministry of Water and Environment under the Water for Production Regional Centre – North. The estimate of the combined project investment cost for Onyama Valley Dam is **10,311,724,120 (Ten Billion Three Hundred Eleven Million Seven Hundred**

Twenty Four Thousand One Hundred and Twenty shillings only) including an indicative cost of about Uganda shillings Seven Hundred Twenty Seven Million Eight Hundred and Seventy Thousand (UGX **727,870,000**).

ES03: Policy, Legal and Institutional Framework

For the project to achieve its intended objectives, it will operate under various policies, legal and administrative frameworks. These include laws and policies of Uganda, as well as international treaties and conventions, environmental laws and guidelines with the aim of promoting the positive impacts of the proposed project while minimizing the negative effects. In particular, the various policies and laws were reviewed in relation to the proposed project and among them include:

S/No	Policies
1.	The National Environment Management Policy 1994 (NEMP)
2.	The National Development Plan 2021-2025
3.	The Uganda Vision 2040
4.	The Uganda Agriculture Policy, September 2013
5.	National Water Policy, 1999
6.	The National Agriculture Policy (2013)
7.	The National Land Use Policy
8.	The Occupational Health and Safety Policy
9.	The National Gender Policy, 1997
10.	National Irrigation Master Plan for Uganda (2010-2035)
11.	The National HIV/AIDS Policy, 2004
12.	Uganda National Climate Change Policy, 2015
13.	National Orphans and other vulnerable children's Policy, 2004
14.	National Equal Opportunities Policy, 2006
15.	The National Child Labour Policy 2006
16.	The National Policy for Older Persons 2009
17.	The National Policy for the Conservation and Management of Wetland Resources, 1995.
Legal Framework	
1.	The Constitution of the Republic of Uganda; 1995; amended as at 15th February 2006, Government of Uganda.
2.	The National Environment Act; No.5 of 2019
3.	The Occupational Safety and Health Act, 2006
4.	The Land Act, Cap 227
5.	The Employment Act, 2006
6.	Workers' Compensation Act, 2000
7.	The Water Abstraction Regulations, 1998
8.	Public Health Act, Cap 281
9.	The Local Governments Act, Cap 243
10.	Environmental Impact Assessment Regulation, 2020
11.	The National Environment (Wetlands, Riverbanks and Lake Shores Management) Regulations, 2000
12.	The National Environment (Waste Management) Regulations, 2020

13.	The National Environment (Noise Standards and Control) Regulations, 2000.
14.	The Children's Act, Cap 59
15.	The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 2020
16.	Draft National Air Quality Standards, 2006
17.	The National Environment (Audit) Regulations, 2020
Regional and International Treaties	
1.	EAC Treaty; Protocol on Environment and Natural Resources Management
2.	Stockholm Declaration (Declaration of the United Nations Conference on the Human Environment 1972)
3.	African Convention on the Conservation of Nature and Natural Resources (1968
4.	Convention on Wetlands of International Importance Especially as Waterfowl Habitat
5.	The Convention on Migratory Species of Wild Animals (CMS)
6.	Montreal Protocol on Substances that Deplete the Ozone Layer (1987)
7.	Convention on Biological Diversity (1992)
8.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)

ES04: Baseline Environmental and Social Conditions.

An assessment of the baseline and social conditions of the project area was conducted and this considered the following conditions under the area of influence; topography, drainage, climate, geology and Soils, Seismic activities in the project Area, hydrology, noise, air quality, flora, fauna (birds, amphibians, reptiles, mammals), population demography, telecommunication networks, socio-economic activities, power sources, institutions, ethnicity and religion , Gender analysis, land cover changes, physical cultural resources and common community resources, settlement patterns & housing, sanitation and solid waste management, vulnerability assessment, energy for cooking and lighting.

ES 05: Stakeholder Consultations and engagement

A comprehensive stakeholder engagement was carried out during ESIA specifically with Agago District Local Government Officials, Adilang Sub County Officials, Local Community Representatives and Community members among others. The main findings from the stakeholder engagements were largely categorized into two parts i.e. the anticipated impacts (both negative and positive) and general concerns on the project. Two meetings were held; one at the Adilang Sub County and another one at one of the homes of the participants on top of the Key Informant Interviews (KII) held with the district officials. 34 members were engaged with 22 Males and 12 females. The KIIs were held with individuals who were assumed to have specific information related to the project. Some of these were pre-set while others were identified during the interactions with other stakeholders. Some of such stakeholders included; The CAO's office of Agago, LC V, the District Production office, the District Water Engineer, CDO, Environmentalist among others.

Some of these issues included the requirement to engage all the relevant stakeholders, sufficient water supply for production, mode of operation of the earth dam, considering the gender issues by incorporating them into project design and protecting women during the project implementation, employing local community members, no child labour on the project, contractors providing protective personal Equipment (PPE), contractor paying all the workers on time,

contractor providing first aid kits, animal watering points among others.

The SEP was prepared to help in establishing a general framework for cooperation and participation by seeking Securing commitment but also to create awareness about the earth dam project and to highlight the obligations of the community to a wider audience. The foundation upon which to gauge progress and to evaluate the impact at the end of the project was created in this SEP. The SEP created a great opportunity to share how the project will positively impact on the community and Training of a gender sensitive Water and Sanitation Committee on their roles and responsibilities, training of the grievance redress mechanism committee and educating the community on the efficient and effective ways of using water e.g. (leakages before and after the meter) under the O&M of the earth dam

Grievance management is an important step in community engagement. There had been and will be community grievances throughout the project's various development stages. It is expected that all such grievances be amicably resolved if the developer is to abide by the global and country specific Social Safeguard guidelines. In practice, in similar compensation and resettlement activities, many grievances arise from misunderstandings of the Project policy, or result from conflicts between neighbors, which can usually be solved through adequate mediation using customary rules or local administration at the lowest level.

The Grievance management will provide opportunity for the aggrieved parties to resolve issues through arbitration and negotiation based on transparent and fair hearing. It will allow the parties in the dispute to arrive at a win -win solution. Final outcome thus be that the extra judicial systems will work smoothly and that number of disputes seeking interventions at the country judiciary will be made minimal. The functioning a proper grievance management mechanism is a requirement in view of the above.

ES06: Analysis of Project Alternatives

Analysis of the "no project option" as an alternative provided an environmental baseline against which impacts of the proposed action can be compared. This alternative meant that the Earth Dam sites will be left in their original state. The alternative ignored all positive impacts likely to be realized in the project area and throughout the region due to the proposed Earth dam like transformation of agriculture practice in the area, sustainable and optimal use of irrigation water resources. The No Project Option is the least preferred option from both the socio-economic and environmental perspective because the Sub County and surrounding areas would be deprived of increased accessibility to suitable water for Production

If the planned project would cause significant environmental issues that could not be fairly and efficiently managed, a different site might be taken into consideration. The proposed mitigation measures, however, are thought to be sufficient to reduce the impacts to levels that do not call for considerable environmental harm. The suggested location is also deemed appropriate due to its extensive bedrock and contributing catchment area. As a result, this solution (of looking for another possible location) is not thought to be practicable.
The advocate would also have chosen to use other quarrying dam techniques and equipment.

Several quarrying techniques are categorized. Earth dams have a number of alternatives, including but not limited to concrete dams, rock-fill dams, sand dams, and subsurface dams. Some of the parameters used to choose the suggested alternative are displayed as availability of local materials, handling of construction materials, foundation condition and cost of construction

E07: Anticipated potential impacts from the project implementation.

The proposed project has potential to significantly improve quality of life in the Adilang Sub County and the neighbouring towns both during construction and operation phases. Like in other areas, the long-term socio-environmental benefits of a reliable supply of potable water and access to sanitary facilities include reduced morbidity and increased productivity of households along with increased enrolment of children in educational institutions. In addition, project development and operation in the project area will provide considerable economic opportunity and attraction of other services. However, development of the project can also bring with it negative impacts. The key significant negative impacts will arise from construction phase of the valley Dam and associated infrastructure. Reason for the ESIA thus to assess, identify and suggest ways to reduce and / or avoid occurrence of such adverse effects during construction and operation of the system component facilities.

Onyama valley dam is envisaged to improve water storage targets in Adilang Sub County and neighbouring community and reduce overreliance on the unreliable rainfall patterns. Further still, the project will also address the focal area of water for production (WfP) as stipulated under the Uganda Vision 2040, National Development Plan III and National irrigation policy as well combat drought to ensure food security and jobs creation. The project also contributes towards achieving SDG *(specifically SDG 6 on clean water and sanitation)*. Several beneficial impacts envisaged will include: Improved quality of water supplied to communities; Improved and increased access to safe water supply; Provision of employment opportunities during construction and operation phases; Transformation of agriculture practice in the area, Improved health and sanitation due to improved water quality and quantity; Address food security in the area, Improved local economies and induced development especially sourcing of raw materials for construction activities; Lead to crop diversification and intensification, Increased house hold acreage, An increase in revenue for the Municipality from water project collections. The project will further, initiate the move away from the status quo of women and children's perpetual carrying of water on their heads from unprotected and distant point water source and allow them to engage in income generating activities and to improve the image of the woman and children.

However, the ESIA findings indicate that direct impacts will be mitigated and are limited to the project area where construction of the Earth dam works will be undertaken. Direct negative impacts will include: Accidents due to increased traffic; Minimal destruction of vegetation and crops; increased noise nuisance by construction workers and equipment; increased sediment loads into the surrounding water sources; improper disposal of wastes; other concerns include occupational safety hazards, and HIV/AIDS risk associated with construction labour.

Mitigation measures have been proposed and the developer should ensure that these are implemented such as Maintaining good house-keeping; Screening unsightly aspects from public view including excavations, construction material storage areas, waste storage areas and ablutions, Erecting fencing around construction site to act as a screen minimizing the effect of wind in generating dust emissions; Re-vegetation of all areas of natural vegetation that have been disturbed

as a result of construction activities; Proper waste management and containment of storm water especially during rainy season among others.

ES08: ESMP implementation and Costing

An ESMMP has been drawn up and presents the actions required to ensure that the mitigation measures proposed in this environmental and social impact study are carried out to a satisfactory conclusion and thus ensure that the environmental risks are reduced to an acceptable level. The ESMMP provides a delivery mechanism to address potential adverse impacts, to enhance project benefits and to introduce standards of good practice to be adopted for all project works. The ESMP covers each stage of the project from construction, operation and decommissioning.

The following institutions will play a key role in the ESMP implementation and monitoring; Contractor, WfPRC-N (developer), Ministry of Water and Environment, the system Operator, the Agago District Local Government (ADLG) especially the DNRO/DEO/DWO, NEMA, MGLSD, MAAIF. AfDB will also play a big role in ensuring that the Bank's Operational safeguards (OSs) and the Performance Standards (PSs) are compiled and adhered to, as appropriate. AfDB will also review the monitoring reports during the implementation of the project.

The following costs have been included to cate for the capacity building and training using the AfDB's and the National social and environmental (E&S) safeguards, as required by the AfDB for its projects to ensure early identification of possible risks and propose management measures so that the project is able to address the risks while maximizing positive outcomes.

Description of training	Target participants	Timeframe	Responsibility	Costs (UGX)
Labour conditions, GRM health and safety	District Local Government	During construction and operation	MWE/ Contractor	40,000,000
Water rights issue, Community disagreements, GRM	Project Beneficiaries/ Farmers	During Operation	MWE/System Operator (SO)	32,000,000

WfPRC-N and contractor will contact the external monitor on subjects like noise, biodiversity, air and water quality monitoring. The external monitor can be a lead agency and other authorities like NEMA, DNRO/DEO/DWO or a NEMA Certified Consultant. To guarantee adherence to established rules and standards, Lead Agencies will arrange their own site inspections. Start-up reports, incident reports, quarterly reports, progress reports, regular reports, annual audit reports, and completion reports will all be mentioned. However, it should be underlined that the E&S components should be included in the BoQs during the bid process or when choosing the contractor.

An ESMMP implementation matrix has been elaborated to guide all the involved institutions (Table 28) and this considers the different project phases, Environment and Social Impacts, objectives to address the impact, mitigation measures, monitoring activities, the responsible parties, frequencies and the estimated costs to be involved. The procedure will start during site preparations, move into the construction stage, and last through operation. Additionally, it involves routine reviews of

any implications that were not anticipated or could not be fully analysed before to the project's start. In these circumstances, new and appropriate activities will be made to lessen any negative impacts.

During the construction, the Contractor will be expected to prepare the following key plans and strategies: Contractor ESMP (C-ESMP), Waste Management Plan including for hazardous wastes, Occupation Safety and health (OSH) plan, Emergency Preparedness plan, Code of conduct for workers, Traffic management Plan, Labour Management plan, Gender and Child protection plan, HIV/AIDs Management Plan, Site Restoration Plan, Biodiversity management plan, Landscape and tree planting plan among others.

The general indicative budget for ESMMP implementation and monitoring is presented in the table below:

Item	Indicative Costs
ESMP	336,870,000
GRM	67,000,000
Stakeholder Engagement	87,000,000
Annual Environment and Social Audit	165,000,000
Environment and Social (E&S) Capacity Building and Trainings	72,000,000
Total	**727,870,000**

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

1 INTRODUCTION

1.1 Background

The government of Uganda through Water for Production department of the Ministry of Water and Environment is making considerable efforts in raising the water for production coverage and availability across the country through construction of multi-purpose reservoirs (earth dams and valley tanks) for domestic water supply, irrigation, livestock watering, rural industries, wild life, fisheries and aquaculture with the objective of increasing agricultural production and productivity, and regulate dependency on rain fed agriculture which is heavily affected by prolonged droughts. Water for production is key to the successful implementation of the GoU's plan for poverty eradication and climate change mitigation through provision of dams and valley tanks for storing excess flood water during heavy rains for use during the dry seasons.

As part of the initiative, the Water for Production Regional Center North (WfPRC-N) has prioritized rehabilitation of Onyama Dam to increase water storage for domestic water supply, aquaculture, livestock watering and irrigation especially during the dry season in Agago district. Onyama dam was established around 1952 and is located in a grazing land which is communally owned and the land where the dam sits is government land and currently silted with presence of aquatic weeds of *Eichhornia crassipes and Nymphea mexicana*. There were no evident farming activities within the vicinity of the dam and is currently being used for fishing and animal watering by the surrounding community, cattle keepers from Lira Kato Subcounty and Karimojong pastoralists who came around January to March. The dam has since outlived its design life. The embankment is presently in bad condition with significant evidence of slope failure, especially on the upstream face/side, piping through the dam body and extensive siltation. The spillway channel is non-functional thus posing danger of total breach to the embankment. The dam is recharged by Onyama seasonal stream, existing natural spring and groundwater whose water table is high.

In the project area Subsistence agriculture is the main economic activity carried out in the district and the main source of income of the farm families in Agago. 90% of the population in the district is Subsistence farmers. The main food crops grown in the district include; finger millet, maize, sorghum, cassava, peas, beans and vegetables. The traditional and non - traditional cash crops grown include; Cotton, tobacco, soya beans, sim-sim, rice, sunflower and groundnuts. Other agricultural activities include; fish hunting and fish farming.

Provision of water for production is one of the responses to the adverse effects of climate change to the agricultural sector. The intensity and frequency with which the drought and floods occur require more proactive responses. New approaches to water for production service delivery under the Agro-Industrialization (AGI) Program are therefore needed as a proactive response towards drought and to guarantee food security for the future generation. Given the district's vulnerability to climate change, and its importance for national and local food security, rehabilitation of Onyama dam will increase agricultural production and productivity and regulate dependency on rain fed agriculture which is heavily affected by prolonged droughts in the district.

1.2 Justification of the Project

Uganda's Vision 2040 and National Development Plan III (NDP III) recognize agriculture as being the central sector to the country's food security, economic growth, income enhancement and

employment. NDP III, which aims to increase household incomes and improve quality of life of Ugandans, presents Agro-industrialization (AGI) as one of the key programs to deliver its goal. The AGI program identifies lack of irrigation, soil and water conservation practices, and water harvesting (storage) as major constraints to one of its objectives of ''Increasing agricultural production and productivity'. Furthermore, the region experiences intense and prolonged droughts most notably in the cattle corridor districts where Agago lies, leading to significant livestock water demand and loss of livestock.

Supporting the country's development priorities as highlighted in the NDPIII, calls for more investments in construction of water surface reservoirs like earth dams and valley tanks aimed at increasing agricultural productivity, essential support services for agricultural production and value-chain development within the project area as well as reduce the impacts, foster resilience and enabling people to manage the consequences of climate change.

The construction of Onyama dam shall contribute towards the cumulative water storage target under Vision 2040, NDPIII and the National irrigation policy as well combat drought to ensure food security and jobs creation. The dam shall contribute 1,143,904m3 (with a potential increase up to 17,077,352m3) of water storage. This water shall be used for domestic water supply in Lapyem parish, Adilang sub county with a population of about 251,200 people, irrigation of 52Ha of coffee (64Ha), banana (4Ha) and horticulture crops (4.1Ha), livestock watering of cattle, goats, sheep, pigs and poultry; constituting an average water demand of 393,221m3 in 4dry month, fisheries and aquaculture.

The proposed Onyama Earth dam is also motivated by the need to resolve the ongoing water supply issues the local population has been facing. Because it dries out the ground (aquiver), ground water has been regarded unsustainable and unfriendly to the ecosystem because it affects the area's ability to recharge and discharge. Lack of a dependable water source in the area has hindered growth and development.

1.3 Need for the ESIA

National Environmental Act (NO.5 of 2019) mandates an Environmental Impact Assessment for all projects or policies that may, are likely to or will have significant impacts on the environment so that adverse impacts can be identified, Avoided, reduced, mitigated or compensated for based on the mitigation hierarchy (i.e., Water storage and Irrigation). The proposed project falls under Schedule 5 of the National Environment Act specifically under Utilization of water resources and water supply (No. 4) and Construction of valley dams and valley tanks where the threshold is 1,000,000 m^3 or more (h) and support facilities (k) which lists projects to be considered for ESIA. The proposed Onyama Earth Dam is in the category of projects requiring mandatory Environmental and Social Impact Assessment (ESIA) before implementation.

It is in this regard that in accordance with the National Environment Act (NEA) NO.5 of 2019, the Scoping/Terms of Reference (ToR) were prepared and submitted to NEMA for consideration, which paved way for undertaking a full ESIA for the project. In preparing this report, particular attention was paid to the issues specified in section 10 (1) of the EIA Regulations of 2020 with due reference to Section 13 of the same regulation and the African Bank's (AfDB) integrated safeguards system through the Operational Safeguard 1 on the Environment and Social Assessment. This ESIA presents information required for the protection and governance of the environment during the design, construction, operation and decommissioning stages of the proposed project. This will

enable NEMA and other lead agencies including the AfDB take a decision on whether to approve the progress of the project in light of the identified environmental and social impacts or not. Specific attention was paid to the Environmental Impact Assessment Guidelines and the specific EIA guidelines for water sector for Uganda and the OS1 of the AfDB.

1.4 Objectives of the ESIA

The main objective of the ESIA was to carry out a comprehensive (full) environmental and social impact assessment for the proposed construction of Onyama Valley Dam and propose measures to mitigate the adverse impacts while enhancing the positive ones.
The major tasks of the ESIA were:

- A description of the project areas environmental and social baseline conditions of the surrounding, study and assess how these conditions will be affected by the proposed development.
- Identification, assessment, and determination of the likely potential impacts (positive and negative) of the proposed project construction, operation phases and recommend feasible measures to avoid, minimize or mitigate the negative impacts.
- To engage and consult the relevant stakeholders especially those that may be affected by the project implementation.
- To develop an environmental and Social Management Plan/Mitigation plan (ESMP) for the identified negative impacts and an Environmental Monitoring Plan (EMP) for project implementation; and consultation with major stakeholders.
- To compile an Environmental and Social Impact Statement for submission to NEMA for consideration and approval.
- Assessment of national and international legislative, institutional and policy frameworks and guidelines relevant to the project;

1.5 Project Area

Onyama dam is located in Ajwa central village, Lapyem parish, Adilang sub county in Agago district on GPS location 36N 553494E, 310672N. It boarded by vallages of Ajwaa- lela-pura, Ajwaa-wipolo, Anyami Akuuri and Biwang who are earmarked to benefit from the dam. Onyama dam is located 300m off Adilang – Alwala road. The dam which is located in a Government owned land was established around 1952 and is currently silted and having acquatic weeds. The proposed dam has a height of 4m with storage capacity of 199,692m^3 (with a potential increase up to 17,077,352m^3), embarkment length of 130m and would provide water for livestock watering, irrigation, domestic use, reservoir fisheries, flood control, etc. The most appropriate dam shall be an earth fill embankment dam.

There were no evident farming activities within the vicinity of the dam; the dam is currently being used for fishing and animal watering by the surrounding community, cattle keepers from Lira Kato Subcounty and Karimojong pastoralists who came around January to March. The dam is recharged by Onyama seasonal stream, existing natural spring and groundwater whose water table is high. The place experiences severe flooding of about 50m from the visible dam extents during the dry season. Using the ArcGIS 10.4 software and the digital elevation model (DEM) of 30m, a catchment area of Onyama dam was delineated and found to be 66.93 sq. km.

Agago District is bordered by Kitgum District to the north, Pader District to the West, Otuke District to the south Abim District to the East and Kotido District to the North East. Agago, the district

headquarters, is located approximately 442 kilometers, by road, North of Kampala, the capital of Uganda, and the largest city in that country.

1.6 Project description and Design.

1.6.1 Extent of project area

Onyama valley dam is seated on government land (the land title is at the district) with an acreage of 50 acres. During colonial time, this dam land was 110 acres but due to population increase over time 50 acres of this land has been encroached by the neighboring community. The catchment area is 66.93 km^2, Figure 2 shows the dam extent and the catchment area.

Currently, the embankment length is 152m, the crest width is 4m and the dam height is 4m, with a capacity of 201,539.2m^3. However, with the renovation works, the dam capacity shall be 1,247,658.98m^3 with dam height of 10m and a surface area of 315,931.19m^2. However, according to Table 1 below, the dam has a potential of storing 17,077,352$m^3$of water at a contour height of 1270m with a surface area of 2,442,892.48m^2 and a height of 25m. This water shall be used to irrigate 72Ha of land, water heads of cattle, small animals and birds and also provide domestic water to 5,402 people during the initial year. The dam shall also support fisheries and aquaculture.

Table 2: Volume elevation relationship

No	contour (m)	Volume (cu.m)	Surface area (sq.m)	Elevation (m)
1	1245	-	-	0
2	1250	92,913.54	37,495.71	5
3	1255	1,247,658.98	315,931.19	10
4	1260	4,177,073.43	763,257.48	15
5	1265	9,852,628.20	1,413,149.49	20
6	1270	20,077,559.07	2,442,892.48	25

1.6.2 Components of the project

The dam shall provide water storage for multi-purpose uses through irrigation, livestock watering, domestic water supply, aquaculture and fisheries production. The project shall consist of the components;

x. Dam
xi. Reservoir
xii. Irrigation system of 72Ha and above
xiii. Pipe network
xiv. 4no. tap stands
xv. Solar abstraction system (hybrid system to run on both solar and hydro-electricity)
xvi. Pump house
xvii. 3no. 2 stance VIP latrines
xviii. Office and store building

1.6.3 Activities to be carried out during implementation

The activities to be carried out will include;

xii. De-silting of the reservoir
xiii. Construction of the dam

xiv. Construction of water abstraction system
xv. Laying of the transmission and distribution lines, and laterals for irrigation of 72Ha of land
xvi. Construction of project structures which include pump control room, 2 stance VIP latrines, project office and store for the produce
xvii. Construction of 6no. cattle troughs
xviii. Construction of night storage reservoir
xix. Construction of 5no. tap stands
xx. Installation of hydrant system on 72Ha
xxi. Socio-economic activities i.e. stakeholder engagements and mobilization
xxii. Agronomy activities i.e. training farmers on the good agronomy practices

1.6.4 Equipment to be used during construction and operation

i. Bull dozers
ii. Excavators
iii. Roller/rummers
iv. Dump trucks
v. Dewatering pumps
vi. Surveying equipment
vii. Pressure testing equipment
viii. Pickup double cabins

1.6.5 Mode of operation and maintenance

The operation and maintenance of the project shall be done using the Community Based Management System plus (CBMS+) approach. With the CBMS+ approach, the MWE shall formally outsource a System Operator (SO) with the requisite training, skills, and experience to perform the O&M function of the project. The System Operator shall operate on a contract management arrangement. The Water users shall pay fees for the water; but the role of the System Operator shall be to collect fees, carry out routine servicing of the water points and manage the Water User Committee (WUC).

1.7 Details of Developer and Investment Cost

The project is being implemented by Ministry of Water and Environment under the Water for Production Regional Centre – North. The estimate of the combined project investment cost for Onyama Valley Dam is **10,311,724,120 (Ten Billion Three Hundred Eleven Million Seven Hundred Twenty Four Thousand One Hundred and Twenty shillings only)** including an indicative cost of about Uganda shillings Seven Hundred Twenty Seven Million Eight Hundred and Seventy Thousand (UGX **727,870,000**). The address/contact person of the Developer is presented below:

Mr. Eric Ocan
Regional Manager
Directorate of Water Development,
Water for Production Regional Center - N
Plot 14-16, Maruzi Road
P.O. Box, 381 Lira, Uganda
Tel: +256-392705945

1.8 Response to NEMA Approval of Terms of Reference Conditions

SN	REQUIREMENTS	COMMENTS
1.	Provide a comprehensive description of the proposed Earth Valley Dam rehabilitation and the associated Piped Water Supply System, the specific components and associated infrastructure, and the activities that will be undertaken during both the construction and operational phases of the project and the size of the work force.	Addressed under Chapter 3 of this Report
2.	Include in the ESIA, a hydrological investigative report in regard to the potential impacts of the project on water resources within the proposed project area, incorporate in the Environment and Social Impact Statement (ESIS) mitigation actions to address such impacts.	The hydrological investigative report has been attached as Annex VIII of this report
3.	Provide a detailed description of the waste streams that will be generated from the activities of the Earth Valley Dam rehabilitation and the associated Piped Water Supply System, and the measures and equipment that will be put in place to handle such waste.	Addressed under Chapter 8 of this Report
4.	Include in the report other relevant baseline information that is project site specific, on the soils, water, air quality and noise; as well as clear-colored photographs depicting the current status of the project area and the neighboring environs.	Chapter 5 of this Report considers the baseline information of the project area
5.	Provide clear, colored and well-labelled location maps/images (preferably each covering A-3 size paper and accurate sets of GPS coordinates clearly indicating the site boundaries. Ensure that all GPS coordinates are provided in UTM format.	Addressed under project location and baseline information. Table 5 gives the coordinates of the project area
6.	Provide a clear and legible copy of the site layout plan (preferably on A-3 sized paper).	Attached as Annex VIIII
7.	Carry out comprehensive consultations with all the relevant key stakeholders including Agago District Local Government authorities, the Directorate of Water Resources Management (DWRM) particularly in regard to the potential impacts of the proposed project on water resources in the project area. The views of the stakeholders consulted should be well documented and appended to the ESIA report.	Addressed and evidenced under Chapter 7 of this Report and then annexes II and III
8.	Include in the ESIA report, comprehensive analysis of alternatives/options to the selected project location, design, and technology, among other aspects	Addressed under Chapter 6 of this Report
9.	Carry out a comprehensive evaluation of the negative environmental impacts associated with the proposed project activities and the relevant mitigation measures to minimize the identified negative impacts and environmental management/monitoring plans that relate to the identified environmental impacts of the proposed project.	Addressed under Chapter 8 of this Report
10.	Make reference to all the relevant provisions of applicable policies, laws, regulations, guidelines and standards, in particular, the National Environment Act, No.5 of 2019.	Addressed under Chapter 2 of this Report

11.	Append to the ESIA report authentic copies of land ownership and acquisition documents.	Attached as Annex IV
12.	Indicate the actual total project (investment) cost including costs of works, machinery/equipment and land where applicable; and these should be submitted by a Certified Valuer and Valuation Certificate attached to the ESIA.	Addressed under Chapter 1, section 1.9 and Annex IX
13.	In line with Regulation 49 (2) of the National Environment (Environmental and Social Assessment) Regulations S.I. No. 143/2020, pay a non-refundable administration fee of thirty percent (30%) of the total fees payable on submission of the Environmental and Social Impact Statement	Attached as the First page of this Report and Annex X of this report

1.9 Structure of the report

This Environmental and Social Impact Assessment report is concise and limited to the significant environmental issues. It focuses on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting the data. The report contains, but not limited to the following major contents:

1) Cover Page (Title of the proposed project, Location, Name, Address and information of the developer)
2) Table of content
3) Declaration by ESIA team and their details
4) List of acronyms
5) Executive Summary
6) Introduction
7) Policy, Legal and Administrative/Institutional Framework.
8) Description of the Proposed Project.
9) Description of methodology and techniques used in the assessment and analyses of project impacts,
10) Baseline conditions of the physical, biological and socio-economic environment of the project area, including results of relevant studies and other geophysical and geotechnical studies.
11) Description/Assessment of the Environment and social impacts of project activities.
12) Analysis of Alternatives.
13) Environmental and Social Impacts and Mitigation Measures.
14) Chance finds procedure to facilitate the handling of any unknown or known Physical Cultural Resource(s).
15) Grievance Redress Mechanism to facilitate the handling of any complaints that may arise during project implementation.
16) Environmental and Social Management Plan (ESMP) matrices detailing measures for addressing potential negative environmental and social impacts of the project. In addition, the ESMP should clearly identify institutional arrangement, roles, responsibilities, implementation schedules and costs in addressing the mitigation measures proposed in this ESIA, including capacity building requirements; and
17) Propose an E&S Monitoring Plan with clear monitoring indicators and institutional roles to be used in tracking the implementation and compliance of the proposed mitigation measures;
18) Inter-Agency and Public/NGO Consultation.

19) List of References.
20) Appendices:
    - The Environmental and Social Impact Assessment team.
    - Approved Scoping Report/Terms of Reference
    - Land title/agreements
    - Records of Stakeholder meetings
    - Data and Unpublished Reference Documents.
    - Map, drawing and pictorial complement, especially to convey information on the project affected area and proposed project activities
    - Chance Finds Procedure
    - Grievance Redress Mechanism
    - Monitoring check-lists

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 Introduction

Key legislation governing an ESIA study in Uganda includes the National Environmental Act NO.5 of 2019 of the laws of Uganda and the Environmental Impact Assessment Regulations (2020). The National Environmental Act established NEMA and entrusts it with the responsibility to ensure compliance with ESIA process and procedures in planning and execution of development projects. The procedures require that a project proponent prepares an ESIA report with a clear assessment of relevant potential impacts, based on Terms of Reference (ToRs) developed from a scoping exercise. This requires that the ESIA addresses potential direct and indirect socio-environmental impacts during the pre-construction, construction, operation and decommissioning phases and an environmental and social management plan (ESMP) has also to be prepared.
Policies, legal and institutional framework considered relevant to this proposed project are discussed in this section. Various laws here reviewed relate to minimum acceptable construction, operational and decommissioning requirements, environmental quality, land use, public health, occupational safety, labour standards and international legal obligations.

2.2 Policies relevant to the Proposed Project

Table 3 below presents the Policy framework related to the project

Table 3: Policy framework relevant to the proposed project

Policy	Goal	Relevancy
The National Environment Management Policy 1994 (NEMP)	The key policy objectives include the enhancement of the health and quality of life of Ugandans and promotion of long-term, sustainable socio-economic development through sound environmental and natural resource management and use; and optimizing resource use and achieving a sustainable level of resource consumption.	Regarding the planned Onyama Valley dam Irrigation Project, aspects of Environmental Assessment will be integrated into the project in with the objective of ensuring sustainability in the project.
The National Development Plan 2021-2025	It underscores the country's medium-term strategic direction, development priorities and implementation strategies. According to the NDP, the share of agriculture in GDP has been declining which represents significant structural transformation in the economy	In that case, a number of interventions to be pursued under the project are aimed at addressing some of the pillars in NDP III which are all geared towards socio-economic transformation and improvement in the livelihoods at household levels.

The Uganda Vision 2040	Uganda Vision 2040 is anchored on the national shared vision which is attaining "A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years". However, it is clear, agriculture is the main stay of the Ugandan economy employing 65.6% cent (UBOS, 2017) of the labor force and contributing 21% to the GDP. Despite these, agricultural contribution to the GDP has been declining but remains very important to provide a basis for growth in other sectors	For Uganda to shift from its current largely peasantry economy in most of the households to an industrialized and urban society, it must be propelled by multi-sectoral development interventions such as the project seeks to address electricity, water supply and agricultural production which therefore makes the project consistent with the GoU Vision 2040.
The Uganda Agriculture Policy, September 2013	The policy outlines six principles to guide the sector, which entail pursuance of a private sector led and market-oriented economy; zoning to promote the most suitable commodities per area and provision of government support for such commodities to enhance commercialization, development of value chains for these commodities and food security.	The policy principles are important aspects of the planned Valley dam irrigation project which focuses on increasing production and commercial agriculture, development of value chains for the produce of the irrigation scheme and capacity development of farmers of all categories with the support of government.
National Water Policy, 1999	The policy objective of this instrument is to sustainably manage and develop the water resources of Uganda in a coordinated and integrated manner so as to secure/provide water of an acceptable quality for all social and economic needs.	Allocation of water to meet irrigation demand in the project will be done considering the economic, social and environmental values and uses of water by its various users especially downstream communities.
The National Agriculture Policy (2013)	Uganda's agricultural sector policy highlights the country's high potential in agriculture which it seeks to exploit in order for it to realize its overall development and poverty reduction objectives. Uganda expects to attain middle-income country status by 2020 and to reduce its poverty levels to 5% by 2040. The National Agricultural Policy provides the framework within which the sector expects to contribute towards achieving these targets.	To have a sustained positive impact on overall economic growth, poverty reduction and food security, the agricultural sector must grow at a rate of 5.6%.

The National Land Use Policy	The overall policy goal is to achieve sustainable and equitable socio-economic development through optimal land management and utilization in Uganda.	In the planned project, women are key beneficiaries in its agricultural activities and therefore, where land is to be taken up for project infrastructures, opinion of women have to be factored in compensation as well as during allocation of resources of irrigations interventions.
The Occupational Health and Safety Policy	This policy will be especially relevant for Occupational Health and Safety (OHS) of the Project and associated transmission line construction crews and subsequently, maintenance personnel	The policy will also have relevance in mitigation measures that protect the workers and the public from adverse health and safety impacts as a result of project construction and subsequent operation and maintenance activities.
The National Gender Policy, 1997	The GoU adopted a National Gender Policy of 1997, a tool to guide mainstreaming gender interventions into the development process and planning in sectors of economy. The gender policy is to facilitate Uganda's gender mainstreaming programs in all sectors of the economy.	The valley dam irrigation project will mainstream gender dimensions into its activities, plans and policies with objective of seeking economically empower the women in particular at household level.
National Irrigation Master Plan for Uganda (2010-2035)	The Overall Objective of irrigation development in Uganda is: "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".	These objectives of the Irrigation Master Plan will be in line with the aspirations of Earth dam Project especially, its irrigation component.
The National HIV/AIDS Policy, 2004	The policy provides the principles and a framework for a multi-sectoral response to HIV/AIDS in Ugandan's world of work.	The requirements of this policy are expected to be fulfilled by the Project in that, its contractors are to have an in-house HIV Policy, workers sensitization, conducting VCT, provision of free condoms as well as other supportive measures for prevention and management of HIV, including its gender dimensions.
Uganda National Climate Change Policy, 2015	The overarching objective of the policy is to ensure that all stakeholders address climate change impacts and their causes through appropriate measures, while promoting sustainable development and a green economy including integration of climate	ESIA promotes the wise use of water resources to minimize harmful effects to the environment and water resource monitoring. It promotes and strengthen the conservation and protection against degradation of watersheds, water catchment

	change issues into planning, decision making and investments in all sectors.	areas, riverbanks and water sources in order to increase their resilience to climate change impacts.
National Orphans and other vulnerable children's Policy, 2004	The goal of the Policy is full development and realization of rights of orphans and other vulnerable children. The policy provides support to vulnerable children and families such that their capacity to sustain themselves is strengthened; and provides residential care for orphans and other vulnerable children as a last resort	The project Developer (MWE/WfPRC-N) and the contractor(s) including their sub-contractor(s) will ensure that the project activities do not compromise or in any way affect the lives and livelihood of all the vulnerable groups like the orphans and children in general during the project implementation
National Equal Opportunities Policy, 2006	The National Equal Opportunities Policy provides a framework for re-dressing imbalances, which exist against marginalized groups while promoting equality and fairness for all. With a goal of: providing avenues where individuals and groups' potentials are put to maximum use by availing equal opportunities and affirmative action.	The earth dam projects come along with a lot of opportunities including service delivery, trainings and employment. The project will avail equal opportunities and affirmative action.
The National Child Labour Policy 2006	The policy provides an enabling environment for the prevention, protection and elimination of child labor. It is intended to establish guiding principles in Uganda's effort to eliminate child labor and priorities for government and stakeholder action. This policy is based on recognition that all human beings, adults and children, have rights. Children by virtue of their age and needs are entitled to specific rights, including education, health, survival development, protection and participation	The project management including all the contractors will ensure that all employees are above 18years and not school going students or pupils.
The National Policy for Older Persons 2009	The policy seeks to achieve equal treatment, social inclusion and empowerment of older persons. The values of the policy are: i. Equity; Fairness, fair play, impartiality and justice in the distribution of benefits and responsibilities in society.	Persons above 65 years old are categorized as old. These should be incorporated in the compensation process where necessary and will be treated with Equity and respect; all their views will be considered regarding the execution of the project.

	ii. Respect; Views, opinions and rights of older persons will be upheld while they are also expected to exhibit high sense of self- respect. Commitment; The willingness to work hard and give all the energy and time to meet the vision. iii. Accountability; All stakeholders are expected to fulfill their obligations towards one another. iv. Equality; All older persons will be accorded same opportunity and rights as other individuals.	
The National Policy for the Conservation and Management of Wetland Resources, 1995.	The goal of this Policy is to curtail the rampant loss of wetland resources and ensure that benefits from wetlands are sustainable and equitably distributed. Wetlands acting as sources of wastewater treatment should be fully protected. This policy outlines guidelines for wetland resource developers.	The proposed project is aimed at Conservation and Management of Wetland Resources within the catchment area. The designs will adhere to the principles of sustainability such that areas within wetlands are left intact, as much as possible.

2.3 Legal Framework relevant to the proposed project

Table 4: Legal framework related to the project

Legal Framework	Relevancy	Requirement
The Constitution of the Republic of Uganda; 1995; amended as at 15th February 2006, Government of Uganda.	The State shall promote sustainable development and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for the present and future generations. The right to a clean and healthy environment is enshrined in Article 39 of the Constitution of Uganda, 1995.	ESIA report will be prepared for NEMA's consideration before implementation of the project. This ESIA has been prepared which amongst others, outlines anticipated environmental and social negative impacts of the project and outlines measures for addressing such concerns through its ESMP.

The National Environment Act; No.5 of 2019	Schedule 5 of the National Environment Act, No. 5 of 2019 lists projects to be considered for environmental impact assessment. Under that categorization, the proposed project falls Section 4(h) & (k).	The proposed development falls under Schedule 5 of the National Environment Act No.5 of 2019, Section 4(h) & (k) (i.e., Construction of valley dams and valley tanks where the threshold is 1,000,000m^3 or more). ESIA report will be prepared for NEMA's consideration before implementation of the project.
The Occupational Safety and Health Act, 2006	The Act provides for the prevention and protection of persons at all workplaces from injuries, diseases, death and damage to property.	An ESMP has been prepared and the Contractor will ensure the workplace is registered under the Ministry.
The Land Act, Cap 227	Section 74 (i) states that where it is necessary to execute public works on any land, an authorized undertaker shall enter into mutual agreement with occupier or owner of the land in accordance with Act.	The land for the proposed Onyama earth dam belongs to the Agago District Local Government and therefore, there are no expected issues regarding land acquisition for the infrastructure
The Employment Act, 2006	This Act spells out general principles regarding elimination of forced labor, discrimination in employment, sexual harassment and provisions to settle grievances. It further provides that, a child under the age of twelve years shall not be employed in any business, undertaking or workplace.	No doubt, this law will oblige the project to ensure no employment of children below the age of 18 years in the project activities.
Workers' Compensation Act, 2000	This requires compensation to be paid to a worker injured or acquired an occupational disease or has been harmed in any way in the course of his/her work.	The developer shall ensure that all contractors and sub-contractors provide personal protective equipment (PPE) to employees to minimize accidents and injuries and ensure workers safety onsite.
The Water Abstraction Regulations, 1998	The Water Abstraction Regulation in Section 18 provides for the establishment of a controlled mechanism through issuance of permits to regulate the amount of water abstracted by users. The Regulation requires that a water abstraction permit either for ground or surface water abstraction are pre-requisites for motorized and/or abstracting of quantities above 400m3/day for persons involved in construction (damming, diverting surface water).	Irrigation and associated considerations may require abstraction permits from DWRM after detailed feasibility is conducted.
Public Health Act, Cap 281	Provision of clean and sanitary premises; Protection of public health and Prevention of public nuisance.	The developer will ensure provision of sanitary facilities to workers and proper management of waste.

		Public health and hygiene are key in the project implementation with regard to handling of waste arising from the project as well as agro-chemicals use, including use of pesticides.
The Local Governments Act, Cap 243	Provides for the system of local governments based on the decentralization of district for the enforcement of environmental law.	The developer will work closely with the District Water Officer (DWO), District Environment Officer (DEO) and Sub-County Community Development Officer in carrying out monitoring activities to ensure no damage onto the environment and social amenities.
Environmental Impact Assessment Regulation, 2020	According to sections 19-20 of the NEA, all projects that have or are likely to have a significant impact on the environment are required to undergo an EIA process prior to implementation.	ESIA report has been prepared for NEMA's consideration before implementation of the project.
The National Environment (Wetlands, Riverbanks and Lake Shores Management) Regulations, 2000	Regulation 12(1) prohibits any person from carrying out an activity in a wetland without a permit issued by the Executive Director of NEMA.	Water source protection measures have been proposed to protect the wetlands and streams within the catchment area.
The National Environment (Waste Management) Regulations, 2020	Regulation 5 (8) stipulates that (1) A person who generates waste, a waste handler or product steward has a duty of care and shall take measures to ensure that waste is managed appropriately and securely in accordance with the Act, these Regulations, any other applicable law, environmental standards and conditions of the licence; (b) waste is managed in a manner that does not cause harm to human health or the environment.	Waste management options have been proposed in this ESIA report and all waste shall also be disposed of in a gazette premise by the Local Government.
The National Environment (Noise Standards and Control) Regulations, 2000.	Regulations 6 & 7 sets permissible noise levels, Part III calls for the control and mitigation of noise; Regulation 9 specifically prohibits the generation of noise and Part IV provides for a license for noise in excess of permissible levels.	All construction activities should be carried out between 7am – 6pm by the Contractor as working hours. No construction activities to be carried out at Night. Noise levels should also be monitored and not to exceed 85dB as per Regulation.

<table>
<tr>
<td>The Children's Act, Cap 59</td>
<td>This is an Act to reform and consolidate the law relating to children; to provide for the care, protection and maintenance of children; to make provision for children charged with offences and for other connected purposes.

Part II of the second schedule of this Act defines a child as a person below the age of eighteen (18) years.

In the same schedule under Section 8 of this Act provides that no child shall be employed or engaged in any activity that may be harmful to his or her health, education or mental, physical or moral development.</td>
<td>This Project will require workers during construction, operation and maintenance phases. No child should be employed under project work force requirement however, any employment or engagement of children will be done in line with the restrictions of this Act and the Employment Act to ensure that risks to children are either eliminated, or reduced to as low as reasonably practicable. In addition, the contractor will confirm age of potential labourers prior to hiring through National Identity card, birth certificate or confirming with LC and community elders. Agago District Probation Officers will provide guidance to Contractors and their employees' areas of compliance.</td>
</tr>
<tr>
<td>The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 2020</td>
<td>Section 5 details that a person shall not discharge effluent into water or land except in accordance with the Act, the Water Act, the National Environment (Waste Management) Regulations, 2020, the Petroleum (Waste Management) Regulations, 2019, the Water (Waste Discharge) Regulations, these Regulations and environmental standards. For this project, this standard is applicable to liquid waste/ sewage treatment plant and public toilets.</td>
<td>Effluent/liquid waste (such as human waste, food scraps, oils, soaps and chemicals) should not be discharged into any wetland or in the River water resources and should be managed in a manner that does not cause harm to human health or the environment.</td>
</tr>
<tr>
<td>Draft National Air Quality Standards, 2006</td>
<td>The draft national air quality standards provide Uganda's regulatory air quality standards.

<table>
<tr><th>Pollutant</th><th>Averaging time for ambient air</th><th>Standard for ambient air</th></tr>
<tr><td>Carbon dioxide (CO_2)</td><td>8 hour</td><td>9.0 ppm</td></tr>
<tr><td>Carbon monoxide (CO)</td><td>8 hour</td><td>9.0 ppm</td></tr>
<tr><td>Hydrocarbons</td><td>24 hour</td><td>5 mg m^{-3}</td></tr>
<tr><td>Nitrogen oxides (NO_x)</td><td>24 hour
1 year arithmetic mean</td><td>0.10 ppm</td></tr>
<tr><td>Smoke</td><td>Not to exceed 5 minutes in any one hour</td><td>Ringlemann scale No.2 or 40% observed at 6m or more</td></tr>
<tr><td>Soot</td><td>24 hour</td><td>500 µg Nm^{-3}</td></tr>
<tr><td>Sulphur dioxide (SO_2)</td><td>24 hour</td><td>0.15 ppm</td></tr>
<tr><td>Sulphur trioxide (SO_3)</td><td>24 hour</td><td>200 µg Nm^{-3}</td></tr>
</table>
Note: ppm = parts per million; "N" in µg/Nm-3 connotes normal atmospheric conditions of pressure and temperature (25oC and 1 atmosphere).</td>
<td>These standards will apply particularly during construction of the earth dam and reservoirs.</td>
</tr>
</table>

The National Environment (Audit) Regulations, 2020	Part III on Environmental Compliance Audit, Section 12, Sub-section (1) requires the developer of a project or activity listed in Schedule 3 to these Regulations to carry out an environmental compliance audit.	The project will involve construction and operation of earth dam facilities that have a potential to impact negatively of the environment. Therefore, MWE/WfPRC-N should conduct Environmental Audits to assess if there are impacts, to what extent and mitigate them.

2.4 International legal and lenders requirements

Uganda is a party to a number of international and regional agreements which requires her to comply with provisions of the agreements when setting up projects like Onyamo Valley Dam.

International financial institutions like the African Development Bank (AfDB) have environmental and social safeguard policies that are designed to avoid, mitigate, or minimize adverse environmental and social impacts of projects supported by them. These are complimented by the Performance Standards (PS) which have been set by the International Finance Corporation (IFC). These safeguard policies and performance standards (Table 4) can be used and adhered to during the project cycle to ensure that the project meets the international standards.

Table 5*: The Safeguard policies and Performance Standards relevant to the Project*

Operational Safeguard/ Performance Standard	Key Issues	Relevance/Applicability
OS 1: Environmental and social assessment	Mainstream environmental and social considerations, including those related to climate change vulnerability and thereby contribute to sustainable development in the region. It governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements	An environmental and Social Impact Assessment (ESIA) has been conducted for this project (this Report) where potential impacts have been identified and mitigation measures proposed. This will ensure that the project is implemented in a sustainable way.
OS 2: Involuntary resettlement, land acquisition, population displacement and compensation	Mainstream resettlement considerations in AfDB operations. It consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and incorporates a number of refinements designed to improve the operational effectiveness of those requirements	There are no anticipated issues of resettlement and compensation because the land has no encumbrances. All land at the proposed earth dam facilities was secured by the Agago District Local Government as seen in the annex IV of this report.
OS 3: Biodiversity and ecosystem services	Identify and implement opportunities to conserve and sustainably use biodiversity and natural habitats as well as observe, implement, and respond to requirements for the conservation and sustainable management of priority ecosystem services.	Mitigation measures have been proposed in this Report to minimize probable impacts of this project on biodiversity, including water resources so that their ability to provide ecosystem services to people are not compromised.

OS 4: Pollution prevention and control, hazardous materials and resource efficiency	Manage and reduce pollution in AfDB funded projects. It covers a range of key impacts including pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry specific and regional standards, to be followed to safeguard the environment and humans from being polluted as a result of the development activities	The project proponent and contractor will set up a waste management plan to handle liquid and solid wastes, including those of hazardous nature.
OS 5: Labour conditions, health and safety	Protection of workers' rights and provision of their basic needs. It establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation of the labourers	The project will abide by the labour laws to protect the interests of workers. This will include for example: providing contracts to all hired workers, providing workers with personal protective equipment, setting up a grievance handling mechanism (**Annex VII**) to enable workers express their complaints, among others.
Performance Standards		
PS1: Social & environmental assessment and management systems	It establishes the importance of: (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project.	An ESIA has been carried out. Potential impacts of the project have been identified and their mitigation measures proposed. Stakeholder involvement was a major component of the ESIA.
PS 2: Labour and working conditions	This performance standard is concerned with management of labour risks such as lack of contracts, insufficient wages, exploitation of minors, discriminatory hiring, unsafe	A grievance handling mechanism will be put in place where workers can lodge their complaints.

	and un hygienic living conditions, internal grievance handling, excessive over-time and handling of casual laborer.	The project will employ workers following the relevant labour laws of Uganda.
PS3: Resource efficiency and pollution prevention	Requires project to efficiently use resources and to minimize or avoid pollution to the environment	The Developer shall ensure that pollution control measures are in place and only the required resources are utilized.
PS4: Community health, safety and security	This performance standard looks at aspects that can expose the public to accidents, excessive noise, traffic congestion, diseases, insecurity, among others	An ESMMP has been put in place detailing the management of impacts related to community health, safety and security.
PS5: Land acquisition and involuntary resettlement	Establishes requirements for efficient and timely compensation and/ resettlement of project affected persons	There are no anticipated issues of resettlement and compensation because the land has no encumbrances. All land at the proposed earth dam facilities was secured by the Agago District Local Government as seen in the annex IV of this report.
PS6: Biodiversity conservation and sustainable management of living natural resources.	Requires that projects put up necessary measures to conserve biodiversity and natural habitats	An ESMMP has been put in place with measures to ensure biodiversity is not adversely impacted by the implementation of the project.
PS7: Indigenous peoples	Promotes the protection of indigenous people	No indigenous peoples as defined under this standard are considered to be resident in the project area.
PS8: Cultural heritage	Requires that all resources of cultural importance are identified and protected	No cultural resources were identified during this assessment. However, any cultural resource that may be identified at any stage of project operation will be protected and relocated according to the established laws of Uganda. A chance finds procedure (Annex VI) will guide

		handling and management of any PCRs that may be found during civil/earth works.

