The Republic of Uganda
Ministry of Water and Environment
In Financial Cooperation with

African Water Facility
Facilité africaine de l'eau
Mobilising Resources for Water in Africa
Mobiliser des ressources pour l'eau en Afrique

ENVIRONMENTAL SOCIAL IMPACT STATEMENT

FOR THE PROPOSED FAECAL SLUDGE MANAGEMENT FACILITY IN KAKUBANSIRI CELL, BUTININIDI WARD, KAWOLO DIVISION, LUGAZI MUNICIPALITY, BUIKWE DISTRICT

Prepared by:

STUDIO GALLI INGEGNERIA

Sustainable engineering for people and the environment

95 ANNIVERSARY 1920 - 2015

September 2022

ESIA TEAM

The ESIA team consisted of the following specialists.

Name	Qualifications	Role on Project Team	Signature
Mr Oluka Moses **CC/EIA/105/23**	BURP, MSc, CEP	EIA Team Leader / Environmentalist	
Ms Rasheedah Agero **CC/EIA/271/23**	BSc, CEP	Environmentalist	
Contributing Experts			
Ms Kasande Glorious	BA, MA	Sociologist	
Mr Musitwa Paul	BSc, MSc	Occupational Health and Safety Specialist/Pollution Expert	
Mr Dominic Kazooba	BURP	Land use	
Eng. Dan Otwane	BSc, MSc	Water and Sanitation	

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ABBREVIATIONS AND ACRONYMS

CCS	Carbon Capture and Storage
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO2	Carbon-dioxide
DWD	Directorate of Water Development
E&S	Environment and Safety
EA	Environmental Assessment
EH&S	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
ESIS	Environmental and Social Impact Statement
ESMMP	Environmental Social Management and Monitoring Program
CCS	Carbon Capture and Storage
IFC	International Finance Corporation
GIPA	Greater Involvement of People living with AIDS
PAPs	Potentially Affected Persons
NWSC	National Water and Sewerage Corporation
NEMA	National Environment Management Authority
NEA	National Environment Act
MoWE	Ministry of Water and Environment
M	Metres
Km	Kilometres
FSTP	Faecal Sludge Treatment Plant
PAI	Potential Area of Influence
STI	Sexually transmitted infections
FS	Faecal Sludge
O&M	Operation and Maintenance
PAI	Potentially Affected Individual
PEAP	Poverty Eradication Action Plan
RAP	Resettlement Action Plan
ToR	Terms of Reference

ACKNOWLEDGEMENTS

We are thankful to the people who provided information for the preparation of this ESIA. The team is grateful for the support from the community of Kakubansiri Cell, Lugazi Municipal Council officials, and Buikwe District Local Government Administration and Technical Staff. For the local community members, we are not only grateful for your open discussion but also for being hospitable. We are hopeful that the project will meet your expectations. Lastly, we highly appreciate the great support of the technical staff in the various government departments and agencies that provided enriching information necessary for the quality output of this report.

EXECUTIVE SUMMARY

Introduction and Background

The Government of Uganda (GoU) has adopted the Uganda Vision 2040; and has committed to improving the socio-economic status of Ugandans through key interventions like improved delivery of water and sanitation services. Recent Government efforts to promote the delivery of household and public sanitation facilities, coupled with behaviour change campaigns have resulted in increased access to sanitation (about 86%) in urban areas. Over 90 per cent of the existing sanitation facilities are on-site and lack safe means of faecal sludge chain management (emptying, transportation, and disposal or re-use). The situation is exacerbated by the steady population growth due to the increasing rate of urbanization (approximately 5.3%).

A nationwide sector assessment supported by World Bank Water and Sanitation Program (WSP) in 2014, identified fifty (50) potential clusters of small towns to be provided with shared FS treatment/disposal infrastructure to help improve faecal sludge (FS) service chain management across Uganda. To date, less than 40% of the number of clustered towns has been provided with the needed treatment facilities but without improved collection capacity. The Ministry is therefore directing its efforts towards improving the situation by providing additional treatment facilities and improving collection capacity to ensure universal access to all small-town dwellers by 2030, in line with Government development aspirations and the Sustainable Development Goals (SDGs).

In addition, the existing potential for reuse is not adequately explored to maximize the related economic benefits. Several initiatives on FS reuse exist but are not coordinated to derive synergies and draw lessons to improve performance. Reuse benefits can contribute to the partial recovery of operation and maintenance costs, and the creation of job opportunities to improve livelihoods, particularly for the urban poor. A systematic and coordinated assessment of FS reuse market potential, together with the development of strategies for promotion, marketing and sales would provide the opportunity to maximize related economic benefits.

To ensure sustainable delivery of infrastructure and services along the entire sanitation value chain (containment, collection, treatment and reuse), each link along the chain must be developed based on appropriate business models, supported by relevant and effective regulations and institutions. Given a supportive environment, and based on experience in Kampala, this is likely to attract private sector participation and financing to accelerate delivery along the chain, once the business models are demonstrable and can result in achieving some margin of profit.

At the request of the Government of Uganda, the African Water Facility has provided funding support for consultancy services to undertake stakeholder consultations and prepare feasibility studies, detailed designs and investment plans for faecal sludge management in un-sewered urban centres in Uganda. The results of the studies and designs will inform stakeholders and development partners about the investments required and will help mobilize resources for finance-related infrastructure and services.

In a bid to fulfil the above-mentioned assignment, The Ministry of Water and Environment contracted M/s SGI, Studio Galli Ingegneria to provide consultancy services for the Feasibility Studies and Detailed Design for Faecal Sludge Service Chain Management in Selected Un-Sewered Urban Centres in Uganda Covering Central and South-Western Towns of Kigumba, Wobulenzi, Kiira, Kanungu, Kyazanga, Buikwe and Kyenjojo under assignment 1.

It is against this background that the Ministry of Water and Environment (MoWE) intends to develop a faecal sludge management facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District under assignment 1.

SGI has prepared this Environmental and Social Statement for the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District for submission to NEMA for review and approval in line with Schedule 5 (1) of the National Environment Act, No 5 of 2019.

Developers' Information

Name of Developer: Ministry of Water and Environment

Address: P.O. Box 20026, Kampala, Uganda

Tel: +256-414-4505942/5/50/414220203/ 414321316/ 414221198/ 414505941

Email: mwe@mwe.go.ug

Website: www.mwe.go.ug

Project Cost Estimates

The investment cost of the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District will be UGX **4,900,493,400 (Four Billion Nine Hundred Million Four Hundred Ninety-Three Thousand Four Hundred)**

The main conclusions are as follows:

- The Preliminary and General Items is approximately 1,018,800,000
- The Faecal sludge treatment unit construction breakdown includes 4,454,994,000 with a Contingency (10% of Subtotal C) of 445,499,40.

ESIA Methodology

The ESIA study process followed the EIA process as outlined in the National Environment Management Authority (NEMA) Guidelines for Environmental Impact Assessment in Uganda, 1997. As such, a scoping exercise was carried out as an initial step of the ESIA study. The scoping exercise was aimed at determining the scope of work to be undertaken in assessing the likely environmental and social impacts of the proposed project. The scoping exercise involved field reconnaissance visits, a literature review and comprehensive consultations with relevant stakeholders. The scoping exercise led to the development of the Terms of Reference (ToR) for the

ESIA study that was submitted to NEMA for review. Based on the ToR, a detailed ESIA study was carried out. The ESIA Study was concluded by preparation of this Environmental and Social Impact Statement under which the findings of the study are presented.

The surveys were carried out, not only to provide an understanding of prevailing socio and environmental situations but also to provide a basis for future monitoring of the environmental and social implications of the faecal sludge treatment project. A baseline study of the Project was undertaken through:

Field visits and detailed studies of the site took place between **April 2022-May 2022**. During the site visits, the different biodiversity features, habitats, vegetation and landscape units in the project area were identified and recorded.

The purpose of the baseline assessment was to define the baseline condition, against which the activities proposed, and alternatives can be compared when assessing probable impacts. Observations in the field and the biodiversity indicators used to establish a baseline include the surveyed taxas of flora and fauna, occupational health and safety studies, geotechnical site investigations, hydrogeological survey and hydrology. The Biophysical surveys were conducted only within ecologically sensitive habitats such as wetlands.

Review of literature on appropriates the project area including environmental management in Uganda and project background documents from the Ministry of Water and Environment and Buikwe District;

Consultations as a means of getting additional information regarding the possible impacts/concerns and suggested mitigation measures of the proposed faecal sludge treatment plant were extensive carried out.

Expert judgment was also used to identify some of the likely issues to occur as a result of the proposed development; and

Relevant Policy, Legal, and Institutional Frameworks

Review and reference existing Laws, Regulations, Policies and working documents to verify how the proposed project conforms to them; the following relevant laws and regulations were reviewed;

1) National Environment Act 2019
2) Physical Planning Amendment Act (2010) as amended 2020
3) Water Act Cap 152
4) Investment Act (2001)
5) Land Act (1998) and the revised version 2010
6) Local Governments Act (1997)
7) Noise Pollution Regulations (2003)
8) Water Resources Regulations (1998)
9) The National Gender Policy (1997)
10) Worker's Compensation Act (2000)

11) Safety and Health Act (2006),
12) HIV/ AIDS Policy
13) National Wetlands Policy, 1995
14) Uganda Resettlement / Land Acquisition Policy Framework, 2001 among others

Baseline Conditions

Buikwe District lies in the Central Region of Uganda. The district is bordered by Jinja District in the East, Kayunga District in the North, Mukono District in the West and Lake Victoria in the South.

The proposed site is located within 2 villages, Kasana and Kakubansiri villages, Butinindi parish in Kawolo Division, Lugazi Municipality. The approximate acreage of the proposed Site is 19.7 acres. The site was also designated as a solid waste disposal site. The solid waste is currently dumped on less than 2 acres. The proposed project site is owned by Lugazi Municipal Council. The access road is maintained by the Mehta group Sugar Factories.

The proposed towns under the Buikwe cluster are Buikwe Town Council, Ngogwe, and Nkonkonjeru Town Council. All the towns are located in Buikwe District.

The surrounding vegetation of the faecal sludge treatment plant site comprises farmlands of bananas, maize and shrubs, grasslands, eucalyptus spp to the south, Meta sugarcane plantations in the East, shrubs, grasslands and farmlands in the North and West

Administrative Structure: Buikwe District has 1 County (i.e., Buikwe) with 8 rural Sub-counties and 4 Town Councils. The sub-counties are Buikwe, Kawolo, Najja, Najjembe, Ngogwe, Nyenga, Ssi-Bukunja, and Wakisi; while the Town Councils are: Buikwe, Lugazi, Njeru, and Nkokonjeru. Under these Lower Local Governments, there are 64 parishes/wards and 464 Village Councils.