2.5 Institutional Framework and Capacity Assessment of the public entities in charge of ESIA

Table 6 below presents the institutional framework.

Table 6: Institutional framework related to the project

Institution	Role
African Development Bank (AfDB)	Support the project with funding To ensure that the Bank's operational Safeguards (Oss) are observed and implemented as appropriate Review of the ESIA report
Ministry of Water and Environment	▪ Development of legislation, policy formulation, sector coordination and ▪ guidance, and monitoring and evaluation.
Directorate of Water Resources Management (DWRM)	▪ Issue water abstraction permits. ▪ Ensure environmental compliance of large scale water resources related project activities with the water regulations, guidelines and procedures.
National Environment Management Authority (NEMA)	▪ Coordinate, inspect, supervise and monitor project activities to ensure that the environment and natural resources are not depleted but managed sustainably.
Directorate of Environment Affairs (DEA)	▪ Coordinate, inspect, supervise and monitor the environment and natural resources. ▪ Ensure that environmental policies and laws are respected while implementing water resources related projects.
Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	▪ Is mandated amongst others and specific relevance to this project, to support the development of infrastructure and use of water for agricultural production and to develop and promote collaborative mechanisms nationally, regionally and internationally on issues pertaining to the sector.
District and Sub County Local Authorities	▪ Facilitate and/or coordinate activities of the developer in their areas of jurisdiction. ▪ Mobilize local communities and key stakeholders to participate in EIA consultations and/or public hearings.
Ministry of Gender, Labour and Social Development (MGLSD)	▪ The department of Occupational Health and Safety (OHS) is responsible for inspecting and registering the workplace and monitoring of conditions under which employees on the project are subjected.
Developer / WfPRC-N	▪ Apply for Surface Water Abstraction Permits from DWRM. ▪ Compensate local Project Affected Persons (PAP) for any loss or negative effect of the project before implementing the project. ▪ Implement mitigation measures and actions to protect the environment and monitor implementation of proposed measures in the specific site- ESMPs.

Contractor	▪ 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 WfPRC-N. ▪ It is recommended that the Supervising Consultant Team include an Environment Management Specialist, who must be responsible for the day-to-day guidance of the project activities on environment and social compliance to the requirements of the Contract and legislation. ▪ To develop a code of conduct that all the workers will read and acknowledge to abide by through signing
System Operator (SO)	▪ Operation of the earth dam in reference to the memorandum of understaing (MoU) signed between them and the Ministry of Water and Environment (MWE)/WfPRC-N ▪ Manage and maintain the earth dam in reference to the memorandum of understaing signed between them and the Ministry of Water and Environment (MWE)/WfPRC-N ▪ Collection of the user fees from the project beneficiaries in respect to the signed MoU. ▪ To develop a code of conduct that all the workers will read and acknowledge to abide by through signing

2.6 Permits and Licenses

A list of some of the permits and licenses necessary for execution of the project are indicated in the Table below.

Table 7: Permits and licenses required by the proposed development

No.	Permit or License Name[1]	Issuing Authority	Responsible for acquiring the permit
1.	Certificate for Approval for ESIA for the project	National Environment Management Authority (NEMA)	Water for Production Regional Center- North (WfPRC-N) under the Directorate of Water Development (DWD)
2.	Surface Water Abstraction Permit	The Directorate of Water Resources Management (DWRM) under the Ministry of Water and Environment (MWE)	System Operator (SO)
3.	Permit to carry out an activity in a wetland/river bank	NEMA	WfPRC-N

[1] And any other permits or licenses prescribed by NEMA in the Certificate of Approval for the ESIA Report.

4.	Construction Permit	Agago District Planning Office	Contractor
5.	Workplace Registration Certificate	Department of Occupational Safety and Health under the Ministry of Gender, Labour and Social Development (MGLSD)	Contractor
6.	Equipment Inspection Certifications	Department of Occupational Safety and Health/Ministry of Gender, Labour and Social Development (MGLSD)	Contractor
7.	Solid Waste Management License *(to collect, transport, store, treat or dispose of waste)*	NEMA	Both the Contractor and System Operator
8.	Effluent Discharge Permit	DWRM under MWE	System Operator

2.7 Regional and international agreements

Uganda has signed and/or ratified several regional and international agreements and conventions relating to the environment such as ones below. However, due to the low environmental sensitivity of the project sites no impact associated with these conventions are anticipated. The foregoing notwithstanding, the contractor and MWE will have a contractual obligation to avoid impacts that may violate above conventions, wherever encountered.

Table 8: Summary of International Treaties and Conventions

Convention/Protocol/Treaty	Triggered	How it is triggered and key issues
EAC Treaty; Protocol on Environment and Natural Resources Management	Yes	It applies to all activities, matters and areas of management of resources of Partner states. Specifically, this ESIA has been undertaken to cover the following: Sustainable environment and natural resources management; Management of Water Resources; Management of Wetland Resources; Soil and Land Use Management; Management of Wastes and Hazardous Wastes; Environmental Impact Assessment and Environmental Audits; and Environmental Standards.
Stockholm Declaration (Declaration of the United Nations Conference on the Human Environment 1972)	Yes	Principle 15 of the Stockholm Declaration states that, "Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and

		environmental benefits for all". In this respect, projects aimed at exploiting local people or the environment are discouraged.
African Convention on the Conservation of Nature and Natural Resources (1968)	Yes	The earth dam to be rehabilitated will not discharge the effluent into sensitive natural resources or wetland ecosystems.
Convention on Wetlands of International Importance Especially as Waterfowl Habitat	Yes	Although no gazetted wetlands are traversed by the project facilities, the earth dam will not discharge any effluent into wetland ecosystems that could be draining into gazetted wetlands.
The Convention on Migratory Species of Wild Animals (CMS)	Yes	This convention is relevant to the Project as implementation could impact on migratory species to only very small extent by attracting birds to earth dam.
Montreal Protocol on Substances that Deplete the Ozone Layer (1987)	No	No such substances will be used during construction and operation of the project facilities.
Convention on Biological Diversity (1992)	No	There was no significant biological diversity in the project area.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	No	No project facility is located in a protected wildlife area.

3 DESCRIPTION OF PROPOSED PROJECT

3.1 Location of Project Site

Onyama dam is located in Ajwa central village, Lapyem parish, Adilang sub county in Agago district on GPS location 36N 553494E 310672N. It boarded by vallages of Ajwaa- lela-pura, Ajwaa- wipolo, Anyami Akuuri and Biwang who are earmarked to benefit from the dam. Onyama dam is located 300m off Adilang – Alwala road. The dam was established around 1952 and is currently silted and having aquatic weeds. The dam is located in a grazing land which is communally owned and the land where the dam sits is government land. The proposed dam has a height of 4m with storage capacity of 201,539m3 (with a potential increase up to 20,077,559m3), embarkment length of 152m and would provide water for livestock watering, irrigation, domestic use, reservoir fisheries, flood control, etc. The most appropriate dam shall be an earth fill embankment dam.

There were no evident farming activities within the vicinity of the dam; the dam is currently being used for fishing and animal watering by the surrounding community, cattle keepers from Lira Kato Subcounty and Karimojong pastoralists who came around January to March. The dam is recharged by Onyama seasonal stream, existing natural spring and groundwater whose water table is high. The place experiences severe flooding of about 50m from the visible dam extents during the dry season. Using the ArcGIS 10.4 software and the digital elevation model (DEM) of 30m, a catchment area of dam Onyama was delineated and found to be 66.93 sq. km. Some coordinate points of the valley dam

Table 9: Coordinates of some of the points around the Dam

POINT	COORDINATES	
	LATITUDE	LONGITUDE
1	2.811385N	33.481010E
2	2.810362N	33.481486E
3	2.811475N	33.482216E
4	2.810986N	33.482215E
5	2.811375N	33.481392E
6	2.811488N	33.481926E
7	2.811120N	33.482702E
8	2.811318N	33.483213E
9	2.810852N	33.482873E
10	2.810936N	33.482466E

Agago District is bordered by Kitgum District to the north, Pader District to the West, Otuke District to the south Abim District to the East and Kotido District to the North East. Agago, the district headquarters, is located approximately 442 kilometers by road, North of Kampala, the capital of Uganda, and the largest city in that country.

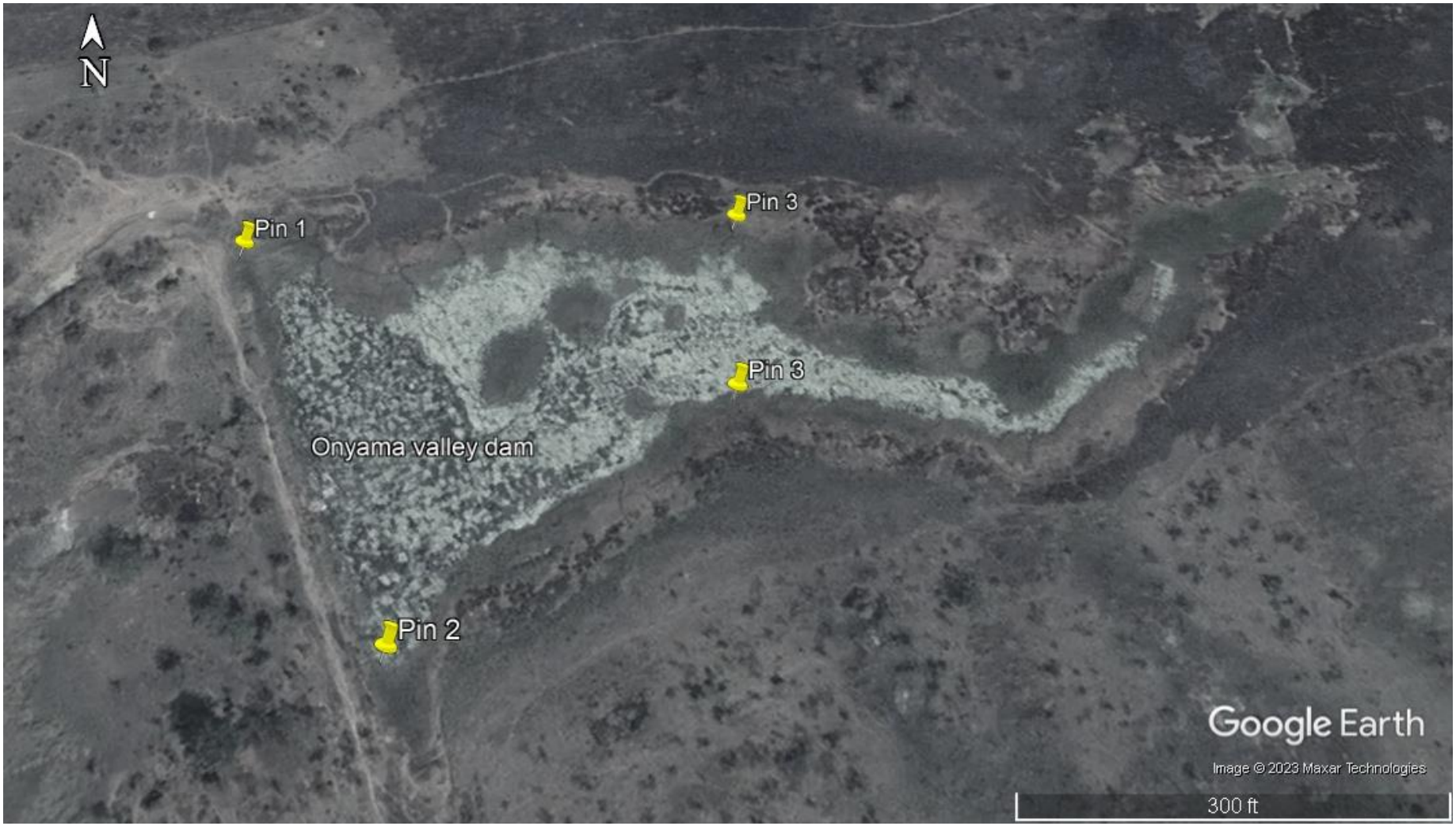


Figure 1: Google Earth map showing the location of the Onyama Valley Dam

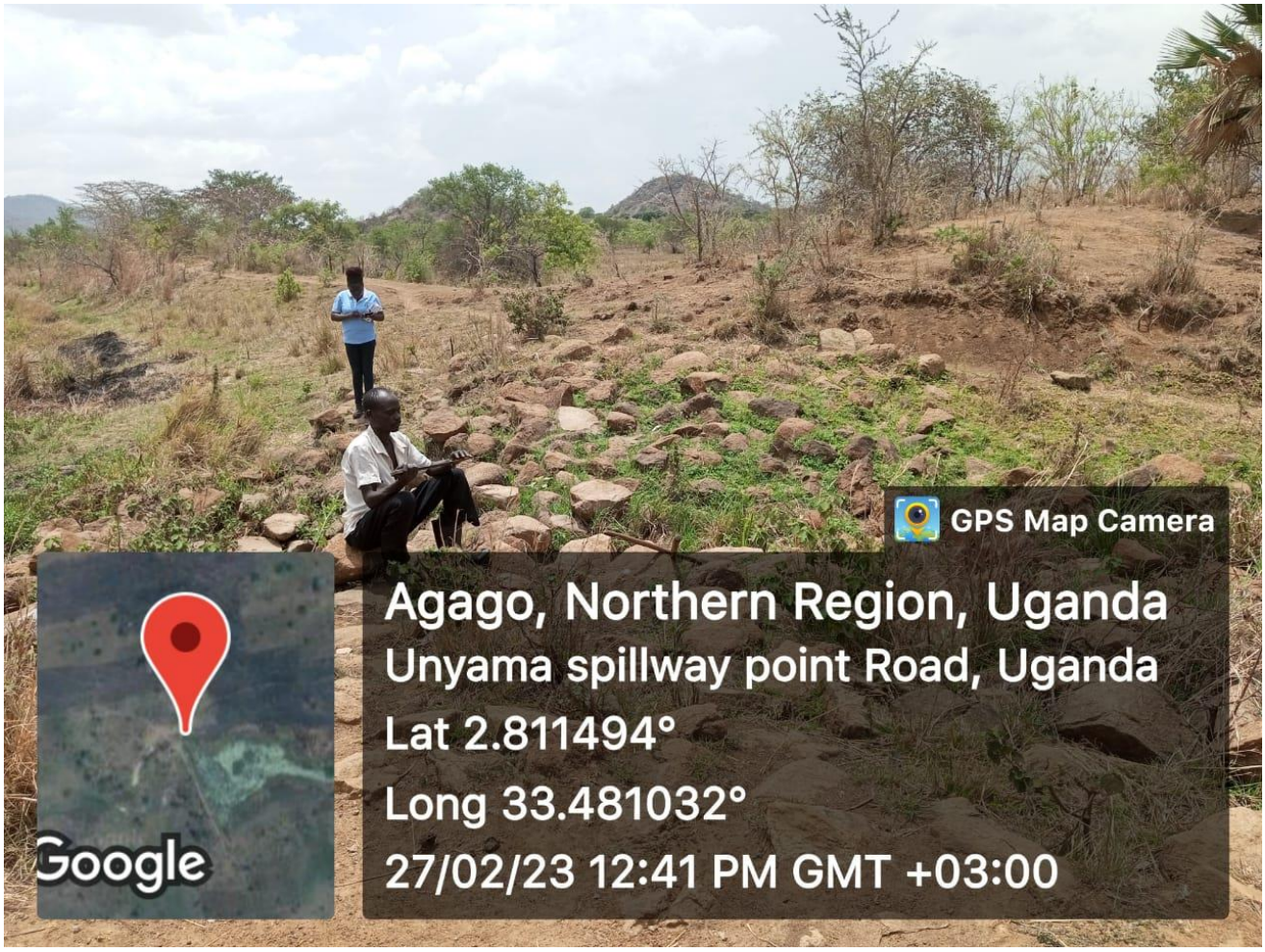


Plate 1: Proposed location of the Onyama Earth dam

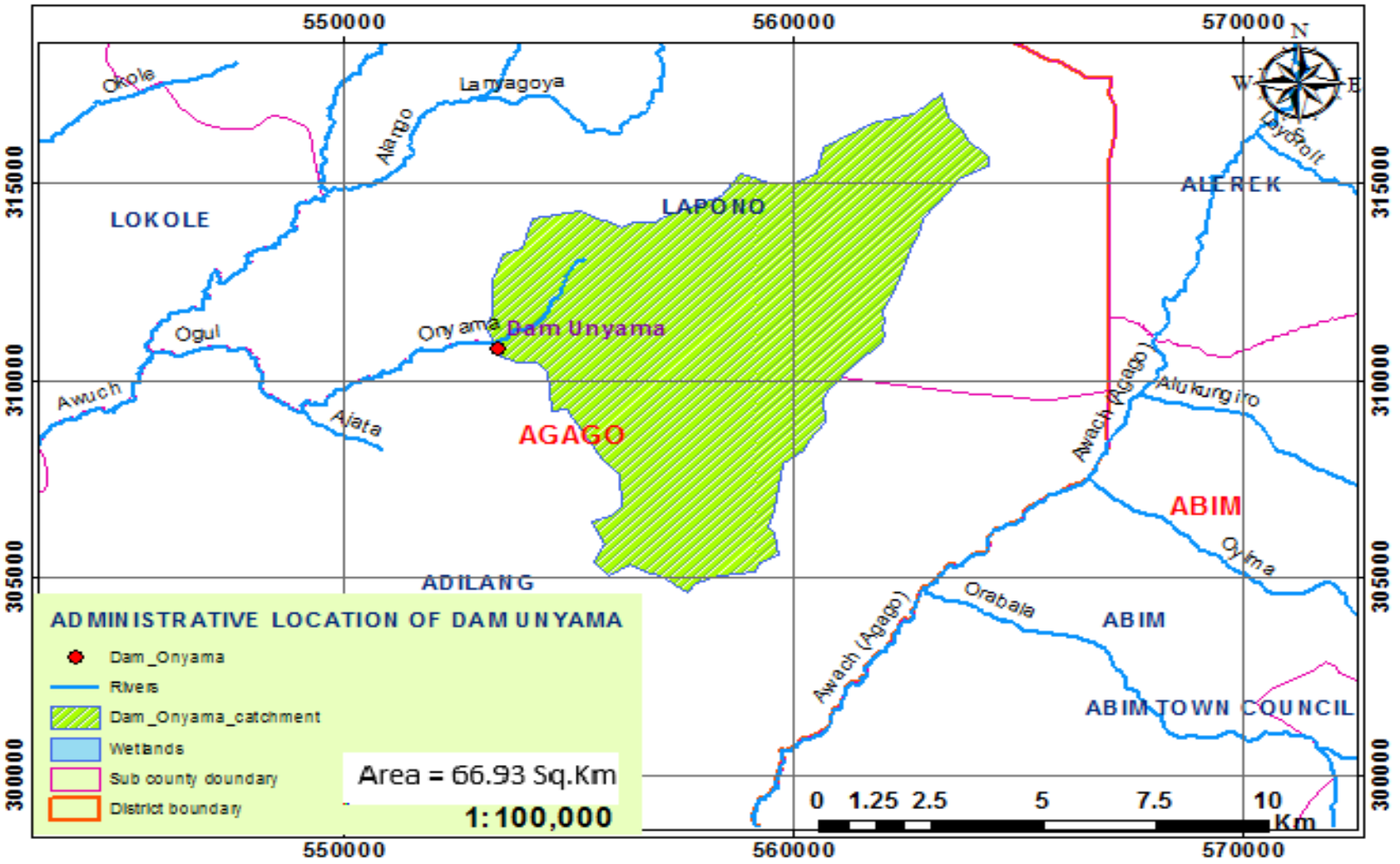


Figure 2: Location and administrative map of Onyama dam site in Agago District

3.2 Description of the main project components

3.2.1 Project Components

The project will include construction of a dam and its auxiliary works; and an irrigation network and associated structures, which will comprise a low-pressure pipe system. The project is composed of the following main works:

a. A zoned earth-fill dam with 9.1m maximum height and a crest length of approximately 700 m;
b. A spillway designed to discharge a flood of 49 m^3/s, with a return period of 10,000y;
c. A Control Building;
d. An irrigation network consisting of:
    - ❖ main and secondary distribution lines reaching the different zones in the command area,
    - ❖ Tertiary lines distributing water directly to the irrigation units and relevant hydrants.

3.2.2 Dam

Onyama dam is located in Ajwa central village, Lapyem parish, Adilang sub county in Agago district on GPS location 36N 553494E 310672N. It boarded by vallages of Ajwaa- lela-pura, Ajwaa-wipolo, Anyami Akuuri and Biwang who are earmarked to benefit from the dam. Onyama dam is located 300m off Adilang – Alwala road. The dam is a zoned earth-fill dam type. All the materials foreseen for the construction of the dam body are available on site or in close proximity.

Table 10: Main Features of the Dam

Maximum dam height (H)	11.6 m
Maximum crest length (m)	800 m
Crest Elevation (Cel)	1368.5 m.a.s.l
Maximum Base Width (upstream to downstream toe) (BW)	1357 m
Upstream slope (S_{US})	2.25:1+2.5:1+2.5:1 (h/v)
Downstream slope (S_{DS})	2.25:1+2.5:1 (h/v)
Crest road width (CW)	7 m

A drainage pipe around 210m long, has been designed along the dam axis at a depth of about 7m from the original ground elevation. The drainage pipe is a corrugated steel pipe and is accessible from the intake gallery. The main function is to collect the water from the drainage system and to monitor the eventual presence of seepage problems.

Table 11: Drainage Dimensions

Type	Corrugated steel pipe 3''x 1''
Diameter (D)	2.4 m
Thickness (tk)	4.5 mm
Length (L)	210 m

The characteristic elevations of the reservoir are listed below.

Table 12: Reservoir Levels

Reservoir Elevations M a.s.l.			Reservoir Volume Mm^3
Minimum Operating Level	Min OL	1356.0	1.3
Maximum Operating Level	Max OL	1363.0	6.1
Flood Level @ 10,000 yrs	FL	1370	7.3
Extreme Flood Level	Ex FL	1361.2	9.1

3.2.3 Control Building

The control building will serve for the management of water use. From the control building it will be possible to divert the reservoir water into the:

a. pressurized irrigation system;

b. Natural stream for the ecological flow.

3.3 Construction Materials

The materials required for the construction of the dam will mainly include;

1. Murrum from borrow pits or another source

2. Clay core in layers to Provide Casing embankment over homogeneous soils on Dam's side.

3. Graded sand in Inclined/Horizontal filter/sand blanket

4. Rock fill for graded filter media and rip-rap

5. Cement for concrete works

Some of the materials are expected to be sourced from quarries to be developed in the vicinity of the Onyama site while others will be outsourced from local and international suppliers. Water for construction will be abstracted from Onyama stream. The dam will be built with the same soil material as the foundation (lean clay or clay with low plasticity or silt or silt with low plasticity CL/ML), suitably selected and compacted. 300 mm thick rip rap will be constructed over graded filter media on embankment; such material will be taken from quarries in the vicinity of the dam site.

The estimated required quantities of the construction materials can be summarized below.

Table 13: Estimated materials for dam construction

Material	Amount required	Remarks
Clay	56,615.00 m^3	Cut-off trench/dam body embankment
Murrum	185,473.00m^3	Casing embankment over homogenous solid in downstream side
Graded sand	18,593.00m^3	Inclined/Horizontal filter/sand blanket
Rock fill	752.00 m^3	Riprap on upstream side of embankment
Cement concrete	248.28 m^3	Longitudinal drain/chute drain/profile walls, solid parapet wall, guard stones

An investigation was conducted by MWE to identify potential sources for Dam construction materials in the vicinity of the project as well as investigate the materials quality and quantity. The investigations included identification of Sources of natural granular, clay and sand materials for Dam construction. The investigation showed that there is sufficient quantity of the materials within the vicinity and these are of good quality.

3.3.1 Auxiliary Facilities

These are components a project system that are not deemed part of the main pipeline project infrastructures but are key in supporting the operations and functions of project. For this project, auxiliary facilities includes stone quarries, borrow pits, access roads.

3.3.1.1 Stone Quarries

There are possible sources of construction materials especially crushed stone aggregate could be from two existing stone quarries close to Onyama i.e. from Patongo and Adilang which are 35km and 15km respectively from the dam site.

It is suggested that, the ideal quarry site(s) will be zeroed on by the contractor taking into account the following considerations:

a. Where the stone quarries are existing and operational, Environment Due-Diligence

shall be conducted to establish their operational compliance with applicable EIA requirements;

b. Its distance away from ecologically sensitive ecosystems such as wetlands, rivers, forests and national parks, CFRs i.e. how far away is a quarry is from these ecosystems? Quarries which are closer to ecologically sensitive ecosystems (minimum distance away should be atleast 2km) will not be taken up by the project because quarry dust and associated operations will have large negative impacts on the protected areas;

c. Distance from settlements, schools and health centres taking into account risks of quarry operations to such establishments for fears of risks from flying stones on the safety of the inhabitants in such areas;

d. Existence of access route to and from the quarry without necessarily requiring construction of access route across rivers and swamps; and

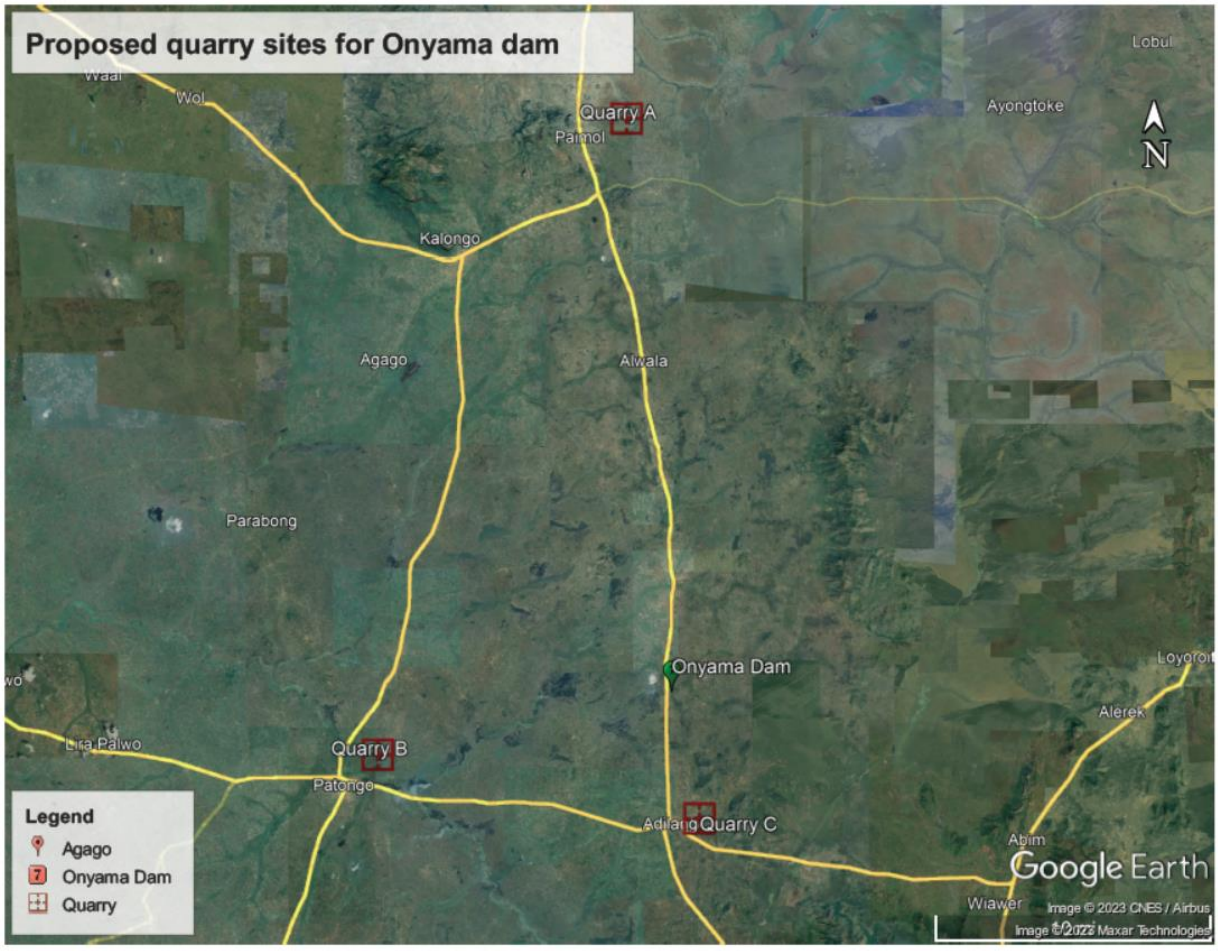
e. Distance from the quarry to the dam with the objective of keeping the haulage distance shorter by comparison.

Table 14: Proposed Sources of rock materials (quarries)

Location	Sub-county	District	GPS Coordinates		Distance to Onyama Dam, km
			Northings	Eastings	
Patongo	Patongo TC	Agago	307596.13	536695.09	35
Adilang	Adilang	Agago	304149.76	557012.12	20
Paimol	Kalongo TC	Agago	343734.78	550878.32	45

For the existing rock material sources, the Contractor will be required to undertake due diligence to establish operational compliance status of these sites before procuring the rock material. For any new stone quarry sites, it is a statutory obligation for the Contractors to undertake ESIA for facilities that will be under their direct control and accordingly be held responsible for their operations. However, MWE will undertake due diligence to supervise the assessment process (review TORs, review ESIAs for completeness and accuracy) and monitor implementation of the ESMPs.

Figure 3: Proposed stone quarry sites



3.3.1.2 Murram, Sand and clay sources

Existing sand and clay sources

Considering a number of aspects such as proximity to wetlands, streams and settlements as well as operational status, all the existing sources appear to be very close to settlements and these will pose labour influx, health and safety issues to the community. Therefore, the existing sources of clay and sand listed under Table 10 will not be used by the project. The project will consider utilization of 2 new clay and 2 new sand sites, and one existing sand source listed under Table 11. MWE will undertake due diligence to supervise the required statutory approvals (review TORs, review ESIAs for completeness and accuracy) and monitor implementation of the ESMPs.

Table 15: Existing sources for sand and clay

Location	Sub-county	District	GPS Coordinates		Distance to Onyama Dam, km
			Northings	Eastings	
Kilokoitiyo	Adilang	Agago	309698.77	548359.03	17
Lira Kato	Adilang	Agago	316913	557164	08
Ajal-Lajuwa	Adilang	Agago	312917	548187	20

3.3.1.2.1 Other considerations in locating auxiliary facilities

It is also important to note that, in instances where the project will have to establish new auxiliary facilities (especially new quarries sites), the contractor/s will take into consideration the following:

a. ***Location:*** Auxiliary facilities shall be located outside ecologically sensitive areas (forests, wetlands, PCRs, settlements-observe minimum distance of 2 km from public establishments such as schools, health centers, trading centers, and markets). All auxiliary facilities shall be subject to environmental and social screening using the screening form contained in the project ESMF. This will help to guide on the level of Environmental Assessment that will be required before the onset of such quary operations;

b. ***Access:*** While siting any new stone quarries, the contractor shall closely consult with: the client (MWE and MAAIF), Agago District Local Government Administration, Adilang S/C, host LC-1 Chairperson/s, host communities, and land-owners with whom the Contractor has to obtain a lease agreement to access and use the sites;

3.3.1.3 Access Roads

Adilang town council is located approximately 38km from the District headquarters. The project area can be accessed from Adilang – Alwala non asphalted road about 20km from Adilang town council. The access to the dam area is from a secondary, non-asphalted road that branches out from the main Adilang – Alwala road about 300m from Ajwa central village, where the road ends.

3.3.1.4 Management's Camp and Workers' Camp

A temporary camp will be built to be used by the Contractor, the Employer and the Engineer during construction of the works. Location of the camps has not been identified. The campsite will be located outside the project area. Camp/s ESIAs shall be done by the contractors as part of Contractor's ESMP before commencement of civil works. At the end of Construction phase, all project structures not required during the operation phase of the Project, including workshop structures and workers' camps, will be demolished and the debris disposed of in a legally acceptable manner.

3.4 Project labour

During the Construction Phase, the Project will employ approximately 300 employees, of whom 138 will be unskilled, 120 semiskilled and 42 skilled. During labor recruitment, the locals should be prioritized.

3.5 Dumping sites

Sanitary wastewater from toilets, drains and wash sinks will drain directly into a septic tank. A dumping site for solid wastes will be located close to the quarry site area. Use of excavated material and spoil will be necessary for the restoration of the quarry site and other degraded areas. The other solid wastes generated and stored at the dumping site will be collected and disposed by a licensed solid waste management company.

3.6 Project cost estimate

The construction costs include mobilization and installation works, construction costs, supply, and installation of equipment etc. The other costs include environmental mitigation measures, resettlement costs, land acquisition, insurances, administration, supervision of construction etc. The total investment for rehabilitating Onyama earth dam is estimated to be SHS UGX 9.8 Billion.

3.7 Project activities

3.7.1 Pre-construction activities

Activities to be undertaken during the pre-construction phase of the project will basically include land surveys, acquisition of construction equipment and materials, site clearance, construction of access roads, improvement of existing roads, construction of management's camp, workers' camp and offices and transportation of construction material and equipment to the project sites.

3.7.2 Construction phase

During the construction phase, the dam, spillway, intake and bottom outlet, irrigation networks, drainage networks and other structures will be put in place. This will include activities such as further site clearance, excavation, blasting and surfacing of cleared areas. This is projected to take a period of two years.

The diversion of the seasonal stream during dam construction will take the following steps;

a. Step 1. Excavating a diversion channel large enough to convey a flood of a desired return period, the excavated material is placed on the river bank, during this process the river continues flowing through the natural course.

b. Step 2. Import the excavated material and place it as a coffer dam/ dyke so that the stream-flows through the diversion channel downstream.

3.7.2.1 Steps for rehabilitation of the dam.

These can be a summary of the activities to be undertaken in an irrigation dam facility construction much as they may not really be sequential *per se*. They include:

a. ***Site investigations:*** Before construction of the dam commences the site will be subjected to a host of thorough engineering investigations to establish the nature of the foundation, and to locate sufficient suitable clay material to use in the embankment. Test pits will be excavated, and soils subjected to through geotechnical tests. Investigation of the foundation of the dam will equally be done to ensure that it will not fail and cause the embankment to fail.

b. ***Engineering:*** During dam construction, specialized engineering supervision will be required. The level of specialized engineering supervision required is generally proportional to the size and anticipated hazard category of the dam. Appropriately qualified and experienced engineer services will be required during dam construction to ensure the infrastructure under construction is being done to the required and applicable standards and specification as in the design provisions. Engineering expertise can be used during the planning, and construction of the dam, as well as throughout the life of the

dam.

c. *Clearing:* The area to be covered by the embankment should be pegged out prior to commencement of any works. The embankment and the area to be excavated should be cleared and grubbed. Topsoil should be stock-piled in areas outside of the area to be covered by the embankment and all trees, scrub and roots removed. Topsoil should be stock piled in layers not exceeding 200mm and planted with grass if it is to be left for a considerable time (more than 6 months). This will conserve the integrity of the topsoil. All loose and unusable material in the embankment area has to be removed clear of the site and must not be used in the embankment construction.

d. *Borrow pits*: The full excavation for embankment material, will be kept as much as possible below the full supply level of the storage area. Excavating suitable materials within the wetted perimeter of the storage will maximize the total storage potential. Otherwise, suitable material to construct the dam will be sourced outside the wetted perimeter from borrow pits. Great care will be taken when obtaining borrow materials from steep bank areas that may be prone to instability. A person should never enter an excavation that is deeper than chest level unless the excavation has been made safe from collapse.

e. *Foundation:* The base of the embankment is to be stripped of all topsoil, silt, loose material, vegetable matter, and then scarified over its whole area.

f. *Embankment compaction:* Leaks in earth-filled dams that lead to dam failures are often the result of inadequate compaction levels as such, it is important that, effective compaction is achieved and this can be by applying the required compaction effort to high clay content materials. Compaction should be undertaken by using a tamper foot roller, commonly referred to as a sheep foot roller.

g. *Settlement of the embankment:* Settlement of soil banks is common and an allowance must be made for settlement of the dam embankment. The embankment may settle to a level where it is overtopped by water and failure will result. Or overtime settlement may result in the height of the embankment becoming lower than the spillway. Clay soil can settle in excess of 10% of the dam's height, but well-constructed and compacted clay dam embankments are not likely to settle more than about 5%. An allowance of 5% of the height of the embankment (along its length) to cater for settlement is necessary.

h. *Planting of vegetation:* Topsoil should be spread over the exposed surfaces of the embankment to a depth of at least 150mm and sown with pasture grass to establish a good cover as soon as possible. Always, it is important to ensure that, vegetation should not be higher than knee-height on or near the embankment. Tree roots, can cause the core to crack resulting in the failure of the dam as such, no trees should not be allowed to establish on the embankment as such, trees and shrubs should be kept to a minimum distance of 1½ times the height of the tree away from the embankment of the dam.

i. *Cut-off trench or keyway:* Dams lose water through evaporation and seepage. Little can be done for evaporation losses, but with good construction methods seepage losses can be reduced. One critical aspect is the construction of the cut-off trench. This keyway will minimize seepage under the embankment and increase the stability of the dam. It should be taken down to a minimum of 600mm into impervious soil and rock and backfilled with the appropriate quality clay that is thoroughly compacted. It should extend for the

length of the embankment including the hillside flanks, but should not need to be extended under the spillway where the spillway is cut into rock.

j. ***Outlet pipe:*** An outlet pipe will be installed in the base of the dam. It is also required to allow water in the stream, upstream of the construction work to be bypassed during construction. The minimum size outlet pipe is to be specified in the project design. However, if need for a specific size pipe to suit the pump/irrigation plant it is recommended that dedicated pipe work also be installed for that purpose. Every precaution is to be taken with the installation of the pipe, given the fact that a large percentage of dam failures are associated with poor installation of outlet pipes.

k. ***Protection from wave action:*** where the dimensions of the surface of the stored water are such that the prevailing winds will cause wave action on the embankment, protection of the upstream face of the dam is to be provided in the form of stone pitching or rip-rap and this will depend on the design.

l. ***Filling of the dam:*** Once construction of the dam is complete, the dam will be inspected thoroughly ahead of filling of the dam commencement. The dam should be filled as slowly as possible, preferably not more than 0.3metres depth per day to let the new embankment adjust to the increasing water loads. The need for caution cannot be overstated because breaching of the dam and the resulting wave of water may cause considerable damage to the facility.

m. ***Maintenance and inspections:*** Regular maintenance and inspections are required to ensure it remains in a good operating condition.

3.7.3 Post Construction Activities

During the operation phase, water from Onyama stream and associated tributaries will be used in filling the dam. The dam, control building, pipelines and other structures will require maintenance.

3.7.4 Decommissioning

All project structures not required during the operation phase of the project, including workshop structures and workers' camps, will be demolished and the debris disposed of in a legally acceptable manner. Any waste on the project site at the end of the construction period will be properly disposed of. The project site will be reinstated to as near as possible its original state. Landscaping and grassing of degraded areas will be done.

Plate 2: A view of the Onyama Valley Dam

A good, recommended earth dam should consist of the following key structures

a) Foundation

It will consist of either earth or rock and provides a support for the embankment and resists both vertical and horizontal loads. It also resists under seepage on the flow of water beneath the dam.

b) Core or Membrane

It holds back the free water of the dam reservoir. It is located either at the Centre or upstream from the Centre of the dam. In case of rock fill dams, the core is provided on the upstream face. To resist the under seepage, the core is extended down into the foundation till an impervious layer of sufficient thickness is reached. The extension of the core into the foundation is termed as a *cut off*.

c) Shell

It provides structural support for the core and distributes the load over the foundation. The dams which are constructed of the same materials are called homogeneous dams. Small dams can suitably be constructed as homogeneous dams if the available materials are suitable.

d) Transition Filter

In core dams, a *transition filter* between the core and shell is generally provided to prevent the migration of the fine-grained core materials into the pores of the coarse-grained shell materials. In case of difference in particle sizes of the materials of the core and shell is small, the transition filter is omitted but in case of clay cover and rock or gravel shell, a transition filter is necessarily provided.

e) Internal Drain

An *internal drain* is provided on the downstream side of the dam to carry away the seepage through the core and cut off, and also to prevent the saturation of the upper part of the downstream shell by rain on the dam.

f) Toe Drain

A toe drain is provided at the downstream face of the shell. A riprap or grating is provided to cover the upstream face to prevent erosion or wash by waves. The dam shall provide water storage for multi-purpose uses through irrigation, livestock watering, aquaculture and fisheries production. The project shall consist of the components;

General items including the access road
Embankment works
Construction of intake structure
Electromechanical works
Pumping mains
Storage reservoir
Distribution network
Livestock water system
Irrigation scheme
Construction camps and scheme buildings

3.7.5 Coffer dam

Since this project involves rehabilitation of existing dam where fishing and farming is taking place, there is a plan to construct a coffer dam in the upstream to divert the water and aquatic ecosystem. This will be a structure that will retain water and allow the work area to be dewatered so that crews can rehabilitate the existing earth dam. This will be made by vertically driving a single wall of sheet pile around the work area. Struts, or beams, then brace the walls to keep them from collapsing inward. When dewatered, a cofferdam will withstand the force of the water while allowing crews access to the work area.

3.7.6 Water Offices and store building

The water offices will be located within the Onyama dam land after the district leadership granting permission to project development. The office block will comprise of the Manager's Office, Commercial Officer's Office, Store, Eco-San toilets and other components. Disinfection facilities are part of the Water Supply System.

3.8 Project Phases

3.8.1 Mobilization Phase

This phase will involve mobilisation of the construction human resource, equipment, construction materials, erection of temporary worker's camp and storage yard. The location of the project temporary camp will be agreed upon with the local leadership, landowners and contractors or its sub-contractors.

3.8.2 Construction Phase

Upon completion of preliminary activities and onsite investigations, actual construction of the project components and facilities will start which will involve:

- Setting out to demarcate rights of way, work areas, clearing limits. Access paths, detours, bypasses and protective fences or barricades should all be in place before construction begins.
- Excavation of trenches for water pipe transmission and distribution;
- Trench sheeting and bracing to protect collapsible trench side walls;
- Placing concrete to bases of foundations;
- laying of main water pipes;
- Backfilling, disposal of overburden and surface restoration to at least match the condition that existed prior to the water works construction.

All project activities under this phase are supposed to be carried within the boundaries of the identified project sites without disturbing or obstructing the people from carrying out their activities. To ensure this, the contractors and the sub-contractors will seal off the different site perimeters (where necessary) with corrugated iron sheets or other suitable material during project implementation. In case of trenches, proper barricade have to be applied to warn and protect the people of impending dangers of falling into open pits and trenches.

3.8.3 Demobilization Phase

Demobilisation phase will involve clearing of the project sites of all construction and unwanted material. The disposal of any unwanted material will be done by the contractor. The waste materials may include packaging, wood, steel crates, cardboard, wrapping materials, construction debris, boxes, sacks, drums, cans and chemical containers, etc. Damaged areas will need to be restored before commissioning the project. Upon completion of the contractor's obligations, the contractor will hand over the project to MWE, WfPRC, the client and the Operator

3.8.4 Operation Phase

This will involve employment of operators both skilled and unskilled, operation of the water supply system and sanitation facilities, maintenance of the facilities put in place, etc.

3.8.5 Construction Method

The actual choice of construction method and resources will be the Contractor's responsibility as dictated by the site conditions, productivity and construction schedule. The choice has a bearing on the cost implication. In all construction activities safety of operations is paramount. It entails carrying out of construction activities and operation of equipment by experienced personnel under supervision of experienced and qualified staff and use of well serviced construction equipment in good working condition. Safety on site will be managed by close supervision of the contractor's Health & Safety Officer and the Engineer's construction Supervision staff of the site activities with regard to the working environment in accordance with the applicable Environment, Safety, Health and Social Safeguard Policy.

a) Plants and Equipment

Because of the nature of the construction activities that will be undertaken, a number of plants and equipment will be used to execute the assignment by the contractor or the sub-contractor(s)

and these will include among the following: Graders, Vibrators /Rollers, Water Trucks, Bulldozers, Front End Loader, Vehicles, Containers, Excavators, Water Pumps, Mechanical Tool Boxes, Civil Plate Compactors, Dump truck, Concrete Mixer, Crane and Compactor.

b) Earthworks

The earthworks including site clearance, general filling and excavation, and trenching can be carried out either by manual labor or mechanical equipment where large quantities are involved.

c) Concrete works

Concrete production is expected to be by the use of concrete mixers and/or manual production for the small works and where use of a mixer may be impractical.

d) Structural Steel

The lifting of heavy structural steel sections will be by cranes. The steel sections will be joined by either bolts or welding.

e) Reinforcement Steel fixing

Various sizes of reinforcement steel bars will be cut to required lengths and bent to design shape either manually or by machines and will be placed and fixed for the works by manual labour.

f) Masonry

All masonry work is to be by manual labor using the necessary hand tools.

g) Pipe laying

Pipe laying is expected to be carried out by manual labor using the necessary hand tools and pipe lifting equipment for the heavy pipes.

h) Electro-Mechanical Installations

All electro-mechanical installations are to be carried by manual labor using the necessary hand tools and mechanical lifting equipment.

i) Implementation Schedule

The main objective is to determine a total duration of the project, which equals a "critical path" of events that determine the total duration. The anticipated implementation schedule is as per Table below

Table 16: Proposed Project Implementation Schedule

Activity	Duration (Months)
Tendering Process	4
Tender Evaluation	
Contract Negotiation and Award	
Construction of Works	12
Defects Liability Period	06
Total	**22**
Total project cost	**9,583,854,120**

j) Estimated Number of Workers

The contractor is expected to employ about 100 workers on the site both skilled and unskilled. However, this number may keep on fluctuating depending on the need and availability of resources.

3.9 Quality Assurance

It is the responsibility of the supervising consultant to ensure that the desired quality of work is achieved. The materials supplied for the works should not deviate from those specified. At each stage during the construction process, samples of materials have to be taken to the Materials Laboratory for testing to ensure conformance to the specifications.

4 ESIA METHODOLOGY

4.1 Introduction

This section outlines the methodology that was used to assess the environmental baseline and to identify, predict and assess the environmental impacts of the project on each relevant environmental component. It also covers the methodology for the identification of mitigation and monitoring measures that were recommended to address these impacts and identification of relevant stakeholders. The methodology consists of a review of Uganda's institutional arrangements, regulations and policies. Environmental impacts of the proposed project were predicted in relation to environmental receptors and natural resources while comparing prevailing pre-project conditions and post-project situations.

The requirement for environmental impact assessment in Uganda is set out by the *National Environment Act No. 5 of 2019* and the *Environmental and Social Impact Assessment Regulations of 2020*. This process was guided by the Environmental Impact Assessment (EIA) Guidelines (NEMA, 1997) and the process is schematically presented in Figure 3. In addition, safeguards implementation has to comply with the requirements of investment project financing and the African Development Bank (AfDB) integrated Environment and Social Operational Safeguards.

4.2 Impact Assessment Approach

The significance of environmental and social impacts was established based on the comparison with the baseline situations in the project area. Generally, the environmental and social impact study involved various methods including:

- Review of relevant literature and secondary baseline data on legislation, policies and guidelines, bio-physical environment, including among others, area land use, sensitive receptor systems and ecology likely to be affected.
- Field studies included flora and fauna species counts, receptor systems baseline data including baseline noise and air quality measurements. Water quality analysis was done at pre-determined locations to set an environmental baseline and establish status;
- An inventory of activities in the neighbourhood likely to be affected by proposed project;
- Safety and health impacts on workers during construction and operation, protection from injury and adequacy of sanitation provisions for the workers;
- Consultations with stakeholders, including the regulatory agencies, and the local community;
- Study and analysis of engineering designs and drawings for civil solutions to be implemented by the developer, including safety measures;
- Prediction and analysis of environmental and social impacts resulting from the project activities such as water abstraction, pump house, distribution lines, reservoir tanks, water offices, sanitation facilities etc., and proposing appropriate mitigation measures, and preparation of an Environment Management Plan (EMP) for implementation by relevant stakeholders;
- Preparation of E&S Scoping report/Terms of Reference Report and ESIA Report and presentation to NEMA by the developer for review and approval.

Figure 3 shows the ESIA process that has been followed.

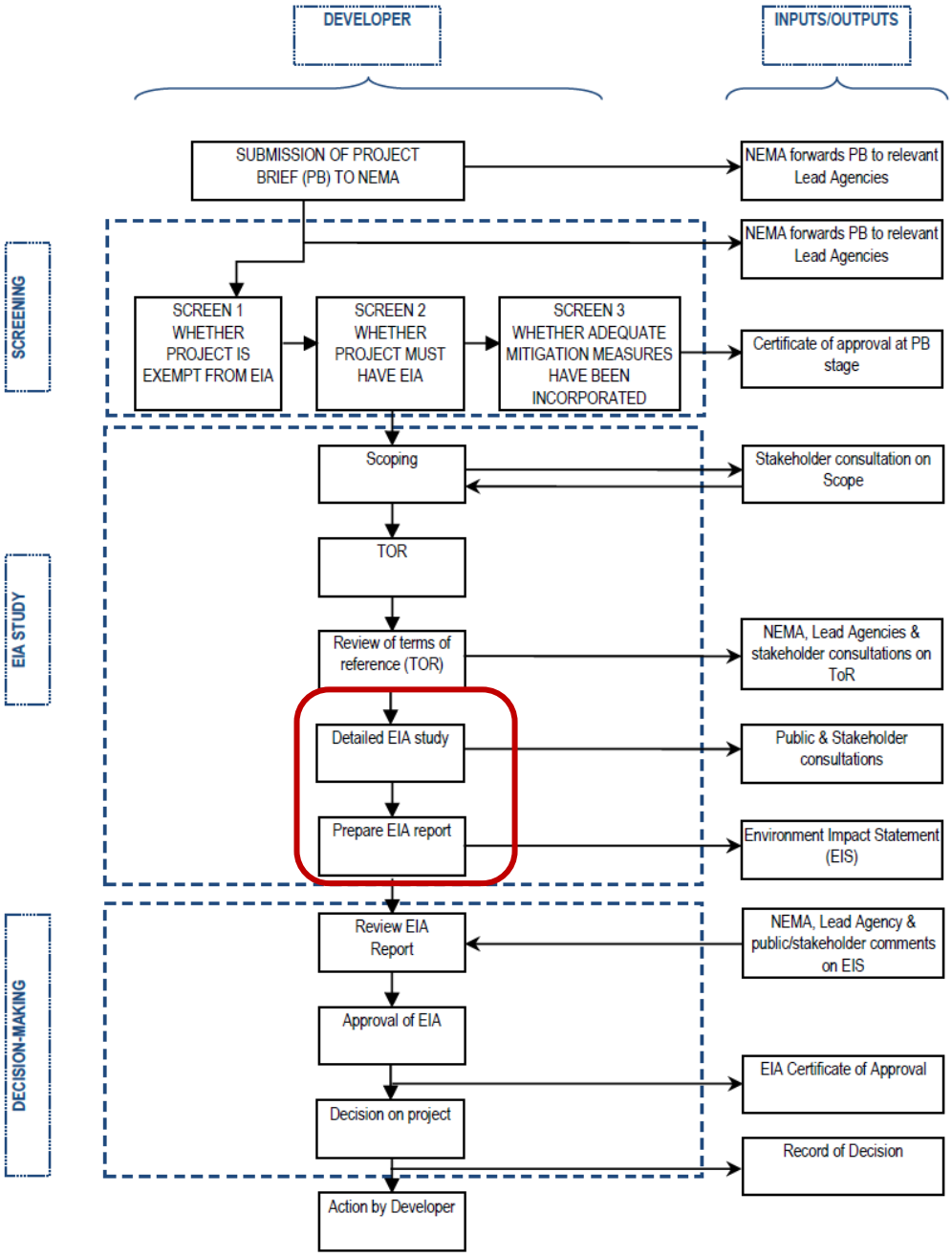


Figure 4: ESIA process that was adopted as provided for under the Laws of Uganda

4.3 Physical Environment

Baseline noise levels and air quality were measured, not only to inform construction contractors about pre-construction conditions existing at proposed sites, but also the first annual environmental audit. These were determined through the following actions:

4.3.1 Land Surface and Visual Impact Assessments

Under the land surface investigations, the character and resources of the landscape, including effects on the aesthetic values of the landscape, caused by changes in the elements, characteristics, character and qualities of the landscape was investigated. The visual amenity, including effects upon potential viewers and viewing groups caused by change in the appearance of the landscape as a result of the development, was also considered.

The landscape and visual impact assessment methodology is applicable, both to the assessment of short-term impacts during the construction of the Project, and to the long-term impacts once completed. The landscape character and resources are considered to be of importance in their own right, and valued for their intrinsic qualities regardless of whether they are seen by people or not. Impacts on landscape are therefore considered as distinct from impacts on visual amenity as perceived by people. For purposes of clarity, Landscape Impacts relate to the effects of the Project on the physical and other characteristics like fabric, character and quality of the existing landscape, whereas Visual Impacts relate to the effects on views from visual receptors (e.g. residents, workers, visitors to the area, etc.) at specific viewpoint locations. The key steps of the methodology for the assessment were as follows:

- The project study area was determined using maps and aerial photos data and field observation.
- Local landscape character areas within the study area were identified.
- The sensitivity of each landscape and potential visual impact was assessed.

The magnitude of change in the character of each landscape character area and the magnitude of change in the view at each viewpoint location was predicted.

4.3.2 Air Quality measurements

Baseline air quality was measured using a pair of digital MX6 iBrid™ portable gas meters (Industrial Scientific-Oldham) and a Microdust 880nm digital aerosol monitor (Casella®). Measurement points or locations were selected basing on presence of potential receptors (such as construction sites for the pumpstation, sanitation facilities etc.) and an averaging period of 8 hours was used. For gaseous emissions.

- The equipment was powered on and left in measuring mode for the first two minutes to allow zeroing and self-calibration. This was followed by ten minutes of measurement to allow digital readings to stabilize before they could be recorded.
- Measurements were conducted at each of the selected points to determine whether there would be any gaseous emissions detected.
- Values for Lower Explosive Limit (LEL), Carbon monoxide (CO), Oxygen (O_2), Hydrogen sulphide, H_2S, volatile organic compounds (VOCs) will be noted.

For particulate matter.

- The equipment was allowed for two minutes for zeroing down and thereafter, it captured the samples for five minutes with interval of 10 seconds.

For every sampled point, a GPS coordinate was noted.

4.3.3 Ambient Noise Measurements

Baseline noise measurements were undertaken at locations around the proposed facility sites (i.e. at production well and construction site for the pumpstation) with potential receptors. Measurement of ambient noise levels were carried out using a precision integrating sound level meter, with an active range of 0-130 decibels (dB) and complying with IEC 651 and ANSI S4 standards. A Casella CEL-621C digital noise logger will set to record for a sample period of 10 minutes at each of the selected locations. The assessment procedure involved recording the LA_{MAX} and LA_{MIN} decibel levels. Measurement points were recorded using a GPS receiver and the noise sources together with the ambient environment at each location noted. The obtained results have been compared against the National Environment (Noise Standards and Control) Regulations, 2003. The regulations require that persons to be exposed to occupational noise exceeding 85 dBA for eight hours in a day should be provided with requisite hearing protection.

4.4 Biological Environment

4.4.1 Flora

Transect walks were taken along the project areas where construction will take place; and notes were made of the vegetation along the stretch. While some plant species were identified on site, specimens of others were collected, pressed, dried, and mounted on thick paper or board and taken for confirmation at the Makerere University Herbarium. The relative abundance of each species was assessed and scored on a DAFOR scale. D=Dominant; A=Abundant; F=Frequent; O=occasional; R=Rare. Additional information was obtained through consultation with communities on the local names, use and importance of some plant species. An inventory of the impacted trees was also taken. The IUCN Red List was utilized for categorization of species. Some of the tools that were used included: Plant press, Secateurs, Ivy tags, Measuring tape, Diameter tape and camera

4.4.2 Fauna

The surveys used both desktop reviews and field surveys

Literature review

Literature was consulted to understand the documented fauna in the project area. This included scientific publications, unpublished reports at the Agago DLG, online sources, international NGOs portal like WCS websites, government agencies like UWA, NFA and other international sources such as the Global Biodiversity Information Facility (GBIF).

Field sampling

Field assessments were undertaken by the biodiversity expert through reconnaissance visits to the project area, identification of sample points from the BH to the reservoir and the associated right of way pipe networks

Stakeholder engagements

During the field visit and field sampling, the biodiversity expert informally consulted the community within the project area on some of the fauna species within the landscape. This aimed at documenting information on the fauna which the consultant may not be able to get during sampling. Inquiries were made on faunal groups or species occurrence (ever seen alive or dead) that occur in the project area

Therefore, field sampling was conducted using known and internally approved scientific methods and international best practices (World Banks Environmental and Social Standards-ESS). Fauna found or living in the project area were registered and or recorded. The methods used per taxon included the following;

a) Avifauna (birds) survey

Apart from the earth dam and reservoir sites, line transect method was used to sample birds. The method provides and encompasses most species and can be used to survey a number of birds together. Here multiple counts can be obtained by counting in the same study site repeatedly in the same season or by counting multiple study sites once.

It is highly adaptive and can be used in terrestrial and freshwater systems. The method can be used to survey individual species, or groups of species. The method is also efficient in terms of

the quantity of data collected per unit of effort expended, it is can be used to examine bird-habitat relationships and can be used to derive relative and absolute measures of bird abundance.

During sampling, the biodiversity expert walked the pipeline right of way and other distribution networks (in this case considered as transects) recording birds on either side of the route/line. Birds identified by sight or sound 50m (rough estimate). The sampling would last for 30mins per sampling point. Birds seen were counted and recorded. A few records were made of species found. To be present in the area outside the time of count.

All bird counts were made with the help of an 8*42 binoculars and where there was any doubt about identification, reference was made to a field guidebook such as Birds of East Africa (Stevenson et al., 2020) and the bird atlas of Uganda (Carswell et al., 2005). Habitat and species categorisation followed the following criteria:

A- Conservation status

Birds were classified according to their conservation status i.e., whether they are species of global conservation concern (IUCN 2021), or regional (Bennun & Njoroge 1996) or Nationally by the Wildlife Conservation Society (WCS 2016). These categories are indicated as;

- CR Critical (Globally or Regionally or Nationally)
- EN Endangered (Globally or Regionally or Nationally)
- VU Vulnerable (Globally or Regionally or Nationally)
- NT Near-threatened (Globally or Regionally or Nationally)
- RR Regional Responsibility (Regionally)
- LC Least Concern (Globally or Nationally)

B-Migratory classifications

Bird species with migratory tendency were also considered as derived from the Uganda Bird atlas (Carswell et al. 2005). There are two categories of migrant species as considered below.

- Afro-tropical migrants (AM), these complete their migration journey within Africa
- Pale-arctic migrants (PM), these breed in Palearctic region between May and August but found in Uganda in the northern winter (October and March).
- However, some species can be both Afro-tropical and Pale-arctic migrants

b) Butterflies

Pallards sweep net method was employed to sample butterflies along the pipeline route and within the project area. The method was used to document the species richness, as well as estimate their relative abundance. The method was used because of time-efficiency, but also the negative effects that maybe brought about during handling of individuals are avoided (Martins, 2016).

Species richness was based on recorded species presence or absence at the different sites that were sampled. The observer recorded the species encountered as he moved along the main transmission and distribution networks. A species list was then generated from the records of the survey. Abundance estimation was assessed by counting and recording the number of individuals of the different butterfly species

c) Herpetofauna (Amphibians and Reptiles)

A combination of scientifically tested methods was used to collect information on herpetofauna as described by Heyer et al 1994, and Olson et 1997. The methods include the following

a) *Audio Encounter Surveys (AES):* This method uses the species-specific calls/Sounds/ advertising calls made by breeding males. The identity of the amphibian species heard calling and their numbers were estimated and recorded.
b) *Dip netting*: Using a dip net, ponds, pools and streams and other water collection points were dip netted. Adult amphibians and tadpoles encountered were also recorded
c) *Opportunistic Encounters*: Herpeto-fauna species encountered opportunistically while moving in the project area recorded in order to accumulate a complete species checklist for the project area
d) *Visual Encounter Surveys (WES):* The method involved moving through the modified habitats watching out for, and recording surface-active herpetofauna species. WES were complimented by visual searches, by examining under logs, leaf litter, in vegetation and crevices. Species encountered and their numbers were recorded and where possible photographed

d) Mammals

Mammals were sampled using four main methods;

a) *Direct observations/Opportunistic encounters*: All mammals seen or opportunistically sighted while moving in the project area were identified, counted and recorded;
b) *Use of Signs e.g., footprints and or dung or calls*: Mammal species whose footprints and dung was seen and is recognisable, were recorded for their presence;
c) *Use of Sherman Live traps*: The method uses baited traps, set and left in place over night before they are m0oved to a different sampling site. Trapping was used to survey small mammals. Live traps have been successfully used to detect patterns of richness, composition, and abundance of small mammal communities (Thorn and Peterhans, 2009), and;
d) *Local consultations*: The Biodiversity expert also help informal discussions with the community members who were found working in the project area, about the availability of mammal species in and around the project area.

4.4.3 Conservation Status of Species

The conservation status of each species was obtained from the 2020 published IUCN redlist data and the National redlist of Uganda's threatened species (Wildlife Conservation Society, 2016). Through examining published distribution records and literature, assessments of the limits of distribution range of the different species, new records, lack of records of expected species, was undertaken.

4.4.4 Impact analysis

The potential impacts likely to arise from implementation of the proposed project were evaluated based on a four-point scale. The scale definitions were adopted to the local level addressed in this study (Table 8). The impacts were evaluated against four criteria intensity, geographic extent, duration and likelihood (Terrapon-Pfaff et al., 2017). *Intensity* refers to the level to which an impact has effects on the livelihood of the local population, G*eographic extent* describes the scale of the area affected, *Duration* defines the time span the impact continues to affect the livelihoods from the time it emergences and onwards and *Likelihood* relates to the probability of the occurrence of an impact.

Table 17: Definition of significance criteria in the expert survey

Criteria	Scale	Definition

Magnitude/Intensity	No	No impact / livelihoods not affected
	Minor	Low impact / no substantial effects on livelihoods
	Low	Moderate impact / moderate effects on livelihoods
	Moderate	High impact / substantial effects on livelihoods
	High	Very high impact / very extensive effects on livelihoods
Extent	Within Limited Area	Communities along the proposed water supply system
	Local	Within Adilang S/C and Agago District
	Widespread	Outside Agago district
Duration	Momentarily	0-1 year
	Short-term	2-5 years
	Medium-term	5-15 years
	Long-term	20 years
	Irreversible	Permanent
Likelihood/Probability	None	Impact will not occur / has not yet occurred
	unlikely	Impact is unlikely to occur / has not yet occurred
	Likely	Impact is likely to occur / has not yet occurred
	Most Likely	Impact is most likely to occur / has already occurred
	Definite	Impact will definitely occur / impact has occurred

Significance evaluation

Based on the outcomes of the expert survey, the impact significance was determined. To this end, the results for each criterion were translated into scores, which were the aggregated into a final significance score. In the *first step*, the evaluation results were translated into numerical values taking the confidence levels into account. As no commonly accepted method exists for this process It is recommended to divide each level of the scale into three intervals based on the certainty level (Table 9). In this way, the final value for each of the criterion also depends on the certainty of the expert judgments.

Table 18: Rating scales for the criteria assessment in the expert survey

Symbol	No	minor	Low	Moderate	Very High
M=Magnitude	0	2	4	6	10
P=Probability	0	1	2	3	5
E= Extent	0	1	2	3	5
Duration	Momentarily (0-1 year); Short-term (2-5 year); Short-term (2-5 years); Medium term (5-15 years); Long term (15-20 years); Irreversible (Permanent)				

In the *second step,* the scores of each criterion and for each impact were aggregated into a final score, which could then be translated into a significance level. Various arguments exist for or against different methods of aggregation, but no commonly accepted aggregation rule exists.

In this study, to aggregate the criteria scores, it was decided to draw on risk assessment research which stresses the importance of the probability of an event followed by the extent of its consequences, applying the following aggregation rule:

Significance= $L_i \times I_i + G_i + D_i$, Where;$L_i$ =Likelihood of impact *i*, I_i =Intensity of impact *i*, G_i = Geographic extent of impact *i*, and D_i =Duration of impact *i*

The values for intensity (*I*), duration (*D*) and geographic extent (*G*) are added together and then multiplied by the value assigned to the likelihood (*l*) criteria, resulting in a range of scores between 0 and 75. The main weakness of the aggregation function is the risk that an impact rated unlikely to occur, but which could have irreversible consequences, could be overlooked. To avoid this risk, the results must be carefully assessed by the researcher after the aggregation to avoid relying solely on the numerical outputs. Once the final scores for each impact are calculated, they must be translated into impact significance levels. We differentiate between four significance levels (very high/high/moderate/low), which are based on the score ranges listed in Table 10.

Table 19: Significance levels and scores for the expert survey

Significance	Scores	Description
Very low	0-15	impact or impact of very low order
Low	16-30	Only very limited effects; social, cultural and economic activities of communities continue unchanged
Moderate	31-45	Medium level impact affecting a limited number of people in a small area for a limited time span
High	46-60	Probable impact with high effects on the livelihoods of communities, affecting many people or having a long-term effect
Very High	61-75	High probability and very high level of effects in a widespread area and with long-term effects on the livelihoods of communities

4.5 Socio-Economic Environment

A detailed social impact assessment and evaluation of the positive and negative, direct and indirect, immediate and long term, and permanent and temporary impacts due to the construction and operation of the water supply facilities and associated works was carried out. An assessment of the impacts identified in either qualitative or quantitative terms, according to their inherent nature and the availability of adequate data to enable predictive analysis was undertaken. Specific activities undertaken included:

a) Land use in site zone of influence: Types of land use were established from observation and consultation with Local/district Planning Authorities on existing land use.
b) Existing infrastructure (water, sanitation, power, telephone): Their presence was established by observation and consultation with relevant utility companies. Potential impact of line during construction on any such existing facilities has been predicted.
c) Settlement patterns including induced unplanned development: Population numbers, characteristics and dynamics were analyzed to predict potential induced developments.
d) Circulation patterns (people and livestock): These were established by observation with the aim of identifying any potential severance of access when existing paths get blocked by construction works.
e) Social cohesion was established from community consultations and literature review to predict any disruption of social ties during or after project construction.
f) Population demographics: Population numbers, education levels, age, gender disparities, access to factors of production, disease burden, income sources and expenditure were established from a social survey and consultations.

g) Community structure: were established from observation, surveys and community consultation.
h) Employment characteristics: were established from social surveys, consultations and review of existing local and national census or labour reports/surveys undertaken by Uganda Bureau of Statistics (UBOS)
i) Local economy and income distribution: were determined through a socio-economic survey by a socio-economist, observation and interviews.
j) Social services: Presence or lack and efficacy of existing services were determined through a socio-economic survey, observations and community consultations.
k) Sociologist established any unique ethnic or tribal customs, traditions/ethos and values which might be affected by the construction works in the project area, we looked out for known sites of significant historic, cultural merit (locally, regional or internationally). A "chance finds procedure" has been prepared.
l) Public health: Potential public health and occupational Health &Safety (OHS) impacts during construction were outlined. Measures to manage dust plumes from excavations, construction; noise levels from construction equipment during construction were developed. Other impacts established included risk of exposure to hazardous substances without adequate protection (skin contact); disease vectors, machine-related accidents and inadequate sanitation, HIV/AIDS.
m) Gender analysis: was carried out to identify potential gender impacts. The SWOT tool was applied during community consultations to reveal expected opportunities that can be evaluated.

4.6 Impact Assessment and Evaluation Method

The purpose of this section is to predict and make an assessment of the impacts on the environment that may potentially arise as a result of the implementation of the proposed project. An assessment of these impacts was made on the basis of information gathered during the environmental baseline study of the project area, which included several field visits to the project sites/area and its surroundings, as well as a desk study of relevant existing documents and information pertaining to the project and information describing the nature and design of the proposed project. From this, mitigation measures have been drawn up to be recommended for incorporation into the design and implementation of the project so as to minimize, compensate for or avoid the occurrence of anticipated potential impacts.

The potential positive and negative impacts were discussed below in terms of the various environmental components. The potential impacts that could occur during the construction and operation phases are categorized and assessed as follows:

i. Type of impact – whether direct or indirect;
ii. Status/Direction Positive or negative;
iii. Duration - Temporary (1 year), short term (1-3 years), medium term (3 -5 years) long term (> 5 years - L) or permanent;
iv. Intensity/Magnitude - Low, medium or Major;
v. Extent: within limited area (1km radius from site), local (up to 5 km) or wide (> 5km radius, district wide, regional or global)
vi. Probability of occurrence: Low (25%), Medium (25-75%) or High (>75%); and
vii. Overall Assessment- Negligible, Minor, Medium or Severe/Significant

Based on the project details and the baseline environmental status, potential impacts as a result of the construction, operation and decommissioning of the proposed project were identified. We therefore propose an impacts analysis criteria that takes into account the magnitude or

intensity of impacts based on project activities and sensitivities to receptors in the project areas that were identified in the environmental and social baseline.

Table 20: Impact Assessment and Evaluation

Criteria	Description
Type of Impact	▪ Direct - An impact that appears immediately as a result of an activity of the project. For example, the loss of vegetation is a direct impact of site clearing. The direct impacts would be experienced mainly during the construction process, and include effects on the physical environment, health and safety of the construction workers. ▪ Indirect - An impact that is related to the project but that arises from an activity of the project at a secondary level. For example, the demand for supplies and services may cause indirect impacts on the local economy by increasing indirect employment opportunities.
Status	▪ Positive ▪ Negative
Duration	The lifetime of the impact; this is measured in the context of the life-time of the proposed development. Whether the Impact will be: ▪ Intermittent – not occurring at all times. ▪ Temporary-only for a short period. ▪ Short term - the impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase. ▪ Medium term - the impact will last for the period of the construction phase, thereafter it will be entirely negated. ▪ Long term - the impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter ▪ Permanent
Intensity	Whether or not the intensity (magnitude) of the impact would be high, medium, low or negligible (no impact). An attempt to quantify the impacts on components of the affected environment to be described whether destructive to alter its functioning or harmless: ▪ Negligible ▪ Low - where impact alters the affected environment in such a way that natural processes of functions are not affected in any significant way. ▪ Moderate - where the affected environment is altered, however, function and process continue, albeit in a modified manner. ▪ High - where function or process of the environment is seriously altered and disturbed to the extent where it temporarily or permanently ceases.
Spatial Extent	The physical and spatial size of the impact; a description of whether the impact would occur on a scale described as follows: ▪ Site - whether the impact will be within limited locale of the project site / study area affecting the whole or measurable portion of the area. ▪ Local - whether the impact will affect the environment or communities along the border of the study area or in the extended area adjacent to the site or perhaps outside the immediate environment. ▪ Regional - whether the impact extends beyond the study area affecting areas on a regional scale.
Likelihood	The probability or likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The probability that a certain impact will in fact realize:

	▪ Uncertain - insufficient information to determine its probability. Because the precautionary principle is followed, this increases the significance of the impact. ▪ Improbable - the impact is unlikely to occur. ▪ Probable - the impact could possibly happen, and mitigation planning should be undertaken. ▪ Highly probable - it is most likely that the impact will occur at some or other stage of the development. ▪ Certain - the impact will take place regardless of any prevention plans, and only mitigatory actions can be relied on to contain the effect.
Sensitivity	▪ Degree of change effected on natural processes or people's livelihoods; the sensitivity of the receptor of the impact to change ▪ Very low ▪ Low ▪ Moderate ▪ High

Table 12 below presents a quantitative format for ranking impacts based on parameters above, summarised as magnitude and sensitivity.

Table 21: Quantitative rating of impacts

Significance			Sensitivity			
			Very low	Low	Medium	High
			1	2	3	4
Magnitude	Very low	1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low	2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Moderate
	High	4	4 Minor	8 Moderate	12 Moderate	16 Severe

Table 13 below presents the overall impact rating criteria, with illustrations of such impacts.

Table 22: Overall Impact Rating and Description

Overall Impact Rating	Description of Impact	Significance
Severe	▪ Non-compliance with national policy, environmental laws and regulations; WB Safeguards Policies and International Treaties on Environment ▪ Highly noticeable, irreparable effect upon the environment and the people ▪ Significant, widespread and permanent loss of resources and livelihoods ▪ Major contribution to a known global environmental problem with demonstrable effects ▪ Causing mortality to individuals of a species classified as globally or regionally endangered ▪ Major exceedance of water/air quality and noise standard quantities representing threat to human health in long and short term ▪ Causing widespread nuisance both on and off site	>12

	▪ Extensive property damage or loss, ▪ Widespread effects on livelihoods.	
Moderate	▪ Frequent breaches of national regulations, WB Safeguards Policies and International Agreements and Treaties including water/air quality and noise guidelines, wetlands and river banks regulations causing localised nuisance both on and off site ▪ Noticeable effects on the environment and the population, reversible over the long term ▪ Localised degradation of resources restricting potential for further usage ▪ Sub-lethal effects upon a globally or regionally endangered species with no effect on reproductive fitness and/or resulting in disruption/disturbance to normal behaviour but returning to normal in the medium term ▪ Elevated contribution to global air pollution problem partly due to preventable releases ▪ Unplanned immigration flows ▪ Increased traffic in sensitive environments ▪ Increased serious crime rates ▪ Widespread physical resettlement, affecting livelihoods	6 – 12
Minor	▪ Noticeable effects on the environment and the population, but returning naturally to original state in the medium term ▪ Slight local degradation of resources but not jeopardising usage ▪ Disruption to normal behaviour of a globally or regionally endangered species returning to normal in the short term ▪ Small contribution to global air problem through unavoidable releases ▪ Elevation in ambient water/air pollutant levels greater than 50% of guidelines ▪ Infrequent localised nuisance ▪ Population increase not expected to stress existing infrastructure	2 – 4
Negligible	▪ No noticeable or limited local effect upon the environment and the population, rapidly returning to original state by natural action ▪ Unlikely to affect resources to noticeable degree ▪ No noticeable effects on globally or regionally endangered species ▪ No significant contribution to global air pollution problem ▪ Minor elevation in ambient air pollutant levels below guidelines ▪ No reported nuisance effects. ▪ Temporary or intermittent changes to livelihoods or life quality aspects	< 2

4.7 Identifying Mitigation Measures and ESMP Preparation

The ESIA team identified and described in detail possible mitigation measures considering all the project implementation phases. Measures and actions to address negative impacts favor avoidance and prevention over minimization, mitigation or compensation. Measures proposed are in compliance with the Ugandan legislation and other development partners (such as World Bank).

We would ensure that our outcomes are well defined and are measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods,

with estimates of the resources (including human resource and training requirements) and responsibilities for implementation.

The ESMP format is flexible to ensure the integration of project specific mitigating, enhancing and monitoring requirements. The ESMP's scope and level of details are proportional to the number and complexity of the measures required to ensure the project's environmental and social sustainability. The following components constitute the minimal contents of an ESMP:

a) *Objectives of the ESMP* - This section specifies that the ESMP aims to bring the project into compliance with applicable national environmental and social legal requirements and the Bank's safeguards policies and procedures. The other objective of the ESMP is to outline the mitigating/ enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts. It shall also address capacity building requirements.
b) *Context the ESMP* - briefly describes project activities and major environmental and social components that are likely to be affected positively or negatively by the project. It describes and analyze the physical, biological and human conditions prevailing in the project area, highlighting relevant environmental and social issues among others.
c) *Beneficial and Adverse Impacts* - This section focuses on beneficial impacts that can be enhanced to improve the project environmental and social performance as well as on adverse impacts that require mitigation measures to be minimized or compensated.
d) *Enhancement/Mitigation Measures and Complementary Initiatives* - This section proposes feasible and cost-effective measures to address the impacts previously defined, in order to accrue project benefits through enhancement measures or to reduce potentially adverse environmental and social impacts to acceptable levels (mitigation measures).
e) *Environmental and Social Monitoring Program* - A monitoring program aims to ensure that mitigation and enhancement measures are implemented, that they generate intended results and that they are modified, ceased or replaced when inappropriate.
f) *Consultations* - The implementation and monitoring of some mitigation or enhancement measures may require that consultative mechanisms be used. In such cases, the ESMP first identifies for which measures consultations would be undertaken as well as the goals and expected outcomes of these consultations. Then the ESMP specifies the target groups, appropriate consultative processes, consultation frequency, reporting methods and result disclosure procedures.
g) *Responsibilities and Institutional Arrangements* - The implementation of enhancement and mitigation measures and the completion of the monitoring program require to clearly establish responsibilities among the various organizations involved in project implementation and operation. The ESMP proposes support to the organizations that may have insufficient capacities to fulfill their obligations. This support could be provided through various means including technical assistance, training and/or procurement.
h) *Estimated Cost* - This section estimates the capital and recurrent cost associated with the various proposed measures (enhancement and mitigation), the monitoring program, consultations, complementary initiatives and institutional arrangements. The cost of each mitigation and enhancement measure shall be estimated, including the cost for environmental and social capacity building.
i) *Implementation Results Schedule and Reporting* - The ESMP includes a results matrix, an implementation schedule taking into account all activities related to the proposed measures (enhancement and mitigation), the monitoring program, consultations, complementary initiatives and institutional arrangements.

j) *Conclusion* - The conclusion summarizes the main expected environmental and social impacts and mitigation and enhancement measures that would ensure that the project meets the Bank's safeguards requirements. It also specifies the environmental and/or social loan conditions or covenants that are part of the project loan agreements.
k) *References and Contacts* - The documents consulted to prepare the ESMP are listed. In addition, the persons to contact for comments or further information shall be mentioned in the ESMP.

4.8 Identifying Monitoring Measures & Monitoring Plan

Monitoring planning includes baseline monitoring, impact monitoring and compliance monitoring. Monitoring points, measures, frequency, cost, reporting format, responsible agency and implementation agency would be identified. Monitoring measures proposed are in compliance with the Government of Uganda legislation and Safeguard Policies of the funder. The table below provides a summary template for Monitoring Requirements.

Table 23: Summary Template for Monitoring Requirements

Phasing	Mitigation Measure	Parameters to be Monitored	Location	Measurements	Frequency	Responsibilities	Cost
Pre-Construction Phase							
Construction Phase							
Operation and Maintenance Phase							
Decommissioning Phase							

A monitoring program aims at ensuring that mitigation and enhancement measures are implemented, that they generate intended results and that they are modified, ceased or replaced when inappropriate. Further, it allows assessing compliance with national environmental and social policies and standards. A monitoring program shall include two parts:

a) *Surveillance activities* - The surveillance aims to ensure that the proposed mitigation and enhancement measures are effectively implemented during the construction phase.
b) *Monitoring activities* - These activities consist in measuring and evaluating the project impacts on some environmental and social components of concern and to implement remedial measures, if necessary.

The program defines as clearly as possible the indicators to be used to monitor the mitigation and enhancement measures that need to be assessed during project implementation and/or operation. The monitoring program would also provide technical details on monitoring activities such as methods to be used, sampling locations, frequency of measurements, detection limits, and definition of thresholds that will signal the need for corrective actions. The process for establishing a monitoring programme would consist of the following actions:

- Specific management and monitoring objectives;
- Identification of the scope of monitoring;
- Recommend appropriate monitoring environmental and social aspects and technology;
- Specify how the information collected should be used in decision-making;

- Define the spatial boundaries and select map scales and sites for observation, measurement or sampling;
- Select key indicators for direct measurement, observation or sampling;
- Define how the data will be analysed and interpreted and how it should be presented in monitoring reports;
- Define the precision and accuracy required in the data;
- Consider compatibility of data to be collected with historical data and with related contemporary data;
- Set minimum requirements for monitoring.

5 DESCRIPTION OF THE ENVIRONMENT AND BASELINE CONDITIONS

5.1 Physical environment

5.1.1 Topography and Drainage

The district generally has flat landscape with intervals of undulating appearance especially on the eastern side with some inselbergs in the sub counties of Adilang, Lapono, Lukole and Parabongo. The district drains into the two rivers; Aswa and Agago which have several streams some of which are seasonal and dry out in the dry season.

Plate 3: Topographical view of the project area

5.1.2 Climate

The district has tropical type of climate with two seasons of dry and wet seasons. The wet season extends from April to November with highest rainfall peaks in April and August. Dry season extends from December to March. The total annual rain fall is 39 1330ml. The average monthly maximum temperature is 29^{0}C and average monthly minimum temperature is 17^{0}C.

In Agago, the dry season is windy and it is hot and mostly cloudy year-round. Over the course of the year, the temperature typically varies from 65°F to 97°F and is rarely below 62°F or above 101°F.The hot season lasts for 2.5 months, from January 14 to March 31, with an average daily high temperature above 94°F. The hottest day of the year is March 1, with an average high of 97°F and low of 69°F. The cool season lasts for 2.8 months, from June 4 to August 29, with an average daily high temperature below 85°F. The coldest day of the year is August 5, with an average low of 65°F and high of 83°F. A wet day is one with at least 0.04 inches of liquid or liquid-equivalent precipitation. The chance of wet days in Agago varies significantly throughout the year.

The drier season lasts 4.9 months, from November 8 to April 5. The smallest chance of a wet day is 5% on January 15. Among wet days, the most common form of precipitation throughout the year is rain alone, with a peak probability of 53% on August 5. Hence in summary, Agago District experience drier months (of about 7.3 months) compared to wet months with Mean annual rainfall of 103.61 mm and wettest month having average precipitation of 143.94 mm.

Agago district is endowed with good climatic conditions that favors agricultural activities carried

within the district. The district has dry and wet seasons. The wet season extends from April to October with the highest rainfall peak in May and August. The dry season is from November to March.

Table 24: Monthly Evapotranspiration for Agago

Month	Min Temp	Max Temp	Humidity	Wind	Sun	Rad	ETo
	°C	°C	%	km/day	hours	J/m²/day	mm/day
January	16.2	34.7	49.0	251.0	8.8	21.8	6.4
February	17.7	35.1	48.0	251.0	8.1	21.5	6.6
March	18.7	34.0	56.0	251.0	7.9	21.8	6.3
April	18.8	31.6	67.0	233.0	7.2	20.4	5.2
May	18.2	30.5	74.0	216.0	7.8	20.4	4.7
June	17.7	29.7	75.0	199.0	7.9	20.0	4.5
July	17.1	28.7	77.0	199.0	6.6	18.2	4.0
August	16.8	29.0	77.0	216.0	7.0	19.7	4.3
September	16.6	30.5	74.0	216.0	7.7	21.3	4.8
October	16.1	31.7	70.0	233.0	7.8	21.1	5.1
November	15.7	32.6	64.0	268.0	7.9	20.6	5.5
December	15.8	32.5	58.0	251.0	8.0	20.1	5.5
Average	**17.1**	**31.7**	**66.0**	**232.0**	**7.7**	**20.6**	**5.3**

Dams serve as water reservoirs, renewable energy sources, and flood defenses. Sadly, they also make climate change more damaging. They displace low-income communities, produce greenhouse gases, obliterate carbon sinks in wetlands, rob ecosystems of nutrients, ruin habitats, raise/increase water levels.

5.1.3 Geology and Soils

Agago district is underlain by granitic and metamorphic rocks of the basement complex including rocks of quartzites, schists, amphibolites, charnockites, phyllites, mylonites etc. Much of these rocks have been very deeply pre-weathered providing the regolith to parent material of soils.

Plate 4: Examples of some of the soil types within the project area of Agago District

5.1.4 Seismic activities in the project Area

In Uganda, history of big earthquakes felt is associated with magnitudes in the range between 5.0 and 6.8. For construction and safety purposes, the earth dam was designed with earthquakes resistant structures for magnitude 7.0 and above and peak ground acceleration of 0.352g for the return period of 950 years. Uganda has severely experienced devastating earthquakes in the past.

5.1.5 Hydrology

The dam is recharged by Onyama seasonal stream, existing natural spring and groundwater whose water table is high. Onyama is a distributary of river Agago that feeds into Achwa River that pours its waters in the Nile river. The project area is also drained by a seasonal swamp that holds water and recharges the dam during the rainy season. Most of the rivers in the catchment and surrounding are seasonal and these include Lanyaaganya, Alango , Abim, Ajata, Ogul and Awuch streams which all are tributaries of river Agago.

The catchment drains subsistence farmlands, grasslands, bushes, woodlands and built-up areas. The wetlands were also observed especially along the river line, which have a major effect on the stream flow regimes in the catchment though the stream recharging the dam is seasonal. The surface water is mainly comprised of surface runoff from the catchment that carries a lot of sediment load.

Plate 5: The current status of Onyama Earth Dam to be rehabilitated in Agago District

5.1.6 Noise Levels

There are no cases of noise pollution at the proposed project location sites. Thus, the project sites indicate a generally pristine environment with respect to ambient noise. However, as would be expected due to the increased human activities and construction activities noise levels are likely to increase. The levels are based on land use Category D (Residential plus Industry or small-scale production and commerce) for which daytime and night limits are 60 and 50 dBA, respectively according to The National Environment (Noise Standards and Control) Regulations 2003.These readings were taken at the site (Earth dam) and there are no sensitive receptors like communities, schools, health centres.

Table 25: Noise levels measured at the proposed project site.

Project Component	Latitude	Longitude	LA_{min} dB	LA_{max} dB	LA_{Eq} dB	Comments (source of the noise and background noise
Project Site	2.811385N	33.481010E	38	76	46	Twittering birds, Swishing tree leaves and consultants' conversations

5.1.7 Air Quality

Proposed project sites currently have no ongoing activities that contribute to air emissions thus an indication of a free environment (generally pristine environment) from key air pollutants such as COx and NOx. The proposed Earth dam can be easily accessed by a foot path, however now a road infrastructure will be graded to open up access to the lake by vehicle. These readings were taken at the site (Earth dam) and there are no sensitive receptors like communities, schools, health centres.

Table 26: Results of air quality measurements taken in the project area

			Particulates (µg/m³)			CO_2 (%)	Comments
Project Component	Latitude	Longitude	Pm2.5	Pm10	Particles (per/l)	(pmm)	
Proposed Earth dam site	2.811385N	33.481010E	6.8	9.2	489	Preheating	Distant vehicular movement

Air quality measurements were taken after sunny day and at one of the corners of the site where air quality monitoring was conducted, Total Suspended Particles (TSP) levels conformed to the draft national limit of 300 µg/m³, concluding a clean environment with respect to air quality. Further still, at the location where measurements were made, gas monitoring equipment did not detect combustible gases, SO_x, VOCs, CO, H_2, NO_x, H_2S, and Cl. These sensors offered a novel method for measuring air quality at a broad scale, and the calibration of the air quality sensors involved modifying the sensor measurements by juxtaposition with a project site as the reference point of concentration of the parameters.

5.2 Biological Environment

5.2.1 Flora

The vegetation of the district is predominantly dry savanna type characterized by open canopy of trees 10-12 meters high and underlying grasses of 80 centimeters high comprising mainly of *hyper hania*, *terminalia acacia* and *Butterspermum* species. The vegetation is predominantly dry savannah woodland, while in the northeastern part of the district are mountain forest and shrubs.

Plate 6: Vegetation cover around the Earth dam.

Apart from *Milica excelsa*, even though nationally classified as not threatened (NT), local ordinances exist for its conservation and will need to be monitored during the construction phase of the project, the remaining species encountered during the study were categorized as least concern (LC) as per the IUCN list of threatened species (IUCN, 2021). The details and possible effect of the earth dam construction on vegetation have been provided under the impact analysis based on occurrence along the project area.

Based on the outcomes of the expert survey, the impact significance was determined. To this end, the results for each criterion were translated into scores, which were the aggregated into a final significance score. In the *first step*, the evaluation results were translated into numerical values taking the confidence levels into account. As no commonly accepted method exists for this process It is recommended to divide each level of the scale into three intervals based on the certainty level. In this way, the final value for each of the criterion also depends on the certainty of the expert judgments.

Table 27: Rating scales for the criteria assessment in the expert survey

Symbol	No	minor	Low	Moderate	Very High
M=Magnitude	0	2	4	6	10
P=Probability	0	1	2	3	5
E= Extent	0	1	2	3	5
Duration	Momentarily (0-1 year); Short-term (2-5 year); Short-term (2-5 years); Medium term (5-15 years); Long term (15-20 years); Irreversible (Permanent)				

In the *second step,* the scores of each criterion and for each impact were aggregated into a final score, which could then be translated into a significance level. Various arguments exist for or against different methods of aggregation, but no commonly accepted aggregation rule exists.

In this study, to aggregate the criteria scores, it was decided to draw on risk assessment research which stresses the importance of the probability of an event followed by the extent of its consequences, applying the following aggregation rule:
Significance= $L_i \times I_i + G_i + D_i$, Where;$L_i$ =Likelihood of impact *i*, I_i =Intensity of impact *i*, G_i = Geographic extent of impact *i*, and D_i =Duration of impact *i*

The values for intensity (*I*), duration (*D*) and geographic extent (*G*) are added together and then multiplied by the value assigned to the likelihood (*I*) criteria, resulting in a range of scores between 0 and 75. The main weakness of the aggregation function is the risk that an impact rated unlikely to occur, but which could have irreversible consequences, could be overlooked. To avoid this risk, the results must be carefully assessed by the researcher after the aggregation to avoid relying solely on the numerical outputs. Once the final scores for each impact are calculated, they must be translated into impact significance levels. We differentiate between four significance levels (very high/high/moderate/low), which are based on the score ranges liste.

Table 28: Significance levels and scores for the expert survey

Significance	Scores	Description
Very low	0-15	impact or impact of very low order
Low	16-30	Only very limited effects; social, cultural and economic activities of communities continue unchanged
Moderate	31-45	Medium level impact affecting a limited number of people in a small area for a limited time span
High	46-60	Probable impact with high effects on the livelihoods of communities, affecting many people or having a long-term effect
Very High	61-75	High probability and very high level of effects in a widespread area and with long-term effects on the livelihoods of communities

Conclusively, whereas no IUCN threatened species were encountered within the project area, valuable trees such as *Milicia excelsa*, *Ficus sur* need to be protected and conserved. Avoidance and replanting of these species is fundamental to maintaining their status in the future within the project area

5.2.2 Fauna

a) Birds

A total of 250 individuals were observed in the project area representing 40 species of birds; the observations were made from the proposed earth dam site, community roads to the Proposed earth dam, whereby sampling sites with most records and diversity recorded along the earth dam (being in a wetland ecosystem) and Pipe line right of way, based on its long distance. The highest numbers of species were recorded at point around the proposed earth dam. Birds having a wider home range and being mobile, they were found in all survey areas. Species abundance was highest in survey areas along the Main distribution line and access roads because both points were near the farmlands where there were trees with lots of black headed weaver birds that were recorded in large numbers compared to other points that had few birds recorded at them being a bit further away from the wetland and nature of land use-farmlands and settlements. Species diversity was generally low from all sites, partly due to the time of the survey, survey effort and most activity by birds was limited.

The most abundant and widely distributed species was the village weaver (*Ploceus cucullatus*) 86% followed by the Black Bishop 60%, forest visitors (Blue spotted wood dove , Black and White Mannikin (*Spermestes bicolor),* and Common Bulbul, *Pycnonotus barbatus*) were observed, eight grassland specialists and one water specialist (Pied Kingfisher, *Ceryle rudis*) often found near water as well as two non-water birds that are usually found next to water but can

as well survive where there is no water were also observed. Most of the species observed were habitat Generalists (Gen).

Most of the observed species were resident breeders except the White-throated Bee-eater *Merops albicollis* an intra-African migrant but non-breeding, a former breeder as well as a regular passage migrant, the Black Kite *Milvus migrans* being a resident breeder and regular passage migrant, the Yellow-crowned Bishop *Euplectes afer* a resident but breeding not yet proved but likely, Common Sandpiper *Actitis hypoleucos* being a winter visiter and an intra-African breeder.

Table 29: Summary of Avifauna species abundance based on habitat types, migratory classifications and ecological significance both global and national rankings

	Target Species			No. Spp
Ecological feature	Forest specialist	FF		
	Forest Generalists	F		3
	Tree Species	f		2
	Wetland Specialists	W		
	Wetland visitor	w		4
	Grassland specialists	G		1
	Aerial feeder	Ae		
	Woodland	Af		3
	Habitat generalists	Gen		31
Migrants	Palearctic	P		2
	Resident Breeder	RB		34
	Afrotropical	A		1
Red-list Species	Globally [a]	Critically	G-CR	
		Endangered	G-EN	
		Near-threatened	G-NT	
		Vulnerable	G-VU	
	Regionally [a]	Endangered	R-CR	
		Vulnerable	R-EN	
		Near-threatened	R-NT	
		Regional responsibility	R-RR	
	Uganda [b]	Endangered	U-EN	
		Vulnerable	U-VU	
		Near-threatened	U-NT	
Non-Redlist species		Least Concern	LC	40

[a] *Bennun et al. 1996*, [b] *WCS 2016*

b) Amphibians

A total of nine (09) amphibian species belonging to one order (Anura), six families and six genera were recorded across the different project area. Most of the species were recorded at the Bore Hole sample points that could be described as aquatic environments (flowing rivers/wetlands) that offer foraging, breeding and refugia for the species. A few marshland sections along the main access road proved to provide refuge to amphibian populations. All

the amphibian species recorded are of Least Concern (LC) according to the IUCN red listing (http://www.redlist.org).

Table 30: Amphibian species recorded

Family	Species	Common Name	Species	IUCN Status	Earth dam
Bufonide	*Amietophrynus regularis*	African Common Toad	8	LC	•
Dicroglossidae	*Hoplobatracus occipitalis*	Crowned bullfrog	4	LC	•
Hyperoliidae	*Hyperolius viridiflavus*	Common Reed Frog	2	LC	•
9	*Hyperolius kivuensis*	Kivu reed Frog	4	LC	•
Arthroleptidae	*Leptopelis christyi*	Christy's Tree frog	1	LC	•
Phrynobatrachidae	*Phrynobatrachus acridoides*	Eastern puddle frog	1	LC	•
Ptychadenidae	*Ptychadena anchietae*	Anchieta's Ridged Frog	1	LC	•
Ptychadenidae	*Ptychadena mascareniensis*	Mascarene grass frog	15	LC	•
Ptychadenidae	*Ptychadena porosissima*	Grassland Ridged Frog	2	LC	•

Key: (●) Observed at a particular site, (-) No observations/Sighting at a particular sight

c) Reptiles

A total of seven (07) reptilian species belonging to two orders (Sauria and Serpentes), five families and six genera were recorded in the project site for which vertebrate fauna were surveyed (Table 31). Some of these species were observed basking on adjacent structures such as buildings, culverts, rocks and on/under logs, while others were reported through interviews by the locals. Reptiles especially the Serpentes were reported by communities. Most of the encountered species were not evaluated by IUCN (2021), and those evaluated were all categorized as Least Concern (WCS, 2016). This therefore, implies that all the species recorded are of least conservation concern probably because they are found in other habitats across the country and the globe, thus their population and habitats not threatened.

Table 31: Reptile species recorded

Family	Species	Common name	Species abundance	IUCN Status	Earth dam Point
Geckonidae	Hemidactylus *mabouia*	Tropical House Gecko	9	NE	•
Agamidae	Acanthocercus *atricollis*	Common Tree Agama	25	LC	•
Agamidae	Agama Africana	Common Agama	15	LC	•
Scincidae	Trachylepis *maculilabris*	Speckle-lipped Skink	5	NE	•
Scincidae	Trachylepis *striata*	Common Striped Skink	6	NE	•
Chamaeleonidae	Chamaeleo *gracilis*	Gracile Chameleon	1	NE	-
Lamprophiidae	Psammophis *sibilans*	Hissing Sand Snake	reported	NE	

Key: (●) Observed at a particular site, (-) No observations/Sighting at a particular sight

d) Mammals

Three mammalian species were recorded, all being rodent's species. This is because the project area is seriously disturbed leaving a few pockets of grasses and bushes that cannot host medium-large sized mammals. Rodents have evolved to survive in areas of human disturbance, reason for their presence. All mammalian fauna recorded during the survey were of least concern with regard to IUCN Redlist (IUCN, 2021). This is because the species encountered easily withstand modified habitats and are widely spread across the entire country and globe and their populations are not threatened at any level.

Table 32: List of mammals encountered

Family	Species	Common Name	IUCN Red list	Bore Hole Site
Sciuridae	Xerus rutilus	Unstriped ground squirrel	LC	•
Muridae	*Rattus rattus*	Black rat	LC	•
Muridae	*Lemniscomys stratus*	Common stripped grass mouse	LC	•

Generally, the fauna richness in the project area is low owing to the degraded nature of habitats where the proposed water supply system will traverse. It was also noted that the earth dam site is capable of hosting fauna that escape disturbance from the surrounding habitats. Therefore, during construction of the earth dam, efforts to minimize impacts on these habitats are highly recommended.

Plate 7: Nymphea mexicana (Aquatic weed) on the silted dam

5.3 Socio-Economic Environment

5.3.1 Demography

According to the NPHC 2014, Agago District has a population of 227,792 people comprising 110,495males and 117,297 females. This has increased in comparison to the 2002 census. The population of Agago District is currently projected to be 251,200 people with a projected population density is 71.49/km². The local population is expected to increase in areas where construction will be undertaken and the community expressed fear about the likely increase in

occurrence of broken marriages, because of married women and young girls being lured into sexual acts by construction workers.

5.3.2 Telecommunications

Mobile telecommunications have eased the burden of communication significantly in Uganda since the communications sector was opened to private operator participation. All the major mobile telephone operators (MTN, Airtel and Orange) have services within the project areas.

Majority of the areas within the project area are accessible by a network of gravel roads off the main road while others can only be accessed by existing local footpaths. The main means of transport are taxis and pickups which connect to the neighboring towns. Boda bodas on the other hand are most used mode of transport within the villages in the project area

5.3.3 Socio economic activities

In the project area Subsistence agriculture is the main economic activity carried out in the district and the main source of income of the farm families in Agago. 90% of the population in the district is Subsistence farmers. The main food crops grown in the district include; finger millet, maize, sorghum, cassava, peas, beans, and vegetables. The traditional and non – traditional cash crops grown include; Cotton, tobacco, soya beans, sim-sim, rice, sunflower and groundnuts. Other agricultural activities include; fish hunting and fish farming. Employment in NGO and government services and petty trade also provide income to the population in the district. However, agricultural activities are greatly affected by the prolonged drought or lack of water for production most of the periods in the year.