Population Size: Buikwe District has a total population of 436,406 people4. Of these, 213,443 are males and 222,963 are females. The sex ratio is, therefore, 95.7 males per 100 females. There are 99,401 households with an average household size of 4.2 persons

Growth Rate: The District population growth rate stands at 2.33%, which is 0.7% less than the national average of 3.03%.

Fertility Rate: Fertility indicators measure the frequency of childbirth in a given population. Such measures can tell how fast the population of a given country or region would increase. The national average is 6.2 children per woman.

Water Supply Situation: Households in the project area were mainly getting water from safe water sources, the main water source reported was protected springs (29.7%), this was followed by Domestic connection (21.8%), public standpipes (19.3%) and rainwater harvest (1%). On the downside, a significant number of HHs (21.8%) reported getting water from unprotected springs while 4% of the HHs reported getting water from the Lake both sources are not safe water sources.

Project Description

This chapter explains in detail the proposed project components and the design criteria of the proposed faecal sludge management facility project for Buikwe Cluster towns. The faecal sludge treatment plant will comprise the following components:

- Construction of a screen and grit chamber;
- Construction of sludge drying beds;
- Construction of a self-priming chamber;
- Construction of Constructed wetlands;
- Construction of facultative pond and maturation pond;
- Construction of laboratory facilities; and
- Treatment Plant Site Works.

Analysis of Alternatives

The construction of a faecal sludge treatment plant is an important project for the socio-economic development of Buikwe as it is dealing with sanitation as a service for the people in Buikwe. Consequently, the project is important and no alternative project can replace it in terms of the overall objective. The analysis of alternatives is therefore in the context of alternatives to the proposed project components. Some project components are so specific and have been carefully analysed in terms of their actions and intended location. For other project components, for example, the proposed locations of the treatment plant and no project option, alternatives have been suggested as in Chapter 7 of this report.

However, because of the dire need to improve sanitation in the Buikwe cluster, the "No Project option" was not considered as it would hinder development and accelerate the poor sanitation situation in the Buikwe cluster towns.

Impact Identification and Mitigation Plan

This report has identified and discussed broad-ranging negative impacts associated with the feacal sludge management project and proposed mitigation measures for the same. These impacts are associated with flora and fauna, erosion and sediment transportation, environmental health and integrity, occupational health and safety, social welfare and equity among others.

Positive Impacts

- ✓ The Project construction will have clear benefits concerning local employment opportunities. Temporary employment opportunities (casual labour) will be provided to over 70 workers during the construction period and approximately 10 during the operation stage of the FSTP. This is especially true for unskilled labour. It is planned to make use of local workers up to 60% of required employment with emphasis on gender balance (At least 30% women).
- ✓ The project will help in empowering women in the management of sanitation issues and improve financial, managerial and administrative skills for the community at large due to training packages;

- ✓ The project will also provide an opportunity for Lugazi Municipal Council to widen its tax base, especially from compost sludge bread sold to the farmers and sanitation local taxes
- ✓ Improved access especially on the main road to Kakubansiri Cell where Faecal Sludge Treatment Plant is to be located. The road is currently very narrow and poor. The road is proposed to be well maintained and upgraded to accommodate heavy trucks transporting materials;
- ✓ While overall improved sanitation facilities will lead to improved standards of living in the Town Council in terms of disease reduction.

Negative Impacts

- ✓ Traffic, machinery, excavation and material transportation activities will produce dust, particularly during the dry seasons, an impact that will affect predominantly the workers at the sludge treatment site and people living along the access route.
- ✓ Disposal of excavated material especially topsoil and excess material is likely to be a challenge during construction.
- ✓ Material haulage and transportation could have major implications on the noise levels, dust and traffic accidents involving people, and livestock. The likely affected receptors will be the community living and en route to the site and where materials are sourced, air quality is likely to be affected by noise and vibration from vehicles; dust generation and exhaust emissions resulting from the heavy vehicles during construction hours and material haulage.
- ✓ Close interactions between workers and communities may also result in cases where some workers commit sexual abuse with underage community members leading to early child pregnancies.
- ✓ Child labour and school dropout as a result of increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labour to produce and deliver these goods and services, while others may be encouraged to work on sites which in turn can lead to enhanced school dropout.
- ✓ During construction, there is a likelihood of occurrence of workforce accidents, especially as a result of unsafe working practices, negligence and lack of adequate Personal Protective Equipment (PPEs). Some of these health risks may result in permanent injuries or death.
- ✓ During the construction of the FSTP, there is a likelihood of temporary interference along the main access route to the site as a result of heavy trucks transporting construction materials to and from the site.
- ✓ Pollution through gaseous emissions in the project area will emanate from exhaust pipes for vehicles and machinery used in the construction works. Though to a less extent, they are a contributing factor to the general greenhouse gases and subsequent global warming. The

generation of air emissions at the site will be a particular concern for workers employed in various site operations, especially during excavation and site levelling activities.

- ✓ The influx of over 70 workers who are required to be involved in the project's activities especially labourers from outside the residential areas will increase the potential risk of sexually transmitted diseases including the Human Immune-deficiency Virus/ Acquired Immune- Deficiency Syndrome (HIV/AIDS) among the program workers and local communities.
- ✓ On-site construction will generate substantial amounts of construction waste. These solid wastes will include; excavated earth/debris which will be a result of excavation activities (Some excess material will be left over which needs to be disposed of appropriately although the quantities will be relatively low); waste oils from servicing; medical wastes from injuries and domestic wastes (e.g., food staffs, polythene and plastics).
- ✓ There is likely to be an odour nuisance from Inlet Works and Anaerobic Ponds if not well managed during operation. This impact may be of great concern to the public especially those neighbouring the treatment plant.
- ✓ There is likely to be a health risk of pathogens for potential users of the wetland/ river by liquid effluent discharge from the faecal sludge plant. This may lead to the transmission of water-borne diseases and vector-transmitted diseases if the faecal sludge treatment is not well handled.

Environmental Social Management and Monitoring Plan

The environmental and Social Management Plan involves the implementation of measures to eliminate or reduce significant adverse environmental and social-economic impacts of a project to acceptable levels.

Monitoring is a long-term process, which should begin at the start of construction and should continue throughout the life of the project. The purpose of monitoring is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. The overall objective of environmental and socio-economic monitoring is to ensure that recommended mitigation measures are implemented during faecal sludge construction and operation. Monitoring is also conducted to determine the effectiveness of proposed mitigation measures, to check if the magnitude of anticipated impacts is in line with predicted and to establish if any project unforeseen impacts would require addressing. Monitoring hence enables corrective actions to be undertaken in good time.

The key environmental aspects that will require monitoring include the following;

- Effluent Quality
- Air quality,
- Water quality,
- Noise levels,

- Flora and Fauna
- Soil quality.

In conclusion, if the mitigation measures for adverse impacts identified in this ESIA are implemented, as presented in the Environmental and Social Management and Monitoring Plan (ESMMP), the project will meet its intended objective of improving sanitation and health in Buikwe District. It is recommended that the project Developer/Contractor engages all stakeholders during project implementation to create a sense of ownership, transparency and accountability.

Table 0-1: Environmental and Social Management and Monitoring Plan (ESMMP)

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
Pre-Construction Phase					
Vegetation loss	• Restrict vegetation clearance to those areas where the permanent structures and beds for the faecal sludge plant are to be located; and • Re-vegetate, landscaping and restoration vegetation to the affected areas after construction to allow regeneration	• Type of vegetation lost	During site clearing	Contractor MoWE	9,000,000
Construction Phase					
Soil Related Impacts	• In cases where it is identified that during construction there is a danger of increased run-off or at the project site, drainage channels with stone pitching or holding ponds can be employed • After completion of the construction works, restoration of the ground by sowing adequate grass cover and planting of trees will be followed, therefore the impact is temporary and reversible • Demarcate the access routes to be used by vehicles and machinery to minimise the affected areas • Carry out work under mild weather (not strong rains or winds). • Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type.	• Records of vehicle maintenance • Vegetation restored • Site routes demarcated • Stockpiles of topsoil • Written down soil protection measures and record of implementation • Results of chemical analysis of treated soils Monitoring for storage reports, • Designated sanitary containers Monitoring reports on the	During construction	Contractor MoWE	9,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• Remove and store topsoil in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation. • Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. • Installing leak-proof fuel storage on a concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. • Strictly enforce and monitor standard procedures for storing and handling hazardous wastes and raw materials (e.g., fuel or chemicals). • Place strong drums for oil storage on impermeable floors in the stores. • Provide appropriate hoses for re-fuelling of pumps and vehicles. • Parking vehicles on paved platforms whenever possible • Sites for cleaning, fuelling and maintaining equipment and vehicles should be able to prevent leakage (e.g., paved or with settlers).	parking of vehicles and the status of fuel storage			
Air pollution	• Maintain vehicle and equipment according to manufacturers' specifications. • Use standard fuel and lubricants • Sprinkle water to work areas to reduce and	• Record of repairs • Fuels and lubricants conforming to specifications	During construction	Contractor MoWE	3,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	prevent dust during dry weather periods. • Clean access routes in the surrounding area daily to prevent dust. • Collect and hold sanitary and cleaning wastes in appropriate containers. • Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust.	• Record of water sprinkling • Record of cleaning • Designated sanitary containers • PPEs Distribution list/stores, percentage of workers using nose and ear masks			
Vibration and Noise pollution	• Minimize noise according to NEMA, Uganda standards. • Control noise and vibration on site. • Install adequate noise prevention devices, *e.g.* mufflers on noise-generating sources. • Maintain vehicle and equipment according to manufacturers' specifications • Switch off the engines of vehicles and machinery while not in use. • Provide information to the local communities (e.g. through the LC system or local radio (FM) stations) concerning work programmes, and strict adherence to such • Workers who may unavoidably have to work with noise-generating equipment, *e.g.* earthmoving equipment should be provided with ear plugs and advised/monitored to put them on with punitive measures to those who don't oblige.	• Noise-making machines/equipment fitted with mufflers • Record of noise measurements • Record of vehicle and equipment maintenance • Equipment log sheets • Receipts from radio stations for announcements made • Workers with PPEs including • helmets, boots, nose and ear masks	During construction	Contractor Buikwe Environment officer MoWE NEMA	As per Civil works- Contractor BOQ