Plate 8: Fish Pond being excavated along the inlet to the dam

5.3.4 Power source

The main source of energy for domestic needs in Agago is firewood for cooking and kerosene/paraffin for lighting, for most households that can afford it. Other energy sources for lighting in the Project Area include solar energy, generators and UMEME in centres. It was observed that there are activities undertaken, such as maize milling, battery charging, and hair salons that are powered by diesel power generators.

5.3.5 Institutions

There is education (nursery, primary, secondary and tertiary), religious (mosques, churches) and health (hospitals, clinics, health centres, drug shops, pharmacies) institutions in Agago project area. The Project district has about 40 health Centres. However, Adilang Sub County where the earth dam is located has Adilang Health Centre III as the main health facility but with a number of smaller health clinics.

The most mentioned reported diseases include malaria, cough, common flu, and waterborne diseases (diarrhea, typhoid, cholera, dysentery). These are supported by the information from the Health Assistants at Adilang Health Centre III, which indicated that the community members mostly suffered from malaria, pneumonia, diarrhea, and common flu and cough.

5.3.6 Ethnicity and Religion

The Agago District the Acholi people (also spelled Acoli) are a Nilotic ethnic group of Luo peoples (also spelled Lwo), found in Magwi County in South Sudan and Northern Uganda (an area commonly referred to as Acholi land), including the districts of Agago, Amuru, Gulu, Kitgum, Nwoya, Lamwo, Pader and Omoro District.

Available records show that the largest single ethnic group in Agago District is the Acholi/Labwor which constitute about 94% of the total district population. The Langi, who are ethnically closely related to the Acholi are the second dominant group in the district and are just 4% of the population in the district. Other Ugandan ethnic groups do not have a significant number in the district. There are some refugees from southern Sudan but a few of them rarely settle outside gazzetted areas if any.

5.3.7 Gender analysis

Gender is interpreted as the socially ascribed roles and responsibilities of men and women in society; it has gravely affected development as it takes the responsibility for imbalances in access to services, benefit from the proceeds and control over capital resources away from women and girls. The situation has further been aggravated by the fact that the Agago. District economic base is unreliable, due to dependency on the subsistence agriculture sector. There is growing unemployment and under-employment levels, with little recognition of the contribution of women to development. Agago District Local Government has over the years made efforts to develop interventions that can help in addressing issues of persistent inequality reduction, vulnerability and risk reduction, homelessness, social protection and gender imbalances.

Most of the interventions have been directed to gender inequalities, abject poverty and HIV/AIDS epidemic that have continued to place a huge burden on the District, Lower Local Governments, community and household resources, which in turn have endangered human capacity and productivity. Similarly, cases of domestic and gender-based violence (GBV) were quite prevalent in the project area with most of the residents saying that they had heard of GBV cases in their area.

5.3.8 Land cover change pattern in Agago sub catchment (2000-2018).

The district has three major land tenure systems. The predominant one is the customary land tenure system. Land is normally obtained through inheritance from father to son and controlled by the household and elders. A few individuals, especially from urban centres and institutions obtain land through leasehold, which was previously managed by the town council, but now

is directly under the District Land Board. The district administration, development partners and religious institution in the district are established on freehold land.

Five land cover types were identified including built up area, grassland, small-scale farming, wetland and woodland. Results showed significant land cover changes in Agago sub catchment during the last 18 years. The patterns of land cover change. Results show that in 2000, grassland dominated the sub catchment by 40.3%, followed by woodlands (22.0%), wetlands (21.4%), small scale farming (9.9%) and, built up area which covered 6.2% of the land area. In the period 2000-2010, grassland increased to 47.5%, built up area and small-scale farms increased by 8.6% and 14.3%, respectively. On the other hand, there was a decline in wetlands (16.7%) and woodlands (12.7%). During 2010-2018, wetlands and woodlands decreased to 11.5% and 1.7% respectively, while grasslands declined to 32.2% of the total land area. There was continued increase in built up area (9.8%) and small-scale farming (44.6%) during 2010-2018.

5.3.9 Physical Cultural Resources and Common Community Resources

Most of the people in the project area revealed that they had places/items of cultural significance in their communities. These included graveyards, shrines, medicinal plants, cultural trees, worship rocks, and cultural streams/wells. This was backed by the CDO and District Natural Resources Officer who mentioned that the project area has communal graves, shrines, and sacred trees which cannot be tampered with unless the elders have been consulted and cultural rituals have been performed.

However, all these items/places of cultural significance are unlikely to be affected during project implementation since they are not around the proposed site for the earth dam though a Chance Find Procedure to cater for any unknown PCRs that could be intercepted during the construction has been prepared.

5.3.10 Settlement Patterns & Housing

The settlement patterns follow the different land use categorization in the area. These categorizations include local community housing facilities, roads, cattle keeping communities, cyclic farming communities, and trading centres. The structures in the core project area include permanent structures with semi-permanent structures being located mainly in the fringe areas. There are also some typically rural spatial settlements in the immediate fringe area with large open farmland outside the town fringes overleaf.

5.3.11 Sanitation and solid waste management

The population in the centre is mainly served by privately owned pit latrines as there is no public toilets within the trading centre. As regards solid waste management, the trading centre has no waste dump site and the rubbish is collected at household level and indiscriminately disposed anywhere within the centre.

Furthermore, a majority of the households do not have hand washing facilities around the toilet; only have hand washing facilities. Relatedly, most of the households do not have soap in the hand washing facilities as opposed to few that have soap. More sanitation facilities owned in the households included bathrooms, wire for hanging clothes, dish racks, and an improved kitchen (with raised fire-place and improved ventilation).

The most mentioned practices of solid waste disposal at the household level included burning, scattering in the gardens, and disposing to the rubbish pits and composite pits.

The findings suggest that the high disease burden conferred earlier in this study could closely be linked to poor sanitation and hygiene at the household level; simply because, whereas the latrine coverage was relatively high, the coverage of hand washing facilities equipped with soap was very low and this could account for cases of diarrhea. Equally, solid waste disposal was poor; for instance, the burning of rubbish could be the cause of respiratory diseases like coughs and cold flu as discussed earlier.

5.3.12 Vulnerability Assessment

It was reported that most of the homes did not have vulnerable persons in their households though some acknowledged that they have vulnerable people. The most pronounced type of vulnerabilities were elderly persons of 65 years and above, persons with disabilities, widows/widowers, and chronic illnesses. More vulnerabilities stated comprised of female and child-headed households, extremely poor/not earning, and illegal squatters.

According to the engagement done with both local leaders and community members, special consideration needs to be accorded to households with vulnerable people. Specifically, special resettlement assistance should be directed towards women and other vulnerable groups in form of relocation assistance where need be and livelihood restoration or promotion of new livelihoods. Also, the project could sensitize the vulnerable beneficiaries about some of the functional places they could go to receive assistance in their respective areas as well as make referrals for them and as well make strategic coordination with such service provider centers. For example, the elderly could be advised to register for senior citizens grant like SAGE and Counselling and family support for vulnerable households among other such services.

5.3.13 Energy for Cooking and Lighting

During the ESIA study, there were two common sources of energy for cooking mentioned by respondents i.e., firewood and charcoal. This implies that there was a lot of environmental degradation through human activities like cutting of trees and charcoal burning to an extent that some households lack energy for cooking and use maize cobs and uproot deep roots of trees that were cut several years back. The project should not exuberate this phenomenon any further, especially during the construction phase but rather consider some mitigation measures like launching tree planting campaigns. To realize any impact from such critically needed interventions, there is need to educate the beneficiary communities on the importance of trees to environmental conservation, reduction in climate change impacts, and their livelihoods in general. Better still, the local council leaders should be encouraged to make bylaws on tree planting, cutting and charcoal burning to curb the vice further.

6 PROJECT NEED AND ANALYSIS OF ALTERNATIVES

6.1 Introduction

This Section evaluates available options to the proposed action, so as to arrive at the most environmentally friendly alternative, which maximizes economic, social and technical benefits resulting into minimal or insignificant environmental impacts.

6.2 Project Need

Agago is one of the Cattle Corridor Districts of Uganda characterized by livestock production with scarce water and pasture and is one of the most affected regions in the country. While it is not currently classified as semi-arid, this corridor has many semi-arid characteristics which include high rainfall variability, periodic late onset rains/droughts, historical reliance on mobile pastoralism as an important strategy to cope with resource variability. The age structure of Agago population is typical of a rural area in a developing county; 57% of the population is below the age of 18 years. It is mainly a peasant agricultural and patriarchal society; heavily dependent on land for survival. The peasantry is an extremely environment degrading population but extremely vulnerable, any changes in the climate for the worse, can be catastrophic. Satellite picture analysis of 1990 and 2005 showed that Agago District had lost 79% of its forest cover. The leading cause of massive encroachment on water resources in Agago district was attributed to prolonged dry spells, increased demand for agricultural land, charcoal production and fuel wood demands for the rapid population growth.

Provision of water for production is one of the responses to the adverse effects of climate change to the agricultural sector. The intensity and frequency with which the drought and floods occur require more proactive responses. New approaches to water for production service delivery under the Agro-Industrialization (AGI) Program are therefore needed as a proactive response towards drought and to guarantee food security for the future generation. Given the district's vulnerability to climate change, and its importance for national and local food security, rehabilitation of Onyama dam will increase agricultural production and productivity and regulate dependency on rain fed agriculture which is heavily affected by prolonged droughts in the district. The dam has since outlived its design life. The embankment is presently in bad condition with significant evidence of slope failure, especially on the upstream face/side, piping through the dam body and extensive siltation. The spillway channel is non-functional thus posing danger of total breach to the embankment.

The proposed dam will address the need to resolve the ongoing water supply issues the local population has been facing. Because it dries out the ground (aquiver), ground water has been regarded unsustainable and unfriendly to the ecosystem because it affects the area's ability to recharge and discharge. Lack of a dependable water source in the area has hindered growth and development.

6.3 No Project Alternative

Analysis of the "no project option" as an alternative provides an environmental baseline against which impacts of the proposed action can be compared. This alternative means that the Earth Dam sites will be left in their original state. The alternative ignores all positive impacts likely to be realized in the project area and throughout the region due to the proposed Earth dam like transformation of agriculture practice in the area, sustainable and optimal use of irrigation water resources, creation of employment to both skilled and unskilled labour, better livelihood opportunities and induced development, address food security, crop diversification

and intensification, considerable economic opportunity for material/ equipment suppliers, construction contractors and other project-relevant professionals.

This option implies that the existing situation prevails (status quo remains) i.e., no implementation of the proposed Onyama Earth Dam. This option is mostly applicable in situations where the proposed project area is in ecologically or socially sensitive areas and the negative impacts will be of significance and no proper mitigation measures can be formulated to eliminate or minimize the impacts to manageable or acceptable levels. The land on which the Earth Dam infrastructure will be constructed is not ecologically sensitive and no households will be displaced. The community in the project area has been engaged and are willing to make land available for this project as they are in agreement it will address their dire need and access to water. Sub County local leaders will engage the owners of land especially the land for new proposed reservoir.

The No Project Option is the least preferred option from both the socio-economic and environmental perspective because the Sub County and surrounding areas would be deprived of increased accessibility to suitable water for Production in addition to the socio -economic benefits especially during construction i.e., provision of jobs for skilled and non-skilled workers.

6.4 Alternative dam location

If the planned project would cause significant environmental issues that could not be fairly and efficiently managed, a different site might be taken into consideration. The proposed mitigation measures, however, are thought to be sufficient to reduce the impacts to levels that do not call for considerable environmental harm. The suggested location is also deemed appropriate due to its extensive bedrock and contributing catchment area. As a result, this solution (of looking for another possible location) is not thought to be practicable.

6.5 Alternative Design and Technology

The advocate would also have chosen to use other quarrying dam techniques and equipment. Several quarrying techniques are categorized. Earth dams have a number of alternatives, including but not limited to concrete dams, rock-fill dams, sand dams, and subsurface dams. Some of the parameters used to choose the suggested alternative are displayed as below.

- Availability of local materials
- Handling of construction materials
- Foundation condition
- Cost of construction

6.6 Environmental and Social Considerations

The potential impact of the Earth dam infrastructure on the landscape and ecology were considered, this was mainly from the field studies. These factors have been subsequently addressed within the interactive process of environmental assessment and the findings presented in this ESIA report.

- **Noise and proximity of housing:** The proposed Earth dam infrastructures were judged to lie distant from homesteads and settlements but within the commercial centre of the project area; that adequate separation distances could be achieved to avoid noise nuisance during both the construction and operation phase given the nature of the development. Construction activities for the Earth Dam should be carefully controlled. In addition, apart from the vehicle movements, the noise in this kind of project is minimal.

- **Land ownership:** Onyama dam is seated on government land (the land title is at the district) with an acreage of 50 acres. During colonial time, this dam land was 100 acres but due to population increase over time 50 acres of this land has been encroached by the neighbouring community. The transmission lines will pass along road reserves but where peoples land will be affected, local leaders and the local communities have been engaged. Agago District Local Government (ADLG) secured the land as seen in the annex IV, there are no resettlement and displacement issues anticipated since the land has no encumbrances.
- **Community Opinion:** Dams elsewhere in Uganda have not attracted local concern and resentment among the local residents. Likewise, in the case of the Onyama Earth Dam, the development would not have much significant negative impact on the dwelling and settlements. The communities and the local leaders consulted welcomed the proposed project.

6.7 Technical and Design Considerations

There is a wide range of construction and furnishing materials which can be sourced locally for example sand, aggregates, bricks, etc. During construction, certified equipment and modern technology e.g., Water pipes, Storage Reservoirs, metal bars and fittings that meet the Uganda National Bureau of Standards (UNBS) requirements. Implementing the Earth Dam according to approved designs will be a priority as it will lead to the provision of improved quality and quantity of water supplied, reduced morbidity and increased productivity of households; and increased agricultural production, better livelihood opportunities and induced development and employment opportunities. Therefore, it will be paramount that WfPRC-N and the Operator ensure that the Earth Dam has the following in place:

- Enough area recommended for fencing in order to prevent vandalism of the infrastructure and for the safety of hydraulic structures and installations of the pumpstations.
- Well-designed drainage system at the dam facilities
- Consideration of noise and traffic generated by the trucks to and from the site during the construction, solid waste management itself at the site both during construction and operation (especially at the offices premises)
- Security mechanisms including fire safety mechanisms and security guard at all the Eart infrastructure facilities
- Well-designed access route from the main road

6.8 The Action Alternative as Described in this ESIA

This option implies that WfPRC- N continues with the implementation of the proposed project as per the project designs and recommendations by different stakeholders. We have made a comprehensive Environmental study for the proposed project area. Details of the study are the subject of this ESIA report. The study has found no significant issues (environmental, economic or social) to stop the implementation of the project. Mitigation measures for the identified negative impacts of this alternative have been thoroughly discussed throughout this Report. If they are implemented as proposed, the project will not do any damaging to the environment. It is here thus we recommend that this alternative is the most appropriate.

7 STAKEHOLDER CONSULTATION AND ENGAGEMENT

7.1 Introduction

Consultation with relevant stakeholders and regulatory institutions was carried out to ensure participation of relevant stakeholders, as recommended by the National Environment Act, No.5 of 2019, EIA Regulations (2020), and conduct of Environmental Practitioners (2001) and guidelines for EIAs in Uganda. The consultations aimed to identify and take note of environmental and social concerns and views of all the stakeholders at an early stage so that appropriate mitigations are incorporated in the final implementation plan for the proposed project.

Stakeholder meetings were held at Agago District, Adilang Sub County. The consultation process ensured that their concerns were captured and have been addressed during ESIA. Informal conversational interviews and observations were the key data collection methods applied. The consultation process ensured that their concerns were captured and addressed. A wider intensive consultation process was carried out during the Environmental and Social Assessment. In general, the majority of stakeholders supported the project and found it to be beneficial.

7.2 Objectives of Public Disclosure and Consultations

The primary purpose of the stakeholders' consultations was to provide an overview of the project to the relevant agencies, stakeholders and all the communities where the Onyama Earth Dam components are to be located and therefore impact on the communities. It further helps them to understand how the WfPRC-N and the project team will operate to the highest possible environmental, social, health and safety standards prior, during and after the construction of Earth Dam the related infrastructure.

7.1.1 Specific Objectives

The specific objectives of the Consultations were;

i) To obtain an understanding of the number and types of stakeholders in the socio-economic study area
ii) To provide information about the project and to tap stakeholders' information on key environmental and social baseline information in the project area
iii) To provide opportunities to stakeholders to discuss their views, opinions and concerns
iv) To manage expectations and misconceptions regarding the project
v) To discuss potential impacts and verify significant or major environmental, social and health impacts identified.
vi) To inform the process of developing appropriate mitigation and management measures as well as institutional arrangements for effective implementation.
vii) To inform stakeholders about the engagement process and grievance management
viii) To provide a mechanism for ongoing stakeholder engagement and ways in which the stakeholders can continue to participate in the stakeholder engagement process
ix) To ensure regulatory requirements and project standards are met.

Stakeholder consultations and public participation during the ESIA process were conducted in line with the requirements of the National legislation and regulations. According to the National

Environment (Environmental and Social Assessment) Regulations, 2020, Part III under section "*Procedure for Undertaking Scoping and Environmental and Social Impact Study*", Sub-section 16; "*Stakeholder consultation during the environmental and social impact study"*, stakeholder consultation is crucial during the ESIA study.

7.3 Stakeholder Identification and Analysis

7.3.1 Stakeholder Identification

A stakeholder may be defined as 'any individual or group who is potentially affected by the project or can themselves affect the project. To develop an effective stakeholder involvement programme, it is necessary to determine exactly who the stakeholders are based on their roles, influence, objectives and priorities specific to the project. The ESIA team formulated a stakeholder matrix and identified key stakeholders who were engaged during the study. A stakeholder engagement plan was drafted and populated with additional stakeholders during the ESIA study. The study targeted individuals, groups/institutions and communities that have a stake in the priority water project. Thus, only such entities as identified in the stakeholder analysis were selected to participate in the consultation process.

When identifying and prioritizing stakeholders, the following aspects were considered:

(i) Who could be adversely affected by environmental and social impacts?
(ii) Who are the most vulnerable among the potentially impacted, and are special engagement efforts necessary?
(iii) Which stakeholders can best assist with the early scoping of concerns and impacts?
(iv) Who strongly supports or opposes the changes that the project will bring and why?
(v) Who is it critical to engage with first, and why? (IFC 2007) Stakeholders were then identified:

7.3.2 Stakeholder analysis

The stakeholder categories and sub categories identified are presented in table below

Table 33: Stakeholder Matrix

Group	Stakeholder	Description and key attributes
Funder	AfDB	✓ To ensure that the Banks Operational Safeguards have been observed and implemented as appropriate. ✓ Support the project with funding
National Level Stakeholders	Ministry of Lands Housing and Urban Development (MoLHUD)	✓ Approves all reports presented by the consultant regarding valuation
	Ministry of Gender, Labour and Social Development (MoGLSD)	✓ Protection of human rights and vulnerable social groups. ✓ Occupational and community health and safety of roads. ✓ Approval and monitoring of the social safeguards ✓ Approval of permits like workplace permits, OHS

	Ministry of Water and Environment (MWE)	✓ Overall mandate to monitor, assess and regulate water resource ✓ Monitor and guide the use of wetlands for sustainability and other water bodies within the project areas ✓ Approval of the Water abstraction permits ✓ The implementer of the Project ✓ Overseeing and monitoring the project activities
	NEMA	✓ Regulation of the environmental aspects of the project(s). ✓ Legally mandated to handle certain critical environmental issues ✓ Provide the necessary permits and approvals for quarries, borrow pits and other auxiliary sites ✓ Work closely with the project team to handle all matters related to environmental protection ✓ Overall clearance of ESIA and other project briefs about the project facilities. ✓ Monitor and supervise the ESIAs compliance
Local Governments	District (Agago District Local Government)	✓ Mobilize various stakeholders including the communities/beneficiaries ✓ Monitoring and supervision support for the implementation of the projects. ✓ Offer security to the project team (RDCs Office) ✓ Review the ESIA and give comments (Environment Office)
	Adilang Sub County (Technical and political staff)	✓ Make decisions that may affect the project, ✓ Offer support and supervision of the project ✓ Help in the identification of the location of the water and sanitation facilities.
	Local Councils	✓ Mobilize communities ✓ Offer support in the planning, implementation and operation of the project ✓ Offer support in the identification of the locations of the water and sanitation facilities ✓ Monitoring of the projects ✓ Provide social justice to vulnerable communities ✓ Incorporate information about the project in their teachings, gatherings/meetings for acceptance especially regarding water and hygiene-related information.
Different Community groups,	Traders, landlords, tenants, business people, affected persons (Landowners who offered land for the project)	✓ Develop construction (works) schedules in their respective areas. ✓ Participate in the scheduled meeting regarding the project activities and progress ✓ Identify mitigation measures of the environmental and social issues

		✓ Monitor the progress of the project activities ✓ Input in the planning and identification of water and sanitation facilities.

7.4 Methodology for stakeholder engagements

Different methods were espoused to undertake the stakeholder engagements on this project. These were taken up depending on two major premises; the type of information required, and the number of participants involved in the data collection process. These methods were used to inform the development of an appropriate water supply system within this proposed project area. Here-under are the methods that guided the stakeholder engagement process;

7.4.1 Formal meeting with the Stakeholders

The project had an inception workshop where all the stakeholders were invited as a start meeting to inform all the stakeholders about the project. MWE/WfPRC-N organized the meeting to inform all stakeholders about the project, its objective, the intended activities, the project extent, and the related studies to be undertaken, including the Engineering Design and ESIA, Photographic Surveys, source of water among others. The main object was to solicit, potential impacts and possible mitigation measures and also solicit initial community responses. Two meetings were held; one at the Adilang Sub County and another one at one of the homes of the participants on top of the Key Informant Interviews (KII) held with the district officials. 34 members were engaged with 22 Males and 12 females. The stakeholders were able to express comments and queries during this meeting as seen under table 18 and minutes attached.

Plate 9: Community project awareness with District, S/C and WfPRC-N officials around Onyama dam of Agago

Plate 10: Stakeholders' meeting with Adilang S/C leadership and the community

7.4.2 Key informant interviews; .

(KIIs) were held with individuals who were assumed to have specific information related to the project. Some of these were pre-set while others were identified during the interactions with other stakeholders. Some of such stakeholders included; The CAO's office of Agago, LC V, the District Production office, the District Water Engineer, CDO, Environmentalist among others.

Plate 11: An engagement with the CAO, Agago DLG

Plate 12: An interview with the DWO, Agago DLG

7.5 Key findings from stakeholder consultations

In relation to the project, the main findings from the engagements and public participation were largely categorized into two parts; the envisaged impacts (Both negative and positive) and general concerns on the project. The main findings from the engagements are presented below; For example, according the local leaders and community members, the rehabilitation of the Earth dam is expected to have the following benefits:

- Transformation of agriculture practice in the area
- Sustainable and optimal use of irrigation water resources
- Employment during construction and operation of the Earth Dam
- Eradication of poverty and improved livelihoods of the local people
- Crop diversification and intensification
- Serves to address food security and water for animals in the areas of the project
- Ensure environmental sustainability

However, some concerns were raised as regards to the project and these include:

- Destruction of crops especially during construction works
- Contamination of water from runoff water off project sites
- Land conflict issues could arise,
- Dust and vehicle emissions,
- Increase in noise and injuries on duty,
- Increased spread of communicable disease,
- Poor waste management practices at construction sites

However, there were also issues that rotated around the following during the community consultation meetings;

- *Property to be assessed* - Land, structures (or improvements) and Perennial crops will be assessed. However, the project designs were developed in such a way that there is no physical displacement of PAPs.
- *Connection to water for irrigation for individual farmers far away from the built system* - Upon completion of the pipe network system, households will be encouraged to apply to the operator for water connection and water pipes will be extended.

Stakeholder engagements will continue throughout the implementation and operational stage with different stakeholders. It is likely that more relevant agencies and stakeholders will be identified during these phases and will be engaged accordingly.

7.6 Public Consultations and Sensitization

Consultation and participation is a process through which stakeholders influence and share control over development initiatives, and the decisions and resources that affect them. It is a two-way process where the executing agencies and developers, policy makers, beneficiaries and affected persons discuss and share their concerns in a project process. The specific aims of the consultation process were to:

- Collect individual responses reflecting knowledge and attitudes towards the project;
- Conduct informal discussions with earlier identified opinion leaders to enrich the social survey
- Provide clear and accurate information about the project to the communities;
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;
- Increase the effectiveness and sustainability of income restoration strategies, and improve coping mechanisms;
- Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.

7.7 Public Disclosure and Consultation Plan

Public Consultation and Disclosure (PCDP) is a key element in the engagement and essential for collective involvement of stakeholders in the proposed development. Disclosure refers to the provision of relevant and adequate project information to enable stakeholders understand risks, impacts and opportunities of the project. Consultation is an inclusive and appropriate process that provides stakeholders with opportunities to express their views which should be considered, responded to and incorporated into the decision-making process. In the context of the proposed development, stakeholder consultation aimed at:

- Generating good understanding of the project;
- Enabling stakeholders to engage and participate in proposed project design;
- Understanding what local community expect throughout the life of the project;
- Optimizing local benefits of the project;
- Developing effective mitigation measures and management plan;
- Characterizing environmental, health and socio-economic impacts of the project.

The proposed project is within the jurisdiction of Agago District Local Government headed by a Local Council V (LCV) Chairman and Chief Administration Officer (CAO) who is the political head and technical head respectively. Various district offices whose functions would be relevant to the project include offices of Natural Resources/Environment, District Health Inspector, District Planner, Community Development Officer, District Health Officer, District Water Officer and

District Engineer. Equally important are village-level local council administration (LC I and LC III). Leaders at these levels of local administration are closer to residents and therefore important in effective community mobilization, sensitization and dispute resolution given that the proposed project is going to benefit communities. Like stakeholder identification, public consultations and information disclosure is a continuous process throughout the ESIA exercise. KIIs and FGDs were utilized for PCDP. Key stakeholder concerns were also identified so that they could be considered in the implementation of the project.

Grievance Redress Mechanism (GRM) as a key element of the PCDP to actively identify, manage and follow up grievances received to ensure that appropriate resolutions and actions are taken by relevant authorities especially MWE, Agago District Local Government and Adilang Sub County.
In order to ensure transparency and accountability, a GRM shall be established by the Project Support Team in line with the guidance provided in the ESMP. The GRM shall have a clear set of goals and objectives and a well-defined scope for its interventions, especially geographical area coverage to ensure its accessibility and effectiveness. A set of procedures for receiving, recording, and handling complaints shall be available in the GRM. This will be managed by a National Grievance Redress Committee (GRC) consisting of a MWE/WfPRC-N Chair, the Project's Environmental Focal Point, the chair of the community mediation board, a member of a recognized non-government organization, and a community leader. The GRC members shall be qualified, experienced, and competent personnel who can win the respect and confidence of the affected communities.

GRCs shall also be established at District and Lower Local Government Levels as appropriate. For easy accessibility, GRCs shall also be formed at or closer to project implementation site at Agago District. Grievances shall be first reported and handled at the lowest level or project site, and referred to the next level if not resolved. The GRM shall include procedures for:

- recording, registering, and sorting grievances;
- conducting an initial assessment of grievances;
- referring grievances to appropriate units or persons;
- determining the resolution process;
- making decisions, including parameters and standards for accurate and consistent decision making;
- directing relevant agencies responsible for implementing decisions;
- notifying complainants and other affected parties of eligibility, the resolution process, and outcomes;
- tracking, monitoring, documentation, and evaluation; and
- a Grievance Log, that shall summarize all grievances registered, resolution reached, and feedback provided.

Depending on the nature and the severity of the complaint/s, the GRC in consultation with the Project Affected Persons (PAPs) or Complainant, shall identify and decide on an approach for grievance resolution. Where appropriate, complainants shall be given the choice of selecting an affordable approach with which they are comfortable and confident and that is beneficial to them. For construction-related complaints, it will be the Contractor's responsibility to address them. Usually, these kinds of complaints are described as environmental and social impacts and include issues related to dust, flooding, blasting (noise, vibration, and evacuation), lost access, and dangers to life, damage caused to public roads from heavy machinery, deteriorating water quality and

quantity, damage to property and crops, soil erosion, workers misbehavior, defilement/child abuse, and others.

7.8 Feedback from All Stakeholders Engaged

Many of the comments captured from stakeholders presented views on the expected benefits and concerns on the adverse impacts the proposed project may have on the environment and the existing activities. A summary of key environmental and social issues and recommendations raised by stakeholders are presented in Table below 18.

Table 34: Key environmental and social issues and recommendations raised by stakeholders

No	Name of Stakeholders	Comments	Opportunities	Suggestions
DATE: 02/02/2023				
Agago District.	CAO	Appreciated the initiative to rehabilitate the dam and welcomed the team and cleared it for community engagement.	The district is already set to support the dam rehabilitation and restoration activities.	The communities around the dam will now have chance not to lose their animals to draught and may as well expand their farms.
	LCV	Welcomed the idea about the rehabilitation of the dam. It has been idle for a long period of time The project will benefit a large number of people	Farmers around the dam are all eager to tap into the benefits the dam presents once rehabilitated.	Partnership in the redevelopment of such project is essential. Also suggested that farmers were willing to contribute once mobilized towards the dam rehabilitation.
	DWO	The dam has a lot of potential to serve the community. It can serve several purposes beneficial to the communities including enhanced water storage, supply and utilization through the year. MWE, the district and consultants should plan for adequate sensitization about the project Addition facilities like sanitation, public animal feeders/drinkers should be part of the rehabilitation plan	Due to its big capacity, a number of users including Crop cultivators, animal grazers, and other beneficiaries	Rehabilitation of smaller dams in the neighbouring sub counties could be more impactful than this one dam.
	District Environmen t Officer	The initiative to rehabilitate the dam is very much welcome The contractor should consider Environment Restoration after	Personal protective gear will be equipped with the workers.	Environmentally friendly will be planted in the affected areas.

No	Name of Stakeholders	Comments	Opportunities	Suggestions
		construction and should implement ESMP while on site There is need to interact with the beneficiary community The project should not pose Environmental and community risks during excavation of construction works		
	DCDO	The project will enable members of this community to engage in productive agricultural activities by irrigation during the dry months to enhance their livelihood and this will improve the livelihoods of people It will solve problems associated with moving long distances in search for water among women and children	Improve food security, household nutrition, incomes and also share knowledge.	Embrace inclusive planning with all stakeholders.
Adilang Sub County	LCIII & LCIs	The dam had long been neglected and its rehabilitation is much recognised. This dam has got a lot of potential once given priority. It supports irrigation, animal feeding, SMEs, water for domestic use.	Livelihood activity diversification and induce innovative survival skills.	The rehabilitation of the dam should not delay. Urgency is very essential
Community around the dam	Crop farmers	Water for Irrigation especially during the dry spell will helps farmers adapt to smart farming to suit the dry seasons.	The dam will offer opportunity for alternative livelihoods and survival.	Establish an irrigation and animal drinking sections to enable farmer progress.
	Animal grazers	The Dam utilization needs to be controlled to ensure no water is not wasted but productively benefits the farmers and domestic users.	Once the dam is rehabilitated animal diseases are likely to be controlled. Thus, improvement in the quality of animal products.	Build better water points for animal water for drinking.
	Other	It will Promote tourism and enhance study Environment. Promote fish farming	The dam will provide water for industrial	Better fish species should be introduced into the dam

No	Name of Stakeholders	Comments	Opportunities	Suggestions
		It will attract industries	establishments and provide room for study	

All the stakeholders consulted supported the project on the basis that it would solve the water scarcity problem that serious affects the entire community. However, concerns of ownership and sustainability were mentioned, locals are also worried of possibility of being displaced from land they have settled on for years and expect the authorities to mitigate all project related negative impacts such as destruction of crops, Increased spread of communicable diseases, HIV/AIDS spread in the area and any other negative impact as would be realized.

7.9 Workers Grievance Redress Mechanism

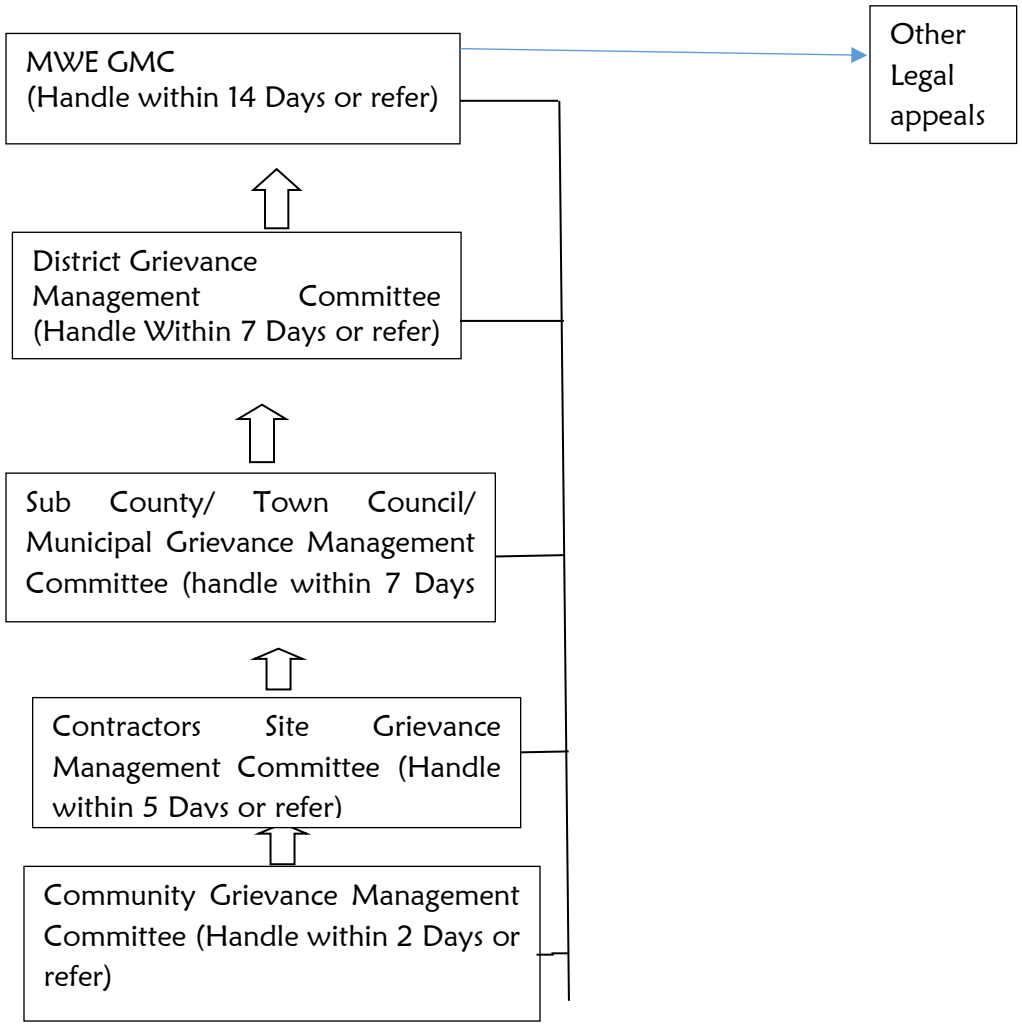
In accordance with the Employment Act (2006), the MWE/WfPRC-N shall ensure that the Contractor has provided contracts to all workers and has established a GRM and grievance redress committee with workers' representation. It is the responsibility of the Contractor(s) to ensure that Workers GRMs and with redress and appeal processes and institutions is in place and shared with MWE/WfPRC-N before the commencement of the Construction Phase.

The steps in grievance handling for the PAPs and the community in general are outlined in Table below and once received, all grievances will be responded to in a maximum of 19 days.

Table 35: Grievance handling steps

#	Step	Responsibility
1	Receive Grievances and Provide PAPS with a Grievance Acknowledgement Form	MWE, , and GMCs
2	Grievance Registration and Acknowledgement	MWE, , and GMCs
3	Grievance Sorting and Logging in database and tracking system	MWE,
4	Grievance Assignment	MWE
5	Grievance Processing and Feedback (30 days)	MWE, , and GMCs
6	Corrective Actions, Grievance Follow Up and Closure	MWE

7.10 Flow of Appeals or Referral of Grievances and Timelines



Grievance Types

The Project grievance mechanism classifies grievances into three types, as described in the following sections.

- **Cadastral Survey Grievances**

Cadastral Survey Grievances may require the Cadastral Surveyor to rectify errors in the initial surveys, subdivision of plots, or boundary markings.

- **Valuation Grievances**

Valuation Grievances arise out of compensation package disagreements and may include the values determined for crops & trees, buildings, and other structures as well as errors of omission.

- **Gender Based Violence (GBV), Sexual Exploitation and Abuse (SEA) and Violence Against Children (VAC) related grievances.**

As per the WB Good Practice Note (GPC) on Gender, "gender-based violence is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed

(i.e. gender) differences between males and females. It includes acts that inflict physical, sexual or mental harm or suffering, threats of such acts, coercion, and other deprivations of liberty. These acts can occur in public or in private). Women and girls are disproportionately affected by GBV across the globe".

In order to proactively protect women from GBV during the land access and resettlement process, the Project will apply a series of differentiated measures to ensure engagement of women in Project activities and more specifically, to ensure open and easy access to the grievance mechanism for Project Affected Women. Therefore, the following measures will be implemented:

- Focus group and one on one discussions with Project Affected Women including discussions specifically related to accessing the grievance redress mechanism and raising awareness of any GBV risks
- As part of the financial management program, attendees will be sensitized on the GBV
- Establishment of a grievance redress mechanism with procedures and channels to enable confidential reporting of GBV incidents.
- Engage with LC1s and other community members to raise awareness on preventing and reporting GBV.

Grievance Database Management and Tracking

All received grievances shall be registered and logged into the grievance register for further management and tracking. An acknowledgement receipt shall be issued to the complainant. MWE shall keep written records of all complaints for effective grievance management.

All decisions reached at the different resolution levels shall be communicated to the complainant and other stakeholders by the Chairperson of the respective GMC. It will be the responsibility of the Grievance Officer (GO) to deliver the communications. Evidence of communication of decisions to complainants shall be acknowledged by way of signing a dispatch form or acknowledgement of a file copy.

Agreed corrective action will be undertaken by the responsible agency/ part for example a Local government, MWE, contractor or authorized sub-contractors in close consultation with the complainant within the agreed timeframe and completed action recorded in the grievance database. To verify satisfaction, the Grievance Committee will upon receipt of a completion report from the GO verify that corrective actions have been implemented. A signature of the complainant will be obtained on the consent form. If the complainant is not satisfied with the outcome of corrective action, additional steps may be undertaken to reach agreement, or an appeal will be lodged by the complainant.

As part of the broader community engagement process, MWE shall also report back periodically to communities and other stakeholder groups as to how the company has been responding to the grievances it has received (i.e., time to respond, percentage of closed/resolved cases, number of complaints monthly).

8 POTENTIAL IMPACTS AND MITIGATION MEASURES

8.1 Introduction

Key potential environmental and social impacts of the project for each stage of the project cycle are assessed in this chapter and an Environmental and Social Management Plan (ESMP) is provided in Chapter 9. The ESMP seeks to translate mitigation measures into actions. Prediction and analysis of possible positive and negative impacts of construction of the Earth dam and reservoir works in neighbouring Lapyem are discussed. Impact analysis involved determination of nature of impact, its magnitude, extent, duration of potential impacts. For the proposed development, potential positive and negative impacts were identified both for the construction phase and operation phases. Throughout this report, impacts have been characterized as:

a) "Positive" when they;
   - Enhance socio-economic welfare e.g., health, employment,
   - Enhance quality of existing environment.

b) "Negative" when they;
   - Reduce socio-economic welfare of people,
   - Reduce quality of existing environment,
   - Reduce economic value e.g., of surrounding property.

A sustainable and optimal use of irrigation water resources, and transformation of agriculture practice may generate interrelated improvements in Livelihoods, food security, economic and social welfare of the community. However, in addition to the many possible beneficial impacts, adverse impacts may arise from these improvements.

The impact of potable water supply and sanitation on health depends on the quality and quantity of the piped water supply; the proportion of population covered; and the utilization of the water and sanitation facilities by the population. In this chapter, prediction and analysis of possible positive and negative impacts of construction and operation phases of the water extraction and treatment system and water reservoir is presented, with main focus on the proposed construction of the water treatment plant and intake works. Table 20 below provides a summary of the Positive benefits that will be realised as a result of implementation of this project.

Table 36: Over view of Positive Impacts of the Proposed Project

No.	Impact	Remarks
1.	Increased access to clean water	▪ Elimination of current water shortages. ▪ Improvement of water quality. ▪ Reduction of the time spent and distance travelled to fetch water, which would signify an improvement in the general living conditions of the people. ▪ Improvements in public and household sanitation. ▪ Awareness of personal hygiene. ▪ Overall improved health conditions for the beneficiary population. ▪ Income generating activities for the poor will increase as result of availability of reliable supply of water in public places e.g. commercial water service providers.

2.	Transformation of agriculture practice	▪ Transform its economy from largely peasantry and subsistence agriculture to modern economy Improvement of water quality. ▪ Improvements in household income and livelihoods ▪ Improvements in public and household sanitation. ▪ Increased access of water for livestock watering
3.	Employment opportunities and increased household incomes and revenues	▪ The use of appropriate labour-intensive methods for some of the construction activities (e.g., construction of the earth dam, office block and Reservoir) would present employment opportunities for local people and generate direct income benefits to local households. ▪ Some people will be employed in the digging of the transmission and distribution networks, sand and stone quarries, and sale of earth materials to the proposed project and in the service sector around the project site.
4.	Income to material/ equipment suppliers and contractors	▪ Earth materials needed for construction, for example, aggregate (stones and sand) will be obtained from quarry operations. ▪ Number of equipment and materials (such as gravel, bricks, plumber, steel reinforcement and cement for civil works) will be sourced locally within Agago district and the neighbouring districts.
5.	Increased Public Revenue / Taxes	▪ People who have never worked on such projects would acquire such skills, which they would use to seek employment in future. ▪ The Project would provide grassroots management opportunities for the local people to both be involved in the management of the water supply and protect their local environment.
6.	Boost to the local economy	▪ Provision for direct employment opportunities to the workforce thus contributing towards alleviation of poverty and income generation for the local community; ▪ Stimulation of business activities related to contracting works for local entrepreneurs (sub-contractors); ▪ Providing trading opportunities for local communities and other small enterprises in the area; ▪ Providing opportunities for provision of basic and other services for the contractors and immediate community. The project will consider employment of locals.
7.	Crop diversification and Intensification	▪ Improvements in household income and livelihoods ▪ Available information indicates that, the local population in the areas of Agago are largely engaged in Maize production despite the climatic limitations affecting the crop. Once the irrigation scheme is operational, it is expected that, the famers will take up horticultural production thereby diversifying their income base
8.	Gender Benefits	▪ The expected reduction in water collection distances and times will be particularly beneficial to women and children, especially girls, who bear the burden of fetching water and have to walk long distances or queue for long periods. ▪ It will mean more opportunities for girls to attend schools and more time for women to engage in other economically and educational beneficial activities.

9.	Health Benefits	▪ Direct health benefits of the project to the affected population will result in a reduction in the incidence of water-related diseases particularly diarrhoea, typhoid, intestinal worms, skin and eye problems, and dysentery and cholera. ▪ Loss of productivity resulting from sickness related to water-borne diseases and expenditure on related medical care will therefore reduce.
10.	Improved service delivery	▪ The proposed project would result in bringing improved water and sanitation services closer to the people.
11.	Eradication of poverty and improved livelihoods of the local people	▪ The proposed project would result in an increase in the volume of water for production which could result in improved livelihoods of the local people. ▪ Water is indispensable for survival and improving the quality of life – for health (drinking, eating and bathing) and for economic development (agro-processing and business). The project would, therefore increase productive activities through reduced sick days and time saved in fetching water.
12.	Combat HIV/AIDS, malaria, typhoid, and other diseases	▪ The awareness campaigns for public health, hygiene and sanitation particularly targeted at women and girls would be widened to include measures for tackling HIV/AIDS and other diseases such as schistosomiasis and diseases related to excreta contaminated water and poor hygiene (cholera, typhoid, and diarrhoeal diseases).
13.	Ensure environmental sustainability	▪ Implementation of catchment and water source protection measures would ensure reliability to the water source.
14.	Develop a global partnership for development	▪ The Project would provide opportunities for the GoU through MWE/WfPRC-N to aim at achieving the Sustainable Development Goals (SDG) specifically SDG 6.
15.	Increase in investment in the area standard of living	▪ MWE/WfPRC-N will invest heavily in the construction and operation of the Onyama Earth Dam which would involve use of locally available materials. ▪ The business community could take advantage of the proposed development to establish businesses that would otherwise be impossible without safe piped water.

8.2 Positive Impacts during Construction Phase

Few impacts of construction phase for example construction of the new pumpstations are permanent and majority of the environmental impacts attributed to construction works are temporary in nature, lasting mainly during the construction phase or quite often little beyond the construction period. However, certain conditions could lead the impacts (positive or negative) to continue even after the construction phase for longer duration.

a) Employment opportunities

The design, feasibility and planning phase provided financial benefit and employment for local consultants. This was a positive but short-term and reversible socio-economic impact. Contract provisions for construction require most of the labour force (at least 60%) to be drawn from the local population with particular emphasis on youth and women. Since construction is estimated to

go on for about a year, this phase will provide short-term job opportunities for local people. The project is estimated to employ around 60 workers during the construction phase.
Furthermore, indirect opportunities for employment will be stimulated in the other sectors related to construction, such as manufacturers of local raw materials and finished products and providers of services. It is also anticipated that indirect employment opportunities will be created within local communities through the provision of services to the construction teams, such as the sale of food and beverages.

Impact enhancement

The contractor should involve local leaders in recruitment process to ensure full and fair participation of local communities. Wherever feasible, local people should be considered for job opportunities commensurate with their level of skills. Adequate occupational health and safety standards should be provided to ensure the work environment is conducive. A training programme for artisans (builders, carpenters, plumbers) in the project area could be facilitated by the project to ensure skills transfer during the construction period.

b) Income to material/ equipment suppliers and contractors

Although some of the equipment and materials required for the project will be sourced nationally or even internationally to ensure quality is achieved, a number of equipment and materials (such as gravel, bricks, lumber, steel reinforcement and cement for civil works) can be sourced locally within Agago district and the neighbouring districts. Local suppliers of materials and equipment involved in the project will benefit financially. This is a positive but short-term and reversible impact.

Enhancement measure

Earth materials needed for construction, for example, murram; aggregate (stones and sand) will be obtained from quarry operations. Conscious or unwitting purchase of these materials from unlicensed operations indirectly promotes environmental degradation at illegal quarry sites and can cause medium to long-term negative impacts. It should therefore be a contractual obligation for contractors or/and the Sub Contractors to procure construction materials from quarries legitimately licensed by the respective district authorities.

c) Acquisition/improvement of skills

People who have never worked on such projects would acquire such skills, which they would use to seek employment in future, and as a benefit from the capacity building incorporated in the program, the implementing authorities would have adequate capacity for managing the environmental and social assessment and permitting processes. The Project would provide grassroots management opportunities for the local people to both be involved in the management of the water supply and protect their local environment.

Enhancement measures

The Local leaders will play a vital role in screening and recommending those seeking for employment to weed out wrong elements who may instead cause serious setbacks to the project in terms of offering labour both skilled and unskilled.

d) Increased Public Revenue / Taxes

The implementation of the project will increase revenue and taxes for both the central and local authorities. This includes indirect taxes resulting from the construction project such as Value Added Tax (VAT) on materials and services, Pay As You Earn (PAYE) for construction workers and other formally employed persons who will form by far the majority of created employment opportunities) as well as revenue to pension funds such as National Social Security Fund (NSSF).

e) Impacts on Local Capacity

The scale of the construction of the project with the logistics involved and speeds of construction that will be required, while maintaining construction, health and safety standards will involve considerable management and planning skills and will contribute to capacity building within the country's engineering and construction sector. Co-operation between international suppliers of specialized equipment and contractors and local contractors and sub-contractors and companies will result in the transfer of skills and will also build additional local capacity.

f) Boost to the Local Economy

The workforce will get most of their food and other necessities from the surrounding area and this will provide a market for the local agricultural producers, and craft producers and other small businesses (local shops). This will in turn increase the incomes of the local people, which can be invested in other (productive) activities and be used for paying school fees, medical expenses and other domestic needs. The project will stimulate local economic activities by:

- Provision for direct employment opportunities to the workforce thus contributing towards alleviation of poverty and income generation for the local community;
- Stimulation of business activities related to contracting works for local entrepreneurs (sub-contractors);
- Providing trading opportunities for local communities and other small enterprises in the area;
- Providing opportunities for provision of basic and other services for the contractors and immediate community. The project will consider employment of locals.

g) Capacity Building

It is expected that for the construction of the earth dam, some degree of capacity building will be provided (organised and un-organised) through the transfer of new technologies and new skills to (un-skilled) labour. This will happen through on-the-job training as well as through exposure to modern water quality practices, management and logistics procedures. Local sub-contractors and companies will also benefit from the transfer of skills and will also build additional local capacity.

Enhancement Measures

To maximise capacity building for local communities, programs and technical training courses as well as on-the- job training will be provided in specific skills areas for suitable candidates from local communities to enhance minimum levels of education and the possibility of being employed during operational phase.

h) Infrastructure

The community will benefit from an improved road network, as the construction activities will necessitate roads to be graded in some cases to improve access especially to the Earth dam and other project components/facilities.