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
Solid waste generation	• The Contractor should prepare a Solid Waste Management Plan • The contractor should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste • Any waste including excess soil should be disposed of at gazetted sites. The solid waste shall not accumulate on site, to cause odour, fly, or rodent problems. • Excavated soils should be reused as much as possible as filling material. • Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted. • Use licensed recycling companies to externally collect and recycle, recover or dispose of the waste	• Written down Solid Waste Management Plan (SWMP) and implementation schedule. • Records of types of wastes generated, transported and delivered to gazette sites • No visible soil stockpiles • Depressions filled • Sealed storage containers on site • Contracts with licensed waste disposal/recycling firms	During construction	Contractor Engineer Buikwe district Environment officer Buikwe district and Lugazi Municipal Council	7,000,000
Occupational Health and Safety concerns	• Fill up all depressions to avoid pools of stagnant water that may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes which cause malaria. • Mark all dangerous areas and fence them off. • Restrict access to work areas by unauthorized persons • Ensure that work sites (especially excavation works), have proper protection with a clear marking of safety borders and signals and fence off all dangerous areas.	• All excavated potential depressions were re-instated, filled and re-vegetated. • All excavated potential depressions were re-instated, filled and re-vegetated. • All dangerous areas are fenced off and	During construction	Contractor District medical officer-Buikwe Uganda Police-Buikwe	31,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• Confine access to restricted work sites (including those with the operation of mechanical and electric equipment) to persons with permits. • Provision of personal protective equipment i.e. safety clothing and equipment for the workforce (70 workers) • Provision of first aid kits and health personnel • Capacity building needs. Training will be required to ensure the implementing agency/proponent etc. can implement the ESMP and monitor it successfully	warning signs • Written communication to neighbouring communities • Security guards to restrict access • Demarcated work sites and signals • Receipts from radio stations for the announcement			
	• Employment of Environmental Health and Safety supervisors	• Monthly Progress Reports	Monthly	MoWE Consultant Contractor Buikwe &Lugazi Environment and Health Officers	40,000,000
Socio-Economic Impacts	• The workers and the resident community should be cautioned to avoid immoral behaviours as may lead to HIV/AIDs; • Awareness programmes on the ongoing construction activities, HIV /AIDs and STDs among construction workers and condom distribution • The contractor will be required to conduct massive sensitization both to the workers and the resident community and also put in place	• Community awareness of HIV programmes • Community sensitization programs	During construction	Contractor Health Inspector Buikwe Environment officer	5,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	proper guiding and educative signage at the site to keep the workforce informed and aware of their obligations; • Where necessary, the contractor should distribute condoms to all workers; and • All workers, contractors and sub-contractors to recruit staff with proven morals and with recommendable records				
Temporary Interruption of Traffic during Construction	• Inform local communities about the construction programme in advance. • In case access roads have to be closed, inform local communities and road users in advance • Use reflective signs to direct traffic to designated areas. • Use flagmen to give directions to traffic. • Install speed reduction humps at crossings of many people, *e.g.*, at a school, or market. • Sensitize drivers to observe speed limits	• Written communication to neighbouring communities • Receipts from radio stations for announcements • Traffic Management Plan (TMP) in place • Record of vehicular accidents and incidents • Sensitization reports	During construction	Contractor Traffic Police - Buikwe	3,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
Disturbance and interruption of commercial and social activities	• Inform local communities about the construction programme in advance. • In case access roads have to be closed, inform local communities in advance. • Clean and maintain access roads in the neighbourhood of earth and sand daily. • Provide temporary access ways with the approval of local authorities where access roads are closed. • Carry out work under mild weather (not strong rains or winds). • Reduce obstruction of access to and use and occupation of roads and footpaths • Protect any items and/or sites of archaeological or cultural value (e.g., private graveyards) discovered during works with the aid of the appropriate authorities.	• Written communication to neighbouring communities • Presence of access roads • Record of protection and/or compensation of items of cultural values	During construction	Contractor Lugazi Municipal Council – Buikwe District	
Social Disharmony	• The priority for employment should be given to the locals of the area, especially those living within the project areas. • Employment emphasis should be placed on gender balance where about 30% of all workers should be women; • The Contractors and Lugazi Municipal Council should endeavour to inform and sensitize both the new employees and the residents on the importance of respecting local customs and norms; • The contractor should provide his workers with proper identification and uniforms during the	• Record of sensitization sessions • Register of workers	During construction	Contractor Local councils	

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	activities so that it is simple to identify and weed out those with social problems; and • The new workers should be registered with the L.C chairperson of the area so that in case of any wrongdoing they are easily tracked down				
Operation and Maintenance					
Odour Nuisance / obnoxious smell from the treatment plant area	• Trees should be planted along the sludge treatment plant boundary; and • Periodic maintenance and monitoring of the air quality along the proposed faecal sludge treatment Plant. • Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills.	• Fenced area of waste stabilization pond • A well-maintained and operated sewage treatment plant	During operations	NEMA District Environmental Office	
Mosquito breeding and disease transmission	• Eliminate spillage and all unnecessary standing water. • All floating vegetation should be removed from the water to avoid the disruption of drainage channels. • Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills.	• All excavated potential depressions re-instated, filled and re-vegetated.	During operations	NEMA Health Inspector – Buikwe District Health Inspector – Lugazi Municipal Council	
Public Health Risk	• No cattle grazing or irrigation to be allowed to use water from the ponds/ wetlands created on site for treatment purposes; • Fencing of 100m from the wetland to the discharge point, provision of disinfecting facility, if found necessary;	• All dangerous areas are fenced off and warning signs • Written communication to neighbouring communities	During operations	NEMA Health Inspector – Buikwe District Security	

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• A Vector control program should be put in place, i.e., fish & frogs feeding on insect larvae; and • For use of insecticides, environmentally best practices will be used, e.g., bacillus thuringiensis (bacterial toxin).	• Security guards to restrict access		guards	
Impact of Sludge on nearby wetland/Stream Water Quality	• To realize effluent that meets the required discharge standards, the FS from these cluster towns should be treated through a combination of several unit processes and operations, namely; screening, grit removal, Settler, drying beds, waste stabilization ponds and constructed wetland. The pH of the receiving water and soil shall be monitored continuously; • Arrange a facility to provide stabilised sludge to farmers for agricultural purposes. If there is surplus sludge, disposal at a controlled solid waste disposal site; and • Requires monitoring for pollutants and pathogens as provided under the Environmental Management Plan. • Monitoring of effluents and waste water	• Written down Solid Waste Management Plan (SWMP) and implementation schedule. • Records of types of wastes generated, transported and delivered to gazetted sites • No visible soil stockpiles • Depressions filled • Sealed storage containers on site • Contracts with licensed waste disposal/recycling firms	During operations	Health Inspector (Buikwe District and Lugazi Municipal Council) Engineer- / Environment officer Buikwe District	70,000,000
Solid Waste from screens	• Screenings should be contained and disposed of in approved areas, • Other solid wastes generated at the site will be minimal and should be stored on site until they are collected by the Municipal councils or other authorized service providers for disposal	• Written down Solid Waste Management Plan (SWMP) and implementation schedule. • Records of types of	During operations	Environmental Officer – Buikwe District Licensed Waste Handler	Operation and Maintenance Budget

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
		wastes generated, transported and delivered to gazette sites • Contracts with licensed waste disposal/recycling firms			
Health and Safety Concerns for Workers	• Provide and wear the appropriate personal protective equipment (PPE) to avoid direct and indirect exposure to FS (e.g. gloves, coveralls, rubber boots with a metal sole, safety glasses and safety masks); • Develop and provide training on the use of tools customised for local conditions and local containment systems to avoid direct contact with faecal sludge; • Provide a training programme on standard operating procedures including the proper use of PPE, tools and equipment; and • Preventative measures related to personal health care are recommended including immunisation and a deworming program. The latter is recommended particularly for service providers transitioning from unsafe to safe practices • Training of workers on Environmental Health and Safety issues	• Appropriate PPE provided to workers • Records on training undertaken • A written Health and Safety Management Plan (H&SMP) • Medical records	During operations	Health and Safety Inspector	60,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• Environmental and Social Audit	• Audit Reports • Records of compliance	During operations	MoWE Buikwe and Lugazi Environment and Health Inspectors	30,000,000
Traffic Concerns	• Traffic control will be simplified through a well-designed facility layout. Access roads that allow vehicles to drive through after discharge rather than turn around will be encouraged as they are not only more efficient but also safer; • Mechanized unloading stations that record the driver's identification and discharge volume can also reduce traffic problems and costs at busy facilities; • The turning radius and weight of the largest trucks that will utilise the facility will be considered when planning roads and driveways; and • In addition, off-loading and truck parking areas will be level, and access roads shall not have more than a 3% gradient.	• Records of the daily number of transportation trucks moving in and out of the site • The access road to the site worked on	During operations	Traffic supervisor onsite	
Total ESMP Costs					**267,000,000**

Conclusion and Recommendation

The anticipated benefits of the construction and operation and maintenance of the faecal sludge treatment plant are immense. The project will result in an improvement in public health conditions, spur social economic development, and provide employment to residents.

However, just like most developments, the immense benefits of the project do not necessarily insulate it from negative impacts. To evaluate the project so that its undesirable impacts on the environment and social economic set-up are minimised, an evaluation of the possible project alternatives was also conducted. The planning and design of the treatment plant were found to be so specific that no alternative sites were proposed. In that case, the impacts of those project components were carefully analysed in terms of their actions and intended location.

The developer (Ministry of Water and Environment) and beneficiary (Lugazi Municipality/Buikwe District and other cluster towns) have all expressed willingness and commitment to carry out development in an environmentally sustainable manner and implement all the suggested mitigation measures to minimise the negative impacts from the proposed Faecal sludge treatment plan/drying bed.

Based on the immense project benefits of the sanitation Project to the people of Buikwe cluster towns, which have been stated above, and the fact that the identified negative impacts can be mitigated following the proposed ESMMP, the study recommends the project to be implemented provided that the recommended mitigation measures are adequately and timely implemented.

1 INTRODUCTION

1.1 Background

The Government of Uganda (GoU) has adopted the Uganda Vision 2040; and has committed to improving the socio-economic status of Ugandans through key interventions like improved delivery of water and sanitation services. Recent Government efforts to promote the delivery of household and public sanitation facilities, coupled with behaviour change campaigns have resulted in increased access to sanitation (about 86%) in urban areas. Over 90 per cent of the existing sanitation facilities are on-site and lack safe means of faecal sludge chain management (emptying, transportation, and disposal or re-use). The situation is exacerbated by the steady population growth due to the increasing rate of urbanization (approximately 5.3%).

A nationwide sector assessment supported by World Bank Water and Sanitation Program (WSP) in 2014, identified fifty (50) potential clusters of small towns to be provided with shared FS treatment/disposal infrastructure to help improve faecal sludge (FS) service chain management across Uganda. To date, less than 40% of the number of clustered towns has been provided with the needed treatment facilities but without improved collection capacity. The Ministry is therefore directing its efforts towards improving the situation by providing additional treatment facilities and improving collection capacity to ensure universal access to all small-town dwellers by 2030, in line with Government development aspirations and the Sustainable Development Goals (SDGs).

In addition, the existing potential for reuse is not adequately explored to maximize the related economic benefits. Several initiatives on FS reuse exist but are not coordinated to derive synergies and draw lessons to improve performance. Reuse benefits can contribute to the partial recovery of operation and maintenance costs, and the creation of job opportunities to improve livelihoods, particularly for the urban poor. A systematic and coordinated assessment of FS reuse market potential, together with the development of strategies for promotion, marketing and sales would provide the opportunity to maximize related economic benefits.

To ensure sustainable delivery of infrastructure and services along the entire sanitation value chain (containment, collection, treatment and reuse), each link along the chain must be developed based on appropriate business models, supported by relevant and effective regulations and institutions. Given a supportive environment, and based on experience in Kampala, this is likely to attract private sector participation and financing to accelerate delivery along the chain, once the business models are demonstrable and can result in achieving some margin of profit.

At the request of the Government of Uganda, the African Water Facility has provided funding support for consultancy services to undertake stakeholder consultations and prepare feasibility studies, detailed designs and investment plans for faecal sludge management in un-sewered urban centres in Uganda. The results of the studies and designs will inform stakeholders and

development partners about the investments required and will help mobilize resources for finance-related infrastructure and services.

In a bid to fulfil the above-mentioned assignment, The Ministry of Water and Environment contracted M/s SGI, Studio Galli Ingegneria to provide consultancy services for the Feasibility Studies and Detailed Design for Faecal Sludge Service Chain Management in Selected Un-Sewered Urban Centres in Uganda Covering Central and South-Western Towns of Kigumba, Wobulenzi, Kiira, Kanungu, Kyazanga, Buikwe and Kyenjojo under assignment 1.

It is against this background that the Ministry of Water and Environment (MoWE) intends to develop a faecal sludge management facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District under assignment 1.

SGI has prepared this Environmental and Social Impact Statement for the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District for submission to NEMA for review and approval in line with Schedule 5 (1) of the National Environment Act, No 5 of 2019.

1.2 Scope of Services

The study undertook investigations on social aspects, economic activities, and biophysical aspects, conservation of natural resources, historical and anthropological heritage, public consultations and disclosures.

Task 1: Detailed Desk-top Review

The study reviewed all existing documentation, and any previous ESIA-proposed faecal sludge treatment plant taking into account the critical study of the aquatic environment including and not limited to migratory species, semi-aquatic, and ecological flow and therefore has recommended mitigation measures.

Task 2: Description of the Baseline Environment

Baseline information was collected, collated and presented on the environmental characteristics of the project area for the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District**.** This description involved but is not limited to:

- Physical environment (topography, land cover, geology, climate and meteorology, air quality, hydrology, etc.)
- Biological environment (i.e., flora and fauna types and diversity, endangered species, sensitive habitats etc.)
- Social and cultural environment, including present and projected. Where appropriate (i.e., population, land use, planned development activities, community social structure, employment and labour market, sources and distribution of income, cultural/religious sites and properties, vulnerable groups and indigenous populations etc.)

- Economic activities, agriculture, livestock, small-scale industries etc.

Task 3: Legislative and Regulatory Framework

The study identified and described the pertinent regulations and standards - both local and international, governing the environmental quality, health and safety, protection of sensitive areas, land use control at the national and local levels and ecological and socio-economic issues including the project activities that should comply with the identified regulations.

Task 4: Determination of Impacts of Project Facilities and Activities

From the detailed field study, data were analysed and used to describe all significant changes brought about by the proposed Faecal Sludge Treatment Plant project. These comprised environmental, ecological and social impacts, both positive and negative. Prioritization of all concerns identified and the project-related impacts differentiated into short, medium, long-term and cumulative impacts during construction, operation and decommissioning.

Recommendations on corrective and remedial measures to be implemented under the Environmental Social Management Plan have been elaborated in this report.

Task 5: Development of Management Plan to Mitigate Negative Impacts

A Comprehensive Environmental, Social Management Plan was developed. The plan recommends a set of mitigation, monitoring and institutional measures to eliminate, minimize or reduce to acceptable levels of adverse environmental and social impacts and/or maximize socio-economic benefits.

Task 6: Development of Monitoring Plan

A specific description, and technical details, of monitoring measures for both ESMP, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, and the definition of thresholds that will signal the need for corrective actions as well as deliver a monitoring and reporting procedure have been reviewed including estimated costs for monitoring as well as their institutional and financial support, timeframe and responsibility.

1.3 The Environmental Impact Assessment Process

The International Association for Impact Assessment (1999) defines an Environmental Impact Assessment (EIA) as, "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals before major decisions being taken and commitments made".

Under Section 3 (1) of the NEA, No.5 of 2019 is the principal law on Environmental protection in Uganda, “Every person in Uganda has a right to a clean and healthy environment per the Constitution and the principles of sustainable development”.

Following the requirements of the Fifth Schedule of the National Environment Act No.5, 2019, the proposed project falls under the category of projects for which an Environmental and Social

Impact Assessment (ESIA) is required. Particularly **Category 2 Waste Management facilities; subsection (c) Construction of waste management facilities, including (v) wastewater/effluent treatment plants and (VI). Sewage treatment plants.** This is also in line with the Environmental Impact Assessment (EIA) Guidelines (1997) and National Environment (Environmental and Social Assessment) Regulations (2020) for Uganda.

Under Part X (13), the National Environment Act categorizes projects for ESIA into three levels

a) Conduct an environmental and social impact assessment by way of scoping;

b) Prepare terms of reference for an environmental and social impact study; and

c) Undertake an environmental and social impact study as prescribed by regulations.

1.4 Objectives of the ESIA

The general objective of the Environmental and Social Impact Assessment (ESIA) is to identify, assess and mitigate the potential environmental and social impacts that might result from the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District.

Specific Objectives of the ESIA are;

- ✓ To identify and assess potential adverse environmental and social effects of the planned infrastructure projects.
- ✓ To make recommendations that can be used for mitigating adverse effects resulting from project implementation.
- ✓ To identify stakeholders and undertake stakeholder mapping including their information needs throughout the project cycle.
- ✓ To analyse the environmental and social impacts of the project and come up with feasible mitigation measures
- ✓ To prepare Environmentally and Social Management Plans (ESMP) for each sub-project that can assist in implementing the mitigation measures recommended.

1.4.1 Scoping Stage and Preparation of Terms of Reference

According to the Uganda ESIA Guidelines (1997), the Environmental Impact Study process starts with the scoping exercise (See **Figure 1-1** below). In addition, the ESIA Guidelines (1997) and National Environment (Environmental and Social Assessment) Regulations (2020) specify that the issues in the scoping process should be developed into Terms of Reference (ToR) that are submitted to NEMA and other stakeholders (Lead Agencies) for review. Environmental scoping is a critical, early step in the preparation of the ESIA. Environmental scoping identifies issues that are likely to be the most important during the ESIA. The key objectives of the scoping exercise were:

- ✓ Inform the public about the proposed Faecal Sludge Treatment Plant;

- ✓ Identify the main stakeholders and their concerns and values;
- ✓ Define the reasonable and practical alternatives to the proposed Faecal Sludge Treatment Plant;
- ✓ Focus on the important issues and significant impacts to be addressed by this ESIA;
- ✓ Define the boundaries for an ESIA in time, space and subject matter;
- ✓ Set requirements for the collection of baseline and other information; and
- ✓ Establish the Terms of Reference for an ESIA study

Subsequently, the Environmental and Social Scoping report and TORs were prepared and submitted to NEMA for review and approval. Approval for the Terms of Reference is attached under **Appendix 1**.