Enhancement measure

The communities along the road should be sensitized and encouraged to be cooperative when this kind of infrastructure, for example, new access roads will be established.

i) Rise in value of land and property

The value of land within the project area could go up due to the likely increase in activity in the area due to the construction and operation of the project.

j) Enhancement of Tree Species Diversity

Environmental management best practices dictate that the proponent makes sure that after construction is over, the environment is restored. The proponent could increase the biodiversity of the project area through landscaping projects that would engage the neighbourhood and afforestation with native, non-invasive species. The initiative's sustainability would be ensured by regular auditing of this activity.

k) Increase in land value

Because to the availability of water and the enhanced infrastructure, the dam will attract people to invest in and stay in the area. As more people are encouraged to stay in the project location, the value of property will also increase.

8.3 Positive Impacts during Operational Phase

I. Improved health status of households of the project host communities

The provision of an adequate, safe water supply and sanitation has positive impacts on the health of users by greatly reducing the incidence of communicable enteric and infectious related diseases, which, in many instances occur in communities due to lack of adequate sanitation and potable water supply. Both potable water supplies as well as safe disposal of human excreta are needed to break the chain of transmission diseases. Changes in water supply may affect different groups of disease in different ways; one group may depend on changes in water quality, another on water quantity and availability and another on indirect effects of standing water which is related to sanitation. Therefore, improvement in water supply in several of the poor informal settlements will directly contribute to improved public health within the project communities.

Enhancement measures: Educate users on the proper use, regular cleaning and effective maintenance of both the household and public facilities through stakeholder engagement, social and risk management.

II. Educational enrolment and attendance

Construction and Operation of the earth dam will lead to considerably increased and consistent access to safe water for the project host communities. In relation to increased provision of

potable water supply, time savings are the most immediate and easily measured benefits although its magnitude will depend on the conditions prevailing before the construction of the piped water supply. Consequently, time spent on searching and waiting for water by women and children will be saved. This will enable children, especially the girl child to regularly and promptly attend school, while mothers will get more time to prepare their children for school. Assuming other factors are available (such a scholastic material, teachers) school attendance and performance will improve.

III. Acquisition of new skills

Most water related projects and infrastructures like earth dams are built through the labour of local residents who are directed by a small cadre of sub-professional or supervisory personnel from outside the community. Community participation can also have a great impact on the effectiveness and sustainability of water supply and sanitation programs. It can also help to minimize many of the potential negative environmental impacts associated with them.

Enhancement measures: Where the required skills are available locally, the local people should be given first priority commensurate to their level of training.

IV. Improvement in household economic status

The increased provision of water from the Earth dam has positive beneficial impact on health and ultimately directly and indirectly on productive and economic benefits.

- ***Livestock and poultry keeping:*** Improved water supply would lead to an increase in poultry and livestock keeping in homesteads. A permanent water source near or on the farm will permit an increase in cattle and improve the production of milk and beef. Those farmers who previously felt water to be a crucial constraint preventing them from keeping such livestock as grade cows and pigs, poultry like chicken or expanding their activities in this regard, may find it feasible to do so.
- ***Small- Large scale gardens:*** The increased provision of water supply from the Earth dam may have positive beneficial impact on the irrigation of small-scale gardens around homes if there is excess water available and it can be used for irrigation of small-scale garden plots near each household or tap. This will have positive beneficial *impacts* on increasing agricultural productivity and perhaps also improving nutrition status of households.
- ***Small scale industries:*** The ample availability of piped potable water supply may lead to improvements in the small-scale industrial development and increased production.

Enhancement measures: Water supply should be set taking into consideration the different levels of users. The users should also be educated to avoid wasteful use of the resources through the stakeholder engagement, social and Environment risk management.

V. Employment opportunities

Operation of the constructed Earth dam will create additional long-term technical and non-technical job opportunities for professionals, casual labourers, etc. Staffing will be required in the Town Council to operate the constructed Earth dam by: Operating the system in accordance with the service standards; Maintaining the system; Developing the system; Billing the consumers; Collecting revenue; Receiving applications for and making new connections; Making

extensions to the system or assets; Attending to all customers; Keeping records of the operations of the system; and Writing status reports for the operations of the system.

Enhancement measure: Wherever feasible, local qualified people will be considered for job opportunities. Adequate occupational health and safety standards should be provided to ensure the work environment is conducive.

VI. Transformation of agriculture practice in the areas:

The proposed Onyama earth dam Project is consistent with GoU strategic development enshrined in its Vision 2040 in which, the country strives to transform its economy from largely peasantry and subsistence agriculture to modern economy. In this Vision, Uganda aspires to transform the agriculture sector from subsistence to commercial agriculture through mechanization and introduction of modern irrigation systems which is what is being planned under this project.

VII. Sustainable and optimal use of irrigation water resources:

The project provides opportunity to promote agricultural development strategies through sustainable use of the country's fresh water resources through measures such as irrigation coupled with catchment management interventions. Available information indicates that, with even full exploitation of irrigation potential only 14.1% of Internal Renewable Water Resources will be utilized. To mitigate rampant country wide seasonal local scale water shortages, GoU plans to put in place water reservoirs as planned under this project.

VIII. Serve to address food security in the areas of the project:

The planned irrigation project, is a timely intervention by GoU to address water scarcity which has chronically affected crop production in Agago District. It is well known that Agriculture is major source of livelihood in the district. Therefore, the planned irrigation intervention is timely in addressing water needs for crop production and addressing food security a situation which is worsening by over-reliance on traditional rain-fed crop production.

IX. Promotion of gender equality and empowerment of women and the girl child

The proposed project would free women and girls of the burden of having to spend a lot of their time collecting and carrying water almost on a daily basis often from sources distant from their houses since there is a component of extending safe water to the Earth dam host communities. This reduction in burden would allow women and girls time for other activities including involvement in economic ventures that could contribute to reducing poverty and furthering their education (thus increasing school enrolment).

X. Attainment of the Sustainable Development Goals; SDGs

The effect of providing safe water and hygienic sanitation services would help in the attainment of all other Sustainable Development Goals (infant mortality, poverty reduction, improved health and increased school enrolment rate).

XI. Crop diversification and intensification:

Available information indicates that, the local population in the areas of Agago are largely engaged in Maize production despite the climatic limitations affecting the crop. Once the irrigation scheme is operational, it is expected that, the famers will take up horticultural production thereby diversifying their income base. This diversification implies diverse sources of income at household and improved livelihoods as well.

XII. Environmental sustainability

The skill for managing the earth dam facilities would result in building social capital which could be extended to better manage the local environment and water resources. The project would include environmental awareness which could be deployed to manage the environment better

XIII. Improved household acreages:

In most rural areas, crop production systems using rudimentary cottage labor and equipment have for long typified agricultural production in the proposed project areas which in a way has kept it plunged in food insecurity, limited production and productivity, limited household acreages summing to poor household incomes. In addition, the irrigation technology to be introduced will likely be one which is more adaptable can be customized to household levels. The project is envisaged to assist farmers clear their lands alongside a host of farming husbandry support services which will bring about improved production at household levels.

XIV. Combat HIV/AIDS, malaria, and other diseases

The Project would result in prevention of vector borne diseases related to water sources (such as guinea worms, Onchocerciasis, and schistosomiasis) and diseases related to excreta contaminated water and poor hygiene (cholera, typhoid, and diarrhoeal diseases) due to the increased provision of safe and clean water. Safe drinking water, personal/household hygiene and improved sanitation would reduce infant/child morbidity and mortality; improve their nutritional status and their ability to perform better in schools. The marginal price of improved hygiene and sanitation promotion would make them cost effective health interventions.

8.4 Positive Impacts during the Decommissioning Phase

a) Employment Opportunities

The employment opportunities especially for non-skilled labour will benefit the locals within the project area; the communities are likely to get jobs as casual labourers. Therefore there will be skilled (technical and administrative) and semi- skilled workers during the decommissioning phase.

b) Project area restoration

After the earth dam has superseded its life time, it will be decommissioned as well as any associated infrastructure, to return the affected area to a natural environment similar to that which would have existed prior to construction. However, some of the structures/facilities may still have other beneficial uses such as: run-off control, recreation, water supply among others. Therefore, prior to destroying the structure it is crucial to know whether the structure can be reused through refurbishment of pond structures and equipment

8.5 Negative Impacts during Construction

a) Land acquisition for infrastructure and loss of structures/property

This will include permanent land acquisition for the construction of other project infrastructures like office block, pipeline network and trenching to the detriment of land owners. The land-take would be permanent where all the project components would be constructed and temporary along the pipeline network. However, both the transmission and distribution lines would be confined to the road reserves where possible. The land where the earth dam will be constructed is owned by the government of Uganda as it well stipulated by the Agago District Local Government (ADLG) (**see annex IV**) and it has no encumbrances. No issues of compensation and resettlement are anticipated.

Another important distinction in defining impacts is between permanent land acquisition and permanent land restrictions, which are defined as follows:

- **Permanent land acquisition** involves the project acquiring all land including land registration and title processing. This is the case for land required for the Earth dam, and reservoirs. This land has already been secured by the ADLG and it has no encumbrances.
- **Permanent land restriction** involves limitations imposed on the land which prohibits building any structures or cultivating perennial crops and trees within the corridor.

However, any existing PAH retains land use/ownership rights and cultivation of seasonal crops within the easement corridor, or any other land uses. Land use restrictions decrease land use potential which decreases the land value. It is this diminution (reduction in value) that is compensated

Mitigation Measures

- The district local Government authorities were engaged and offered land for the development. No grievances were reported and or are envisaged.
- ADLG secured the land to be used for the project and it has no encumbrances. No issues of compensation and resettlement are anticipated

b) Loss of vegetation flora and top-soil

The existing vegetation and top soil will be cleared to give way to the construction process on all sites. The study team discovered that the project area will cover a small space and therefore limited flora of significant impact will be affected. However, clearing of this vegetation will lead to permanent loss of vegetation cover and likelihood of soil erosion due to removal of top soil. The project activities are likely to destroy vegetation with subsequent loss of some shrubs and grasses from the area of operation albeit on a small scale. This is likely to cause loss of habitat and disturbance to faunal communities in the affected sites but at an insignificant level.

Proposed Mitigation Measures

- After construction, there should be landscaping and re-vegetation. The premises will be planted with vegetation/grass and ornamental trees.
- Minimize vegetation clearance by clearly demarcating work areas.

- Provide environmental awareness training to all employees.
- Rehabilitate all disturbed areas

c) Fauna

Dredging within the dam and depositing material within the vicinity of the scheme may disturb fauna by blocking access to feeding grounds, breeding grounds or injury from moving or dredging vehicles. The flood mitigation proposed area does not harbor a lot of wildlife accordingly all mammals encountered were of least concern. Disturbance or loss of protected/endangered animal species/communities and their habitat due to construction activities (noise, dust, fumes, pollution, vehicles).

Mitigation / Enhancement Measures

- Minimise un-authorised access to the wetland area and reduce disturbance to the fauna habitat
- Monitor for the two key species periodically to determine changes in ecosystem
- Project work force must do a pre-work site survey to ensure no fauna is harmed during dredging. Any fauna found on site before the day's activities is to be relocated a safe distance away from project activities
- Sensitize workers to respect wildlife and not engage in killing animals or consuming wild eggs
- Maintain vehicle speeds at 30km/hr to avoid road kills
- No works in an area once a nest is observed. Communication to MWE should be done immediately and UWA engaged to remove, where activities would damage the fauna nest

d) Insecurity Risks

Influx of people in a project area in search of jobs is likely to come with a host of vises such as thefts, crime and general deterioration of area security. Materials prone to theft include cement, fuel and equipment. Theft of materials will lead to an increase in the project cost and project delays. Besides theft of the project materials, the community property and assets could also be stolen. The impact will be short term and may go up to district level. The impact will moderately affect the communities and the project in general. The significance of this impact is thus assessed as medium negative.

Mitigation / Enhancement Measures

- Collaborate with the local security set ups in areas of labour recruitment such that, priority is given to locals in the areas in terms of casual and non-skilled jobs;
- Those seeking jobs are to present their details accompanied with recommendations from their area LCs as well as next of kin for purposes of traceability in case of engagement in any misconduct or otherwise;
- Employ private security guards at the construction site.
- The contractor should work closely with the area police out-posts, local defence secretaries and general community policing.
- Contractor will put in place an internal control system to curb cases of theft of materials.

Impact Significance after mitigation

After application of the above mitigations, the impact significance was of a minor ranking after mitigations. Therefore, no further mitigations are proposed at this stage.

e) Effects of Poor Solid Waste Management

Waste will be generated from the construction sites. The waste to stream from the construction sites will include Cement bags, timber and pipe cuttings empty water bottles, food remains from the construction workers and other forms of waste. If not well managed, the area could be prone to nuisance from foul smell, breeding of vermin and vectors, and lead to outbreak of diseases.

Impact significance: Extent of this impact will be local to areas where waste is dumped or their immediate neighborhoods. The impact ***intensity*** is assigned ***Medium*** due to the lack of a well streamlined waste management system in Agago. The ***sensitivity*** of receptors is assessed as ***'low'*** given that similar activities have and are taking place in the area and that an experienced contractor will be hired. This gives rise to Moderate impact significance.

Proposed Mitigation Measures

- Waste collection bins will be provided at strategic positions at the construction sites for temporary waste storage.
- The waste collection bins should be provided with covers to avoid spillage by scavengers and clearly coded for sorting purposes.
- The contractor will hire a certified waste collection company to transport the waste for final disposal to designated waste dumping sites by NEMA/ADLG/Adilang Sub County
- Burning of waste on-site shall not be allowed.

Impact Significance after mitigation

After application of the above mitigations, the impact significance was of a minor ranking after mitigations. Therefore, no further mitigations are proposed at this stage.

f) Generation of Noise

Increased noise levels will be experienced from the use of heavy construction equipment. Increased vibrations during construction by equipment movement, excavations and blasting may transform the calm and quiet conditions in the area. Noise during the project construction will mainly be caused by construction machinery, such as bulldozers, excavators, pile drivers, concrete mixer trucks, and transport vehicles among others could exert noise impact. The vibration effect during the construction period will mainly result from the operation of machinery and equipment. However, the site is set aside for the dam construction works and it was observed that the site is not inhabited, the construction process will therefore have no key receptors except for the construction workers who will have the necessary PPEs such ear plugs.
Construction traffic associated with the construction will be routed via main roads and along the ROW as far as is possible. Some minor roads will have to be used for access to the pipeline spread itself and some new access roads will be created.

The increase in traffic movements on minor roads may cause a noticeable increase in daytime noise levels through small villages; this effect will be localised and temporary, and will, for the

most part, be restricted to the construction phase of the project. A number of roads will require repair prior to use for construction vehicle access. These repairs will help to reduce noise levels generated by such access, and other vehicular movements.

Impact significance: Due to the intermittent and short-term nature of the activities, the ***intensity*** of impact is assessed as ***low*** and ***sensitivity*** of the receptors as ***medium***, given that most of the proposed routes for the water pipelines are located in relatively noisy mixed residential and commercial areas of the project area and its neighbourhood. This results into ***moderate*** impact significance.

Proposed Mitigation strategies:

- Contractor will be careful when selecting the working equipment to avoid use of old equipment or damaged equipment with high level of noise emissions that would have a negative impact in the environment.
- Contractor will ensure that equipment is properly maintained and fully functional in accordance with the manufacturer's recommendations.
- The contractor should ensure that noise levels emanating from machinery, vehicles and noisy excavation and construction activities are kept at a minimum for the safety, health and protection of people in the nearby areas.
- Regular maintenance, monitoring and, where necessary, the use of silencing equipment will be employed with the aim of reducing noise emissions.
- The selected contractor will be required to submit detailed information on the noise levels which will be generated by the specific methods and equipment proposed and to identify actions required to minimise the noise impact.
- Pumps, generators and other mobile equipment will be sited as far as practicable from housing and other noise sensitive locations, work will not be carried out Sunday during service time or hours.
- During periods of inactivity, equipment will be switched off whenever possible. A limited number of construction activities may have to continue on a 24-hour basis. These include horizontal direction drilling, pipeline cleaning and hydrostatic pressure testing which are relatively low noise activities.

Adoption of the above mitigation measures will reduce impact intensity to "very low" resulting in a residual impact of minor significance.

g) Increased incidences of diseases

The increase of people involved in the project activities is likely to increase the incidences of diseases in the area. The above situation will be aggravated by the entry of commercial sex workers into the area following the commencement of the project activities. Consequently, there will be potential risk of contracting sexually transmitted diseases (STDs) especially the Human Immuno-Deficiency Virus/Acquired Immuno-Deficiency Syndrome (HIV/AIDS) among the program workers and the local communities. This will be increased due to influx of people seeking for employment.

Mitigation / Enhancement Measures

- The contractor should liaise with the District and Sub County CDO to mobilise communities during the recruitment process to reduce on influx of people who are unskilled.

- The contractor should emphasise equal opportunities for both men and women.
- The Contractor should, in conjunction with local health authorities, undertake to educate and sensitise the workforce on communicable diseases such as cholera, STDs and HIV/AIDS. Condoms must be made available to the workforce.

h) Change in Land scape/visual intrusion

This will mainly arise from the erection of service reservoir tanks on the high altitude. In addition, visual intrusion will occur where project activities are likely to create disfigured landscapes in the project area especially where the construction activities will result in deposition of large spoils and digging of the trenches.

Mitigation / Enhancement Measures

- The contractor should maintain as much as possible the existing landscapes and plant trees and vegetation to enhance the visual aspect.
- Rehabilitate all areas disturbed by construction and landscape with trees, grass and shrubs.

i) Increased accidents and occupational hazards

Implementation of the project will definitely increase volume of human and motor traffic in the project area. The increase in human and motor traffic will be aggravated by the transportation of construction materials, water pipes and other equipment required in the construction of the water supply facilities. This is likely to result in a higher risk of accidents and occupational hazards occurring in the area of operation. Factors that may exacerbate this situation are inadequate appropriate working gears for project workers including the helmets, overalls, boots and gloves.

Impact significance: Accidents could cause considerable ecological damage, financial loss and harm to human life. While largely reversible, some impacts such as loss of human life are irreversible. The receptor ***sensitivity*** is considered ***high*** given that such impacts may be irreversible once they occur. The impact ***intensity*** is considered to be ***low*** since MWE/WfPRC-N will procure a qualified contractor who is aware of OHS measures. Nevertheless, this gives rise to an impact of ***moderate*** significance.

Mitigation / Enhancement Measures

- The contractor should ensure that workers are provided with adequate personal protective wear to mitigate injuries such as gloves, helmets, overalls and gumboots.
- Traffic guides and signs should be utilized to avoid accidents on busy roads and junctions especially with vehicles transporting materials.

j) Sourcing of Construction Materials

Sourcing of materials such as sand, gravel bricks/blocks and timber if not well regulated and controlled can have a significant impact in the points of sourcing.

Proposed Mitigation Measures

- The Contractor should liaise with local authorities to ensure that materials such as sand and gravel are only taken from quarries and borrow pits with the necessary environmental permits.

k) Air quality

Limited air pollution will occur mainly due to fugitive emissions and dust generation from various construction activities. Particulate matter pollution is likely to occur during the site clearance, excavation, loading and transportation construction materials. However, the site is not inhabited and will therefore have no key receptors except the construction workers who will have the necessary PPEs such as dust masks.

Proposed Mitigation measures

- The areas of such works be routinely sprinkled with water to suppress dust during works.
- Restricting excavations to those sites needed for the works.
- For the safety of the workers on such areas, the workers supplied with appropriate PPEs to protect them dust nuisance.

l) Impact on current water supplies

Disturbance or loss of protected/endangered plant species or communities (terrestrial, wetland, aquatic) due to construction activities of the different project components.

Proposed Mitigation measures

- Project implementation should be planned in a way to allow users of these continued Earth Dam access. This is to be adhered to, bearing in mind that the project area is prone to water scarcity and long droughts.

m) Risk of Accidents

During the construction of the proposed project, it is expected that construction workers are likely to have accidental injuries as a result of accidental occurrences, neglect of the use of protective gears among others. Accidents may also occur to members of public, livestock and wildlife from open trenches, but they will be reduced by fencing of the construction site and restricting access to the site.

Impact significance: The receptor sensitivity is ***medium*** given the number of pedestrians and commercial activities along the roads while the intensity is ***medium*** given the temporary nature of the construction activities, however, some of the impacts may be irreversible. The impact significance is thus assessed to be ***major***.

Proposed Mitigation measures

- Best transport safety practices will be adopted with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public by: employing safe traffic control measures, including road signs and flagmen/traffic guides to warn of dangerous conditions and children crossings; and setting speed limits on all access roads in the project area will be 30km/h for light vehicles and 20km/h for heavy vehicles.
- Service ducts installed by the road contractor will be used where applicable to avoid cutting through roads that have just been upgraded.
- All workers, including sub-contractors and casual labour, will undergo an environmental,

health and safety induction before commencing work on site. This will include a full briefing on site safety and rules.

- The affected communities will be informed of the timing and duration of the construction activities across access roads and any uncertainties or potential for change and also sensitised on the dangers of construction sites and the need to keep away.
- Restrictions on hours of driving (including night time restrictions where sensitive receptors may be affected) and timing of vehicle movements to avoid busy periods in urban areas, particularly the start and end of school and the working day
- Control over routes used by vehicles to avoid construction traffic using inappropriate roads and other road users gaining access to the pipeline spread and access roads.
- Ensuring adequate vehicle maintenance to ensure that vehicles do not produce significant emissions and that all safety features including brakes, lights etc. are in good condition.

Adoption of the above mitigation measures will reduce impact intensity to "very low" resulting in a residual impact of minor significance.

n) Social Misdemeanour by Construction Workers

While most workers may originate from the local community where they have families, there might be others from distant places and working away from their families. With some disposable income to spend, this might induce illicit sexual relationships, with attendant risk for spread of HIV/AIDS. Irresponsible sexual relationships in project communities can break families and heighten risk of contracting HIV/AIDS. Illicit sexual relationships can be short-term but have long-term and irreversible effects. The Code of Conduct for Contractors has to be signed by contractor upon award of contract and copies displayed for workers to view. It ought to be translated into predominant local language of the workforce.

Impact significance: Duration of the impact will be short-term or long-term depending on whether HIV/AIDS is contracted and the extent of the impact will be local or national depending on origin of construction workers. The ***intensity*** of the impact is ***very low*** given the small size of the project and

other similar construction activities like for roads are already taking place in the area. ***Sensitivity*** of the receptor is rated ***high*** given that some of the outcomes have a long-term effect. Therefore, significance of the impact is ***minor***.

Proposed Mitigation measures

- As a contractual obligation, contractors shall be required to have an HIV/AIDS policy and a framework (responsible staff, action plan, etc.) to implement during project execution.
- A sensitization programme for the would-be affected local communities will be conducted prior to commencement of and during the project implementation.
- A code of conduct (appropriate to behaviors in workplace and with respect to relations with local community) will be developed and approved by MWE/WfPRC-N which will be signed by all workers on the project.
- Local workers will preferentially be employed, paid directly through their banks and access to bars by workers from outside the project area in the local communities controlled.
- All construction workers shall be orientated and sensitized about responsible sexual behavior in project communities.

o) Destruction of Cultural Resource/Heritage

No known archaeological or historical sites exist in the project area or around proposed project sites and no impacts on any features of importance to national heritage are expected. Any such features that may be found (e.g., during excavation works) that were not apparent on surface investigation or that did not come to light during the ESIA study will be reported by the project and a chance finding procedure will be followed as annexed in this report as **annex VI**.

p) Violence Against Children (VAC) and Child labour

According to the consultations made during the stakeholder engagement, most of the community members are aware of children's rights. On the other hand, the common abuses are child labour, parental neglect, child marriage, violent discipline/harsh punishment and sexual abuse. With the implementation of the project, there must be stringent measures in place to protect children's rights against child abuses.

Impact significance: The receptor sensitivity is **medium** given the number of children and construction activities at the different sites while the intensity is **medium** given the temporary nature of the construction activities, however, some of the impacts may be irreversible. The impact significance is thus assessed to be **major**.

Proposed Mitigation measures

- The contractors should put in place child protection policy/code of conduct to ensure that no child is employed during the construction works and zero child rights abuses are recorded.
- Preparation of the Stakeholder Engagement Plan to cater for mobilization and sensitization on child rights and child protection.
- Strengthen the referral pathways for cases of child rights abuses by involving the relevant child protection actors such as LCI, Police, CDOs, Probation Officers in some of the project activities like community mobilization and sensitization, development, and dissemination of the referral pathways. This would reinforce prompt response to cases of child rights abuses and derail the abusers from perpetrating the vice further.

q) Domestic, Sexual and Gender Based Violence (SGBV)

SGBV is likely to be experienced, for example, an increase in intimate partner violence (IPV) when compensation schemes that share funds equally among husband and wife at the household level do not provide adequate sensitization and safety measures to reduce potential for increased tensions due to females receiving funds. This also refers to other GBV-related risks incurred as a result of project implementation that do not adequately consult women and adolescent girls in the community about safety and security issues related to the delivery of water and sanitation services. However, the impact intensity is ranked as low because of the low number of workers who would be exposed to incomes that can encourage irresponsible behaviour. The overall significance is ranked as ***Moderate***.

Proposed Mitigation measures

- Sensitizations should include the men to champion the GBV/DV fight and should as well

target awareness creation sessions for women and girls since they are the most prone.

- Promote good relationships and improved communication skills amongst couples and positive parenthood through the various stakeholder engagements.
- Emphasize GBV in codes of conduct for contractors and these should be disclosed in local language and be widely publicized to all workers and community members in the project area.
- Accessible grievance reporting, referral pathways and support systems should be established for and popularized for workers and community members.
- Deliberate measures to ensure that gender dynamics including GBV at household and community levels especially during compensation payments.
- Social management plans should be developed to include aspects of GBV.
- All construction workers shall be orientated and sensitized about responsible sexual behavior in project communities.
- The Contractor should have a "No sexual harassment" policy and mainstream it to ensure strict adherence to established mechanisms to avoid the emergence of these challenges.
- Contractor should restrict access to the workers' camps to only authorized persons.
- The contractor shall involve police in case of illicit behavior.
- MWE should ensure that social safeguards personnel are recruited as part of the project implementation personnel to supervise contractors and to continuously engage communities concerning SGBV.

- *Crime, Drug Abuse and Prostitution*

The Earth dam implementation will attract a number of workers on the site who may have different behaviours and habits. These may result in the increase in the number of crimes, drug abuse and prostitution.

Proposed Mitigation measures

- Contractor should involve local (LC) leaders in labour recruitment to reveal criminal record.
- The hired labour shall be made to sign the code of conducts to hold them accountable.
- Contractor should work with local authorities and police to contain criminal activities.

r) HIV/AIDS Risk

The ILO's Code of Practice on AIDS recognizes HIV/AIDS as a workplace issue and goes beyond raising awareness to include non-discrimination, confidentiality, care and support. UNAIDS and other agencies produce guidelines of employer good practice with regard to HIV/AIDS. The Earth dam project contractor will also follow applicable Ugandan national policy on HIV/AIDS.

Proposed Mitigation measures

- Contractor will develop an HIV workplace policy.
- Contractor shall provide condoms and an HIV/AIDS poster to workers in places of convenience.
- Contractor shall procure a service provider for professional HIV/AIDS prevention and counselling.
- Contractor shall put in place work place committees to oversee implementation of HIV/AIDS control activities.

- Contractor shall liaise with the Local Government and other HIV/AIDS service providers to hold outreaches for HIV/AIDS awareness and prevention activities.

s) Labour Exploitation

The construction works for the water project will require a number of employees for its various works though details of the specific labor needs will be clearer during works. It is estimated that, about 50 workers will be recruited in the project for its various works and these to include: Civil engineers, works supervisors, Human resource managers; Clerks of works, Laborers; Security
Other staff shall include Skilled Workers like drivers, masons, carpenters, operators, technicians, admin staff, foremen, mechanics, welders and Unskilled Workers mostly the casual Labourers, cleaners, kitchen and traffic control.

Proposed Mitigation measures

- Contractor should verify the age of every applicant before they are recruited in order to eliminate any cases of Child Labor
- Contractor should ensure that they pay hired labour on time or have a solid justification for delayed payment
- The contractor should stick to the agreed working hours
- Contractor shall discuss the work schedule with the local labour obtained from the project area so as not to clash with cultural norms

t) Sexual Exploitation and Abuse (SEA)

This impact refers to sexual exploitation and abuse committed by Project staff against communities and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEA in the Project

Proposed Mitigation measures

- Develop and implement a SEA action plan with an Accountability and Response Framework as part of the C-ESMP. The SEA action plan will follow guidance on the addressing Gender-based Violence in Investment Project Financing involving Major Civil Works.
- The SEA action plan will include how the project will ensure necessary steps are in place for:
  - ✓ Prevention of SEA: including COCs and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project level IEC materials;
  - ✓ Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management;
  - ✓ Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of PSEA awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their PSEA-related rights;

- ✓ Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistle blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.

u) Effects on Aquatic & Terrestrial Ecology

During setup of the earth dam, there is expected to be impacts arising from sediment erosion and deposition in the neighbourhood. This is very significant since any deposition in the wetland reduces wetted area, therefore reducing size and efficiency of the natural system.

Sedimentation also reduces spawning areas for fishes and in some cases, sediment suffocates fish eggs if the erosion happens during breeding periods. Suspended sediments are also dangerous to mature fishes since they cause injury to the gills, reducing oxygen absorption areas and therefore suffocating the fishes. In the event that the fish are negatively affected, they will migrate, and therefore migratory birds will lose their feed, leading to their demise, and eventual migration to other places. When this happens, the main tourist attraction to the project site will be lost, and a degradation of the water quality.

The impact intensity is high, given that the ponds have not been de-sludge in a long while. With the construction process, saturated sediments may be released to the environment which could result in negative impacts as discussed in the paragraphs above. The Receptor sensitivity is medium, since the area is known for periodically hosting a variety of migratory birds and other species.

Impact significance: The gently sloping terrain makes soil erosion and sedimentation likely impacts. The ***sensitivity*** of the receptor is ***medium*** because of the aquatic life. The intensity of the impact is assessed as ***high***. Given the size of stream, intensive sedimentation would have far reached effects in addition to its flooding nature during the rainy season but the activities taking place in its catchment already largely contribute to the sediment transport.

Mitigation / Enhancement Measures

- Excavated soils from the construction process will be taken to the section for drying, to prevent/reduce their mobility and eventual progression to the nearby water resources
- The developer should ensure that there is zero release of nutrients into the adjoining water resources to reduce fertilisation of the bay, which could result in creation of hypoxia, which kills fish and other aquatic organisms. This can be monitored through water/wastewater analysis on a monthly basis.

Impact significance after mitigation: No further impact is envisaged at this stage.

v) Pollution of water

During the construction, the likely impacts arise from inappropriate disposal of muck, effluents and sewage from labour force, oil spills and hazardous waste from workshops. It is envisaged significant amount of both solid waste and wastewater will be generated from the sanitation facilities used by

both the resident and non-resident workers. Other sources of contaminants include: Oil and fuel spillages and leachate from the unlined treatment ponds.

Impact significance: Water quality parameters that could be affected include pH, oil and grease, COD, E-coli, heavy metals, Dissolved Oxygen, and BOD. The impact intensity in this case would be ***high***, since the area, being partly wetland, has a high-water table, therefore connection between ground water and pollutant is high. The receptor sensitivity is ***medium***. This results in ***major*** impact significance.

Mitigation / Enhancement Measures

To prevent or avoid potential sources of pollution to surface and ground water, the following waste management protocols shall be observed by the developer under the supervision of NEMA.

- Routine maintenance of construction machinery and vehicles will be carried out in a designated workshop/maintenance area(s) with concrete hard standing surface.
- The wastes will be properly segregated and separated to encourage recycling of some useful waste materials, that is, some excavated material can be used as backfills
- No fuel storage tanks are to be constructed on-site. Used oil and lubricants will be stored in drum and disposed by licensed waste collection company as per requirements of the waste management regulations.
- Depending on the rate of accumulation, waste collection will be made at least once in 24 hours. The contractor and WfPRC-N should work hand in hand together with Agago District authorities to facilitate sound waste handling and disposal from the site. All wastes must be taken to the approved dumpsites;
- All hazardous wastes will be collected in well labelled containers and should be managed through a third-party contractor certified by NEMA. The contractor and WfPRC-N will work hand in hand with Agago authorities to facilitate sound waste handling and disposal from the site; and
- The contractor will be required to develop a waste management plan prior to start of construction activities.
- The concrete batching plant/mixing area will be surrounded by a retention bund and all excess wash water will be retained in a sedimentation reservoir from where it will be removed and reused as far as is applicable.
- Disposal of construction waste and refuse such as rejected off-cuts and packaging, workers garbage, waste from workers canteen etc. Waste from the skip shall be collected on a regular basis by for disposal of by a waste collection company for disposal at an approved site. Provision will be made for the separation and composting of organic waste from workers canteen/workstations.
- All hazardous wastes including material soiled with hazardous wastes and empty containers of hazardous materials shall be stored in a designated area on site for regular removal and disposal by a registered contractor in accordance with NEMA's Hazardous Waste Management Regulations.
- Ongoing monitoring by NEMA, MWE and Agago District Local Government has been proposed, to ensure compliance.
- The Contractor will prepare a waste management plan for approval by NEMA.

Impact significance after mitigation: No further impact is envisaged at this stage.

w) Siltation and sedimentation

Increased water runoff and erosion from various work sites could potentially result in siltation of drainage systems. Excavations for foundations along the drainage system could potentially result in substantial siltation of the ecosystem. Significant erosion can occur at unstable spoil dumps resulting in the transport of material and siltation of nearby water course.

Impact significance: Because most of the area is covered under grasses, the impact intensity from erosion is expected to be ***low***, however the area sensitivity is ***medium*** given its location on the Onyama project system. This results in ***moderate*** impact significance.

Mitigation / Enhancement Measures

To minimise potential siltation and sedimentation of wetland system/water courses:

- Sediment control and attenuation facilities such as sand traps, temporary attenuation ponds will be used as necessary during construction to protect the site, adjacent areas and the drainage system.
- Stockpile areas for materials such as sand, gravel, stone, laterite, and topsoil, as well as overburden dumps should be located not less than 100m away from water courses and will be surrounded by perimeter drains with sediment and other pollutant traps located at drain exits.
- Restoration of disturbed sites will be undertaken as an ongoing activity during construction. This will include planting with indigenous grass within the vicinity of the project ecosystem including *Setaria spacelata* in wetter grassland areas, *Sansveria spp* in riverine shaded area and *Hyparrhenia rufa*, *Brachiaria decumbens* in wooded grassland area, and with *Hyparrhenia rufa*, *Brachiaria decumbens, Paspalum conjugatum* and *Setaria sphacelata* in the community area.

Impact significance after mitigation: Erosion of soils within the area is expected to seize during the operation phase, however continuous monitoring will be undertaken by the developer to ensure that any exposed surfaces are protected from runoff which may carry soils to the Onyama system.

x) Impacts on Fishery

The decomposition of vegetative matter into the water resources would result in a nutrient rich environment, disturbing natural equilibrium and leading to possibilities of eutrophication and related danger of establishment of Invasive Alien Species (IAS). Decomposition of organic matter will also lead to depletion of oxygen levels in the aquatic environment.

A nutrient rich environment stimulates the growth of aquatic weeds such as water hyacinth, a common problem within the water resources. This might result into eutrophication and deterioration of water quality. Eutrophication can lead to a number of negative impacts on freshwater ecosystems, including noxious blooms of blue-green algae, lower dissolved oxygen, and shifts in species composition of many taxa, including fishes.

Impact significance: The impact intensity is ***medium*** and the receptor sensitivity is ***high***, since the fringing wetland is breeding grounds for fishes which are a primary source of income for many dwellers in the area. This results in ***high*** impact significance.

Mitigation / Enhancement Measures

- In order to protect both ground and surface water from any agricultural and industrial related pollutants such as chemicals, there will be sufficient buffering zone; and planting vetiver grass at the boundary of the earth dam would serve to filter harmful wastes (Xuhui et al. 2003). The proposed buffer zone is about 100m between earth dam and other water resources boundaries.
- Site spoils and temporary stockpiles shall be located away from the drainage system, and surface run-off shall be directed away from stockpiles to prevent erosion.
- Water quality monitoring will be undertaken periodically to ensure that pollutants are not released to the water resources.

Impact significance after mitigation: No further impacts are envisaged after application of the above mitigations.

y) Impacts on public access road and traffic

The operation traffic may contribute to reduced road safety from the Agago district to project site. This will be from trucks accessing the site to deliver construction materials.

Impact significance: The impact intensity is **low**, and the environmental sensitivity is **medium**, given there already exists traffic within the Agago district prior to the project site and the project area has an access road. This results in ***moderate*** impact significance.

Mitigation / Enhancement Measures

- Traffic accessing the site will be required to slow down on approach to the project site;
- Speed limit signs, traffic and safety barriers and other relevant warning signs will be established at the branch off to the site to warn other motorists of heavy vehicles to and fro the project site;
- Awareness campaigns on traffic safety will be held for the general public and children through the local schools and notice and warning messages,
- Transport of exceptionally large volumes of waste will be done by NEMA lisenced waste carriers with respect to specified requirements stated in their registration with the Authority to transport waste.

Impact significance after mitigation: No further impacts are envisaged after application of the above mitigations.

8.6 Negative Impacts during the Operation Phase

i) Downstream flow variations

Downstream flow variations may be either beneficial or harmful. Releasing of water to simulate normal flood conditions can be beneficial in that it can lead to fish migration and create enabling environment for trees to set seed and germinate. On the other hand, low flow variations can affect

fish migration and their breeding patterns. Similarly, low flow variations can affect downstream community who depend on the river for their domestic and livestock water use. For the case of the Proposed Onyama Earth Dam the downstream flow variation will be beneficial to the local community.

Proposed Mitigation measures.

- MWE should abstract the right amount of water recommended on the Abstraction permit issued by DWRM.
- Frequent monitoring of the water yields abstracted.
- Get involved with Water source catchment protection and management planning that could improve land management and restore groundwater recharge.
- Encourage contour ploughing, mulching and other agricultural practices that increases soil water retention and percolation into the underlying aquifer

ii) Water quality and pollution

Onyama and surrounding location/ do not have formal wastewater disposal system. Provision of additional water to the surrounding location is expected to spur economic growth of the area leading to additional wastewater which will unlikely be managed by use of septic tanks. This can cause pollution of surrounding rivers besides increasing cases of water related diseases which are already significantly affecting the local community. Suitable mitigation measures have been proposed.

Proposed Mitigation Measures

- The reservoir should be constructed with an embarkment to prevent water, sand and other debris cannot fall in. Transmission and distribution pipes should also be covered underground to reduce exposure.

iii) Risks of water and vector-borne diseases:

The water in the reservoir will be stagnant and will act as a breeding ground for mosquitoes and this will have consequence in terms of incidence of mosquitoes and malaria at large in the area. The water in the reservoir may also be unsafe for human consumption as such, contaminated by human activities in the vicinity of the dam, thereby leading to water borne diseases like typhoid. The impact will be medium negative and can be mitigated through:

Mitigation measures

- The project will work closely with some of the on-going water and sanitation programs in the district especially on hygiene and water to reduce mosquito breeding areas and bushes around households;
- The reservoir will be fenced off with restricted access, but in addition the communities will be sensitized to sleep under treated mosquito nets distributed under the Ministry of Health Malaria Control Program; and
- Have primary health care programs in place to create awareness on the risks of diseases from dam waters to discourage farmers from using the irrigation water for domestic purposes.

iv) Introduction of invasive species:

The invasive species may include pests and noxious weeds. Accumulation of sediments and high concentration of nutrients in the water can lead to proliferation of aquatic weeds like water hyacinth, *Pistia* and water cabbage. The impact is likely to occur in the dam reservoir and its shores. The likelihood of the impacts occurring is small negative.

Mitigation measures

a. Ensure construction equipment come on site while clean and leave site after being cleaned to avoid spread of noxious weeds or invasive plant species; and
b. Sensitize communities about the need to control the spread of water hyacinth and encourage them to physically remove and destroy water hyacinth found floating on the river and other water courses. In addition, mechanical removal will be considered.

v) Community Health and Safety:

During the operational phase, there is likely to be risk of drowning by both children and adults in the reservoir. The children or adults may be enticed to swim in the reservoir and may end up drowning or may drown accidentally while passing by. Furthermore, domestic animals may also drown in the reservoir while trying to drink from it. The risk of drowning can be long-term and irreversible when it involves death/loss of life. Dam release operation may lead to unexpected high flows downstream and potential impacts on community safety and downstream activities.

Mitigation measures

- Sensitization of the community on the risks/dangers of swimming in the reservoirs especially for the children;
- Provide watering points for livestock outside the reservoir; and
- There should be Project Management Committee which should address issues of operations of the reservoir

vi) Low hypolimnetic oxygen concentration

Proposed Onyama Earth Dam is likely to suffer from hypolimnetic oxygen depletion during the rainy season because large amounts of fresh oxidizable matter which are likely to be washed into the reservoir and settle at the bottom. However, this will only happen during the initial period of a few years after dam commissioning due to the expected submergence of natural vegetation. The environmental impact of this to the aquatic fauna will be minimal because the reservoir ecosystem will still be at the formative stage and very few species will have established in the area.

Mitigation measures

- Monitoring of the hypolimnetic oxygen within the earth dam/Reservoir and nearby water bodies.

vii) Long-term reservoir nutrient build-up

Improper catchment land-use in the agricultural area above the proposed Onyama Earth Dam if unchecked could eventually lead reservoir nutrient build-up which will affect the quality of drinking water. Nitrogen is likely to be anthropogenically transferred diffusely from the farming areas and pastures especially through the movement of fertilizer residue and animal excrement. High total-P content is likely to occur in Onyama Earth Dam especially at the onset of the long rains through soil movement into the waterbody. High leakage of fertilizer from the agricultural land to the reservoir is likely to occur due to land ploughing in the planting season due to the high rainfall erodibility and soil erosivity levels. Reservoir nutrient build-up is likely to create the problem of eutrophication hence needs mitigation.

Mitigation measures

- Advocating for proper land use practices within the Earth dam catchment area.
- Implementing the Earth dam water Source protection interventions
- Frequent Desilting of the Earth dam reservoir

viii) Potential risk of other reservoir disease vectors

Standing water bodies such as reservoirs attract people to settle nearby and provide the habitat and circumstances for water related problems. For the case of Onyama Earth dam the commonly expected problems will be that of diseases related to mosquitoes and intestinal worms. These are considered to be major and negative impacts and appropriate mitigation measures have been considered.

Mitigation measures

- Training community in vector control strategies
- Clearing of all stagnant water ponds within the Earth dam catchment to control mosquitoes from breeding.
- Community awareness regarding the dangers of vectors within the project area

ix) Risk of dam failure

The Proposed Onyama Earth Dam Project belongs to the Class B Category thus classified as medium risk dam. However, any impoundment of water by a dam forms a hazard so due consideration is required to the nature of the hazard, the risk of harm and/or damage, and mitigation measures that can be undertaken to minimize the risks. The typology of failure could include hydraulic, seepage, structural or operational failure which could lead to downstream flood hazards.

Mitigation measures

- Payment for the Earth dam services is the only way to keep the service running continuously and therefore tariffs would be designed to ensure financial viability. Cost recovery would be achieved through service fee payments.
- Put in place a water user committee to oversee the operations of the Earth dam system.
- Fence off the areas of the Earth dam infrastructures to avoid vandalism

x) Potential water uses conflicts

Currently the local community taps water for domestic and livestock use from the seasonal rivers. This means that communities living downstream of the proposed dam could lose their rights of using the river, if measures are not taken during the design stage to guarantee minimum regulated flow downstream to local community since this is usually taken for granted.

Mitigation measures

- Regulate the amount of water abstracted
- Put in place a water user committee to oversee the operations of the Earth dam system to create ownership
- Community awareness and sensitization regarding the importance of the Earth dam
- Make the tariffs affordable for all those interested in benefiting from the earth dam

xi) Increased agricultural activity

The establishment of the dam will not only increase water availability within the project area but also accelerate other economic activities, there are all possibilities that the outcome of the increased economic activities within the supply area will ultimately exert pressure on the limited forested catchment areas and agricultural activities both upstream as well as downstream of the water reservoir. This may then lead to the following negative impacts:

- ✓ Increased siltation rates due to increased farming activities upstream of the reservoir with potential of shortening the working life of the reservoir
- ✓ Changes in the hydrological regime of the upper river due to changes in vegetation cover and consequently impairment of the base flows of the river with adverse effects on water supplies.

Mitigation measures

- Advocating for proper land use practices within the Earth dam catchment area.
- Implementing the Earth dam water Source protection interventions
- Frequent Desilting of the Earth dam reservoir

xii) Effect of the dam on climate change

The initial filling of a reservoir floods the existing plant material, leading to the death and decomposition of the carbon-rich plants and trees. The rotting organic matter releases carbon into the atmosphere albeit in very small quantities given the small nature of the dam. The decaying plant matter itself settles to the non- oxygenated bottom of the reservoir, and the decomposition– unmitigated by a flow pattern that would oxygenate the water –produces and eventually releases dissolved methane. All these are greenhouse gases that can contribute to global warming and climate change.

xiii)Noise levels from generators

Using of generators to boost the pumping of the water at the pumping stations may lead to moderate noise levels around the project area.

Mitigation measures

- Installation of solar system instead of generator
- Service the generators regularly to minimize on the noise.
- Switch on generators only for few hours to boost on the pumping hours but always use the solar systems.

8.7 Environmental Impacts of Decommissioning

After the Earth dam infrastructure has attained its lifetime, it will either be rehabilitated or decommissioned to return the affected area to a natural environment similar to that which would have existed prior to construction. However, some of the structures/facilities may still have other beneficial uses such as: run-off control, recreation, and water supply among others. Therefore, prior to destroying the structure it is crucial to know whether the structure can be reused through refurbishment of the structures and equipment.
Decommissioning of the water scheme can have negative impact on environment of the area from the release of built-up sediments into the neighbouring ecosystems. There will be changes in the quality of the different water sources (physical and chemical characteristics. These will include:

- *Changes to aquatic ecology:* The smaller animals like the macro–invertebrate's population distributions would be affected, as their digestions would become slower leading to unfavourable conditions for reproduction. When the levels of suspended solids are in excess, the non–organic sediments loading increases where the sediment particles are ingested and becomes hard to digest.
- *Pollution:* Decommissioning will lead to temporary increase in noise and vibration as well as air pollution due to emissions of dust. The removal of concrete and similar non-recyclable construction materials may cause land degradation.
- *Socio-economic impacts:* Removal of structure may impact the socio-economic conditions such as loss of employment thus reduced livelihoods damage of land use.

Mitigation / Enhancement Measures

The Earth Dam and all other infrastructure can always be rehabilitated from time to time and might not necessarily have a life span and with the passage of time social and environmental scenario will change. Therefore, the decommissioning plan discussed above cannot be framed in present scenario however; the various mitigatory measures should meet the following requirement in addition to decommissioning plan to be developed before decommissioning:

- Decommissioning will be undertaken in accordance with the legislation prevailing at that time, in liaison with the relevant regulatory authorities and adhere to the health and safety guidelines to ensure that the decommissioned facilities do not deteriorate to the point where they become a hazard to the public or the environment.
- Safe disposal of waste and concrete and similar non-recyclable construction materials, restoration of all disturbed sites to pre-construction conditions through bioengineering measures.

8.8 Cumulative Impacts

Cumulative effects can be defined as "the impacts on the environment that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions" (Council on Environmental Quality, US 1978).

Cumulative impacts occur when a project activity acts together with other activities from other projects to impact on the same social receptor. This social impact assessment incorporates this cumulative effect considering the past and present activities.

At this stage and from available information, no significant negative cumulative impacts have been identified. The proposed interventions planned as part of the project do not have significant irreversible impacts. Hence, the project interventions are unlikely to contribute to cumulative impacts in the project area. All negative impacts will be addressed in the site-specific Environmental, Social and Management Plans to be developed during the implementation stage of the project
Below are some of the envisaged cumulative effects:

a) Physical Impacts

Predicted physical impact is increasing recession area and water pollution. Also, activities like clearing of vegetation may increase the intensity and frequency of erosion/land degradation. This results in increased sediment concentration in receiving water bodies hence hindering other water usage purposes of affected water sources.

b) Biological Impacts

Changes in the physical and chemical characteristics of water from increased runoff inevitably affect distribution and abundance of aquatic biota. This can be attributed to increased nutrients leached from flooded soils and vegetation, enhanced productivity throughout the food chain.

c) Socio–economic Impacts

The development of proposed project over the time would generate many employment opportunities directly as well as indirectly in the form of various service providers e.g. operation and maintenance.