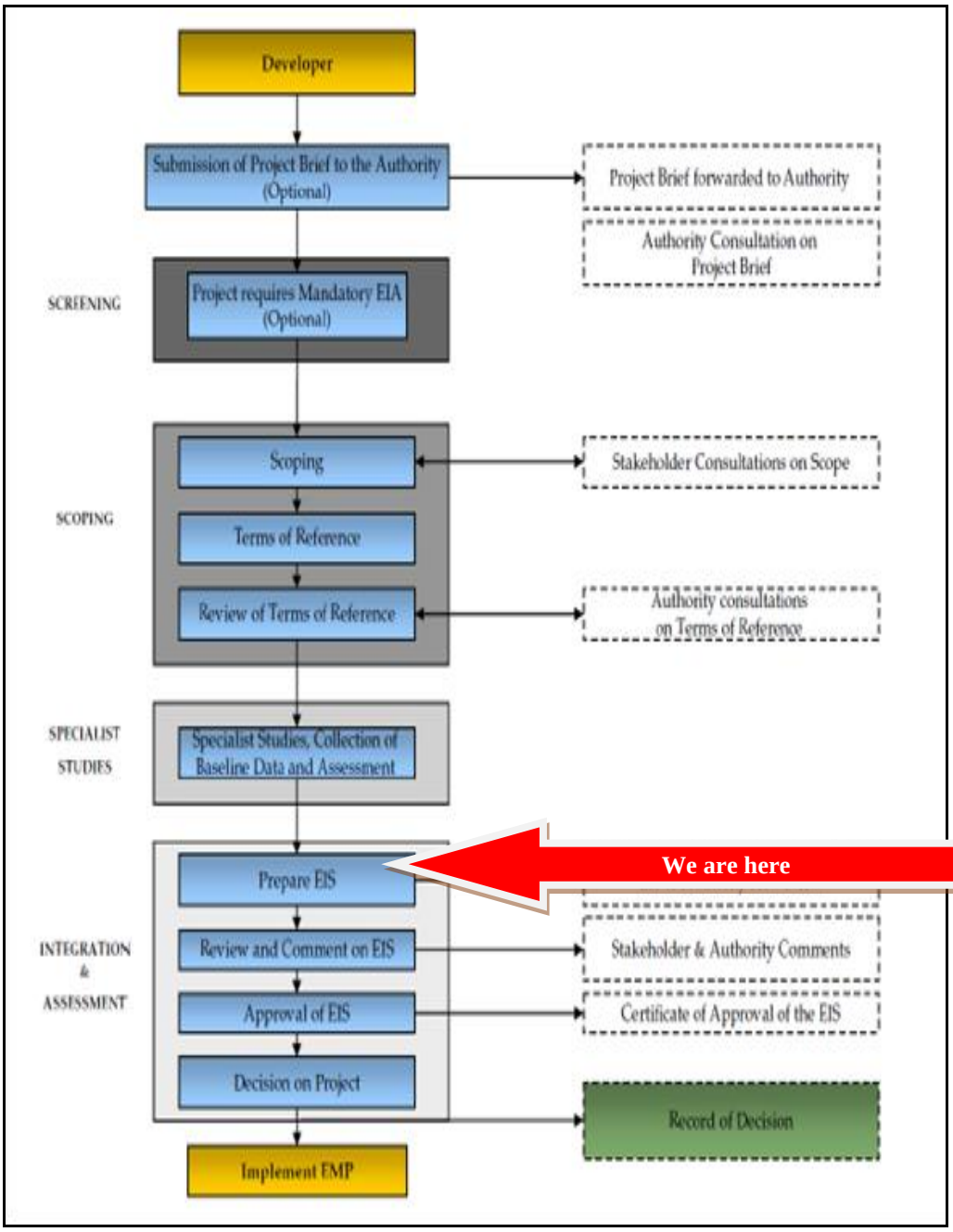


Figure 1-1: ESIA process in Uganda

1.5 Developers' Information

Name of Developer: Ministry of Water and Environment

Address: P.O. Box 20026, Kampala, Uganda

Tel: +256-414-4505942/5/50/414220203/ 414321316/ 414221198/ 414505941

Email: mwe@mwe.go.ug

Website: www.mwe.go.ug

1.6 Project Cost Estimates

The investment cost of the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District will be UGX **4,900,493,400 (Four Billion Nine Hundred Million Four Hundred Ninety-Three Thousand Four Hundred)**

The main conclusions are as follows:

- The Preliminary and General Items is approximately 1,018,800,000
- The Faecal sludge treatment unit construction breakdown includes 4,454,994,000 with a Contingency (10% of Subtotal C) of 445,499,40.

.

Bill No.	Description	No.	Rate Ushs	Amount Ushs
C	**FAECAL SLUDGE TREATMENT PLANT**			

Bill No.	Description	No.	Rate Ushs	Amount Ushs
1	Preliminary and General Items			1,018,800,000
	Treatment Units and			
2	Receiving Chamber Containment Tank			97,415,790
3	Screen and Grit Chamber			40,740,850
4	Settling - Thickening tank			137,883,420
5	Facultative And Maturation Ponds			513,918,000
6	Sludge Drying Beds			826,849,503
7	Composting building			361,589,750
8	Constructed Wetlands			553,210,090
9	Administration Building			170,346,800
10	Attendant's House			92,149,300
11	Ancillary Site works			553,490,000
12	Mechanical Installation			47,500,000
13	Electrical Installation			41,100,000
	Sub-Total "C1"			4,454,994,000
	Allow for Contingency(10% of Sub total A)			445,499,400
	Sub-Total "C2"			4,900,493,400

1.7 Structure of the ESIA report

This Environmental and Social Impact Statement is divided into the following chapters: -

Chapter	Description
1	Introduction and Scope of the study
2	Provides the project methodology and approach
3	Provides the project description
4	Provides the policy, legal and institutional framework

5	Gives the environmental benchmark information of the project site and the surrounding area
6	Provides stakeholder consultation and comments
7	Analyses any possible alternatives regarding the project
8	Identifies potential negative environmental impacts and proposes preventive/mitigation measures against potential adverse ones
9	Proposes environmental monitoring and management plans for the project
10	Conclusions and Recommendations
References: Cites all the literature used to compile this ESIS	
Appendices: Appends all the relevant documents used in the Study	

2 APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

2.1 Introduction

This chapter of the Environmental and Social Impact Statement details the approach to the ESIS phase of the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District with a particular focus on the main aspects of the methodology such as impact significance evaluation.

2.2 General Approach

The study was based on literature reviews, stakeholder consultations, site visits/physical inspections, and the integration and assessment of this information.

2.2.1 Literature Review

Several key documents were reviewed to address the various aspects of the assignment. Some of these documents included; Feasibility and Preliminary Design Report Buikwe Cluster towns, August 2020, National Environment Act, No.5 of 2019, Uganda Human Development Report 2007, Uganda Population and Housing census 2014, Urban Development in Uganda Report 2010, Buikwe District Development Plan (DDP) 2015/16 – 2019/20, the National Environment Management Policy for Uganda; African Development Bank Environmental and Safeguard Procedures; The National Water Policy; National Environment Management Authority (NEMA), 2003, Environmental Legislation for Uganda Handbook; National Environment (Environmental and Social Assessment) Regulations, 2020; Occupational Safety and Health Act 2006, Public Health Act Cap 281; Public Health (Drainage and Sanitation) Rules., S.I. 281-4. Public Health (Grade II Building) Rules, S.I. 281-3. Public Health (Plague Control) Rules, S.I. 281-27, Physical Planning Act 2010.; and other documents that the client deemed as being of fundamental importance to the assignment)

2.2.2 Field surveys

Field surveys included transect walks around the proposed site, to assess the availability and spatial location of utilities, topography, site geophysical environment, geomorphology, air quality aspects, and drainage challenges as well as making an inventory of activities in the neighbourhoods that are likely to be affected. The surveys also included public consultations with the local leaders within the jurisdiction of the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, and Buikwe District for further insight.

2.2.3 Stakeholder Consultations

Several stakeholders were consulted as part of a 'Stakeholder Identification and Engagement Plan'. The details of these are described in ***Chapter 6***.

2.2.4 Site Visits and Physical Inspections

Site visits and physical inspections were key aspects of the study. The proposed Faecal Sludge Treatment Plant site in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District Local Government was visited as part of the ESIA process and the relevant baseline surveys were conducted and data collection was undertaken. Specific details on this aspect of the methodology have been provided in this chapter of this report based on each of the specialist studies. In addition to the above, to ensure that a direct comparison could be made between the various specialist studies, a set methodology was used by all the specialists when evaluating the significance of impacts.

2.3 Qualitative and Quantitative Methods

The purpose of the baseline assessment was to define the baseline condition, against which the activities proposed, and alternatives can be compared when assessing probable impacts. Observations in the field and the biodiversity indicators used to establish a baseline include the surveyed taxas of flora and fauna, occupational health and safety studies, geotechnical site investigations, hydrogeological survey and hydrology. The Biophysical surveys were conducted only within ecologically sensitive habitats such as wetlands.

2.3.1 Noise Level and Air Quality Assessment

Noise is a pollutant, which affects the environment and poses health and communication hazards. The intensity of noise is measured in decibels (dB). An intensity of more than 85 dB becomes alarming from a pollution point of view. Ear protection/safeguard measures must be adopted so that the noise pollution effect can be minimized or mitigated.

This measurement was done through instantaneous spot measurements using a CEM DT-8852 Sound Level Meter with Data Logger Sound Level Meter set at 114 dB (A) range for 45 minutes (15 minutes) for each sampling point. The background noise measurements were undertaken in form of LAeq, LAF max, LAF Min, within the vicinity of the proposed site components.

Table 2-1: Shows the equipment used during the Air quality and Noise pollution assessment

Equipment	Activity	Photo
Altair 4x Multi gas detector	Real-Time gas monitor for Carbon Monoxide, Volatile Organic Compounds, LEL (combustible gases), Oxygen and Hydrogen Sulphide. Sulphur dioxide, Nitrogen Dioxide	
Temtop Airing-1000 detector.	Temtop Airing-1000 Professional Laser Air Quality Monitor for Humidity, temperature and PM2.5/PM10 Detector Particle Counter Dust Meter Real Time Display High Accuracy.	

CEM DT-8852 Sound Level Meter with Data Logger.	This is a brand new CEM DT-8852 CE-certified digital sound/noise level meter. This meter has a built-in USB port which connects to a PC for downloading the sound level data recorded over a while. This is an ideal instrument for noise monitoring in factories, schools, businesses and traffic areas. This meter conforms to the IEC61672-1 Class 2 and ANSI S1.4 Type 2 standards. With its internal memory and battery, this unit can record sound levels over a while as a standalone device. This device operates on a 9V battery (about 30 hours) or an AC adapter (included). It is very accurate (+/- 1.4 dB) and durable, an ideal companion for your field projects. A heavy-duty carrying case is also included for the protection of the device and your convenience. The difference between the DT-8852 and DT-8851 is that the DT-8852 has internal memory, so the sound level can be recorded without a computer. The recorded data stored in the DT-8852 can be uploaded to a PC at a later time.	

2.4 Faecal sludge sampling methodology

Faecal sludge (FS) samples were collected from places with many people such as: hospitals, taxi parks, markets and guesthouses. Samples were obtained from selected lined pit latrines and/or septic tanks (water-borne systems) because they are usually emptiable when they are full, as opposed to unlined pit latrines from which the leachate infiltrates into the surrounding soils. If unlined pit latrines are to be emptied, lots of water is added to fluidize the FS and the pits are susceptible to collapse due to lack of support lining. The sampled sanitation facilities and their locations are presented in **Table 2-2**.

Table 2-2: Sampled sanitation facilities in Buikwe cluster towns

Town Council	Sample ID.	Facility type	Source ID	Remarks
Buikwe TC	1	Septic Tank	Buikwe District Headquarter	Dimensions: 4m in length by 1.3m in width and 3m in depth. The sample is light grey. Limited solid waste quantities were observed.
	2	Septic Tank	St. Charles Lwanga Hospital	Dimensions: 11m length by 3.5m width by 2.0m depth. Not standard construction and presence of much solid waste. This has never been emptied in the last 15 years.
Nkokonjeru SC	3	Septic Tank	Najja Trading Centre	Tank Dimensions: 7m long by 2.4m wide by 3.0m deep. It is a public toilet, where payment is 300 UGX per person per use. The sample is light brown
Najjembe SC	4	Septic Tank	The House Guesthouse	Tank Dimensions: 4m long by 2m wide by 2.5m deep. The sample picked is light black.
Lugazi TC	5	Septic Tank	Lugazi Taxi Park	Tank dimensions: 6m long by 2.5m wide and 2m deep. High presence of scum on top. It's a public toilet, where 300 UGX is paid per person per use. The sample picked is dark brown.

Several grab samples were obtained through the access hole (s) which were included for emptying purposes. Samples were taken at the surface, in the middle and close to the bottom of the sanitation facilities by use of a sampler, which had a capacity of picking samples up to 4.5m in depth (**Figure 2-1**). Samples were collected from **18th to 20th November 2021**.

The grab samples were thoroughly mixed with the use of a soup ladle to make a composite sample for each sanitation facility. Following this, the parameters of temperature, pH, electroconductivity (EC) and oxygen reduction potential (ORP) of the extracted composite FS samples were measured on site using a portable meter (Hach HQ30d flexi model). Thereafter, a sample of about 1000 mL was put in a plastic-bottle container, placed in a cool box and transported to the Public Health and Environmental Engineering Laboratory, at Makerere University for analysis.

	
Najja Trading Centre (18th November 2021	The House Guesthouse-Najjembe (18th November 2021)

Figure 2-1: Faecal sludge sampling onsite sanitation facilities using a sampler

2.4.1 Sample preparation

Preparation of FS samples before analysis involved passing them through a 5 mm sieve to remove the extraneous materials. This is synonymous with screening, a pre-treatment action subjected to FS during treatment. FS to be used for the analysis of all the parameters was homogenized by the use of an electric blender (NIMA, model no. BL 888A, 1.5L, 350 watts, Japan), operated for one minute at its maximum speed. The measured parameters are not affected by FS's physical structure and homogenization limits disparities in the analysis since FS is highly variable, both within and between samples (Semiyaga *et al.*, 2017).

2.4.2 Faecal sludge sample analysis

Potential contaminants in FS were grouped into solids, organics, nutrients and pathogens and some selected parameters under these categories were determined. The solids parameters measured included total solids (TS), total volatile solids (TVS), total suspended solids (TSS) and sludge volume index (SVI); organics parameters included chemical oxygen demand (COD) and biochemical oxygen demand (BOD_5); nutrients parameters included total nitrogen (TN) and total phosphorus (TP), and pathogens indicator included Faecal coliform. Other important general characterization parameters determined included pH, temperature, electroconductivity (EC) and oxygen reduction potential (ORP).

TS, TSS, COD, BOD_5, TN and TP were determined according to standard methods as applied to the examination of water and wastewater (APHA/AWWA/WEF, 2012). TS concentration was

determined gravimetrically by taking the weight of the oven-dried sample at 105^{o}C to a constant weight (for 24 hours) as a fraction of the wet sample volume. TSS was determined photometrically by using Spectrophotometer DR 2800. SVI was determined through the diving volume of FS settled in Imhoff cone by the TSS concentration. The settled volume was estimated by settling one litre of faecal sludge in Imhoff cones for 60 minutes. COD was determined using the closed reflux colorimetric method (APHA/AWWA/WEF, 2012). Concentrations of total nitrogen were determined with standard vial tests of Dr Lange: LCK 238 (5-40 mg/l TN) for total nitrogen. Biochemical oxygen demand (BOD_5) was determined using the CAMLAB BOD track (serial no. 26197-01; Loveland, Co 80539, USA). The concentration of total coliforms was determined with Chromocult Coliform Agar media using the spread plate method (APHA/AWWA/WEF, 2012).

The pH values of all samples were within acceptable NEMA effluent discharge limits of 6.0 to 8.0. High EC values were generally exhibited in FS samples. All the sampled sanitation facilities had high concentrations of total and suspended solids. Specifically, TSS concentrations were 8 to 133 folds more than the acceptable effluent discharge standards of <100 mg/L. High concentrations of TSS can lead to turbidity and may result in the clogging of pipes, pumps (if any) and filter materials used in treatment processes if FS is directly loaded onto some technologies such as drying beds. All samples have SVI values between 10 and 50 (less than 100 mL/gTSS) which implies a good solids-liquid separation can be achieved, hence are suitable for settling technologies. FS from all the sampled sanitation facilities (lined pits and septic tanks) exhibited COD and BOD_5 concentrations beyond the recommended NEMA effluent standards of 100 and 50 mg/L, respectively. The ratio of COD to BOD_5 was generally ranging from 1.6 to 10.2. A low COD/BOD_5 ratio of less than 2.5 indicates high biodegradability (Morel & Diener, 2006). All the sampled sanitation facilities contained FS with total nitrogen (87.5 to 892.5 mg/L) and total phosphorus (48.9 to 79.9 mg/L) beyond the recommended effluent discharge standards of <10 mg/L, each. All sampled FS contained faecal coliform concentrations (an indicator of faecal contamination) in the range of 6.85 $x10^5$ to 3.06 $x10^7$ cfu/100 mL, as opposed to the national effluent discharge permissible limit of $5x10^3$ cfu/100 mL.

2.5 Cultural Heritage Methodology

It is common knowledge that understanding the origins and development of human societies is of fundamental importance to humanity in identifying its cultural and social roots. It is therefore important to protect our cultural/archaeological heritage. This study captures issues concerning the cultural/archaeological heritage existing close to and within the proposed site for the Faecal Sludge treatment facility. Several methods were used to detect the presence of any archaeological heritage. These included;

2.5.1 Literature Review

In the field of archaeology, records are very important, so it was very important to have a look at the available data for information.

2.5.2 Selective Survey Sampling

Brief foot surveys were conducted mostly in areas to be impacted directly by the proposed Faecal Sludge Treatment Facility, areas mentioned by the local people during consultations which yielded built heritage, shrines, burials and pottery for analysis. The method of data collection included observations, recordings, informant interviews and consultations, photographic documentation of cultural resources and other environmental features likely to be both negatively or positively impacted by the project.

2.5.3 Interviews and Focus Group Discussions

Meetings and interviews with community leaders and the local people were a major source of information about the current socio-cultural lives of the people living in and around the project area. In such discussions, members were made to have a better understanding of different heritage properties, with the hope that they will in turn inform the study of such properties in the area.

2.5.4 Legal Frame Work

The umbrella of legislation that exists in the protection of cultural heritage in Uganda is both national and international. The national legal regime stems from the Constitutional provision that specifically provides for the protection of cultural heritage. According to the constitution of the Republic of Uganda, under Article 37 every person has a right to belong to, enjoy, practice and profess, maintain and promote any culture, cultural institution or tradition in a community with others. Under the National Objectives and Directive Principles of State Policy, the State is obliged under objectives XXIV and XXVII to promote protect and preserve cultural values and practices which enhance the dignity and well-being of Ugandans. Other laws reviewed included;

a) The Historical Monument Act of 1967

b) The National Environment Act 2019, Schedule 7

c) The Historic Monuments Act is the principal legislation that provides for the conservation and protection of historical monuments or objects of archaeological, paleontological, ethnographical and traditional interests.

d) National Environment (Environment and Social Assessment) Regulations, 2020.

e) UNESCO World Heritage Convention, 1972) the convention concerning the protection of the world's cultural and natural heritage.

Other documents reviewed included Buikwe District Development Plan (DDP) 2015/16 – 2019/20, UBOS population census 2014 report Buikwe district.

2.6 Methodology/Criteria for Assessing Significance of Impacts

Potential and apparent impacts have been identified based on proposed activities to be undertaken, through specialist studies on-site and a consultative process with key stakeholders as discussed extensively in **Chapter 6**.

The initial impact identification presented in **Table 2-3** specifically targets issues identified within the First Schedule of the ESIA regulations for Uganda of 2020.

Within this Impact identification phase, the project, in general, is evaluated against the possibility of resulting in a stated impact on Ecology, Social considerations, landscape or Land use.

The anticipated probability of causation of impact is rated as:

- ✓ Not possible (No)
- ✓ May impact
- ✓ Likely to impact
- ✓ Will Impact

Table 2-3: Impact Screening based on anticipated activities from the proposed Faecal Sludge Treatment Facility in Buikwe Cluster towns

Recommended Considerations	Will the Project Directly or indirectly impact?	No	May	Is likely	Will impact	Activities/ stage of Project Implementation
Ecological						
Biological diversity	Number, diversity, breeding habits, etc. of wild animals and vegetation				X	Site preparation Existing vegetation to be removed.
	Gene pool of domesticated plants and animals e.g. monoculture as opposed to wild types.	X				
Sustainable use	Soil fertility				X	Soil to be moved, and replaced during site restoration
	Breeding populations of fish and game or wild animals.	X				No breeding site was observed.
	Natural regeneration of woodland and sustainable yield				X	
	Wetland resource degradation or wise use of wetlands	X				
Ecosystem maintenance	Food chains.	X				
	Nutrient cycles.				X	Removal of vegetation is likely to cause changes in soil nutrient recharges e.g. less nitrogen. limited to the construction phase
	Aquifer recharge, water run-off rates etc.	X				Site clearance for siting the Faecal Sludge Treatment facility and the related infrastructure, more paving and less greenery

Recommended Considerations	Will the Project Directly or indirectly impact?	No	May	Is likely	Will impact	Activities/ stage of Project Implementation
						will lead to increased run-off.
	The areal extent of habitats.				X	
	Fragile ecosystems				X	
Social considerations	Generation or reduction of employment in the area				X	Employment opportunities during construction
	Social cohesion or disruption				X	Cohesion is possible with a higher concentration of people in one area, noise
	Effect on human health.				X	The non-direct impact of the project. Crowding does have an impact in exacerbating communicable disease spread, impacts on Occupational and public safety possible during construction
	Immigration or emigration.				X	Very likely that people will migrate to live here.
	Communication roads opened up, closed, and re-routed.				X	
	Local economy				X	Increased revenue and increased reliable energy supply.
	Culture and objects of cultural value.	X				No elements of cultural value were observed in this area.

3 DETAILED DESIGN AND DESCRIPTION OF PROJECT ACTIVITIES

This chapter explains in detail the proposed project components and the design criteria of the proposed faecal sludge management facility project. It is aimed at providing insight into the extent of the proposed project and setting a stage for analysis of the likely impacts.