Tables 21, 22, 23 and 24 below presents a summary of an evaluation of the above envisaged impacts as a result of the implementation of the project

Table 37: Identified Environmental and Social Impacts during phase

Item	Environmental Component	Potential Environmental Impact	Potential Mitigation Measure	Impact Rating
C1.	Land acquisition for infrastructure	The land-take would be permanent where all the project components would be constructed and temporary along the pipeline network.	▪ The proposed land for the earth dam belongs to the District Local Government of Agago as attached see **appendix IV**). No grievances were reported and are envisaged. ▪ Compensation (where possible) to land owners as project affected persons.	Moderate
C2.	Loss of vegetation cover and top soil	The existing vegetation and top soil will be cleared to give way to the construction process on all sites. This is likely to cause loss of habitat and disturbance to faunal communities in the affected sites but at an insignificant level.	▪ After construction, there should be landscaping and re-vegetation. The premises will be planted with vegetation/grass and ornamental trees. ▪ The water source should be fenced off to reduce on going agricultural activities around the Earth dam to avoid pollution entering it especially when it rains heavily. ▪ Minimize vegetation clearance by clearly demarcating work areas. ▪ Provide environmental awareness training to all employees. ▪ Rehabilitate all disturbed areas.	Moderate
C3.	Increase susceptibility to Soil Erosion	Increased soil erosion is likely to occur in the vicinity of project sites during the construction of the Earth dam and other related construction works. The site earthworks will reduce soil stability and hence make the soils aggregated and more susceptible to erosion especially during the rainy season.	▪ The sites will be hoarded off to intercept any eroded material and any soil material will remain within the site. ▪ The project proponent will also ensure that proper landscaping and vegetation restoration is carried out to further reduce the possibility of soil erosion. ▪ Use proper techniques for trenching and shoring	Moderate
C4.	Fauna	Disturbance or loss of protected/endangered animal species/communities and their habitat due to construction activities (noise, dust, fumes, pollution, vehicles).	▪ Minimize vegetation clearance. ▪ Protect water resources from pollution. ▪ Protect soils from contamination. ▪ Rehabilitate all disturbed areas	Moderate

C5.	Insecurity Risks	Influx of people in a project area in search of jobs is likely to come with a host of vises such as thefts, crime and general deterioration of area security. Materials prone to theft include cement, fuel and equipment	▪ Collaborate with the local security set ups in areas of labour recruitment such that, priority is given to locals in the areas in terms of casual and non-skilled jobs; ▪ Those seeking jobs are to present their details accompanied with recommendations from their area LCs as well as next of kin for purposes of traceability in case of engagement in any misconduct or otherwise; ▪ Employ private security guards at the construction site. ▪ The contractor should work closely with the area police out-posts, local defence secretaries and general community policing	Moderate
C6.	Effects of Poor Solid Waste Management	Waste will be generated during the construction of the WSS. The waste stream from the construction will include cement bags, timber and pipe cuttings, empty water bottles, food remains from workers onsite and other forms of waste. If not well managed, the area could be prone to nuisance from foul smell, breeding of vermin and vectors, and lead to outbreak of diseases.	▪ Waste collection bins will be provided at strategic positions at the sites for temporary waste storage. ▪ The waste collection bins should be provided with covers to avoid spillage by scavengers and clearly coded for sorting purposes. ▪ The proponent will hire a certified waste collection company to transport the waste for final disposal to designated waste dumping sites by NEMA/ADLG/Adilang Sub County. ▪ Burning of waste on-site shall not be allowed.	Moderate
C7.	Noise generation	Increased noise levels will be experienced from the use of heavy construction equipment. Increased vibrations during construction by equipment movement, excavations and blasting may transform the calm and quiet conditions in the area	▪ Contractor will be careful when selecting the working equipment to avoid use of old equipment or damaged equipment with high level of noise emissions that would have a negative impact in the environment. ▪ Contractor will ensure that equipment is properly maintained and fully functional in accordance with the manufacturer's recommendations. ▪ The contractor should ensure that noise levels	Moderate

			emanating from machinery, vehicles and noisy excavation and construction activities are kept at a minimum for the safety, health and protection of people in the nearby areas.	
C8.	Increased incidences of diseases.	The increase of people involved in the project activities is likely to increase the incidences of diseases in the area. Consequently, there will be potential risk of contracting sexually transmitted diseases (STDs) especially the Human Immuno-Deficiency Virus/Acquired Immuno-Deficiency Syndrome (HIV/AIDS) among the program workers and the local communities. This will be increased due to influx of people seeking for employment.	▪ The contractor should liaise with the District and Sub County CDO to mobilise communities during the recruitment process to reduce on influx of people who are unskilled. ▪ The contractor should emphasise equal opportunities for both men and women. ▪ The Contractor should, in conjunction with local health authorities, undertake to educate and sensitise the workforce on communicable diseases such as cholera, STDs and HIV/AIDS. ▪ Condoms must be made available to the workforce	Moderate
C9.	Visual intrusion	This will mainly arise from the erection of service reservoir tanks on the high altitude (hills). In addition, visual intrusion will occur where project activities are likely to create disfigured landscapes in the project area especially where the construction activities will result in deposition of large spoils and digging of the trenches.	▪ The contractor should maintain as much as possible the existing landscapes and plant trees and vegetation to enhance the visual aspect. ▪ Rehabilitate all areas disturbed by construction and landscape with trees, grass and shrubs.	Moderate
C10.	Increased accidents and occupational hazards	Implementation of the project will definitely increase volume of human and motor traffic in the project area. The increase in human and motor traffic will be aggravated by the transportation of construction materials, water pipes and other equipment required in constructing the water supply facilities. This is likely to result in a higher risk of accidents and occupational hazards occurring in the area of operation.	▪ The contractor should ensure that workers are provided with adequate personal protective wear to mitigate injuries such as gloves, helmets, overalls and gumboots. ▪ Traffic guides and signs should be utilized to avoid accidents on busy roads and junctions especially with vehicles transporting materials ▪ Fence all construction sites. ▪ Place warning signs. ▪ Enforce maximum traffic speeds to 20kph	Minor

C11.	Sourcing of Construction Materials	Sourcing of materials such as sand, gravel bricks/blocks and timber if not well regulated and controlled can have a significant impact in the points of sourcing.	▪ The Contractor should liaise with local authorities to ensure that materials such as sand and gravel are only taken from quarries and borrow pits with the necessary environmental permits.	Moderate
C12.	Air Quality	Limited air pollution will occur mainly due to fugitive emissions and dust generation from various construction activities. Particulate matter pollution is likely to occur during the site clearance, excavation, loading and transportation construction materials	▪ The areas of such works be routinely sprinkled with water to suppress dust during works. ▪ Restricting excavations to those sites needed for the works. ▪ For the safety of the workers on such areas, the workers supplied with appropriate PPEs to protect them dust nuisance	Minor
C13.	Impact on current water supplies	Disturbance or loss of protected/endangered plant species or communities (terrestrial, wetland, aquatic) due to construction activities of the different project components	▪ Project implementation should be planned in a way to allow users of these continued Earth Dam access. This is to be adhered to, bearing in mind that the project area is prone to water scarcity and long droughts	Moderate
C14.	Risk of Accidents	During the construction of the proposed project, it is expected that construction workers are likely to have accidental injuries as a result of accidental occurrences, neglect of the use of protective gears among others. Accidents may also occur to members of public, livestock and wildlife from open trenches, but they will be reduced by fencing of the construction site and restricting access to the site	▪ Best transport safety practices will be adopted with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public by: employing safe traffic control measures, including road signs and flagmen/traffic guides to warn of dangerous conditions and children crossings; and setting speed limits on all access roads in the project area will be 30km/h for light vehicles and 20km/h for heavy vehicles. ▪ Service ducts installed by the road contractor will be used where applicable to avoid cutting through roads that have just been upgraded. ▪ All workers, including sub-contractors and casual labour, will undergo an environmental, health and safety induction before commencing work on site. This will include a full briefing on site	Moderate

			safety and rules. ▪ The affected communities will be informed of the timing and duration of the construction activities across access roads and any uncertainties or potential for change and also sensitised on the dangers of construction sites and the need to keep away. ▪ Restrictions on hours of driving (including night time restrictions where sensitive receptors may be affected) and timing of vehicle movements to avoid busy periods in urban areas, particularly the start and end of school and the working day.	
C15.	Occupational Health and Safety Risks for the Workforce	Construction traffic, excavation machinery, blasting of rocks and trenches may pose accident risk to workers either when equipment is operated by inexperienced workers or when in a poor mechanical condition or falls into the trenches.	▪ All construction workers will be oriented on safe work practices and guidelines and ensure that they adhere to them. ▪ Training will be conducted on how to prevent and manage incidences. This should involve proper handling of electricity, water etc. and sensitization on various modes of escape, conduct and responsibility during such incidences. All must fully be aware and mentally prepared for potential emergency. ▪ Regular drills will constantly follow on various possible incidences. This will test the response of the involved stakeholders. Such drills will keep them alert and they will become more responsive in the case of incidences. ▪ Signage will be used to warn staff and/ or visitors that are not involved in construction activities of dangerous places.	Moderate
C16.	Social Misdemeanor by	While most workers may originate from the local community where they have families, there might be others from distant places and working away from their families. With some	▪ framework (responsible staff, action plan, etc.) to implement during project execution. ▪ A sensitisation programme for the would-be affected local communities will be conducted	Moderate

	Construction Workers	disposable income to spend, this might induce illicit sexual relationships, with attendant risk for spread of HIV/AIDS	prior to commencement of and during the project implementation. ▪ A code of conduct (appropriate to behaviours in workplace and with respect to relations with local community) will be developed and approved by MWE/WfPRC-N which will be signed by all workers on the project. ▪ Local workers will preferentially be employed, paid directly through their banks and access to bars by workers from outside the project area in the local communities controlled. ▪ All construction workers shall be orientated and sensitized about responsible sexual behaviour in project communities	
C17.	Archaeological / Historical Sites	Throughout the consultations with the locals and local leaders, no known archaeological or historical sites exist on the proposed project routes, and proposed construction sites. Therefore, no impacts on any features of importance to national heritage are expected.	▪ The Contractor shall ensure that key members of his staff are briefed. Any such features that may be found that were not apparent on surface investigation will be reported by the project management and appropriate procedures followed to hand them over to the authority responsible for national heritage and antiquities.	Minor
C18.	Violence Against Children (VAC) and Child labour	According to the consultations made during the stakeholder engagement, most of the community members are aware of children's rights. On the other hand, the common abuses are child labour, parental neglect, child marriage, violent discipline/harsh punishment and sexual abuse. With the implementation of the project, there must be stringent measures in place to protect children's rights against child abuses	▪ The contractors should put in place child protection policy/code of conduct to ensure that no child is employed during the construction works and zero child rights abuses are recorded. ▪ Preparation of the Stakeholder Engagement Plan to cater for mobilization and sensitization on child rights and child protection. ▪ Strengthen the referral pathways for cases of child rights abuses by involving the relevant child protection actors such as LCI, Police, CDOs, Probation Officers in some of the project activities like community mobilization and sensitization, development and dissemination of the referral	Moderate

			pathways. This would reinforce prompt response to cases of child rights abuses and derail the abusers from perpetrating the vice further	
C19.	Domestic, Sexual and Gender Based Violence (SGBV).	SGBV is likely to be experienced, for example, an increase in intimate partner violence (IPV) when compensation schemes that share funds equally among husband and wife at the household level do not provide adequate sensitization and safety measures to reduce potential for increased tensions due to females receiving funds.	▪ Sensitizations should include the men to champion the GBV/DV fight and should as well target awareness creation sessions for women and girls since they are the most prone. ▪ Promote good relationships and improved communication skills amongst couples and positive parenthood through the various stakeholder engagements. ▪ Emphasize GBV in codes of conduct for contractors and these should be disclosed in local language and be widely publicized to all workers and community members in the project area. ▪ Accessible grievance reporting, referral pathways and support systems should be established for and popularized for workers and community members. ▪ Deliberate measures to ensure that the Resettlement Action Plan (RAP) takes into account gender dynamics including GBV at household and community levels especially during compensation payments.	Minor
C20.	Crime, Drug Abuse and Prostitution	The Earth dam implementation will attract a number of workers on the site who may have different behaviours and habits. These may result in the increase in the number of crimes, drug abuse and prostitution	▪ Contractor should involve local (LC) leaders in labour recruitment to reveal criminal record. ▪ The hired labour shall be made to sign the code of conducts to hold them accountable ▪ Contractor should work with local authorities and police to contain criminal activities	Minor
C21.	HIV/AIDS Risks	The ILO's Code of Practice on AIDS recognizes HIV/AIDS as a workplace issue and goes beyond raising awareness to include non-discrimination, confidentiality, care and	▪ Contractor will develop an HIV workplace policy ▪ Contractor shall provide condoms and an HIV/AIDS poster to workers in places of convenience	Moderate

		support. UNAIDS and other agencies produce guidelines of employer good practice with regard to HIV/AIDS. The Earth dam project contractor will also follow applicable Ugandan national policy on HIV/AIDS	▪ Contractor shall procure a service provider for professional HIV/AIDS prevention and counselling ▪ Contractor shall put in place work place committees to oversee implementation of HIV/AIDS control activities ▪ Contractor shall liaise with the Local Government and other HIV/AIDS service providers to hold outreaches for HIV/AIDS awareness and prevention activities	
C22.	Labour Exploitation	The construction works for the Earth dam project will require a number of employees for its various works though details of the specific labor needs will be clearer during works	▪ Contractor should verify the age of every applicant before they are recruited in order to eliminate any cases of Child Labor ▪ Contractor should ensure that they pay hired labour on time or have a solid justification for delayed payment ▪ The contractor should stick to the agreed working hours ▪ Contractor shall discuss the work schedule with the local labour obtained from the project area so as not to clash with cultural norms	Moderate
C23.	Sexual Exploitation and Abuse (SEA)	This impact refers to sexual exploitation and abuse committed by Project staff against communities and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEA in the Project	▪ Develop and implement a SEA action plan with an Accountability and Response Framework as part of the C-ESMP ▪ Preparation of SEA prevention plan	Moderate

Table 38: Operation Phase Adverse/Negative Impacts

Item	Environmental Component	Potential Environmental Impact	Potential Mitigation Measure	Impact Rating
OP1	Downstream flow variations	Downstream flow variations may be either beneficial or harmful. Releasing of water to simulate normal flood conditions can be	▪ MWE should abstract the right amount of water recommended on the Abstraction permit issued by DWRM	Moderate

		beneficial in that it can lead to fish migration and create enabling environment for trees to set seed and germinate.	▪ Frequent monitoring of the water yields abstracted ▪ Get involved with Water source catchment protection and management planning that could improve land management and restore groundwater recharge ▪ Encourage contour ploughing, mulching and other agricultural practices that increases soil water retention and percolation into the underlying aquifer	
OP2	Water quality and pollution	The quality of water recommended is that which is physically, chemically and bacteriologically safe for human consumption. When not thoroughly treated, water could be a source of water related diseases which could affect the project communities, thereby causing an epidemic in the area. Transmission of water can also result into pollution and pollution entering the Earth dam	▪ The reservoir should be constructed with an embarkment to prevent water, sand and other debris cannot fall in. Transmission and distribution pipes should also be covered underground to reduce exposure	Moderate
OP3	**Risks of water and vector-borne diseases**	The water in the reservoir will be stagnant and will act as a breeding ground for mosquitoes and this will have consequence in terms of incidence of mosquitoes and malaria at large in the area. The water in the reservoir may also be unsafe for human consumption as such, contaminated by human activities in the vicinity of the dam, thereby leading to water borne diseases like typhoid	▪ The project will work closely with some of the on-going water and sanitation programs in the district especially on hygiene and water to reduce mosquito breeding areas and bushes around households; ▪ The reservoir will be fenced off with restricted access, but in addition the communities will be sensitized to sleep under treated mosquito nets distributed under the Ministry of Health Malaria Control Program; and ▪ Have primary health care programs in place to create awareness on the risks of diseases from dam waters to discourage farmers from using the irrigation water for domestic purposes	Minor

OP4	Introduction of invasive species:	The invasive species may include pests and noxious weeds. Accumulation of sediments and high concentration of nutrients in the water can lead to proliferation of aquatic weeds like water hyacinth, *Pistia* and water cabbage	▪ Ensure construction equipment come on site while clean and leave site after being cleaned to avoid spread of noxious weeds or invasive plant species; and ▪ Sensitize communities about the need to control the spread of water hyacinth and encourage them to physically remove and destroy water hyacinth found floating on the river and other water courses. In addition, mechanical removal will be considered	Minor
OP5	Community Health and Safety	During the operational phase, there is likely to be risk of drowning by both children and adults in the reservoir. The children or adults may be enticed to swim in the reservoir and may end up drowning or may drown accidentally while passing by	▪ Sensitization of the community on the risks/dangers of swimming in the reservoirs especially for the children; ▪ Provide watering points for livestock outside the reservoir; and ▪ There should be Project Management Committee which should address issues of operations of the reservoir ▪	Moderate
OP6	Low hypolimnetic oxygen concentration	Proposed Onyama Earth Dam is likely to suffer from hypolimnetic oxygen depletion during the rainy season because large amounts of fresh oxidizable matter which are likely to be washed into the reservoir and settle at the bottom.	▪ Monitoring of the hypolimnetic oxygen within the Earth dam/Reservoir and the nearby water bodies	Minor
OP7	Long-term reservoir nutrient build-up	Improper catchment land-use in the agricultural area above the proposed Onyama Earth Dam if unchecked could eventually lead reservoir nutrient build-up which will affect the quality of drinking water. Nitrogen is likely to be anthropogenically transferred diffusely from the farming areas and pastures especially through the movement of fertilizer residue and animal excrement.	▪ Advocating for proper land use practices within the Earth dam catchment area. ▪ Implementing the Earth dam water Source protection interventions ▪ Frequent Desilting of the Earth dam reservoir	Moderate

OP8	Potential risk of other reservoir disease vectors	Standing water bodies such as reservoirs attract people to settle nearby and provide the habitat and circumstances for water related problems. For the case of Onyama Earth dam the commonly expected problems will be that of diseases related to mosquitoes and intestinal worms	▪ Training community in vector control strategies ▪ Clearing of all stagnant water ponds within the Earth dam catchment to control mosquitoes from breeding. ▪ Community awareness regarding the dangers of vectors within the project area	Minor
OP9	Risk of dam failure	The Proposed Onyama Earth Dam Project belongs to the Class B Category thus classified as medium risk dam. However, any impoundment of water by a dam forms a hazard so due consideration is required to the nature of the hazard, the risk of harm and/or damage, and mitigation measures that can be undertaken to minimize the risks	▪ Payment for the Earth dam services is the only way to keep the service running continuously and therefore tariffs would be designed to ensure financial viability. Cost recovery would be achieved through service fee payments. ▪ Put in place a water user committee to oversee the operations of the Earth dam system. ▪ Fence off the areas of the Earth dam infrastructures to avoid vandalism	Moderate
OP10	Potential water uses conflicts	Currently the local community taps water for domestic and livestock use from the seasonal rivers. This means that communities living downstream of the proposed dam could lose their rights of using the river, if measures are not taken during the design stage to guarantee minimum regulated flow downstream to local community since this is usually taken for granted	▪ Regulate the amount of water abstracted ▪ Put in place a water user committee to oversee the operations of the Earth dam system to create ownership ▪ Community awareness and sensitization regarding the importance of the Earth dam ▪ Make the tariffs affordable for all those interested in benefiting from the earth dam.	Moderate
OP11	Increased agricultural activity	The establishment of the dam will not only increase water availability within the project area but also accelerate other economic activities, there are all possibilities that the outcome of the increased economic activities within the supply area will ultimately exert pressure on the limited forested catchment areas and agricultural activities both upstream as well as downstream of the water reservoir	▪ Advocating for proper land use practices within the Earth dam catchment area. ▪ Implementing the Earth dam water Source protection interventions ▪ Frequent Desilting of the Earth dam reservoir	Moderate

OP12	Noise levels from Generators	Using of generators to boost the pumping of the water at the pumping stations may lead to moderate noise levels around the project area	▪ Installation of solar system instead of generator ▪ Service the generators regularly to minimize on the noise. ▪ Switch on generators only for few hours to boost on the pumping hours but always use the solar systems	Moderate

Table 39: Decommissioning Phase Adverse Impacts

Environmental Component	Potential Environmental Impact	Potential Mitigation Measure	Impact Rating before Mitigation
Surface Water Quality	Pollution of water bodies from erosion of unconsolidated materials, contaminated soil, wastes (solid and liquid), etc. as a result of demolition activities.	• Rehabilitate all areas e.g. grass/tree planting. • Take samples of the runoff water into the receiving water body nearby and ensure free pollution. • Remove all contaminated soil identified and dispose of it in an approved site. • Close any waste disposal facility on site and make provision for drainage in such a way as to prevent future pollution.	Moderate
Flora	Disturbance or loss of plant species or communities (terrestrial, aquatic) due to dust fall-out onto leaves and soil, dump erosion.	• Rehabilitate or stabilize all cleared areas using indigenous vegetation until handover of the site.	Minor
Fauna	Disturbance or loss of animal species/communities and their habitat due to the lack of rehabilitation etc.	• Rehabilitate or stabilize all cleared areas using indigenous vegetation where possible.	Minor
Soils	Re-use of soils in rehabilitation and re-instatement of pre-project capability.	• Replace subsoil and overburden first and then cover with saved topsoil. Do not use heavy equipment to replace topsoil because this can cause compaction.	Minor
	Soil erosion from denuded areas and demolition activities.	• Maintain erosion protection works. • Rehabilitate or stabilize all disturbed areas.	Minor
Topography	Reinstate the topographic profile.	• Backfill, contour and landscape.	Minor
Air quality	Dust from un-rehabilitated sites and demolition activities.	• Avoid dusty activities e.g. loading and dumping on windy days & monitor dust emissions.	Minor

	Odors from waste dump.	• Avoid activities that can lead to pilling of wastes in the project area. • Dispose off all the wastes in gazetted sites	Minor
Noise and vibration	Noise generated by demolition equipment and earth moving equipment	• Prescribe noise reduction measures if appropriate e.g. restricted working and transport hours and noise buffering.	Minor
Health and safety	Risk of accidents and ill health as a result of the project	• Fence all unsafe and dangerous areas & monitor environmental health (air quality, water quality).	Minor
Aesthetic and amenity values	Improvement of the visual impact of the site on scenic views.	• Rehabilitate with trees, grass and shrubs where possible. • Consult with the local community and tourist industry.	Minor

Note:

- Mitigation measures have been designed in order to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts and inform the Environmental and Social Management Plan (ESMP).
- Closure and decommissioning of the facility were also identified as a key issue. An environmental management plan has been developed during the assessment that will prescribe procedures for closure and post-operation to ensure that the environment is restored as much as possible to its original state.

9 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

9.1 Introduction

The objectives of the Environment and Social Management and Monitoring Plan (ESMMP) include: compliance with applicable national environmental and social safeguards; propose mitigation, enhancing, management, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts and; address capacity building requirements. The Plan includes details such as the issue to monitor, the indicators, responsibility for collecting and checking data and reporting, costs of implementation (where applicable), responsibility for implementing the action and training or orientation of responsible person (if applicable). It should, however, be noted that the costs indicated in the ESMMP are indicative only and the responsible implementing parties such as Contractors, Supervising Consultants, and respective MWE/WfPRC-N teams and other agencies responsible for monitoring should prepare budgets to include the aspects covered in this ESMMP. The proposed project may have minimal adverse environmental effects, provided that recommendations and mitigation measures identified in this Chapter are incorporated into all project phases and are implemented by the developer and the contractors.

Table 19 presents management plan with specific mitigation measures to be implemented during Design, construction, operation and Decommissioning phases of the proposed project.

9.2 Role of the Developer

The developer will be responsible for:

- Reviewing the approved ESIA document, particularly the required mitigation measures and the Environmental and Social Management and Monitoring Plan;
- Reviewing the approval conditions provided by NEMA (approval certificate), and permits from lead agencies including DWRM (Ground Water Abstraction Permit), MoGLSD, (Workplace Inspection Certification), Ministry of Water and Environment (River bank), NEMA (Environmental Management).
- The developer should prepare Environmental, Social, Health and Safety Action Plans to comply with the above requirements.
- Costs related to complying with the Environmental Safeguards as applicable to the construction and operation of the Water Supply System will be met by the developer.
- The day-to-day responsibility for implementing the ESMMP will be of the Developer/contractor.
- Implementing and complying with the conditions of the ESMMP forms part of the conditions of appointment of all Consultants and Contractors throughout the life of the project;
- Appointing Independent environmental experts to audit the implementation of, and compliance with, the ESMMP and monitoring plan, as well as the NEMA Approval conditions on an annual basis; and the independent environmental Compliance audits, together with other relevant monitoring information made available to the public, throughout the life of the project, summarized in lay person's terms and in a culturally accessible manner.
- Training and awareness creation in environmental and social management and the mitigation of impacts are provided to MWE Project staff, to ensure they are aware of

their responsibilities and are competent to carry out their work in an environmentally and socially responsible manner.

9.3 Role of Construction Supervision Consultants

The Supervision Consultants to whom work is outsourced during project implementation will be responsible for the following:

- Reviewing project design, contractor's contract, BOQs and all other project documents like the ESMP, ESIA report, NEMA project certificate conditions, RAP as to get familiar with in order to build up an additional mechanism for enforcing compliance as per those in contract.
- Ensuring that contractors familiarize themselves with the environmental and social management framework for the project sites and activities.
- Reviewing and approving Contractor's plans as required in the above documents like; EHS Plans, Waste Management Plan, Traffic Management Plan, Emergency Response Plan, Gender Management Plan, Erosion and sediment control plan, Decommissioning and Restoration Plans of the site; among others.
- Following up on Contractor's obligation in acquiring the various permits in relation to the project works which then will be verified like; permit for excavation, Permit for hoarding and scaffolding, Work registration permit.
- Monitoring the Contractor's performance in EHS aspects, particularly in regard to the above-mentioned plans; using the safeguards documents provided by MWE and NEMA, as well as permits from other Lead Agencies, using the safeguards documents provided.
- Ensuring that all the contractors and their subcontractors receive basic training or are sensitized on environmental and social matters, including acceptable conduct, storage and handling of potentially hazardous substances, waste management, and prevention of pollution of natural resources.
- Receiving daily, weekly and monthly reports from the Contractor on EHS aspects, and furnishing MWE/WfPRC-N with the information during monthly meetings or site visits. Any urgent issues will have to be reported to MWE immediately to allow appropriate timely action to be implemented.
- Preparing the environmental supervision statement and also approving of invoices or payments with consideration of ESMP performance.
- Regularly engaging with the local communities to ensure continued social acceptance in the areas where the Contractor is in operation, and also to ensure that Contractor adheres to the recommendations made in this ESMMP.
- Instructing the contractor to correct within the timeframe determined as per contract in case of any corrective actions. If there is breach of contract or strong public complaints on contractor's environmental performance, the Supervision Consultants is obligated to order the contractor to correct, change or stop the work, reporting to relevant agencies and the MWE/WfPRC-N.

9.4 Role of Government Institutions

Agencies such as NEMA, MGLSD, ADLG, MAAIF will be involved in the various phases through the life of the Project as proposed in the ESMMP. The responsibilities of each respective agency will be those that are within their mandate as indicated under **section 2.5** of this report (under their mandate in reference to this project), and as such, no extra costing has been included in the ESMMP since it is expected that their annual operational budgets will be made to include the required works for this Project. For this reason, MWE should regularly update the respective

lead agencies with the Project progress, and challenges and opportunities presented during the implementation of the project.

9.5 The Role of the Contractor and/or subcontractors

During sites preparation and construction for the new Water supply system, the contractor and/or the subcontractors will be responsible for ensuring compliance with all national legislation and Policies as well as adherence to all environmental and socio-economic mitigation measures specified in the ESMP that has been developed during this ESIA study. The contractor and/or subcontractor will also be responsible for managing the potential environmental, socio-economic, safety and health impacts of all contract activities whether these will be undertaken by themselves or by their subcontractors.

9.6 The Monitoring Team

It is recommended that a core team of people preferably headed by the Agago District Natural Resources Office, District Water Office, District Production Office and composed of other officials from relevant ministry and respective local environment committees will carry out monitoring activities. The monitoring team will start its work during the site preparation and construction process and continue throughout the operation phase and should ensure that the proposed mitigation measures are implemented as suggested and recommended in this ESIA study. The monitoring team will most particularly check for the following issues among others:

- Changes in the water quality and quantity.
- Compliance with the conditions set out on the water abstraction permit.
- Compliance with the conditions on the issued Certificate of Approval from NEMA.

9.7 African Development Bank (AfDB)

On top of funding the implementation of the project, AfDB will also play a big role in ensuring that the Bank's Operational safeguards (OSs) and the Performance Standards (PSs) are compiled and adhered to, as appropriate. AfDB will also review the monitoring reports during the implementation of the project.

9.8 Environmental and Social Monitoring Plan

A monitoring process will be established to check/assess the implementation progress and effectiveness of the mitigation measures suggested and the resulting effects of the proposed project on the environment. The process will begin during site preparations, construction stage and continue throughout the operation phase. It also includes regular reviews of the impacts that cannot be adequately assessed before the beginning of the project, or which arise unexpectedly. In such cases, appropriate new actions to mitigate any adverse effects will be undertaken.

The recommendations will provide a basis for tracking progress of the proposed project activities with regard to sound environmental practice and mitigation measures. This will be done with the support of supplementary documents such as specific architectural and engineering plans and designs for civil and mechanical works to be undertaken on the site.

9.9 Capacity Building and Trainings

The Capacity building and trainings will be conducted using the AfDB's and the National social and environmental (E&S) safeguards, as required by the AfDB for its projects to ensure early identification of possible risks and propose management measures so that the project is able to address the risks while maximizing positive outcomes.

Training will be conducted with the following primary objectives:

- Train the project beneficiaries, ADLG, and other government staff interested in the general safeguard requirements built into the E&S safeguards.
- Introduce the participants to the safeguard requirements of the AfDB and of the country.
- Examine the specific safeguard requirements of the AfDB funded project.

The following outcomes are expected as the result of training.

- ❖ Improved knowledge and understanding on the E&S concepts and standards.
- ❖ Improved knowledge and understanding on the ESIA concepts and methodology.
- ❖ Improved knowledge and understanding on the ESMP preparation.
- ❖ Improved knowledge and understanding on the ESMP monitoring and reporting.

Table 40: Training and capacity building requirements

Description of training	Target participants	Timeframe	Responsibility	Costs (UGX)
Labour conditions, GRM health and safety	District Local Government	During construction and operation	MWE/ Contractor	40,000,000
Water rights issue, Community disagreements, GRM	Project Beneficiaries/ Farmers	During Operation	MWE/System Operator (SO)	32,000,000

9.10 Monitoring and Reporting

External Monitor can be a lead Agency and or Authorities like NEMA, DNRO/DEO/DWO or a NEMA Certified Consultant whom the developer and Contractor will contact 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. Reference will be made to commencement reports, incident reports, quarterly reports, progressive reports, routine reports, annual audit reports and completion reports. However, it should be emphasized that during the bidding process or when hiring the contractor, the E&S aspects should be included in the BoQs

Environmental Management and Monitoring Plan is presented below under Table 24.

Table 41: Environmental Management and Monitoring Activities and Criteria

Code	E& Impact	Objective to Address Impact	Mitigation measures	Monitoring Activity	Project Phase	Responsibility	Frequency	Mitigation Cost (UGX)
Construction Phase (CP)1	Land acquisition	The land-take would be permanent where the earth dam facilities, office block, would be constructed and temporary along the pipeline network	• The district local Government authorities were engaged and offered land for the development. • No grievances were reported and or are envisaged. • ADLG secured the land to be used for the project and it has no encumbrances. No issues of compensation and resettlement are anticipated.	Liaise with ADLG, local authorities in Adilang Sub County together with communities for land agreement to be used for the different Earth Dam facilities and Compensate (where possible) to land owners as project affected persons	Construction	Client/MWE/ WfPRC-N	Daily	-
CP2	Loss of vegetation cover and top soil	To minimize on the loss of vegetation cover	• After construction, there should be landscaping and re-vegetation. The premises	Landscaping and re-vegetation after construction and fencing off all the sites.	Construction	Contractor	Daily	14,750,000

		and top soils along the project sites	will be planted with vegetation/grass and ornamental trees. • Minimize vegetation clearance by clearly demarcating work areas. • Provide environmental awareness training to all employees. • Rehabilitate all disturbed areas	Rehabilitation of the site				
CP3	Increase susceptibility to soil erosion	To reduce on incidences of soil erosion at project sites	• After construction, there should be landscaping and re-vegetation. The premises will be planted with vegetation/grass and ornamental trees. • Minimize vegetation clearance by clearly	Hoarding off project sites to intercept any eroded material and any soil material and proper landscaping and vegetation restoration. Use of proper techniques for trenching and shoring	Construction	Contractor	Daily	15,900,000

			demarcating work areas. • Provide environmental awareness training to all employees. • Rehabilitate all disturbed areas					
CP4	Loss of fauna	To minimize on the loss of fauna within the project area	▪ Minimise un-authorised access to the wetland area and reduce disturbance to the fauna habitat ▪ Monitor for the two key species periodically to determine changes in ecosystem ▪ Project work force must do a pre-work site survey to ensure no fauna is harmed during dredging. Any fauna found on site before the day's activities is to be relocated	▪ Minimize vegetation clearance. ▪ Protect water resources from pollution. ▪ Protect soils from contamination. ▪ Rehabilitate all disturbed areas	Construction	Contractor	daily	Included as part of CP3.

			a safe distance away from project activities ▪ Sensitize workers to respect wildlife and not engage in killing animals or consuming wild eggs ▪ Maintain vehicle speeds at 30km/hr to avoid road kills ▪ No works in an area once a nest is observed. Communication to MWE should be done immediately and UWA engaged to remove, where activities would damage the fauna nest.					
CP5	Insecurity risks	To reduce on cases of insecurity in the project	▪ Collaborate with the local security set ups in areas of labour recruitment such	▪ Employ private security guards at the construction site.	Construction	Contractor	Daily	23,000,000

			that, priority is given to locals in the areas in terms of casual and non-skilled jobs; ▪ Those seeking jobs are to present their details accompanied with recommendations from their area LCs as well as next of kin for purposes of traceability in case of engagement in any misconduct or otherwise; ▪ Employ private security guards at the construction site. ▪ The contractor should work closely with the area police out-posts, local defence secretaries and	▪ The contractor should work closely with the area police out-posts, local defence secretaries and general community policing				

			general community policing. ▪ Contractor will put in place an internal control system to curb cases of theft of materials.					
CP6	Solid waste generation	To minimise on cases of poor solid waste management	▪ Waste collection bins will be provided at strategic positions at the construction sites for temporary waste storage. ▪ The waste collection bins should be provided with covers to avoid spillage by scavengers and clearly coded for sorting purposes. ▪ The contractor will hire a certified waste collection company to transport the	▪ Waste collection bins will be provided at strategic positions at the sites for temporary waste storage. ▪ The waste collection bins should be provided with covers to avoid spillage by scavengers and clearly coded for sorting purposes. ▪ The proponent will hire a certified waste collection company to transport the waste for final	Construction	Contractor	Daily	11,400,000

			waste for final disposal to designated waste dumping sites by NEMA/ADLG/Adilang Sub County ▪ Burning of waste on-site shall not be allowed.	disposal to designated waste dumping sites by NEMA/ADLG/Adilang S/C.				
CP7	Noise Levels	To minimise noise disturbance to neighbours	▪ Contractor will be careful when selecting the working equipment to avoid use of old equipment or damaged equipment with high level of noise emissions that would have a negative impact in the environment. ▪ Contractor will ensure that equipment is properly maintained and fully	▪ Measurements of noise levels using a noise meter.	Construction	Site Supervisor	Daily	5,790,000

			functional in accordance with the manufacturer's recommendations. ▪ The contractor should ensure that noise levels emanating from machinery, vehicles and noisy excavation and construction activities are kept at a minimum for the safety, health and protection of people in the nearby areas. ▪ Regular maintenance, monitoring and, where necessary, the use of silencing equipment will be employed with the aim of					

			reducing noise emissions.					
CP8	Incidences of diseases	To prevent cases of potential disease risks within the project area	• The contractor should liaise with the District and Sub County CDO to mobilise communities during the recruitment process to reduce on influx of people who are unskilled. • The contractor should emphasise equal opportunities for both men and women. • The Contractor should, in conjunction with local health authorities, undertake to educate and sensitise the workforce on communicable diseases such as cholera, STDs	Liaising with the District and Sub County CDO to mobilise communities during the recruitment process to reduce on influx of people who are unskilled. Educating and sensitising the workforce on communicable diseases such as cholera, STDs and HIV/AIDS and provision of Condoms to the workforce.	Construction	Contractor	Daily	12,000,000

			and HIV/AIDS. Condoms must be made available to the workforce.					
CP9	Visual Intrusion	To reduces on the changes in landscape	• The contractor should maintain as much as possible the existing landscapes and plant trees and vegetation to enhance the visual aspect. • Rehabilitate all areas disturbed by construction and landscape with trees, grass and shrubs	Rehabilitate all areas disturbed by construction and landscape with trees, grass and shrubs	Construction	Site Supervisor	Daily	6,000,000
CP10	Construction Material Sourcing	To regulate and control the impact in the points of sourcing materials.	The Contractor should liaise with local authorities to ensure that materials such as sand and gravel are only taken from quarries and borrow pits with the necessary environmental permits	Liaise with local authorities to only source materials from legally registered suppliers	Construction	Site Supervisor	Daily	-

CP11	Air Quality	To minimise dust nuisance and exhaust pollution	• The areas of such works be routinely sprinkled with water to suppress dust during works. • Restricting excavations to those sites needed for the works. • For the safety of the workers on such areas, the workers supplied with appropriate PPEs to protect them dust nuisance	Provision of adequate and appropriate personal protective equipment (PPE).	Construction	Site Supervisor	Daily	14,820,000
CP12	Risk of accidents	To reduces on incidences of accidents	▪ Service ducts installed by the road contractor will be used where applicable to avoid cutting through roads that have just been upgraded. ▪ All workers, including sub-	▪ Service ducts installed by the road contractor will be used where applicable to avoid cutting through roads that have just been upgraded. ▪ All workers, including sub-	Construction	Site Supervisor	Daily	8,600,000

			contractors and casual labour, will undergo an environmental, health and safety induction before commencing work on site. This will include a full briefing on site safety and rules. ▪ The affected communities will be informed of the timing and duration of the construction activities across access roads and any uncertainties or potential for change and also sensitised on the dangers of construction sites and the need to keep	contractors and casual labour, will undergo an environmental, health and safety induction before commencing work on site. This will include a full briefing on site safety and rules. ▪ The affected communities will be informed of the timing and duration of the construction activities				

			away.					
CP13	Occupational Health and Safety Risks for the Workforce	To reduce on cases of OSH risks to workforce	▪ The contractor should ensure that workers are provided with adequate personal protective wear to mitigate injuries such as gloves, helmets, overalls and gumboots. ▪ Traffic guides and signs should be utilized to avoid accidents on busy roads and junctions especially with vehicles transporting materials	▪ All construction workers will be oriented on safe work practices and guidelines and ensure that they adhere to them. ▪ Signage will be used to warn staff and/ or visitors that are not involved in construction activities of dangerous places	Construction and Operation	Site Supervisor and Operator	Daily	9,400,000
CP14	Social Misdemeanour by Construction Workers	To minimise on cases of illicit relationships	▪ As a contractual obligation, contractors shall be required to have an HIV/AIDS policy and a framework	▪ A sensitisation programme for the would-be affected local communities will be conducted prior to commencement of and during	Construction	Site Supervisor	Daily	7,800,000

			(responsible staff, action plan, etc.) to implement during project execution. ▪ A sensitization programme for the would-be affected local communities will be conducted prior to commencement of and during the project implementation. ▪ A code of conduct (appropriate to behaviors in workplace and with respect to relations with local community) will be developed and approved by MWE/WfPRC-N which will be signed by all	the project implementation. ▪ A code of conduct (appropriate to behaviours in workplace				

			workers on the project.					
CP15	Violence Against Children (VAC) and Child labour	To reduce on cases of child labour VAC	▪ The contractors should put in place child protection policy/code of conduct to ensure that no child is employed during the construction works and zero child rights abuses are recorded. ▪ Preparation of the Stakeholder Engagement Plan to cater for mobilization and sensitization on child rights and child protection	▪ The contractors should put in place child protection policy/code of conduct to ensure that no child is employed during the construction works. ▪ Protection of child rights	Construction	Site supervisor	Daily	12,300,000
CP16	HIV/AIDS risks	To reduce on the spread of HIV/AIDS	▪ Contractor will develop an HIV workplace policy ▪ Contractor shall provide condoms and an HIV/AIDS	▪ Contractor will develop an HIV workplace policy ▪ Contractor shall provide condoms and an HIV/AIDS	Construction and Operation	Contractor and Operator	Daily	14,690,000

			poster to workers in places of convenience ▪ Contractor shall procure a service provider for professional HIV/AIDS prevention and counselling ▪ Contractor shall put in place work place committees to oversee implementation of HIV/AIDS control activities ▪ Contractor shall liaise with the Local Government and other HIV/AIDS service providers to hold outreaches for HIV/AIDS awareness and prevention activities	poster to workers in places of convenience ▪ Contractor shall procure a service provider for professional HIV/AIDS prevention and counselling ▪ Contractor shall put in place work place committees to oversee implementation of HIV/AIDS control activities				
Total ESMP Implementation costs for the Construction phase								156,450,000

OP1	Occupation Safety & Health	To ensure Health and Safety at the site / Premises	• Sensitization of the community on the risks/dangers of swimming in the reservoirs especially for the children; • Provide watering points for livestock outside the reservoir; and • There should be Project Management Committee which should address issues of operations of the reservoir	Inspect all equipment to ensure that they are in good working condition.		Site Supervisor	Monthly	6,500,000
		To prevent injury to workers and other personnel.		Barrier tape and warning signs will be used, install safety signage, fence off the area.	Construction	Site Supervisor	Weekly	8,670,000
OP2	Public health	To prevent	The reservoir should be constructed with an	Creation of awareness, provision of waste	Construction	Site Supervisor	Quarterly	8,500,000

		spread of diseases	embarkment to prevent water, sand and other debris cannot fall in. Transmission and distribution pipes should also be covered underground to reduce exposure	bins and health care.				
OP3	Water quantity and yield	To improve on the water quality from the Earth dam		Prepare a water source protection plan for implementation	Operation	Operator/ WfPRC-C	Monthly	70,000,000
OP4	Water quantity and yield	To maintain the water levels and yield during abstraction	Obtaining Water Abstraction permit from DWRM	Maintain abstraction records & check for gaps or cracks around the opening of the Earth dam Prepare Water source catchment Plan for the Earth dam	Operation		Daily	10,400,000
OP5	Earth dam failure	To reduce on the chances of the system failure during operation	▪ Payment for the Earth dam services is the only way to keep the service running continuously and therefore tariffs would be designed to ensure financial viability. Cost recovery would be achieved	Putting in place a water user committee to oversee the operations of the water system. Fencing off the areas for the Earth dam facilities	Operation	Client/ Operator	Daily	15,400,000
OP6	Earth dam failures	To minimise on the chances of		Hiring of security guards to monitor and guard the water supply system facilities.	Operation	Client/ Operator	Daily	32,450,000

		vandalism and theft of the water facilities parts	through service fee payments. ▪ Put in place a water user committee to oversee the operations of the Earth dam system. ▪ Fence off the areas of the Earth dam infrastructures to avoid vandalism	Sensitization and awareness about the dangers of vandalizing the water supply system facilities				
OP7	Noise generation	To minimise on cases and nuisance of noise generation	▪ Installation of solar system instead of generator ▪	▪ Installation of solar system instead of generator ▪ Service the generators regularly to minimize on the noise. ▪ Switch on generators only for few hours to boost on the pumping hours but always use the solar systems	Operation	Operator/ WfPRC-N	Weekly	28,500,000

Total ESMP Implementation costs for the Operation phase			180,420,000
	Total for both Construction and Operation phases		**336,870,000**

Note:

However, during the construction, the Contractor should prepare the following key plans and strategies.

Contractor ESMP (C-ESMP), Waste Management Plan including for hazardous wastes, Occupation Safety and health (OSH) plan, Emergency Preparedness plan, Code of conduct for workers, Traffic management Plan, Labour Management plan, Gender and Child protection plan, HIV/AIDs Management Plan, Site Restoration Plan, Biodiversity management plan, Landscape and tree planting plan among others.

Also in summary, the following costs should be clear in the BoQs during the bidding process

Item	Indicative Costs
ESMP	336,870,000
GRM	67,000,000
Stakeholder Engagement	87,000,000
Annual Environment and Social Audit	165,000,000
Environment and Social (E&S) Capacity Building and Trainings	72,000,000
Total	**727,870,000**

CONCLUSION AND RECOMMENDATIONS

Onyama Earth Dam is being proposed by the Ministry of Water and Environment/WfPRC-N for Adilang Sub County in Agago district. This is envisaged to bring an end to water stress and overreliance on Rain fall for crop production and a few existing surface water sources within the project area of Adilang Sub County and neighbouring community. It is also envisaged that, the area experiences scarcity of water for production and high growing population. Further still, the project will also address the focal area of access to clean water and water for production as stipulated under the Uganda Vision 2040 and the National Development Plan III. The project also contributes towards achieving SDG *(specifically SDG 6 on clean water and sanitation)*. Several beneficial impacts envisaged will include:

- Improved quality of water supplied to communities.
- Provision of employment opportunities during construction and operation phases.
- Improved health and sanitation due to improved water quality and quantity.
- Improved local economies and induced development especially sourcing of raw materials for construction activities and tree seedling growing business boost during operation phase.
- Small to Large scale irrigation farming especially in vegetables and flowers since most household heads are involved in subsistence agriculture.
- An increase in revenue for the Sub County from water project collections.
- Initiate the move away from the status quo of rural women and children's perpetual carrying of water on their heads from unprotected and distant point water source and allow them to engage in income generating activities and to improve the image of the woman and children.
- Improved image of the Sub County and parishes in terms of providing good services to its people hence more funding from potential funders.
- Increase in land value within the project area.

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

- Insecurity risks.
- Destruction of vegetation and crops during construction phase.
- Increased noise nuisance during construction phase by workers and equipment.
- Improper disposal of cut out spoil and other construction wastes.
- Other concerns include occupational safety hazards, and HIV/AIDS risk associated with construction labour.

No resettlement issues are anticipated since the land has no encumbrances and an environment and social management plan (ESMP) has been presented in this ESIA report to ensure positive impacts are enhanced while negative impacts are avoided and or mitigated.

During this ESIA study, comprehensive stakeholder consultations were conducted with relevant stakeholders and MWE/WfPRC-N will liaise with them to ensure effective implementation of the proposed mitigation measures for the anticipated negative impacts as indicated in the EMMP. MWE/WfPRC-N should work closely with the local leaders and Local Government to ensure smooth implementation of the Environment and Social Management and Monitoring Plan (ESMMP) and if impacts not contemplated during this ESIA arise, the management of WfPRC-N should immediately address them in consultation with NEMA. If any other structures/ expansion

not described in this report takes place, it will be considered separate and an ESIA Report/Project brief will be prepared by WfPRC-N or the Contractor and submitted to NEMA for approval before implementation.

The following mitigation measures should be considered as conditions of approval as they are regarded as being essential in so far as rendering potentially significant impacts acceptable. Implement the EMMP for all provided project phases with special attention being given on:

- Undertake Annual Environmental Audits and submit reports to NEMA.
- Maintaining good house-keeping through the duration of the construction phase.
- Screening unsightly aspects from public view including excavations (where practical), construction material storage areas, waste storage areas and ablutions.
- Erect fencing around construction sites to act as screens minimizing the effect of wind in generating dust emissions.
- The re-vegetation of all areas of natural vegetation with indigenous species that have been disturbed as a result of construction activities and maintain the 200m buffer zone.
- Designation of construction materials and fuel storage areas.
- Effective control of waste and containment of storm water especially during rainy season.
- Implement dust suppression measures (use of water) when appropriate.
- Train workers on issues of HIV/AIDS and child labour should not be permitted.
- Adhere to Occupational Health and Safety Act, 2006 provisions e.g. monitoring noise levels and provision of protective equipment to staff.
- At least 75 % (subject to availability) local labour from Agago district should be used and 95% (subject to availability and skills levels) local contractors should be used.
- The Developer (WfPRC-N) monitors compliance together with stakeholder wide monitoring group comprising technical staff from local government institutions.
- Fencing is recommended in order to prevent contamination of the water source and for security of hydraulic structures and installations for the pumpstation.
- Prepare a water source protection plan for the catchment area of the water sources.

Therefore, the proposed Onyama Earth dam 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

Annex I: Approved Terms of Reference for ESIA by NEMA

Annex II: Records of Stakeholder Consultations

MINISTRY OF WATER AND ENVIRONMENT

WATER FOR PRODUCTION REGIONAL CENTRE – NORTH

Activity: AWARENESS CREATION AND CONSULTATION ON THE LAND OWNERSHIP TOWARDS THE REHABILITATION OF ONYAMA DAM IN ADILANG S/C, AGAGO DISTRICT

S/N	NAME	DESIGNATION	CONTACT	SIGNATURE
01.	Odokonyero Francis Ongom	BMT-ADLG	0775914247	[signature]
02	Opoka Geoffrey A	SAS Adilang	0772851129	[signature]
03	OROMA EMMANUEL	DWO-ADLG	0775232499	[signature]
04	Mbaagwa X Mwange A.	CAO	0772663285	[signature]
05	ORACH DENIS JACOB	Arim	0782321844	[signature]
06	ANGIIRO CHRISTOPHER	S.E.O-ADLG	0772964903	[signature]

MINISTRY OF WATER AND ENVIRONMENT

WATER FOR PRODUCTION REGIONAL CENTRE– NORTH

Activity: Awareness creation and sensitization meeting of community members towards rehabilitation of Onyama earth dam in Agago district.

Date: ....

S/N	NAME	DESIGNATION	CONTACT.	SIGNATURE
01	Nyeko Samuel	for CAO	0772361024	[signature]
02	Onyuke Andrew	RDC	0782593849	[signature]
03	OGANA MORISH	V.LC V	0774341112	[signature]
4	ARUA JOEL	LC III C/MAN	0787749014	[signature]
5	OPOKA GEOFFREY ABER	Sub county chief	0772851129	[signature]
6	OKEMA EMMANUEL	DWO	0775232499	[signature]
7	Olonyo Joel	Farmer	0779842350	[signature]
8	OMAKA THOMAS	"	0773937860	[signature]
9	Okello Sam Samuel	farmer	0779227460	[signature]
10	OKIDI RUBEN	ADUR	—	[signature]
11	OPIDA JASPHER	FARMER	0777344789	[signature]
12	OKello Isaac	member	0783976945	[signature]
13	Ogwang Benson	F	—	[signature]
14	Aoko Bizenson	FARMER	0773812224	[signature]
15	AKello Eunice	"	0778856376	[signature]

MINISTRY OF WATER AND ENVIRONMENT

WATER FOR PRODUCTION REGIONAL CENTRE– NORTH

Activity: Awareness creation and sensitization meeting of community members towards rehabilitation of Onyama earth dam in Agago district.