3.1 Detailed Design of the Faecal Sludge Treatment Facility

3.2 Design Faecal Sludge Volume

The design assumed the base year to be 2024. The design life of 15 years would make the ultimate year to be 2039. Since this is close to the year for Uganda Vision 2040. The Ultimate year was set to 2040, hence making the considered design life to be 16 years. Design faecal volumes were predicted from categories of households and institutions. The household category had three approaches and the considered value was the average of the three approaches. The total FS produced was the sum of household and institutional FS, which was 91.73 m^3/day

3.2.1 Households' faecal sludge estimation

Three approaches were used to determine the faecal sludge volume at the design horizon:

3.2.1.1 Estimation of the FS Volume for Households Based on Water Connection

In the residential households, those connected to the piped water supply system were considered because they are the likely ones to have septic tanks. However, the majority of households with piped water supply, with yard connections in such town councils use unlined pit latrines, indicating a small percentage of septic tanks in the households. After having water connections in the towns and the construction of faecal sludge treatment plants, many town councils enforce new household construction plans to have a septic tank before approval. This indicates the likely increase of septic tanks in the town councils. Therefore, the following assumptions were considered in volume computations:

- Household populations were adopted from UBOS (2014) Census reports for the respective town councils.
- The number of households connected to the piped water supply and the connection types were obtained from the water supply operator (National Water and Sewerage Corporation - NWSC) in the respective town councils.
- The annual growth rates in water connections of 2% for house connections and yard taps will be adopted from the Final Report for the National Faecal Sludge Assessment for Small Towns in Uganda, 2013.
- The connections per category and population served were projected for the next 15 years, using **2022 as the base/initial year**. The initial year has been set to two (2) years ahead of the detailed design year (2020) to allow for implementation lead time (procurement and construction of the faecal sludge treatment plant). The detailed design year is 2020. This

makes the ultimate year to be 2037 (2022+15). However, since this is close to 2040, the ultimate year was made to correspond with Uganda's vision of 2040, hence the selection of design life as 18 years.

- Lined pits and septic tanks are the only easily emptiable facilities, hence the only ones considered to contribute the required FS to the treatment plants.
- The projected number of households with septic tanks was estimated by adding the current number to the assumed future number based on water connections. The assumption was that 50% of the new connections will construct a waterborne facility since the Town councils are ready to enforce every household to have a septic tank after the construction of the treatment plant. This is because it is very difficult to have 100% because of the following reasons:
    - Most of the water connections are not household. It is a household connection that favours the use of septic tanks.
    - Lined pits and septic tanks are expensive facilities, hence affordable to a few people.
    - Policy implementation/enforcement has always been a challenge, hence not easy to enforce 100% of new connections.
- A sludge and scum accumulation rate of 200l/P/year was adopted (Morel & Diener, 2006). The same value is recommended for septic tanks in the Kampala Sanitation Master Plan, where 120 l/P/year is used for lined pit Latrines.
- A treatment facility is expected to be working 6 days per week (Monday to Saturday), 52 weeks per year and 10 hours per day (8 am to 6 pm).

3.2.2 Estimation of the FS Volume for Households using the Baseline survey Data

This approach uses the responses from the baseline survey data, in which the percentage of respondents with septic tanks and lined pit latrines is used in the computation of the faecal sludge volumes. To arrive at the faecal sludge volume, the following was considered:

- Household populations were adopted from the UBOS (2014) Census reports for the respective town councils.
- Current (2020) household numbers are determined by projecting using the growth rate in UBOS (2015) Census report.
- The percentage of households with septic tanks and lined pit latrines was obtained from the survey data. This was used to estimate the current household number with septic tanks.
- The projected households with septic tanks in the design horizons were calculated using the household growth rate for the Town councils.

$$H_n = H_o(1+r)^n$$

Where:

H_n : is the projected number of households after n years

H_o : initial number of households

r: household growth rate

n: design life

- The population growth rate adopted for Mukono district was 10.2% (UBOS, 2014).
- A sludge and scum accumulation rate of 200l/p/year was adopted (Morel & Diener, 2006).
- A treatment facility is expected to be working 6 days per week (Monday to Saturday), 52 weeks per year and 10 hours per day (8 am to 6 pm).
- With this approach, the FS volume produced will be **62.5 m^3/day** (**Table 3-1**)

Table 3-1: Design FS Volume for Households using the Baseline survey Data

Town Council	% of HH with septic tanks/lined pits using baseline data	Current No. of HH with Septic Tanks/Lined pit latrines - 2020	Projected HH with Septic tanks - 2040	Population per HH	Total population	Sludge and scum accumulation rate, S (N<5)	FS Volume, B=PxS	Daily Sludge generated
							m^3/year	**m^3/day**
Buikwe	3	147	464	4.3	1997	0.2	399.41	1.28
Kikunyu-Kiyindi	3	399	1262	4.4	5551	0.2	1110.16	3.56
Lugazi	30	4368	13826	3.6	49773	0.2	9954.65	31.91
Najjembe	0	54	171	4	683	0.2	136.59	0.44
Nkokonjeru	17	561	1777	3.7	6573	1.2	7887.86	25.28
					64577		19488.66	**62.5**

Source: Project estimates

3.2.3 Estimation of FS Volume for households using baseline survey data – With Unlined pits considered

From practices on the existing FS treatment plants, it has been observed that a fraction of FS from unlined pit latrines is emptied using semi-mechanized means or manually and transported to the

treatment plant. This is usually thick sludge which is emptied into drums and transported using trucks or tricycles to the treatment plants. Therefore, some assumptions are made to consider this fraction of FS to be delivered to the treatment facility:

- Household population based on census report (UBOS, 2014),
- Current (2020) household numbers are determined by projecting using the growth rate in UBOS (2014) Census report.
- The fraction of households with lined pit latrines, septic tanks and unlined pit latrines was obtained from the baseline survey data. The following percentages of the population relying on different facilities were obtained (**Table 3-2**).

Table 3-2: Fraction of population using different sanitation facilities

Town Council	Septic Tanks	Lined pit latrines	Unlined pit latrines
	%	%	%
Buikwe	0.65	1.94	97.4
Kikunyu-Kiyindi	0.84	2.52	96.6
Lugazi	17.94	12.27	64.1
Najjembe	0.45	0	99.1
Nkokonjeru	1.87	14.95	68.2

- Sludge accumulation rates for septic tanks, lined pit latrines and unlined pit latrines were based on those in the Kampala Master Plan and WHO guidelines. Values adopted include 0.2, 0.12 and 0.06 for septic tanks, lined pit latrines and unlined pit latrines, respectively. Using these values, an FS volume of **63.81 m^3/day** is obtained.
- However, it is not possible to have all the pit latrines emptiable since the most commonly available option is to cover a full one and construct a new unlined pit latrine.
- The projected number of households in 2040 is given by the equation below:

$$H_n = H_o (1 + r)^n$$

Where:

H_n : projected number of households in 2040

H_o : initial number of households in 2020

r: household growth rate

n: design life

- Assume, that 30% of the owners of unlined pit latrines are located in urban areas where is it difficult to construct new facilities, hence the need for emptying. The FS volume from unlined pit latrines which will reach treatment plants in 2040 will be 28.68 m^3/day.

  The total FS volume produced is **63.81 m^3/day** (**Table 3-3**).

Table 3-3: Design FS Volume for Households considering unlined pit latrines

Household Facility	Households (potential demand) - 2020	Households Demand - 2040	Average Household size	Total Population	Sludge per capita per annum	Daily Sludge generated
					m^3/P/year	m^3/day
Septic Tanks	2847	10241.2	4.0	40965	0.2	22.45
Lined pit latrines	2682	9647.8	4.0	38591	0.12	12.69
Unlined pits	40413	145372.1	4.0	581488	0.06	28.68
Total	45942	165261		661044		**63.81**

Source: Project estimates

In considering the three approaches, the FS volume based on baseline data, with no consideration of unlined pit latrines can be taken as the minimum variant and that based on the baseline line survey data, with consideration of unlined pit latrines as the maximum variant. In order not to over-design or under-design the system, the average of the three volumes (**FS volume = 63.14 m^3/day**) was taken as the design FS volume for the households in the project areas.

3.2.3.1 Faecal Sludge Volume from Educational, Commercial and Public Institutions

The current number of institutions in each town council was determined through stakeholder consultations. The different institutions considered include schools, health centres, churches/mosques, hotels, restaurants/guesthouses/lodges, fuel stations, markets, vehicle parks, factories and civil institutions (police, prisons, banks, town council/sub-county offices, NWSC offices, etc.). The average number of people per institution category in each town council was determined, through baseline surveys and stakeholder consultations.

The total current population was determined by multiplying the average population by the number of institutions and summing up for different intuitions. Projections for the ultimate year 2040 were made using the population growth rate based on a census report (UBOS, 2014).

Using a sludge and scum accumulation rate of 200l/p/year, the FS volume produced per year was computed and this was used to estimate the daily production rate.

The assumption here is all the institutions are connected to emptiable facilities by the design life of the project. For example, the findings from the baseline survey data show that schools in several town councils were relying on emptiable sanitation facilities (lined pit latrines and septic

tanks). Also, the presence of a faecal sludge treatment facility in the vicinity will lead to enforcement of the regulations to have the non-compliant institutions construct emptiable facilities.

For institutions, it was necessary to convert the number of users into population equivalent (PE), since the user is supposed to produce much less sludge than a "normal" inhabitant. To do that, the number of users was multiplied by a factor lower than 1. This factor can be estimated based on the time that the user passes at a particular institution category. Using this approach, the FS volume produced from the institutions in Buikwe cluster towns was **28.60 m^3/day**.