Date: ....

S/N	NAME	DESIGNATION	CONTACT.	SIGNATURE
16	ABUA KOSE	—	—	
17	ABOMYO MIROSY	Farmer	—	
18	AUMA SOPHIA	m	—	
19	OJEDE JR	A FARMER	0784876717	
20	OKELLO DANIEL	APUR	0783453248	
21	AKITE SARAH	APUR	—	AKITE SARAH
22	AWINYO HEAVEN	C/P LC1	0775597680	
23	Adik Susan	Apur	—	Adw
24	OBOCH PETER	C/Person LC.1	0786541672	
25	AWINYO HEAVEN	C/P L.C.1	0775597680	
26	Awoo Patrick Reg	Apur	0785509882	
27	Abaa Sam	Apur	0775715298	
28	OMARA KENNETH	Farmer	0777093221	

Annex III: Minutes from Stakeholder Consultations

MINISTRY OF WATER AND ENVIRONMENT

Water for Production Regional Centre-North

(WfPRC-N)

REPORT ON SECURING PROJECT CONSENT AND ACCEPTANCE AGREEMENT FOR THE DEVELOPMENT OF ONYAMA EARTH DAM IN THE DISTRICTS OF AGAGO.

Date: March.2023.

Purpose

Therefore, WfPRC-N mobilized Landlords and various stakeholders in the District of Agago in order to sensitize them on the process of securing project consent which would enable signing of the final project consent and acceptance agreements so as to develop the above earth dam. The location and sites visited include;

Main objective:

This activity was majorly to sensitise land lords and the other stake holders on the importance of signing consent agreements before development of the project.

Objective of the activity:

- To seek the consent of the land lords for the acceptance for land offer for the project.
- To give a brief overview of the project to the beneficiaries and other stakeholder.
- Map out the different stake holders for the design construction and sustainable operation and maintenance of the project.

Methodology

- Different methodologies were used like mobilization of the various stake holders both at the District and village levels by writing letters , making phone calls for follow up and using the local area councillor ones for community mobilisation.
- Courtesy visits were paid at the District and Sub County officials.
- Site visits were also conducted by the staff from MWE, District officials, Sub County and Landowners.
- Community engagement meetings were also conducted to give and over view of the project to beneficiaries and other key stake holders.
- Land acquisition document was drafted, reviewed and discussed with the district official, landowners MWE and other beneficiaries, agreed and signed by the relevant stakeholders.

Participants

The meetings were attended by the MWE staff, district and Sub County officials both political and technical, the land lords, community stake holders and the intended beneficiaries.

MINUTES FOR THE MEETINGS:

AGENDA.

1. Opening prayer.
2. Self-introduction.
3. Welcome remarks from LCI.
4. Welcome remarks from the Landlord
5. Communication MWE Staff.
6. Communication from the DWO.
7. Communication from the LCV Councilor.
8. Communication from the Sub County Chief.
9. Communication from the Agricultural Officer.
10. Reading of the land consent agreement, reactions from the community and signing.
11. Closing remarks from the LCIII.

OPENING PRAYER.

This was voluntarily led by one of the family members Mrs. Lucy who thanked God for the meeting and asked him to guide it.

INTRODUCTION.

This was done in groups in the following order: MWE staffs, District, Sub County, Parish, local village leaders, elders, landlords and the neighbors.

WELCOME REMARKS FROM THE LANDLORD:

- He welcomed all the members present in their various capacities to the meeting.
- He noted that they came up as a family and agreed to offer part of their land for the implementation of the irrigation project that will enable the community members to have farm produce all year round.
- He also added that this project will not only belong to their family but the entire community members because the water source/ dam belongs to all.

- He finally notified that they are willing and ready to work with the MWE for the success of the project and also apologized for the absence of some other community members that he blamed it on information and it being a weekly market day in the village.

WELCOME REMARKS FROM THE LC1:

- He welcomed all the members present for the meeting.
- He noted that his office got information about the project and was aware of this particular meeting as well and also thanked the community members for being present.
- He also added that his village was so peaceful security wise and that the visits should feel at home.

WELCOME REMARKS FROM THE LANDLORD:

- He welcomed all the members present for the meeting.
- He thanked the Ministry for following up on the project work.
- He apologized on behalf of some community members who were absent because it being a market day in the village.
- He noted that the project will not only improve on their farming skills but increase their income status as well.
- He notified that his family members and the entire neighborhood welcome the project and they will not disappoint the MWE with the project.

COMMUNICATION FROM THE MWE STAFF:

- She welcomed all the members present in their various capacities and notified the following,
- The meeting is legal that's why we have come through with the district and sub county officials.
- The MWE intends to rehabilitate the Onyama Earth dam . It's therefore important to have evidence that the community is in full support of the support. Hence, the purpose of the meeting.
- Government projects are supported by loans and are repaid through taxes and therefore there is need for all the community to participate in this project because at the end of the day the taxes are put on items such as salt and soap among others that might be impossible for the community members to do without.
- In this project, farmers will be trained on modern agronomic practices, a regional and site agronomist will be availed to the farmers.
- Since the community members have cattle, cattle troughs will be constructed for their animals because no animals will be allowed to water from the valley tank and the farming area would be fenced to protect the crops from the animals.
- Ownership of the project land will still belong to the initial landlords.
- Farmers will only be availed with plots they can effectively and efficiently manage.

- Solar panels will be installed and that are shall be managed by the MWE / Government.
- The community members shall have to sign four (4) copies of the land consent because one copy will be brought back to them and the other to the Sub County, District and the Ministry.

COMMUNICATION FROM THE DWO:

- He thanked and welcomed all the representatives present.
- Our office works closely with the MWE and the community on matters concerning water.
- He is grateful and thankful to the land lords and the community members for their commitment and offering land for the project.
- He notified that Land is a very important issue now days.
- He urged the community members to embrace the project and work on it well for the betterment of their families and children.
- He requested the neighbors to please witness the exercise because they too will be part of the beneficiaries.
- He thanked the community members for being present to witness such an important step of the project.

COMMUNICATION FROM COUNCILOR V:

- She thanked all the members for coming to witness such an important exercise.
- She urged the community members that they should be grateful and thank God for the project in their area because many have missed out.
- She requested the community members to always work hard, support the project and avoid laziness.
- She notified the community members that a number of trainings will be conducted and they should endeavor to participate to improve on their skills and knowledge on the project.
- She encouraged the community members to work together, motive others and involve in the project.
- She added that the district has plans for the community members and all they need is their commitment.
- She concluded by extending regards from the LCV vice who had engagements elsewhere and also had a message for the community, that they should avoid laziness and work for the betterment of their lives and that of their families.

COMMUNICATION FROM THE SUB COUNTY CHIEF:

- He welcomed and thanked all the members present for the meeting.
- He thanked the MWE and also encouraged them to always work with the government structures for better mobilization and service delivery.
- He notified that all development projects are to be put on land. The greatest challenge now is on land. It's a gift from God to be used well. He encouraged the community members to support projects that need land.

- He thanked the community members for supporting development in the area and urged the land lords to involve other community members as well.

COMMUNICATION FROM THE AGRICULTURAL OFFICER:

- He thanked God for the meeting all those present for the meeting.
- He noted that when we move around Agago district, they are so backward in terms of development. Farming is only done in the wet seasons but with this new project, production will be all year round.
- He encouraged the farmers to embrace, support and always know what to communicate about the project.

CLOSING REMARKS FROM THE LCIII:

- He congratulated the MWE for the great work they are doing towards service delivery.
- He also appreciated the family for offering land for the project.
- He requested the MWE to put cattle troughs for the community since most of the members have cattle.
- He requested the family to involve the other community members in the project.
- He notified the community members that no one will be taking their land and that they are still the rightful owners.
- He finally asked one of the community members to volunteer and pray to close the meeting.
- He adjourned the meeting at 14:56pm.

CHALLENGES, RECCOMMENDATION AND CONCLUSION.

Challenges

- There is complain about over delay of the project. This has created mistrust on the side of the community members.
- Some community members believe that the project will only benefit the families that offered land this was witnessed on both sites that were visited.
- Limited knowledge about irrigation agriculture among the community members doing cattle rearing.
- There is very high expectations from some of the community members about the project and the MWE this was witnessed at Onyama site
- There was poor time management on the side of some community members.
- There was limited time given to carry out the activity making some of the challenges inevitable such as late reporting.
- Poor mobile communication network also made mobilisation quite a challenge.

Recommendation

- The beneficiaries at Onyama earth dam are more of cattle keeping and therefore request for cattle troughs to be included in the design process of the project.

- There is need for community sensitization on irrigation agriculture.
- Community members of Adilang need to be sensitized on proper hygiene and the importance of having pit latrines in their homes as this exposes them to a number of diseases and risks.
- The community members are willing to support the project and notified that they are willing to offer more land for future expansions of the project.
- The Operation and maintenance criteria of the Earth dam should be clearly spelt out to the beneficiaries and the various stake holders' right from the start of the project for the purposes of its sustainability.
- The MWE should development the facility soon since the community members still have high morals to work in the project.
- The MWE should also keep very close contacts with the landlords of the project sites to avoid any land incumbencies.

Conclusion

Conclusively, in all districts of Agago, the District officials, Sub County and the community members are grateful to the MWE for bringing such a project to them and pledged to support MWE for the project to be sustained and made a success.

Signing of the project consent agreement by the land lords at Adilang **in** Agag **District.**

Reading and discussing of the project agreement form with the community members at Onyama in Agago district.

One of the district officials in Agago making his remarks to the community .

Signing of the project consent agreement form by the landlords at Onyama **site in Agago district.**

Annex IV: Land Ownership Documents for the Infrastructure

Telephone:
District Chairperson – 0772464193
Chief Administrative Officer – 0772592231
Deputy Chief Admin. Officer – .....
District Planner – 0788382111
Chief Finance Officer – 0776066365
District Education Officer – 0775020205
District Health Officer – 0772380481
Principal Assistant Secretary – 0774850157
District Engineer – 0789751153
District Water Officer – 0779009078
E-mail No: agagodlg2010@gmail.com
Fax .....

THE REPUBLIC OF UGANDA

AGAGO DISTRICT LOCAL GOVERNMENT
OFFICE OF THE
CHIEF ADMINISTRATIVE OFFICER
P.O. BOX 1
AGAGO
UGANDA

IN ANY CORRESPONDENCE ON THIS SUBJECT PLEASE QUOTE NO:

Date: 17 / 03 /2023

The Manager
Water for Production Regional Centre –North
Ministry of Water and Environment
P.O Box 381
Lira, Uganda

Dear Sir

COMFIRMATION LETTER ON ONYAMA EARTH DAM PROJECT LAND

This is in response to yours ref. WfPRC-N/ADM/23/03 dated 6th March, 2023 on the above issue.

This is therefore to comfirm that the above land on which the dam is located is a public land, and as a district, we are in process of securing the land title for the area.

Awaiting your usual assistance

Thank you for your cooperation.

CHIEF ADMINISTRATIVE OFFICER
AGAGO DISTRICT

Mbaagwa Muwonge Abdulnoor

Chief Administrative Officer (CAO)

Agago District Local Government
CC. District Chaiperson
CC. RDC
CC. DWO
CC. SAS Adilang S/C
CC. LCIII Adwilang

ADILANG SUB COUNTY LOWER LOCAL GOVERNMENT

Mobiles:
Chairperson LC III - 0773633704
Sub County Chief - 0772851128
Sub Accountant - 0772005413
Agaric officer - 0772526369
CDO - 0776604424
Clerk to council - 0772833738
E-mail No: adilangsubcounty2015@gmail.com
Fax _____
IN ANY CORRESPONDENCE ON THIS SUBJECT PLEASE QUOTE NO:

THE REPUBLIC OF UGANDA

OFFICE OF THE SUB COUNTY CHIEF
ADILANG SUB COUNTY
P.O.BOX 1, AGAGO
AGAGO DISTRICT
UGANDA

DATE: 17/03/2023

Sec Confirmation to Envt.

THE CHIEF ADMINISTRATIVE OFFICER
AGAGO DISTRICT LOCAL GOVERNMENT

RECIEVED
CENTRAL REGISTRY
AGAGO DISTRICT
DATE: 17/03/2023

RE: CONFIRMATION ON THE LAND OWNERSHIP OF ONYAMA EARTH DAM IN ADILANG SUB-COUNTY.

In response to the letter from Water for Production Regional Center- North (WfPRC-N) under the Ministry of Water and Environment (MWE) on the land ownership regarding the rehabilitation of Onyama Earth Dam located in Ajwa central village, Lapyem parish in Adilang sub county, I write to inform you that the Dam is on public land and government owned constructed in the colonial rule of around 1952 for domestic water supply, livestock watering, rural industries, wild life and aquaculture.

Therefore as the office of the Sub-county Chief, I give consent on any further development upon this land since it is a government owned and no claims regarding ownership.

For that purpose, I encourage the Team to expedite the process of rehabilitation of the dam.

Thanks

SENIOR ASST. SECRETARY
17 MAR 2023
ADILANG SUB - COUNTY
AGAGO DISTRICT

Prepared by:

Opoka Geoffery Adot
Sub County chief

RECIEVED
CENTRAL REGISTRY
AGAGO DISTRICT
DATE: 17/03/2023

TEL: MWE: +256 414 505 942
WSDF-N: +256 392 705 046
FAX: +256 414505947
Email:
website:

THE REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT
WATER FOR PRODUCTION REGIONAL CENTRE – NORTH
P.O BOX 381,
LIRA, UGANDA

In any correspondence on this subject please quote Ref No: WFPRC-N/ADM/23/03

6th March, 2023

Water Officer
Handle Urgently

CHIEF ADMINISTRATIVE OFFICER
★ AGAGO DISTRICT ★

The Chief Administrative Officer,
Agago District Local Government,
P.O. Box 1,
Agago, Uganda

Dear Sir,

RE: CONFIRMATION LETTER ON ONYAMA EARTH DAM PROJECT.

The government of Uganda constructed Onyama Earth Dam around 1952 in Ajwa central village, Lapyem parish, Adilang Sub County in Agago district with a purpose to increase production coverage and availability across the country through construction of multi-purpose reservoirs (earth dams and valley tanks) for domestic water supply, irrigation, livestock watering, rural industries, wild life, fisheries and aquaculture with the objective of increasing agricultural production and productivity.

Onyama earth dam has been proposed for rehabilitation in the WSSP III project by the Ministry of Water and Environment through the funding from African Development Bank (AfDB). The rehabilitation of Onyama dam shall contribute towards the cumulative water storage target under Vision 2040, NDPIII and the National irrigation policy as well combat drought to ensure food security and job creation. This water shall be used for multipurpose uses (livestock watering, Irrigation, Aquaculture and rural industry) in Lapyem parish, Adilang Sub-county with a population of about 251,200 people.

The purpose of this letter is seek confirmation from the district whether the designated piece of land where the earth dam had been constructed is property of Government of Uganda as it is alleged by the community. This is not only a requirement by the development partners but also meant to avoidencumbrances from the landlords or surrounding community members during implementation of the project. Therefore in order for Ministry of Water and Environmentto continue with the process of supporting in the rehabilitation of Onyama Earth Dam, it is a requirement to prove proper land ownership of the designated area where the dam is found.

Therefore, theMinistry of Water and Environment through Water for Production Regional Centre-North (WfPRC-N)seeks tofind out the rightful ownership of the land where the Earth Dam has been constructed.

For: REGIONAL MANAGER WfPRC-N

CC: CAO Agago
CC: DWO Agago
CC: DCDO Agago
CC: LC5 Agago
CC: RDC Agago
CC: LCIII Adwilang
CC: SAS Adwilang

Annex V: General Layout and Layouts of the Earth Dam

Annex VI: Chance Finds Procedure on Physical Cultural Resources Management

The Physical Cultural Resources Policy (PCRs) i.e. OP 4.11 should be triggered because of the excavation works that may encounter PCRs. To meet the requirements of this policy, a Chance Finds Procedure has been developed to indicate a real risk of causing undesirable adverse environmental and social effects on the physical and intangible cultural resources, and that more substantial planning may be required to adequately avoid, mitigate or manage potential effects. Chance find procedures will be used as follows:

i. Stop the construction activities in the area of the chance find;
ii. Delineate the discovered site or area;
iii. Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the Directorate of Museums and Monuments (DMM) take over;
iv. Notify the site / supervisory Engineer who in turn will notify the responsible local authorities and the Directorate of Museums and Monuments under the Ministry of Tourism, Wildlife and Antiquities (within 24 hours or less);
v. The Directorate of Museums and Monuments would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the Directorate of Museums and Monuments (within 24 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
vi. Decisions on how to handle the finding shall be taken by the Directorate of Museums and Monuments. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
vii. Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the DMM;
viii. Construction work could resume only after permission is given from the responsible local authorities and the Directorate of Museums and Monuments concerning safeguard of the heritage;
ix. These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed;
x. Construction work will resume only after authorization is given by the responsible local authorities and the National Museum concerning the safeguard of the heritage.
xi. Relevant findings will be recorded in World Bank Implementation Supervision Reports (ISRs), and Implementation Completion Reports (ICRs) will assess the overall effectiveness of the project's cultural property mitigation, management, and activities, as appropriate.

Annex VII: Grievance Redress Mechanism

There will be a necessity to resolve conflicts swiftly in order to expedite the project's planning and construction phase and for the smooth eventual operational activities. Therefore, a grievance redressing mechanism is essential for Recycling Facility. This procedure will address this need in detail. The objectives of the grievance process as explained in the subsequent chapter of these guidelines will be as follows:

- Provide affected people with avenues for making a complaint or resolving any dispute that may arise;
- Ensure that appropriate and mutually acceptable corrective actions are identified and implemented to address complaints;
- Verify that complaints are satisfied with outcomes of corrective actions;
- Avoid the need to resort to judicial proceedings.

Grievance management is an important step in community engagement. There had been and will be community grievances throughout the project's various development stages. It is expected that all such grievances be amicably resolved if the developer is to abide by the global and country specific Social Safeguard guidelines. In practice, in similar compensation and resettlement activities, many grievances arise from misunderstandings of the Project policy, or result from conflicts between neighbors, which can usually be solved through adequate mediation using customary rules or local administration at the lowest level. Most grievances can be settled with additional explanation efforts and some mediation using customary dispute settlement mechanisms.

The purpose of Grievance management shall be to provide opportunity for the aggrieved parties to resolve issues through arbitration and negotiation based on transparent and fair hearing. It will allow the parties in the dispute to arrive at a win -win solution. Final outcome thus be that the extra judicial systems will work smoothly and that number of disputes seeking interventions at the country judiciary will be made minimal. The functioning a proper grievance management mechanism is a requirement in view of the above. The overall management of grievances is the responsibility of the developer or/and the contractor. The Project, thus, will put in place an amicable, extra-judicial mechanism for managing grievances and disputes based on explanation and mediation by third parties. Procedures relevant to this amicable mechanism are detailed below. It will include three different levels:

- Registration by project of the complaint, grievance or dispute;
- Processing by project of the grievance or dispute until closure is established based on evidence that acceptable action was taken; and
- In the event where the complainant is not satisfied with action taken by project as a result of the complaint, an amicable mediation can be triggered involving a mediation committee independent from the Project.

Managing grievances needs a clear and transparent procedure well instituted within the management structure of the project. At minimum, such a procedure should consist of the following steps:

a) to receive the grievances,
b) to acknowledgement the receipt,
c) investigation and resolution,
d) Closeout and follow-up.

i. The need for maintain a Grievance Register

There should be Grievance Register which would record all the grievances, complaints and issues the stakeholders would wish to bring to the attention of the Developer or the Contractor. It should be kept at a place where all will have easy access; preferably this should be placed at the office (allocated for the Grievance Committee (GC)). It should contain the date of the entry, name and contact details of the complainant; nature of grievance, Signature (on one side of the Register) and actions taken to address or reasons the grievance was not acted on, the signature of the GC and Complainant as to how the grievance was closed and date (on the other side of the Register.

ii. Recording of the complaints into the Grievance Register

The following steps are to be followed when the complaints will be received: Receipt of complaint (a verbal or in written) will be received by the Community Liaison Officer or any other officer (a member of the Grievance committee).

- The complainant can obtain the assistance from a member of the grievance committee or the Site welfare officer to lodge such an entry in to the Grievance Register.
- The Officer Responsible or the GC member, who is at present, will communicate with the complaint in a language acceptable to the complainant.
- Since the site working is carried out in English Language, the Site welfare officer or the member of the Grievance committee may lodge the entry in English language
- After lodging the complaint in the register, the officer recorded such complain shall read to the complaint what is recorded and sign the entry made into the Grievance Register

iii. Formation of a Grievance Committee

In Uganda at the local level, the village leaders and the LC (1) play a key role in managing disputes. The Parish level committees formed for the management of disputes is the lowest level of accepted forms of reconciliation board at which the complainants can have access to for justice if issues will not be resolved at the village level. However, in order to strengthen the village level reconciliation of disputes specially over the issues arising from the project related matters, appointing of a Grievance Committee has been considered a viable option according to the accepted practices. It is expected that grievances depending on the complexity and nature can be resolved either at the site level, at the grievance committee level or at the project developer's top management level or at the judiciary level. It means that if a complainant is not satisfied with the site level solution offered by the site manager or the project's administration manager, the matter can be taken up by the Grievance Committee (GC).

The constituency of the grievance committee and its role is explained in the following section. This GC is to be considered the vital body which prevents any grievances to be heard at higher levels. In parallel and where necessary, the GC holds meetings or other appropriate communication with the complainant, with the aim of reducing any tensions and preventing them from escalating. During closeout, the GC seeks to confirm that its actions have satisfied the complainant. During follow-up, the GC, with the assistance of the Site Construction Manager investigates the causes of grievances, where necessary, to ensure that the grievance does not recur.

The composition of Grievance Committee is depicted below:

a) Representative from area – 01 Members (preferably from Sub County/)
b) Representative of Women – 01 Members
c) Representative of the Local Government – 02 Community Development Officers
d) Representative from the developer – 01 Member
e) Representative from the contractor – 01 Member

Members of the Grievance will be provided training on conflict resolution and given more exposure on procedures of managing grievances.

iv. Performance Indicators in respect of the functioning of the Grievance Committee

Key interventions include:

- Setting up of a Functional Grievance Committee;
- Addressing employee's grievances in all project phases.

Annex VIII: Hydrological Investigations Study Report.

HYDROLOGICAL ANALYSIS

Project description

The government of Uganda through Water for Production department of the Ministry of Water and Environment is making considerable efforts in raising the water for production coverage and availability across the country through construction of multi-purpose reservoirs (earth dams and valley tanks) for domestic water supply, irrigation, livestock watering, rural industries, wild life, fisheries and aquaculture with the objective of increasing agricultural production and productivity, and regulate dependency on rain fed agriculture which is heavily affected by prolonged droughts. Water for production is key to the successful implementation of the Government of Uganda's plan for poverty eradication and climate change mitigation through provision of dams and valley tanks for storing excess flood water during heavy rains for use during the dry seasons.

As part of the initiative, the Water for Production Regional Center North (WfPRC-N) has prioritized rehabilitation of Onyama Dam to increase water storage for domestic water supply, aquaculture, livestock watering and irrigation especially during the dry season in Agago district. Onyama dam was established around 1952 and is located in a grazing land which is communally owned and the land where the dam sits is government land and currently silted with presence of aquatic weeds of Eichhornia crassipes and Nymphea mexicana. There were no evident farming activities within the vicinity of the dam and is currently being used for fishing and animal watering by the surrounding community, cattle keepers from Lira Kato Subcounty and Karimojong pastoralists who came around January to March. The dam has since outlived its design life. The embankment is presently in bad condition with significant evidence of slope failure, especially on the upstream face/side, piping through the dam body and extensive siltation. The spillway channel is non-functional thus posing danger of total breach to the embankment. The dam is recharged by Onyama seasonal stream, existing natural spring and groundwater whose water table is high.

In the project area Subsistence agriculture is the main economic activity carried out in the district and the main source of income of the farm families in Agago. 90% of the population in the district is Subsistence farmers. The main food crops grown in the district include; finger millet, maize, sorghum, cassava, peas, beans and vegetables. The traditional and non - traditional cash crops grown include; Cotton, tobacco, soya beans, simsim, rice, sunflower and groundnuts. Other agricultural activities include; fish hunting and fish farming.

Provision of water for production is one of the responses to the adverse effects of climate change to the agricultural sector. The intensity and frequency with which the drought and floods occur require more proactive responses. New approaches to water for production service delivery under the Agro-Industrialization (AGI) Program are therefore needed as a proactive response towards drought and to guarantee food security for the future generation. Given the district's vulnerability to climate change, and its importance for national and local food security, rehabilitation of Onyama dam will increase agricultural production and productivity, and regulate dependency on rain fed agriculture which is heavily affected by prolonged droughts in the district.

Purpose and scope of report

The main objective of this assignment is to undertake design Onyama earth dams and associated

multipurpose water systems and facilities in Agago District with the agreed investments in infrastructure.

The main objectives of the hydrological study are to:

- Assess water resources available to satisfy the estimated potential future water uses and demands in the sub-project areas together with their seasonality, level of service, priority of use and cumulative effects.
- Perform hydrological analysis to determine dependability of available water resources;
- Assess and quantify any upstream and downstream water uses (abstractions/diversions) and their impacts on the proposed project;
- Match the water availability for each time segment with the livestock, irrigation needs and other demands at different levels of probability;
- Undertake rainfall-runoff modelling to estimate reservoir yield, inflow design flood, reservoir routing to facilitate the sizing of spillway, reservoir, dam and outlet works;
- Determine the flow duration curves to facilitate the design of hydraulic structures;
- Carry out flood routing through the downstream channel and floodplain to enable evaluation of effects in the event of excessive spills or dam break (hydrological dam safety considerations);
- Determine the sediment yield of the river system, forecast the reservoir dead storage volume, future rate of reduction of live storage, and reservoir trap efficiency.

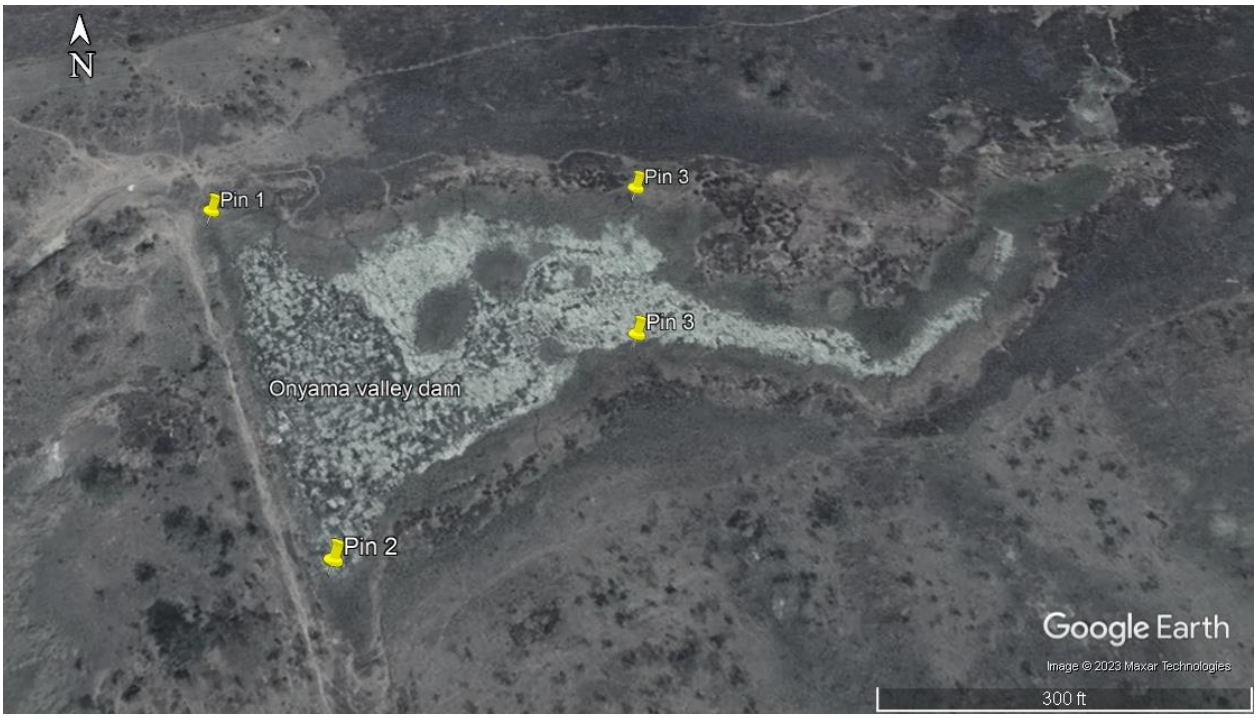
Project Area

(a) Dam site Description

Onyama dam is located in Ajwa central village, Lapyem parish, Adilang sub county in Agago district on GPS location 36N 553494E, 310672N. It boarded by vallages of Ajwaa- lela-pura, Ajwaa-wipolo, Anyami Akuuri and Biwang who are earmarked to benefit from the dam. Onyama dam is located 300m off Adilang – Alwala road. The dam was established around 1952 and is currently silted and having acquatic weeds. The dam is located in a grazing land which is communally owned and the land where the dam sits is government land. The proposed dam has a height of 4m with storage capacity of 199,692m^3 (with a potential increase up to 17,077,352m^3), embarkment length of 130m and would provide water for livestock watering, irrigation, domestic use, reservoir fisheries, flood control, etc. The most appropriate dam shall be an earth fill embankment dam.

There were no evident farming activities within the vicinity of the dam; the dam is currently being used for fishing and animal watering by the surrounding community, cattle keepers from Lira Kato Subcounty and Karimojong pastoralists who came around January to March.

The dam is recharged by Onyama seasonal stream, existing natural spring and groundwater whose water table is high. The place experiences severe flooding of about 50m from the visible dam extents during the dry season. Using the ArcGIS 10.4 software and the digital elevation model (DEM) of 30m, a catchment area of dam Onyama was delineated and found to be 69.9 sq. km.



Google Earth Map showing the location of the Onyama Da

(b) Extent of project area

Onyama valley dam is seated on government land (the land title is at the district) with an acreage of 50 acres. During colonial time, this dam land was 110 acres but due to population increase over time 50 acres of this land has been encroached by the neighbouring community. The catchment area is 66.93 km2, Figure 2 shows the dam extent and the catchment area.

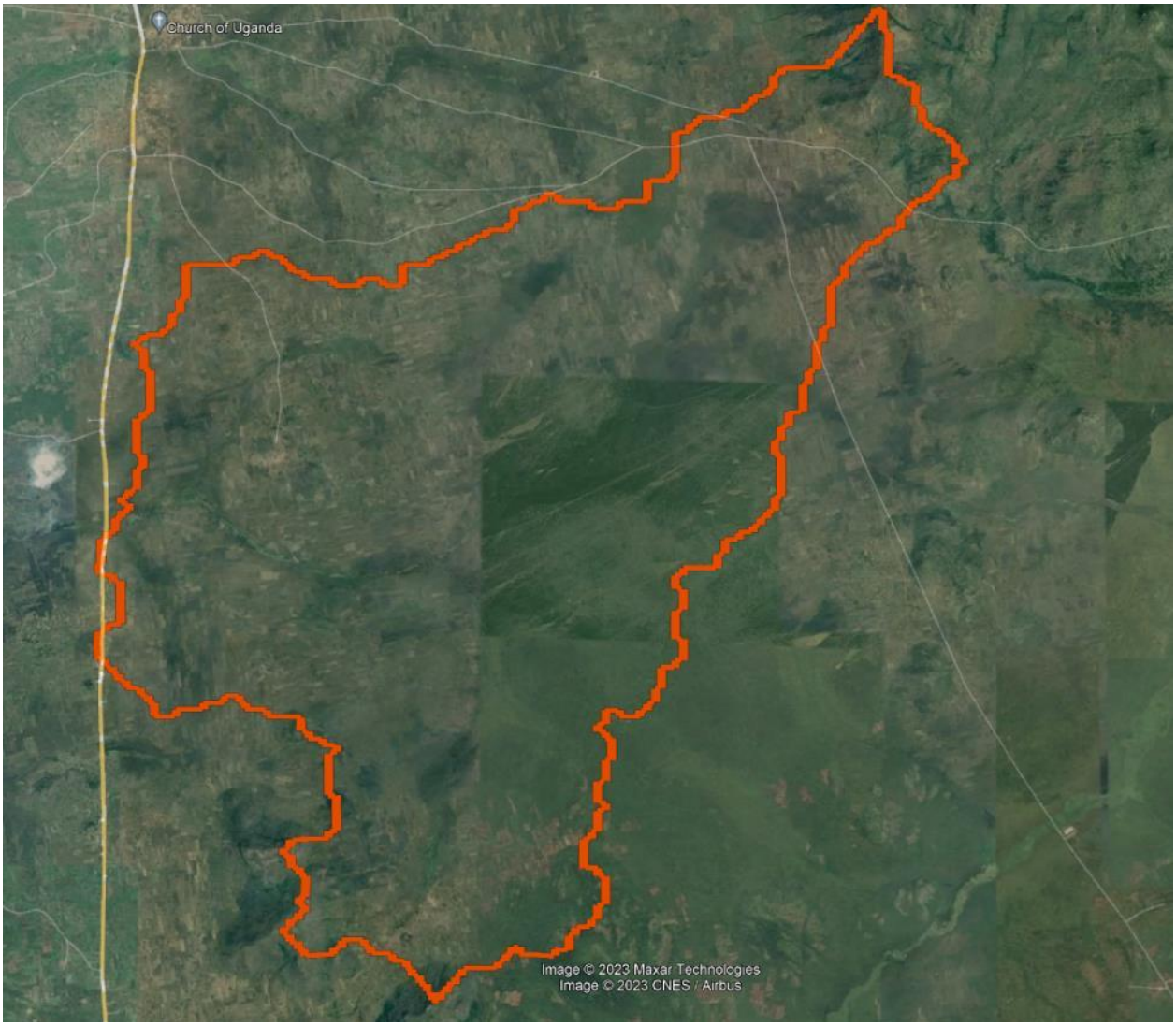
Currently, the embankment length is 152m, the crest width is 4m and the dam height is 4m, with a capacity of 201,539.2m^3. However, with the renovation works, the dam capacity shall be 1,247,658.98m^3 with dam height of 10m and a surface area of 315,931.19m^2. However, according to Table 1 below, the dam has a potential of storing 17,077,352m3of water at a contour height of 1270m with a surface area of 2,442,892.48m^2 and a height of 25m.

This water shall be used to irrigate 72Ha of land, water heads of cattle, small animals and birds and also provide domestic water to 5,402 people during the initial year. The dam shall also support fisheries and aquaculture.

Volume elevation relationship

No	contour (m)	Volume (cu.m)	Surface area (sq.m)	Elevation (m)
1	1245	-	-	0
2	1250	92,913.54	37,495.71	5
3	1255	1,247,658.98	315,931.19	10
4	1260	4,177,073.43	763,257.48	15
5	1265	9,852,628.20	1,413,149.49	20
6	1270	20,077,559.07	2,442,892.48	25

Catchment characteristics



(a) Climatic condition

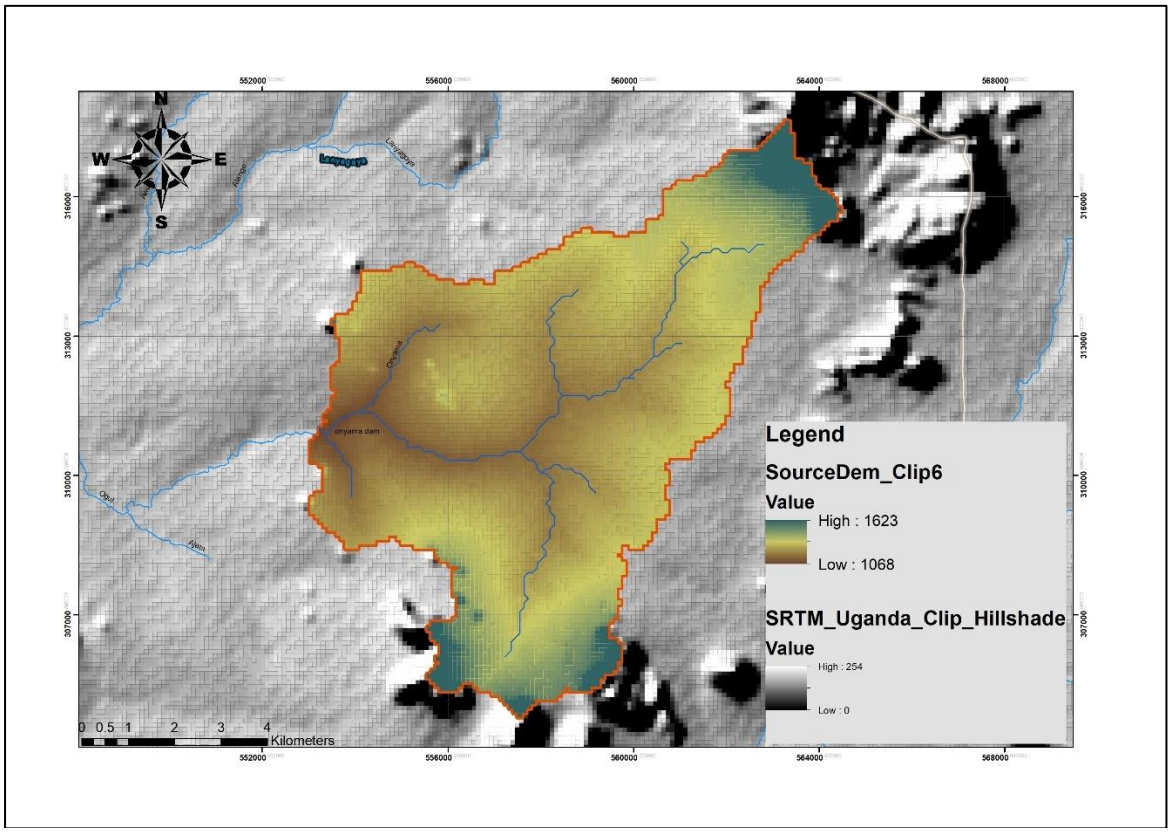
In Agago, the dry season is windy and it is hot and mostly cloudy year-round. Over the course of the year, the temperature typically varies from 65°F to 97°F and is rarely below 62°F or above 101°F.The hot season lasts for 2.5 months, from January 14 to March 31, with an average daily high temperature above *94°F*. The hottest day of the year is *March 1*, with an average high of *97°F* and low of *69°F*. The *cool season* lasts for *2.8 months*, from *June 4* to *August 29*, with an average daily high temperature below *85°F*. The coldest day of the year is *August 5*, with an average low of *65°F* and high of *83°F*. A *wet day* is one with at least *0.04 inches* of liquid or liquid-equivalent precipitation. The chance of wet days in Agago varies significantly throughout the year.

The *drier season* lasts *4.9 months*, from *November 8* to *April 5*. The smallest chance of a wet day is *5%* on *January 15*. Among wet days, the most common form of precipitation throughout the year is *rain alone*, with a peak probability of *53%* on *August 5*. Hence in summary, Agago District experience drier months (of about 7.3 months) compare to wet months with Mean annual rainfall

of 103.61 mm and wettest month having average precipitation of 143.94 mm.

(b) Elevation/Terrain at the project site

Onyama Earth Dam site lies entirely at an elevation range of 1068 – 1623m with the dam being at a minimum elevation of 1068m. The Dam catchment average elevation is 1126.48m with standard deviation of 44.8m at the extreme end/south of the catchment. The difference between the elevation at the dam site and the maximum catchment elevation is 555m and the catchment average slope is 3.2% revealing a fairly flat terrain at the dam site.



Land cover within the project area

The catchment has its outlet at UTM 360N 313065.87, 198426.683m, the catchment has a total area of 69.9km^2. Upon delineation, 17 subbasins were revealed these are presented. Catchment is located within 2^{0}45'30''N, 33^{0}31'0" to 2^{0}51'30''N,33^{0}35'0''E and 2^{0}48'30''N, 33^{0}28'30''E and 2^{0}52'30''N, 33^{0}34'0''E Covers a total area of about 69.9km2; the altitude varies from 1068m a.m. at the outlet to about 1623 m a.m. at the very North-eastern part of the catchment. The average elevation is 1126.48m a.m. with a standard deviation of 44.8m a.m. The catchment is gently slope to flat towards the dam reservoir. The direct distance from the North-eastern to east (outlet of catchment) is about 13.2km whereas the distance from the south to north is approximately 9.7km. The catchment drains subsistence farmlands, grasslands, bushes, woodlands and built-up areas. The wetlands were also observed especially along the river line, which have a major effect on the streamflow regimes in the catchment though the stream recharging the dam is seasonal.

(c) Land use/cover of the project area

Close to the old Dam site, grass land predominates the land use type, further away from the dam site, their existence of trees, shrubs and cultivation land. The land use cover within the Dam catchment is predominantly crop land (covering 16.5% of the catchment area), Grassland (covering 55%), Bush (covering 28% of the catchment area) and woodland cover type with 0.6%. There are relatively small percentages impediments and built-up area of 0.04 and 0.15% respectively.

(d) Soil and geology of the area

The old dam has entirely grey clays and occasionally sandy clays with Majority catchment area having red sandy clay over laterite (often eroded) and shallow skeletal loams often on steep slopes. The catchment lithology is of undifferentiated gneisses having granulite facies rocks in the north.

(e) Hydrogeological condition of the project area

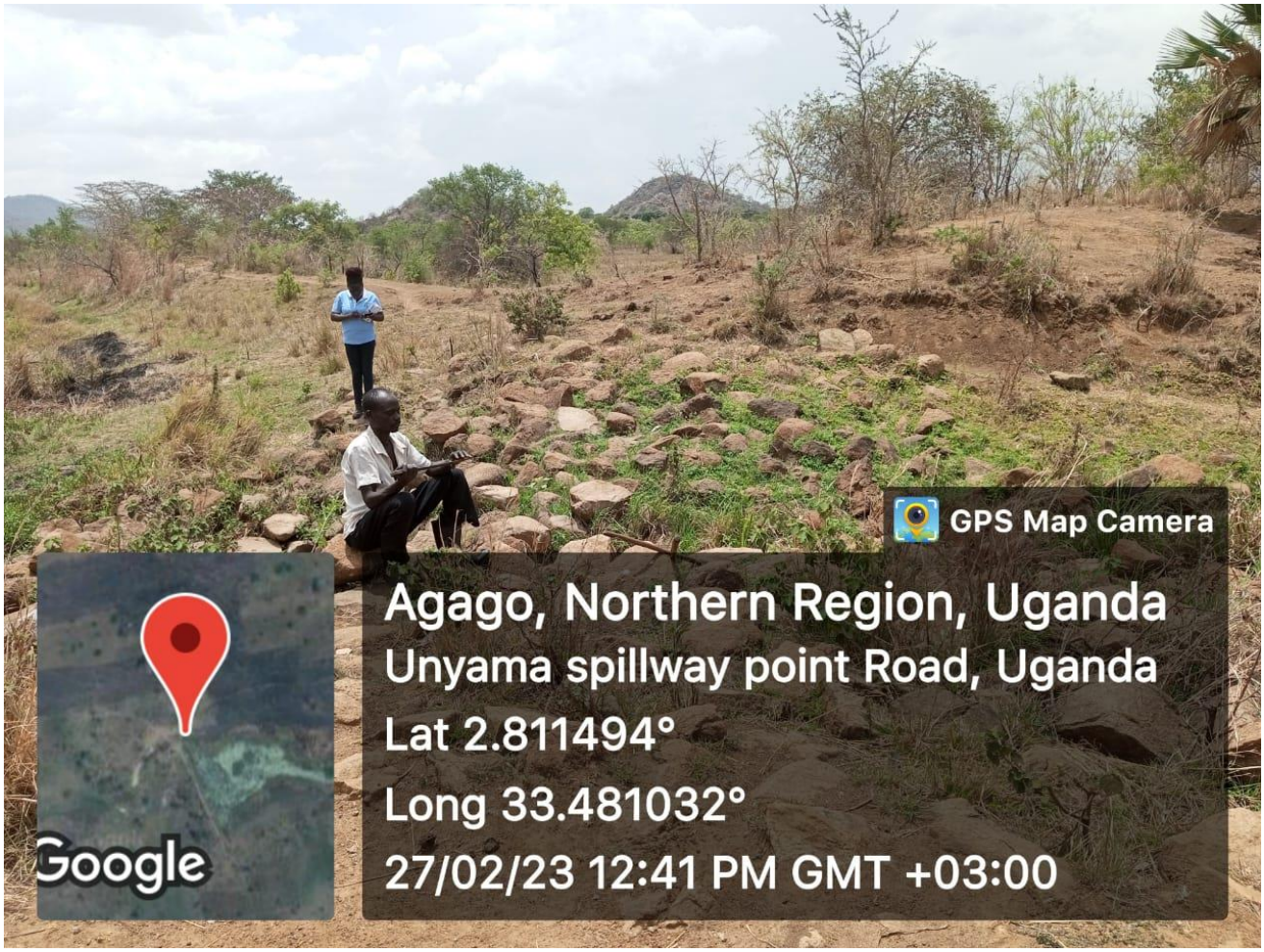
During the visit, the hydrogeological conditions of the project areas were assessed. This included meeting with the local authority and asking questions in line with the hydrogeological setting of the areas. Data on existing boreholes, shallow wells and protected springs for sub counties within the project area were obtained (Both from local Authority and DWD Water supply Atlas) to assess conditions of hydrogeological natures of the project area.

From Table 12 and figure 10 above, it can be clearly seen that the project area is of high ground water potential and good yield since non functionalities of most ground water sources were in relationship to technical breakdown (contributing 50%) other than low yield. However further investigation is required to assess the hydrogeological conditions of the project area using some of the drilled borehole's log to ensure accuracy. This will be done during detail preliminary design phase.

APPROACH TO HYDROLOGICAL ANALYSIS

Field Visits

A site visit was conducted in order to make in-situ observations and assessments. Local conditions were determined and a broad understanding gained of the catchment.



Google location of the Onyama Earth dam

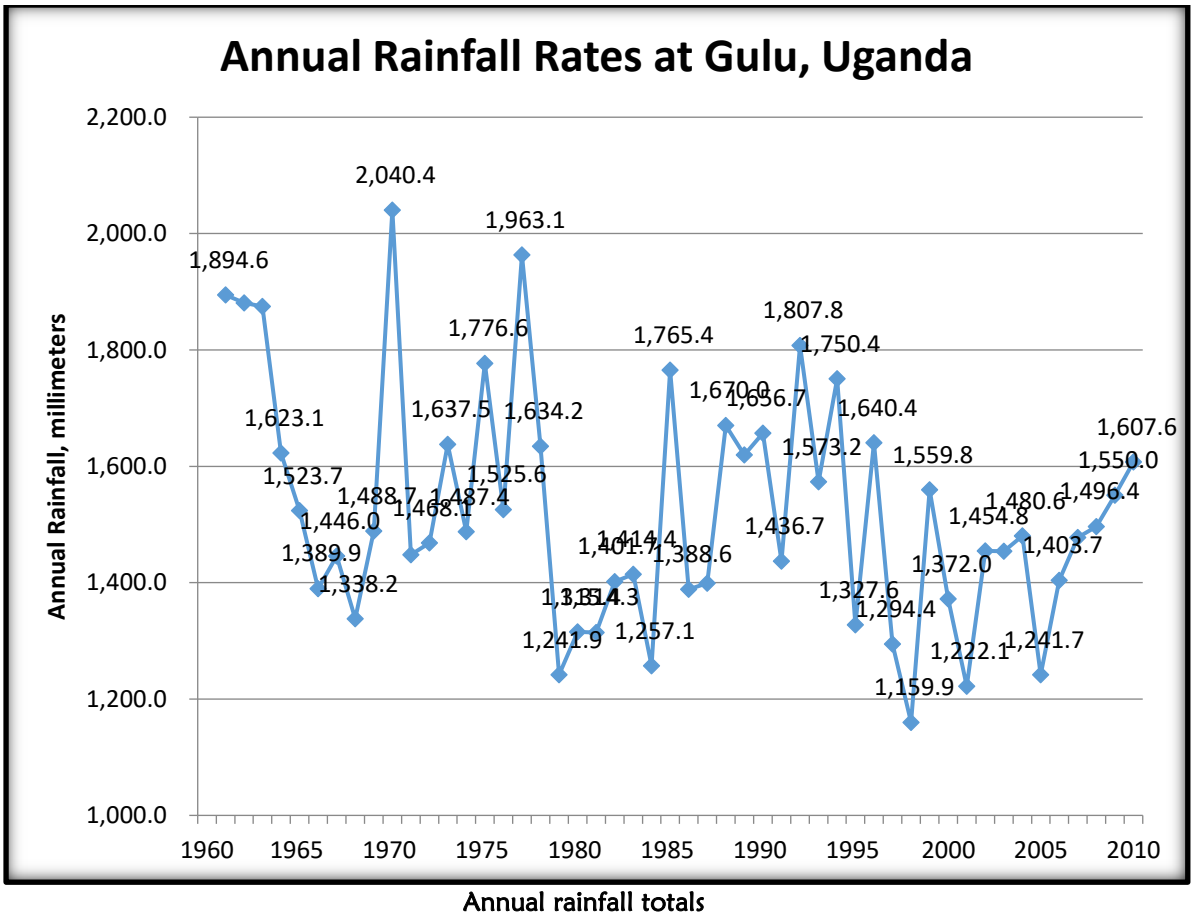
Review of previous project report

Previous reports, which were made available, were reviewed and relevant information utilized.

Rainfall Data Analysis

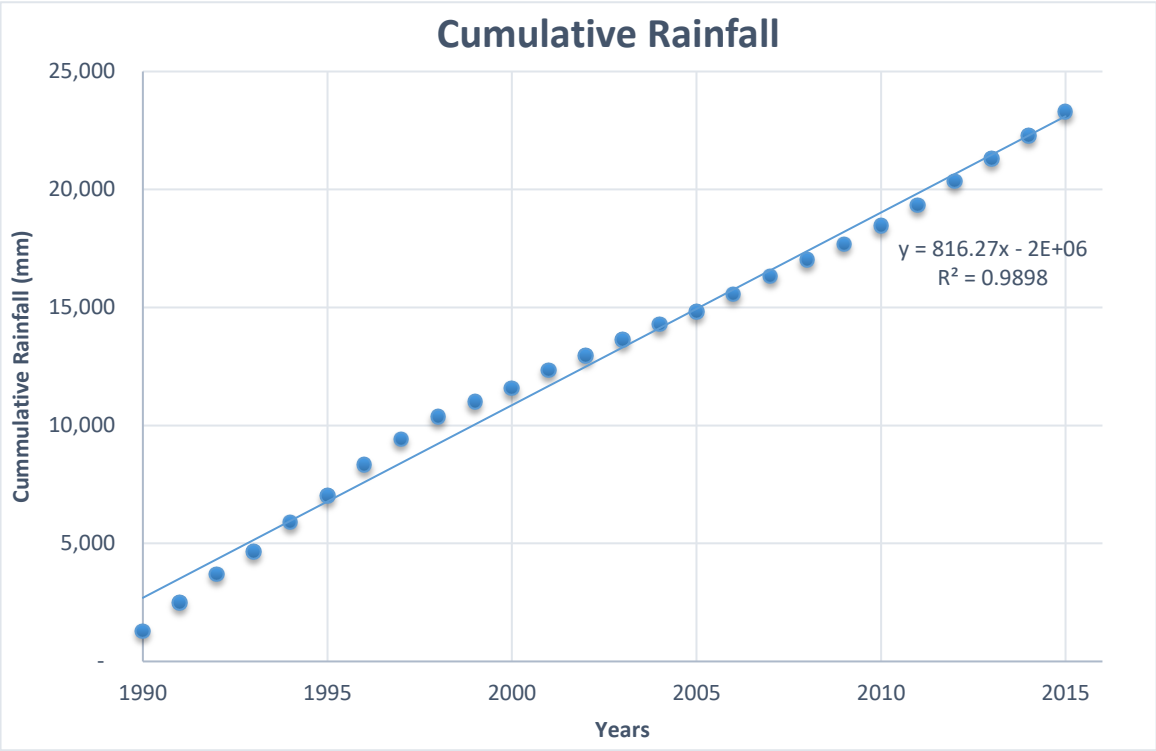
The rainfall data used in analysis was obtained from the Uganda National Meteorological Authority (UNMA). The total rainfall observed in Gulu is plotted for the period 1990 to 2010. The annual rainfall varied between 1159.9mm (year 1999) and 2040.4mm (year 1996).

The annual rainfall data is analysed and the variation in distribution over the area is studied with then statistical parameters. The best fit distribution method is found using various plotting position and probabilistic methods.



Consistency checks /Single Mass Curve

Spearman rank correlation was applied to check to trends within the rainfall time series. The basic data screening approach was intended to test the stability of variance and mean of the rainfall time series. The data may exhibit jumps and trends owing to inconsistency and non-homogeneity.



Single mass curve for rainfall at Gulu

Dependable Catchment yield

The catchment yield for each of the facilities was estimated based on the mean annual rainfall, annual rainfall exceeded 50 and 75% times for the obtained times series for project Districts. The catchment yields also depended upon drainage density, Topography, soil types and land use. The design rainfall is usually assigned to a certain probability of occurrence or exceedance. The catchment areas for each facility were delineated in ArcGIS 10.3 using HEC-GEOHMS interface. The catchment characteristics were derived on the basis of topography, soils and land cover. The catchment yield for the respective facility was directly related to catchment area and was estimated using the Soil Conservation Service Curve Number (SCS-CN) method. The catchments were classified based on the area covered under each catchment.

Due to the inherent nature of the various parameters involved in the processes, the yield is a random variable. A common practice is to assign a dependability value (say 75% dependable yield) to the yield. Thus, 75% dependable annual yield is the value that can be expected to be equalled to or exceeded 75% times was used to assess the catchment yield per site (i.e., on an average 15 times in a span of 20 years). Similarly, 50% dependable yield is the annual yield value that is likely to be equalled or exceeded 50% of times (i.e., on an average 10 times in 20 years).

Average Monthly and annual flow analysis

The SCS-CN method was used to estimate the monthly and annual runoff. The average monthly rainfalls for the period 1990 to 2016 were estimated.

Design Flows

The selection of the probability of exceedance (PX) or return period (TX) for design purposes is related to the damage the excess or the shortage of rainfall may cause, the risk one wants to accept and the lifetime of the project.

Return Period Criteria for Design Purposes

Class of Dam	Minimum Return Period for Design of Spillway (WRM Rules 2007)	Recommended Minimum Return Period for Design of Spillway	Recommended Minimum Return Period for Design of Diversion Works, if required
A (Low Risk)	1 in 50 years	1 in 100 years	1 in 5 years
B (Medium Risk)	1 in 100 years	1 in 100 – 500 years	1 in 10 years
C (High Risk)	1 in 500 years	1 in 1000 years	1 in 15 years

(Source: WRM Rules 2007)

Peak Rainfall Frequency analysis

Annual maximum series was generated by selecting the maximum rainfall for each year from daily rainfall times of 1990 to 2016. The maximum rainfall values for each year were arranged into series then into HEC_SSP and Excel to perform the peak rainfall frequency analysis. Frequency analysis was achieved by fitting the AMS on probability distributions (Normal, Gumbel, Lognormal or Log Pearson Type III distribution onto the datasets). The best fitting distribution was chosen after testing the Goodness of fit. For goodness of fit tests, the Anderson-Darling (AD), the Kolmogorov-Smirnov (KS), and the Chi-Squared tests were used in this report.

(a) Peak Runoff analysis

Estimations of the peak flood are required for spillway design, the dimensions and physical characteristics of which are extremely important. On larger catchments (i.e., greater than 5 - 8 km2) and rivers of a flashy nature, rock spillways are virtually essential. The Hydrologic Engineering Center – Hydrologic Modeling Systems (HEC-HMS) model was set up to develop a series of design flood hydrographs at each facility.

The time of concentration for different sub basins and whole watershed was estimated as a function of length of longest rainfall path, curve number, watershed or sub basin slope. Peak flow from each sub-basin was computed using the SCS-CN method available in HEC-HMS. Sub-basin curve numbers were determined using a weighted average of curve numbers assigned to individual sub-areas of homogeneous land use and soil types. Existing conditions land use data was obtained from GIS maps and aerial photos. Soil types were obtained from shape files based on the FAO classifications.

(b) Sediment analysis

The Garde and Kothyari (1985) formula were used to assess the annual sediment yield at inlet

points for the valley tanks and valley dams. The approach considered the drainage density, average slope, mean annual precipitation, average precipitation for wettest month and ground cover factor. Use of a regional formula by Garde and Kothyari (1985) can support engineering decision making, especially in line with facility operation and maintenance.

In catchments with significant sediment yields the ratio of a dam's capacity to its annual inflow is the most important parameter affecting the siltation rate. A dam that has the capacity to store all of the annual runoff from a catchment (so that no water passes over the spillway) traps all the sediment carried by the runoff from the catchment. When the capacity of the dam is much less, storing say 10% of the annual runoff, the low water velocities in the dam result in it still trapping about 90% of the incoming annual sediment load.

The probability of a dam filling is also related to the variability of annual runoff, measured by the coefficient of variation of annual runoff (the standard deviation divided by the mean) of a long series of annual runoff totals. During the sediment analysis studies, the trapping efficiency was also estimated and ratios of storage capacity to annual inflow developed to assess the probability of dam infilling and dam storage reductions based on the current sedimentation rates

As a selection criterion for new sites, it is recommended that capacity/inflow ratio of less than 0.1 should not be constructed. In catchments supplying significant sediment loads we recommend that the capacity inflow ratio should be larger than 0.1 to ensure a reasonable dam life. A minimum value of 0.3 is suggested.

If trapping efficiencies between 90% and 100% virtually all the sediment entering a small dam will be trapped in it. The loss in a dam's storage volume over time was calculated from the product of the annual sediment yield, the number of years being considered, the catchment area, the dam's sediment trap efficiency and the density of the settled sediment.

FINDINGS

Catchment Water Yield Analysis

Hydro-meteorological

In Agago, the dry season is windy and it is hot and mostly cloudy year-round. Over the course of the year, the temperature typically varies from 65°F to 97°F and is rarely below 62°F or above 101°F.The hot season lasts for 2.5 months, from January 14 to March 31, with an average daily high temperature above 94°F. The hottest day of the year is March 1, with an average high of 97°F and low of 69°F. The cool season lasts for 2.8 months, from June 4 to August 29, with an average daily high temperature below 85°F. The coldest day of the year is August 5, with an average low of 65°F and high of 83°F. A wet day is one with at least 0.04 inches of liquid or liquid-equivalent precipitation. The chance of wet days in Agago varies significantly throughout the year.

The drier season lasts 4.9 months, from November 8 to April 5. The smallest chance of a wet day is 5% on January 15. Among wet days, the most common form of precipitation throughout the year is rain alone, with a peak probability of 53% on August 5. Hence in summary, Agago District experience drier months (of about 7.3 months) compare to wet months with Mean annual rainfall of 103.61 mm and wettest month having average precipitation of 143.94 mm.

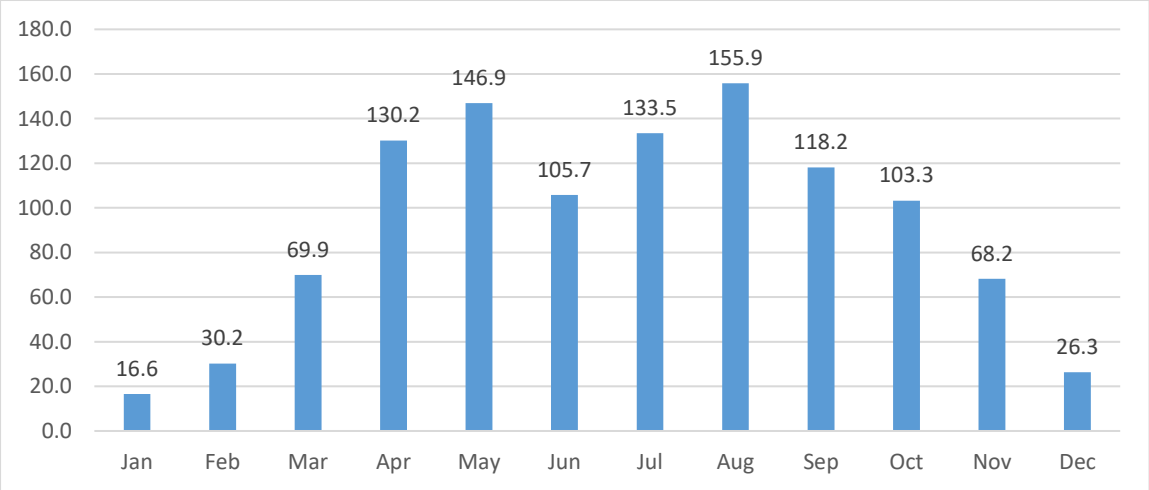
Agago district is endowed with good climatic conditions that favours agricultural activities carried within the district. The district has dry and wet seasons. The wet season extends from April to October with the highest rainfall peak in May and August. The dry season is from November to March.

Monthly Evapotranspiration for Agago

Month	Min Temp	Max Temp	Humidity	Wind	Sun	Rad	ETo
	℃	℃	%	km/day	hours	J/m²/day	mm/day
January	16.2	34.7	49.0	251.0	8.8	21.8	6.4
February	17.7	35.1	48.0	251.0	8.1	21.5	6.6
March	18.7	34.0	56.0	251.0	7.9	21.8	6.3
April	18.8	31.6	67.0	233.0	7.2	20.4	5.2
May	18.2	30.5	74.0	216.0	7.8	20.4	4.7
June	17.7	29.7	75.0	199.0	7.9	20.0	4.5
July	17.1	28.7	77.0	199.0	6.6	18.2	4.0
August	16.8	29.0	77.0	216.0	7.0	19.7	4.3
September	16.6	30.5	74.0	216.0	7.7	21.3	4.8
October	16.1	31.7	70.0	233.0	7.8	21.1	5.1
November	15.7	32.6	64.0	268.0	7.9	20.6	5.5
December	15.8	32.5	58.0	251.0	8.0	20.1	5.5
Average	**17.1**	**31.7**	**66.0**	**232.0**	**7.7**	**20.6**	**5.3**

Mean Monthly Rainfall

Agago district is endowed with good climatic conditions that favours agricultural activities carried within the district. The district has dry and wet seasons. The wet season extends from April to October with the highest rainfall peak in May and August. The dry season is from November to March.

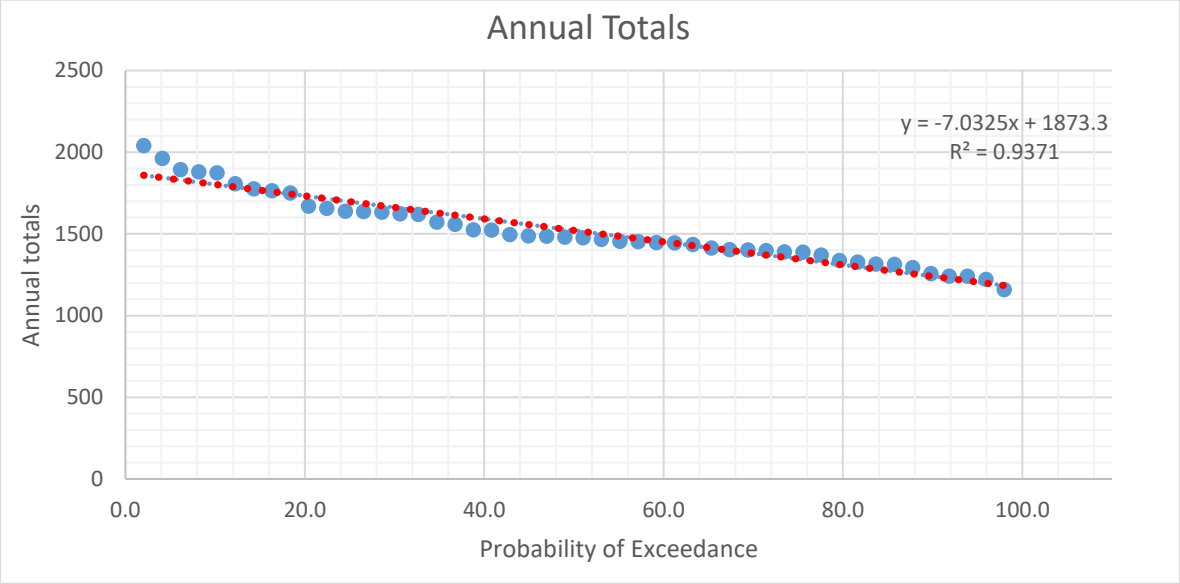


Mean monthly totals

Annual Rainfall Totals

Uganda's rainfall exhibits considerable spatial and temporal variability (500 to 2600 mm/year) partly due to the complex topography, the existence of large inland lakes such as Lake Victoria and Kyoga, and the seasonal migration of the Inter-Tropical Convergence Zone. The average rainfall in Uganda is about 1180mm/yr

A rather simple, graphical method was used to determine the probability or frequency of occurrence of yearly mean rainfall. The aggregated annual totals were ranked and probabilities of exceedance calculated using the Weibull plotting position. The ranked observations then plotted against their probabilities of Exceedance



Frequency analysis of annual totals

The mean, 50% and 75% probabilities of exceedances of annual rainfall are considered as the design rainfall for catchment yield analysis. The model fitted onto the ranked annual rainfall totals slightly under estimates the 50% and 75% exceeded annual values though chi-square test reveals no significant difference. Thus, for this study the computed values were adopted for estimation of catchment yield for Onyama Dam. The percentage of draft are taken between 60% and 80% for the estimation of reservoir capacity.

Annual rainfall exceeded at different times

Probability of Exceedance	Annual Rainfall Totals
10	1803
20	1733
30	1662
40	1592
50	1463
60	1451
75	972
80	809

Estimation of catchment yield

The catchment yield per sub-Catchment of dam site was estimated based on the mean annual rainfall for project area. The catchment area for the facility was delineated in ArcGIS. The catchment characteristic was derived based on topography, soils and land cover as indicated in Table 3. The catchment yield for facility was directly related to catchment area and was estimated using the SCS method.

The Annual runoff yield of the Dam site location catchments at 20% Exceedance, 50% Exceedance and 80% exceedance are 62,586,905.5 m^3, 36,524,785.1 m^3 and 14,169,551.5 m^3 respectively. The catchment has no runoffs during the dry spell scenarios of 80% probability of exceedance except in months of January and February, considering the Wet and normal rainfall exceedance scenarios, the catchment has runoffs in whole twelve months. The high runoffs in the catchment can be attributed to the high catchment curve numbers in the catchment with giving the composite catchment curve number is 75. the catchment experiences its peak runoffs for dry year scenario (80% probability of exceedance) in (3,312,788.4 m^3). Table 5 4 shows monthly runoff yields for Onyama Dam catchment.

Annual runoff of Onyama Catchment

Months	Runoff Volume m^3		
	20% Run-off, Catchment Yield Q (m^3)	50% Run-off, Catchment Yield Q (m^3)	80% Run-off, Catchment Yield Q (m^3)
Jan	484,144.9	-	-
Feb	1,251,419.4	-	-
Mar	3,737,000.2	1,024,070.4	-
Apr	7,661,237.5	3,312,788.4	725,088.7
May	8,755,318.2	6,044,082.6	3,312,788.4
Jun	6,061,686.6	5,014,655.3	1,654,083.3
Jul	7,875,319.1	6,387,861.6	2,308,721.3
Aug	9,344,307.3	6,044,082.6	2,976,247.2
Sep	6,872,454.6	3,650,839.2	1,654,083.3
Oct	5,900,028.9	3,990,760.4	1,334,943.7
Nov	3,625,134.6	1,024,070.4	203,595.6
Dec	1,018,854.1	31,574.2	-
Total	**62,586,905.5**	**36,524,785.1**	**14,169,551.5**

Peak Rainfall Frequency Analysis

Design Storms

Annual maximum daily precipitation data for the project area for time period 1998 to 2014 were obtained from NASA weather satellite. The annual maximum daily precipitation was extracted and subjected to frequency analysis using the Extreme Value Type 1 (EV1, also known as Gumbel distribution method) and Log Pearson Type III method. The Gumbel and LPT III distribution method was used to estimate rainfall depth for the 2-year, 5-year, 10-year, 25 year and 50-year return period.

Summary of peak flows for all probability distributions

Distribution Type	Design Storm (mm) for given Return Period							
	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
Gumbel Distribution (EV I)	42.2	54.6	64.1	73.5	86.0	95.4	104.8	117.3
Log Pearson Type III (LPT III)	45.0	57.0	64.3	70.8	78.7	84.4	89.9	96.8
Log-Normal Distribution	44.7	56.9	64.6	71.7	80.7	87.3	93.8	102.3

Log Pearson Type III Distribution gave intermediate values thus was considered for design storm for proceeding simulation of peak flows for spillway design.

Estimated curves based on Log Pearson Type III Distribution

Percent Chance Exceedance	Computed Curve Flow	Confidence Limits	
		0.05	0.95
0.2	96.8	148.5	78.7
0.5	89.9	128.4	75.4
1	84.4	114.5	72.5
2	78.7	101.7	69
5	70.8	85.7	63.3
10	64.3	74.4	58
20	57	63.8	51.7
50	45	49.7	40.8
80	35.2	39	30.9
90	30.8	34.4	25.9
95	27.5	31.2	21.7
99	22.1	26.3	14.5

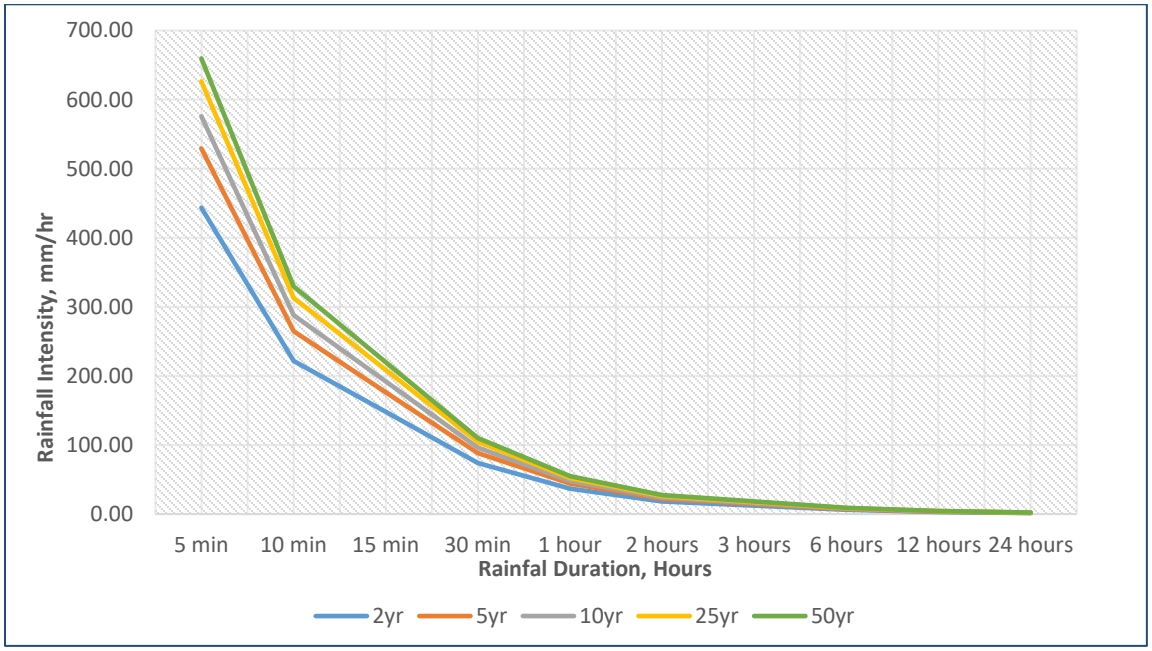
Intensity Duration Frequency Curves

Preliminary Intensity duration frequency (IDF) curves describing how rainfall intensities changes with storm duration were developed for the project area. Short storm durations typically have higher rainfall intensities with longer durations. The Adamson (1981) and Bell (1969) methods were applied for development of the IDF curves. Figure 8 and 9 shows their corresponding IDF curves for the project area. The probability distribution methods used to generate the IDF of the project area will be subjected to the goodness of fit test using the Chi-square test (to determine the

appropriate distribution for the project area). rainfall intensities at 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 3 hours, 6 hours, 12 hours and 24 hours for each return period were calculated. This will be done during the detail preliminary design phase. Table 2 shows the preliminary design storm generated for the project area using Gumbel distribution and LPT III

Rainfall intensities for peaks of different return periods based on LPT III

Return Periods (yrs)	2	5	10	20	50
5 Mins	546.6	685.8	764.2	851.1	909.5
6 Mins	273.3	342.9	382.1	425.6	454.7
10 mins	182.2	228.6	254.7	283.7	303.2
20 Mins	91.1	114.3	127.4	141.9	151.6
30 Mins	45.6	57.2	63.7	70.9	75.8
1 Hour	22.8	28.6	31.8	35.5	37.9
2 Hours	15.2	19.1	21.2	23.6	25.3
3 Hours	7.6	9.5	10.6	11.8	12.6
6 hours	3.8	4.8	5.3	5.9	6.3
12 Hours	1.9	2.4	2.7	3.0	3.2
24 Hours	546.6	685.8	764.2	851.1	909.5

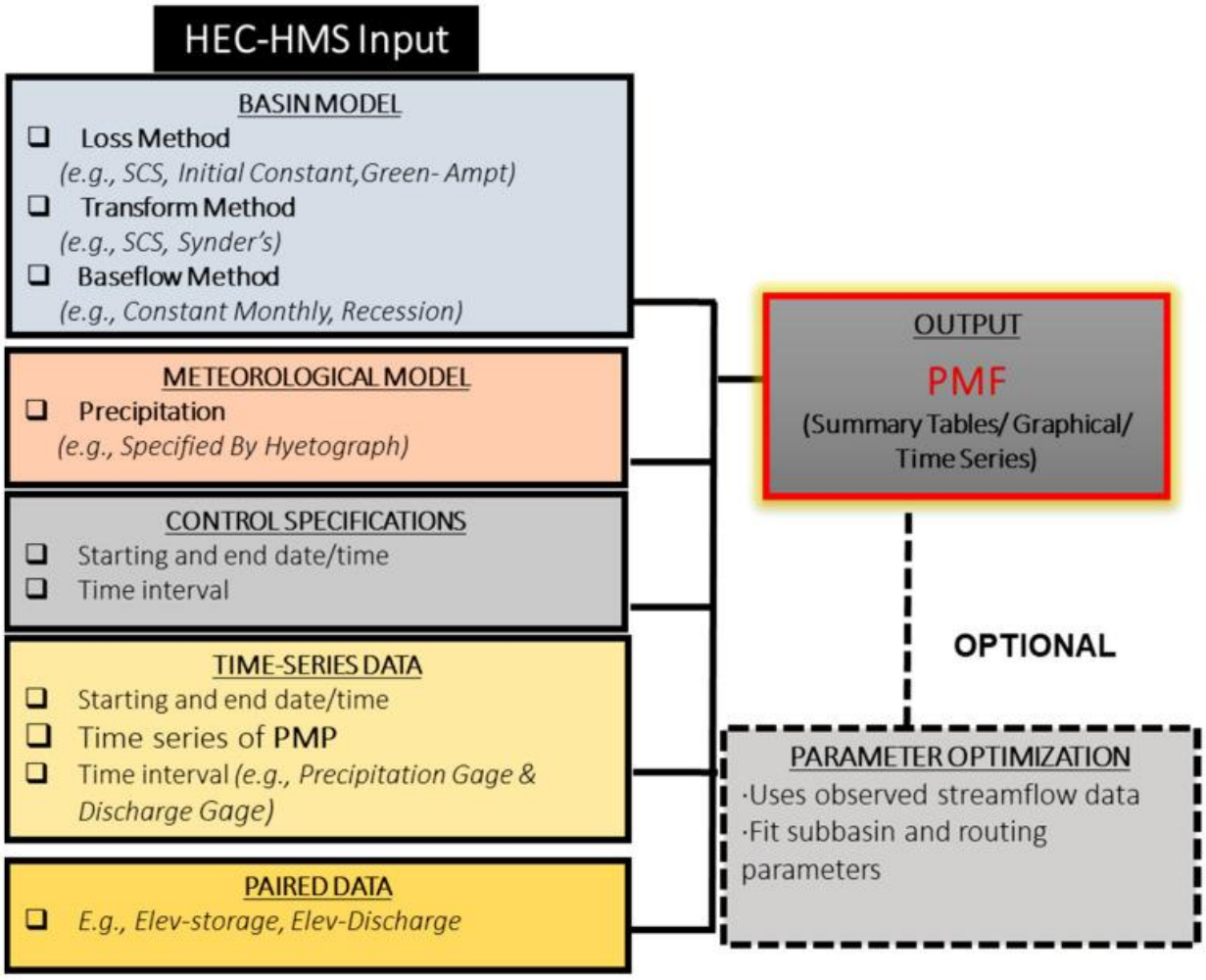


IDF Based on Log Pearson Type III distribution estimated peak rainfall

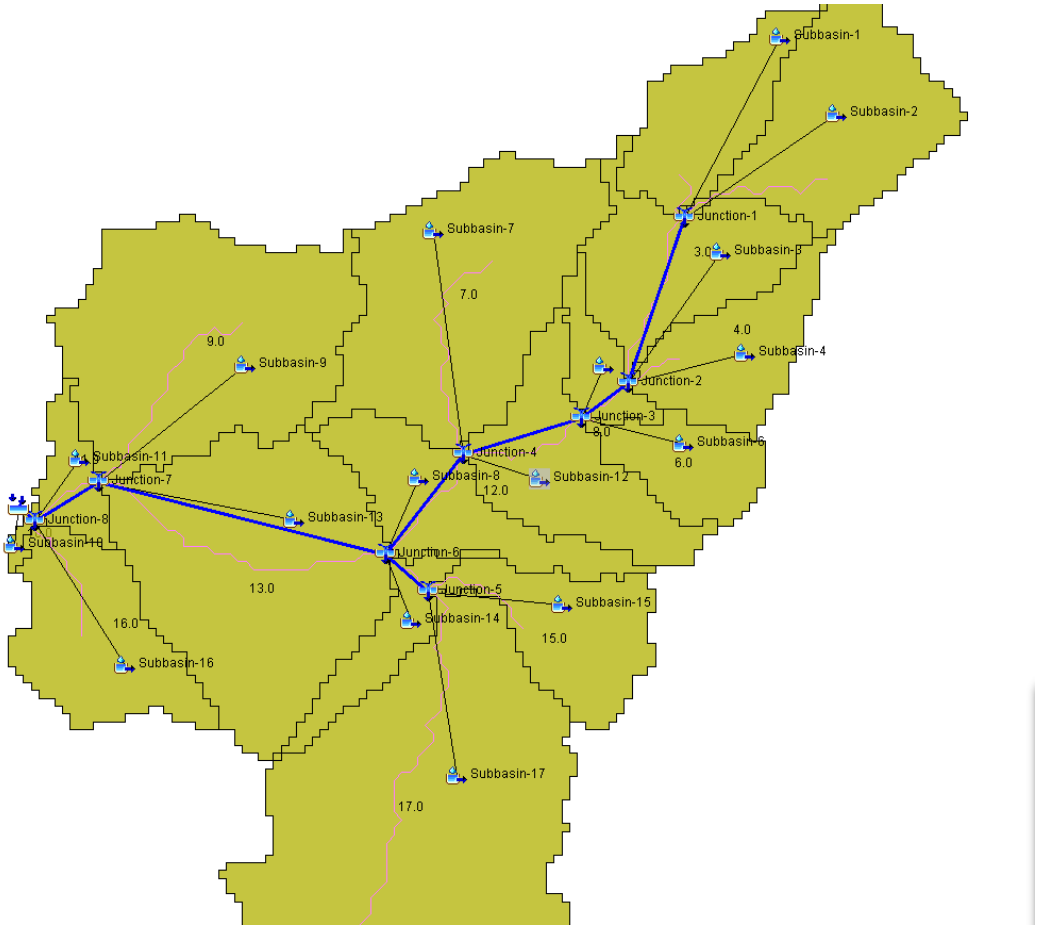
Derivation of Peak Flow rates and Volume

The peak discharges at the outlet were generated for the various design storm generated by gumbel distribution method and LPT III methods for differed return period. The rainfall runoff model (HEC-HMS) peak flow estimates for the catchment are represented in. SCS-Unit Hydrograph () and SCS (**Error! Reference source not found.**) Methods were too used to generate the peak flow at the inlet point to the dam to ensure confidentiality in the HEC-HMS methods.

The flood that could be predicted from the most acute combination of adverse meteorological and hydrologic circumstances is known as the PMF. For this study he PMF is produced using the probable maximum precipitation (PMP) input data.



Estimations of the peak flood are required for spillway design, the dimensions and physical characteristics of which are extremely important. Hydrologic routing employs the continuity equation and an analytical or an empirical relationship between storage within a routing reach and discharges at the end (USACE, 1994). On larger catchments (i.e., greater than 5 - 8 km^2) and rivers of a flashy nature, rock spillways are virtually essential. The Hydrologic Engineering Centre – Hydrologic Modelling Systems (HEC-HMS) model was set up to develop a series of design flood hydrographs at each facility.

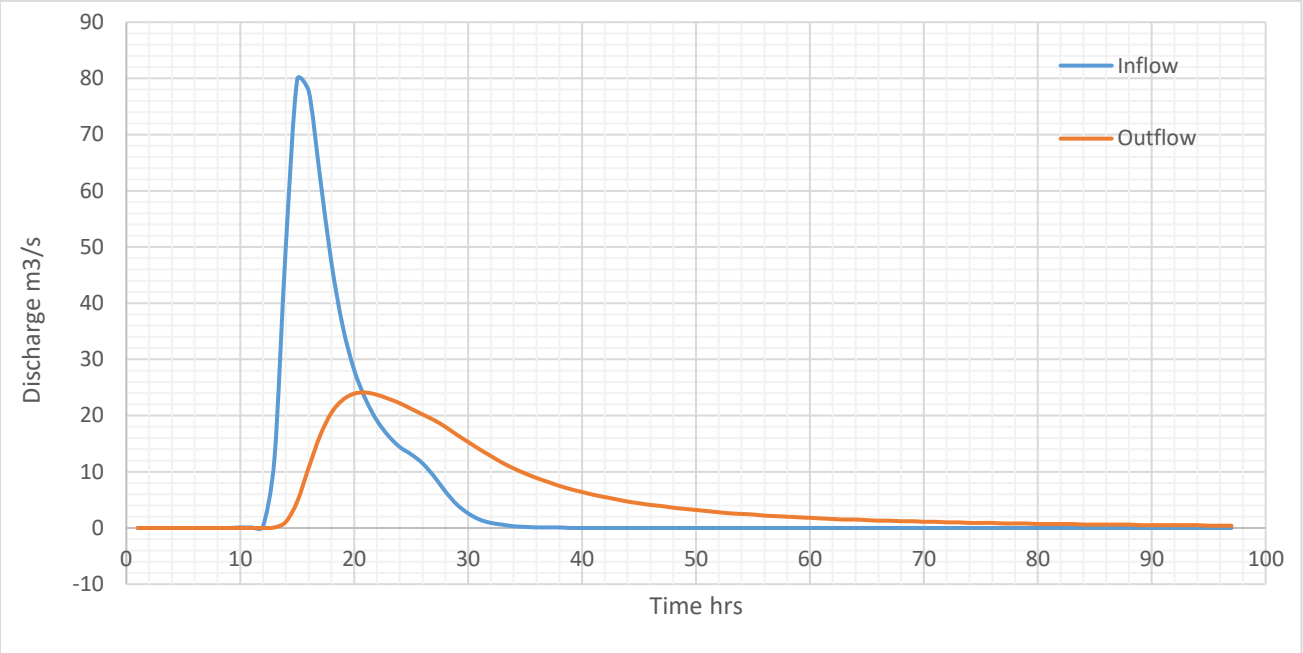


For the HEC-HMS simulation, the required data are hydrological data, rainfall data, details of the dam, elevation-storage curve, and elevation-discharge curve. This model consists of several inputs such as basin model, meteorological model, control specification, time series data, and paired data as shown. The time of concentration for different sub-basins and whole watershed was estimated as a function of the length of the longest rainfall path, curve number, watershed or sub-basin slope. The simulation was made with initial reservoir storage of 3,416,225.52m^3 with 20m width spillway at an elevation 1080.

Estimated peak flow rates and volumes at Onyama Dam with HECHMS

Subbasin	Area	Slope %	Channel slope%	CN	longest flow path	Lhr	Tc(hr)	L(min)	Lat	Longitude	Elev	ElevMin	ElevMax
1	2.74	3.66	10.83	80.8	14,932	1.41	2.35	84.4	2.857	33.55	1153.0	1119	1623
2	4.75	14.83	4.49	77.3	14,532	0.76	1.27	45.8	2.856	33.57	1211.1	1120	1613
3	3.54	1.86	1.00	79.6	13,058	1.84	3.07	110.5	2.841	33.55	1125.9	1105	1146
4	2.61	1.71	1.15	79.1	11,975	1.82	3.03	109.2	2.831	33.56	1125.2	1105	1148
5	1.03	1.74	1.02	79.0	8,397	1.36	2.27	81.7	2.830	33.54	1111.7	1100	1129
6	1.82	1.76	1.15	79.0	8,534	1.37	2.29	82.5	2.819	33.55	1120.4	1099	1136
7	7.26	1.57	0.91	80.0	16,268	2.36	3.93	141.6	2.837	33.53	1115.5	1093	1139
8	3.51	1.64	0.87	79.0	12,091	1.88	3.13	112.7	2.819	33.54	1109.3	1092	1128
9	8.11	2.66	1.04	82.8	16,068	1.64	2.73	98.4	2.832	33.50	1107.5	1074	1182
10	0.16	2.45	2.75	92.9	2,389	0.25	0.42	15.1	2.811	33.48	1077.2	1068	1088
11	1.00	2.80	1.96	88.1	6,377	0.63	1.05	38.0	2.818	33.48	1083.6	1068	1109
12	3.02	1.79	0.98	80.3	12,764	1.81	3.01	108.5	2.815	33.52	1104.2	1087	1129
13	8.61	3.07	1.40	82.6	17,593	1.65	2.75	99.2	2.807	33.50	1104.5	1072	1166
14	1.41	2.18	2.13	81.0	11,071	1.43	2.38	85.7	2.800	33.52	1109.7	1087	1162
15	2.80	1.45	1.00	79.3	11,175	1.86	3.10	111.5	2.801	33.54	1116.8	1092	1128
16	3.55	2.88	2.09	86.9	12,396	1.11	1.85	66.6	2.800	33.49	1101.5	1071	1142
17	14.01	6.28	3.80	75.5	22,203	1.74	2.89	104.1	2.780	33.52	1147.8	1092	1375

Return Period	Peak inflow (m^3/s)	Peak inflow Volume ($1000m^3$)	Peak Discharge (m^3/s)	Discharge Volume ($1000m^3$)	Peak Storage ($1000m^3$)	Peak Elevation (m)
10yr	65.0	1107.5	12.1	1045.0	4086.5	1080.5
20yr	82.0	1347.9	15.8	1282.6	4216.8	1080.5
50yr	82.0	1347.9	15.8	1282.6	4216.8	1080.5
100yr	120.5	1887.3	25.1	1817.6	4503.9	1080.7
200yr	136.8	2115.9	29.3	2044.7	4623.8	1080.8



Sediment yield analysis

Garde and Kothyari (1985) formula was used to assess the annual sediment yield at inlet points for the Dam. The approach considered the drainage density, average slope, mean annual precipitation, average precipitation for wettest month and ground cover factor. A regional formula by Garde and Kothyari (1985) can support engineering decision making. **Error! Reference source not found.** shows the catchment mean sediment yield.

Parameters for estimation of sediment yield for Onyama Catchment

Name of the facility	Catchment area, A (sq.km)	Drainage Density, D (km/sq.km)	Catchment Average Slope m/m	Mean Annual Precipitation, P (cm)	Average Precipitation for Wettest month, Pmax (cm)
Onyama	66.3	978.77	0.0320	110.48	14.692

Estimated sediment yield for Onyama Catchment

Arable land Area, A (sq.km)	Grass land Area, Ag (sq.km)	Forested Area, Af (sq.km)	Waste land Area, Aw (sq.km)	Ground Cover factor, Fe	Mean Sediment Yield (ton/sq.km/ year)	Mean Sediment Yield (ton/year)	Mean Sediment Yield (m^3/year)
11.6	57.9	0.4	0.0	0.631	2,340	155,140	43,095

The determination of Sediment delivery ratio (SDR) is necessary to predict sediment yield at the outlet of catchment. Williams (1977) found the sediment delivery ratio to be correlated with drainage area, relief–length ratio, and runoff curve numbers. The model is expressed as follows:

$$SDR = 1.366 \times 10^{-11}(DA)\ )^{-0.0998} ZL^{0.3629}[CN]^{5.444}$$

Where DA= Drainage area in km2, ZL=the relief length ratio in m/km; CN=the long-term average SCS curve number.

Name of the facility	Elev Min	Elev Max	Length	ZL	CN	SDR
Onyama Dam	1068	1623.0	26852.2	0.021	80	0.042286

The average mean sediment yield of the Onyama Dam catchment is 43,095 m^3/year and the total sediment delivered at the catchment dam reservoir is 805.4m3/year. the catchment has an average sediment delivery ratio of 0.04935 This implies that out of the total soils eroded within the sub-catchment, only 4.9%. of it is delivered or stored at the dam reservoir. The higher the sediment delivery ratio in the catchment, the higher the soil loss within the catchment. Table 5 12 and Table 5 13 below are a summary of the catchment parameters that were used to calculate the sediment yield.

Mean Sediment Yield (m^3/year)	Delivered Sediment (m^3/year)	Specific sediment yield (m^3/km^2/year)
43,095	2,127	32

Reservoir Trap efficiency

As the reservoir Volume Increases the Trapping efficiency Increases. Dams in catchments with a large annual runoff in comparison to their storage volume will have rapid siltation rates and will

require large costly Spillways. Lower Limit on the Ratio between Dam Capacity to Annual Flow of 0.1 is recommended for small dams. In Catchments where significant sediment yields are anticipated dams with a capacity to inflow ratio of less than 0.3 is not recommended. In highly degraded catchments, where large sediment yield is expected, a larger ratio at least 0.5 is recommended.

Reservoir trapping efficiency

Dam Height	Storage Capacity (m^3)	Storage/ Annual Inflow Ratio	Brown Trap Efficiency	Brune's Trap Efficiency	Gill Method
1070	10,000	0%	0%	11%	9%
1075	532,180	6%	76%	91%	82%
1080	3,416,226	39%	97%	99%	95%
1085	10,839,002	123%	99%	100%	97%
1090	26,495,896	300%	100%	100%	98%
1095	56,332,793	638%	100%	100%	98%
1100	104,950,194	1189%	100%	100%	98%

Probability of Dam infilling & Dam Storage Loss and Design Life

The probability of a dam filling was related to the variability of annual runoff, measured by the coefficient of variation of annual runoff (the standard deviation divided by the mean), of a long series of annual runoff totals. When the dam capacity is much less, storing say 10% of the annual runoff, the low water velocities in the dam result in it still trapping about 90% of the incoming annual sediment loads.

Reservoir probabilities of filling due to siltation

Elevation	Storage Capacity(m3)	Storage/ Annual Inflow Ratio	Proportion of Original Dam Capacity Left-50yrs	Proportion of Original Dam Capacity Left-30yrs	Proportion of Original Dam Capacity Left-25yrs
1070	10,000	0.008	41%	65%	70%
1075	532,180	0.411	98%	99%	99%
1080	3,416,226	2.636	100%	100%	100%
1085	10,839,002	8.364	100%	100%	100%
1090	26,495,896	20.445	100%	100%	100%
1095	56,332,793	43.468	100%	100%	100%
1100	104,950,194	80.983	100%	100%	100%

Annex IX: COST VALUATION OF THE PROJECT.

Annex X: 30% PAYMENT PROOF FOR THE REVIEW FEES

Annex XI: STAKEHOLDER ENGAGEMENT PLAN (SEP)

MINISTRY OF WATER AND ENVIRONMENT

URBAN WATER SUPPLY AND SEWERAGE SERVICES DEPARTMENT

WATER SUPPLY AND SANITATION PROGRAM-PHASE III (WSSPIII)

SOCIAL/COMMUNITY ENGAGEMENT PLAN FOR ONYAMA EARTH DAM IN AGAGO DISTRICT

SN	MAJOR ACTIVITY	SUB ACTIVITY	PURPOSE OF ACTIVITY
PRE -CONSTRUCTION PHASE			
1	Securing commitment:	Signing of Memoranda of Understanding (MOU)between MWE and Local Government	To establish a general framework for cooperation and participation.
2	Project advocacy meeting	The advocacy is done at the district, town council and sub-county levels	To disseminate planned project to local leaders and to secure support for the project.
3	Stakeholder sensitisation meeting and design presentation	This is the meeting that targets a cross section of town residents and local leaders. This includes Institutions, councillors, hotel owners, opinion leaders (Everyone in the project beneficially community in general is invited using a sample of different categories of the community)	-To create awareness about the water supply and sanitation project and to highlight the obligations of the community to a wider audience. -To form a gender sensitive Water and Sanitation Committee (WSC).
4	Conduct socio-economic baseline survey	The social-economic baseline survey is conducted to generate data on community, its livelihood, The tools are developed and examined reports are Compiled and Disseminated to the community	- It helps to create the foundation upon which to gauge progress and to evaluate the impact at the end of the project.
5	Land acquisition	-done together with the local governments and is aimed at identifying land owners. -Sign consent forms with land owners -engagement of a registered surveyor -Invite the Chief government values to value the land and other livelihood (present is the land owner and MWE, LG staff Local council one presentative) -Get the details of land owners (National identity card and bank account).	To secure land for all infrastructural developments of the Earth dam project including land for the water source, office, and sanitation facilities.

SN	MAJOR ACTIVITY	SUB ACTIVITY	PURPOSE OF ACTIVITY
		-compile and submitted to MWE for payment -for Government land inform the local government to Cause the meeting to get a council resolution that gives the land for the project use.	
6	Acquiring all wayleaves	-Sensitize the community and land owners along these lines to allow trenching on their property. - identify the affected property/crop owners and verify all destroyed crops/properties/ structures in a transparent manner to avoid wrangles. Engage the District production officer and apply the district compensation rates. Most of the transmission and distribution lines will utilise the road reserves, however, there are cases where the lines will be laid on private property.	To implement a conflict sensitive project and to ensure every smooth implementation of the project
CONSTRUCTION PHASE			
	Site Handover	Invite the district leadership both technical and political. Visit the sites where major components will be installed Sign site handover certificate	• Officially introduce the contractor, consultant and contract management team to the leadership and some community members. • Confirm availability and access of all sites before commencement notice. • Provide information on project components. • Explain the communication channels during implementation.
7	Ground breaking ceremony	-Invite and mobilize the political leadership of the Ministry of Water and Environment, Area members of parliament, and district leadership -There is need to secure necessary event items such as, chairs, public address system, band -School children are also part of the day's event.). -There is also need for meals and refreshments to keep the community energised since the function lasts more than five hours. -It should take place in a field/large compound such as playground or a commonly used ground for similar events	-Great opportunity to share how the project will positively impact on the community -To Flag off the consultant and the contractor -Mobilize and organize to launch the commencement of the construction activities

SN	MAJOR ACTIVITY	SUB ACTIVITY	PURPOSE OF ACTIVITY
8	Conducting trainings	Training of a gender sensitive Water and Sanitation Committee on their roles and responsibilities.	To ensure that the committees are well versed with their roles and responsibility to effectively and efficiently execute their tasks.
		Training of the grievance redress mechanism committee	To ensure that all grievances are handled and responded to in time
		HIV/AIDS This is done for both the contractor's staff and the entire community	To create awareness about the killer disease to avoid transmission in the communities.
		Gender Mainstreaming	To ensure that both men and women, boys and girls, the disabled are involved in the project activities
		Sanitation and Hygiene	To educate the community on the approaches to avoid water related disease by observing TOTAL sanitation.
		COVID 19/ Epidemic awareness raising and another pandemic that might arise in the region such as Ebola.	To educate the community about the SOP and the dangers associated with pandemic disease
		Nutrition mainstreaming	-To highlight the challenges of malnutrition in Uganda -To sensitize the communities about the MWE contribution to nutrition.
		Skills development for women and youth	To Empower the community to do income generating activities.
		Climate change/disaster management	To educate the community about the challenges and the mitigation measures of climate change in Uganda.
		Training on environment and social safeguards	To Equip the local leaders, WUS and community on benefit of observing the

SN	MAJOR ACTIVITY	SUB ACTIVITY	PURPOSE OF ACTIVITY
			environment and social safeguard.
		Water integrity	To foster fairness, honesty and mutual trust between project owners, contractor and community.
	Monthly site meetings	Courtesy call to District, Sub County/Town Leadership Site inspection Review of previous meeting minutes Site Meeting	• Carry out joint monitoring of progress of works. • Keep track of progress to enable communication and preparation of subsequent activities like mobilization for connections, handover, O&M meetings • Handle any issues that may crop up regarding implementation • To respond to the various queries raised by the stakeholders in the respective project towns.
9	Mobilize for new connections	-Sensitise the community on conditions and procedures for connection -Ensure forms are distributed free of charge, -This activity involves working with the construction team to visit each applicant to evaluate technical viability. -The list of verified applicants should be widely publicized. The successful applicants shall be given ample time within which to pay the connection fees.	To sensitize the community on connection procedure and ensure the good number of communities connect to the water supply system
10	Tariff setting	-Training on business plan -Training on water supply management	To educate the community the reason why they should pay for water.
11	Pro-poor mapping	- Meeting with community members to map out the poor community who are concentrated in trading centres -verification of the areas identified	To ensure that all communities especially the poor also benefit from the earth dam.

SN	MAJOR ACTIVITY	SUB ACTIVITY	PURPOSE OF ACTIVITY
12	Project hand over	-Mobilise and organise the community for project handover. (Technical and political commissioning)	The sole purpose is to give accountability to stakeholders and to get their views on any issues that may require attention during the defect's liability period.
POST CONSTRUCTION PHASE			
13	Gazetting of the water supply area	Conducting Pre-gazetting meeting (sensitising about the principles of the water Act)	To prepare and educate the community on the management MWE structure
14	Operation and Maintenance (O&M) training	-Training the community on operation and maintenance of the supply system. -economic management of water supply system Training of institutions (schools) on O&M for sanitation facilities.	-To educate the community on the economic way of using water -To educate the community on the efficient and effective ways of using water e.g. (leakages before and after the meter).
15	End of Implementation survey	This survey shall take place two months after construction completion when consumers are using the water	-To measure the degree and quality of change during the project implementation. -To document the reasons learnt and best practices
	Training on E&S monitoring and reporting	Training of staff of the System Operator, District officials and some Ministry of Water and environment on issues of Environment and Social Monitoring and reporting	To document the requirements of the E&S monitoring and Reporting