Table 3-4: FS Volume from Institutions in Buikwe Cluster Towns

Town Council/ Sub-county	Institution category	No. of institutions	Average population (Baseline studies)	Total population, P (2020)	Projected Population (2040)	Sludge & scum accumualtion rate	Population Equivalent fator	Voulme of faecal sludge
						m^3/P/year	h/24h	m^3/day
Buikwe	Schools	40	396	15,840	22,191	0.2	0.2	2.43
	Health Centres	6	100	600	841	0.2	0.1	0.05
	Church/Mosque	20	100	2,000	2,802	0.2	0.2	0.31
	Hotels/	20	100	2,000	2,802	0.2	0.2	0.31
	Restuarants/ Guesthouses	30	15	450	630	0.2	0.1	0.03
	Petro Stations	8	50	400	560	0.2	0.1	0.03
	Markets/Taxi Parks	3	300	900	1,261	0.2	0.1	0.07
	Civil Insitutions	3	100	300	420	0.2	0.3	0.07
Lugazi	Schools	150	396	59,400	83,216	0.2	0.2	9.12
	Health Centres	24	100	2,400	3,362	0.2	0.1	0.18
	Church/Mosque	100	100	10,000	14,009	0.2	0.2	1.54
	Hotels	30	100	3,000	4,203	0.2	0.2	0.46
	Restuarants/ Guesthouses	40	15	600	841	0.2	0.1	0.05
	Petro Stations	15	50	750	1,051	0.2	0.1	0.06
	Markets/Taxi Parks	4	600	2,400	3,362	0.2	0.1	0.18
	Civil Insitutions	5	30	150	210	0.2	0.3	0.03
Najjembe	Schools	45	396	17,820	24,965	0.2	0.2	2.74
	Health Centres	20	100	2,000	2,802	0.2	0.1	0.15
	Church/Mosque	50	100	5,000	7,005	0.2	0.2	0.77
	Hotels	5	100	500	700	0.2	0.2	0.08
	Guesthouses	20	15	300	420	0.2	0.1	0.02
	Petro Stations	6	50	300	420	0.2	0.1	0.02
	Markets/Taxi Parks	2	600	1,200	1,681	0.2	0.1	0.09
	Civil Insitutions	3	30	90	126	0.2	0.3	0.02
Kikunyu-Kiyindi	Schools	60	396	23,760	33,286	0.2	0.2	3.65
	Health Centres	8	100	800	1,121	0.2	0.1	0.06
	Church/Mosque	45	30	1,350	1,891	0.2	0.2	0.21
	Hotels	5	100	500	700	0.2	0.2	0.08
	Guesthouses	40	50	2,000	2,802	0.2	0.1	0.15
	Petro Stations	6	50	300	420	0.2	0.1	0.02
	Markets/Taxi Parks	2	600	1,200	1,681	0.2	0.1	0.09
	Civil Insitutions	5	30	150	210	0.2	0.3	0.03
Nkkokonjeru	Schools	80	396	31,680	44,382	0.2	0.2	4.86
	Health Centres	7	100	700	981	0.2	0.1	0.05
	Church/Mosque	30	30	900	1,261	0.2	0.2	0.14
	Hotels	10	100	1,000	1,401	0.2	0.2	0.15
	Guesthouses	35	50	1,750	2,452	0.2	0.1	0.13
	Petro Stations	5	50	250	350	0.2	0.1	0.02
	Markets/Taxi Parks	2	600	1,200	1,681	0.2	0.1	0.09
	Civil Insitutions	5	30	150	210	0.2	0.3	0.03
					274710			**28.60**

3.2.4 Design FS Volume delivered to Treatment Plant

The total FS produced was the sum of household and institutional FS, which was **91.73** m^3/day.

Table 3-5: Average FS to be delivered to FS treatment facility

Category	FS produced (m^3/d)
Household FS	63.14
Institutional FS	28.60
Total	**91.73**

Source: Project estimates

3.2.5 Design of FS Treatment Process Units

The faecal sludge treatment process will involve the following units:

1) Inlet works
    a. Bar screens
    b. Grit chamber
2) Settling-Thickening tanks
3) Unplanted drying beds
4) Facultative ponds
5) Maturation ponds
6) Constructed wetland
7) Ancillary works
    a) Administration Building with a laboratory
    b) Storage bunker for dried faecal sludge
    c) Fencing

3.2.5.1 Inlet works

The inlet works are comprised of a galvanized bar screen and a grit chamber. The screen has been sized to the maximum peak flow from a vacuum truck discharging. The screens comprise manually raked 20mm bar screens inclined at 30^o to the vertical. Sanitation technologies were found to have high volumes of solid wastes, which will form the screenings at the FS treatment facility. The screens will be raked manually onto the perforated steel troughs where the screenings will be allowed to dewater. Screenings/solid wastes will be placed in a storage skip and then disposed of at a landfill or space for drying will be provided to aid disposal through incineration.

The screened liquid FS will then be led to the grit chamber to remove suspended inorganic particles such as sand and grit. A twin grit chamber will be provided to allow easy maintenance of one chamber while the other chamber remains in operation. The FS after grit removal will then be led to the settling-thickening tank for the separation of solid from the liquid FS.

3.2.5.1.1 Screens

To prevent bulky material such as solid wastes from entering the treatment plant and disturbing the treatment process, a screen shall be foreseen at the inlet of the plant. The dimensions of the screen at the FSTP are given in **Table 3-6**.

Table 3-6: FSTP Screens Characteristics

Chosen characteristics of the Screens	Units	Buikwe Cluster FSTP
Width of chamber	mm	1000
Depth of chamber	mm	350
Bar thickness	mm	10
Spacing between bars	mm	30
Slope in relation to the vertical	Degree	30°
Number of bars	Nr	20
Bar spacing	mm	30
Bed slope	m	1 in 28
Drop after the screen	mm	150

The FSTP middle fine screen will have 10mm thick bars made of galvanized steel spaced 30mm space apart and inclined at 30° to the vertical.

The screened material shall be removed using hand rakes. Perforated steel trough screenings shall be used for placing the screenings on. The screenings are first raked manually onto the perforated steel troughs where the screenings are allowed to dewater. From there, the screenings can be placed in a nearby storage area and then removed. Screenings should be burnt or buried with 40 cm of soil cover.

The screen chamber will be equipped with an upstream and downstream sliding gate (penstock) for isolating and controlling the flows into the anaerobic ponds if maintenance needs to be done and also if a need for the bypass to be used arises. The cleaning of the chamber and the removal of sand shall be carried out during the periods of low volumes delivered to the treatment plant.

3.2.5.1.2 Grit Chambers

The FS treatment plant shall be equipped with two parallel open-channel grit chambers. FS contains high concentrations of suspended solids and large amounts of inorganic/sand particles. These require a grit chamber for their removal before joining settling-thickening tanks. One chamber shall be used, with the second closed. For large flows at the same time, both channels shall be in use.

Each channel will be equipped with an upstream and downstream sliding gate (penstock) for isolating the channels in the non-working phase. The grit shall be removed manually once the grit channel is filled with sand. A grit deposit area shall be constructed near the grit chamber where the grit can be washed and wash wastewater continues to the settling-thickening tank. The characteristics of the Grit channels at the FSTP are given in **Table 3-7** below

Table 3-7: FSTP Grit Chambers Characteristics

Chosen Characteristics of Grit Channels	Units	Buikwe Cluster FSTP
No. of Grit Channel Units	Nr	2
Depth of channel	m	0.83
Velocity in Channel	m/s	0.3
Width of each Grit Channel unit	mm	600
Length of each Grit Channel unit	m	3.75

The cleaning of the channels and the removal of sand shall be carried out during the low flow periods.

3.2.5.2 Settling-Thickening Tank

The settling-thickening tanks have been designed according to the design criteria. It is designed to remove suspended solids by sedimentation. The low flow velocity in a settler allows settleable particles to sink to the bottom, while constituents lighter than water float to the surface.

A two-compartment settler will be provided of 12m total length, 4.0m width and 1.8 m depth (**Table 3-8**). A desludging interval of 2 months has been considered. Desludging will be done by vacuum tank through the inspection manholes and the sludge will be placed on the sludge drying beds. The FS is retained in the settling tank for 3 hours at the design horizon, the retention period will be longer in the first years of operation. The effluent from the settler will be conveyed to an anaerobic baffled reactor (ABR) and later joins the facultative pond with 150mm diameter PVC pipes for further treatment. The bottom, top slabs and side walls will be constructed with reinforced concrete.

Table 3-8: FSTP Settling-Thickening Tank Dimensions

Chosen Characteristics of Settling-Thickening Tank	Units	Buikwe Cluster FSTP
No. of Tanks	Nr	2
Overall internal length	m	12
Internal width of each tank	m	4.0
Tank depth	m	1.8
Length of the inlet chamber	m	8
Length of the outlet chamber	m	4
Diameter of PVC pipe to facultative pond	mm	150
Desludging interval	Months	2

3.2.5.3 Sludge Drying Beds

6 No reinforced concrete sludge drying beds have been provided each measuring 12.3m x 12.3m and 1.1m deep. Each sludge drying bed shall have ramp access for vehicular access or pedestrian access for moving sludge. Each bed shall be fed by DN 110mm UPVC pipe with a gate valve to allow the choice of beds to fill (**Table 3-9**).

The sludge drying beds are covered with a roof to avoid rainfall from rehydrating the drying sludge. The sides of the roof are elevated to allow for optimum drying conditions and vehicular access. The base shall consist of a slightly inclined reinforced concrete slab. The area shall be surrounded by a protection wall. One drainage pipe shall connect the drying area to the facultative pond so that if sludge drain water still exists it will flow back to the ponds. The dried sludge shall be removed periodically from the sludge drying area and shall be taken to the tip, burnt or given to interested farmers.

Table 3-9: FSTP Drying Bed Dimensions

Chosen Characteristics of Drying Beds	Units	Buikwe Cluster FSTP
No. of sludge drying beds	Nr	7
Length of each bed	m	12.3
Width of each bed	m	12.3
Bed depth	m	1.1
Feeding pipe diameter (UPVC)	mm	DN 110
Depth of sand layer	m	0.20
Depth of fine gravel	m	0.10
Depth of course gravel	m	0.15

3.2.5.4 Facultative pond

Effluent from the settling-thickening tanks and sludge drying beds is collected for treatment in the facultative waste stabilization pond. One facultative pond measuring 42.0m x 21.0m x 1.5m depth has been provided. The BOD is reduced from 875.11 mg/L to 136.9 mg/l and the faecal coliforms reduced from 1.10 x 106 to 9258.4 Faecal Coliforms/100 ml, all these figures are above the NEMA acceptable limits of 50mg/l and 5000 FC/100ml respectively for receiving streams, hence a need for further treatment of the wastewater using the constructed wetland. A geosynthetic clay liner has been allowed on the slopes and bottoms of the pond to prevent seepage of the leachate and contamination of the in situ soil and underground water. The pond embankments will be protected from wave action erosion with concrete slabs, laid on a concrete ring beam. The FSTP for the Buikwe cluster shall contain one Facultative Pond. The dimensions of the pond are given in **Table 3-10** below.

Table 3-10: Dimensions of Facultative Ponds

Term	Unit	Buikwe Cluster FSTP
Total Volume of FS loaded per day	m^3/day	91.58
Freeboard	m	0.5
Slope of Embankment (1: x)	-	2
Relation Length/Breadth	-	2:1
Depth of FS in the pond	m	1.5
Number of ponds		4
Mid-depth dimensions of the pond; L X W	m	42.0 x 21.0
BOD Concentration at effluent from facultative pond	mg/l	63.5
Coliform Load after a facultative pond	No/100ml	9,258.4
Source: *Project Estimates,*		

3.2.5.4.1 Connections

The interconnections between the various ponds shall be with DN 200 pipes fitted with sluice valves. The sluice valves shall be of the socket-ended type to fit uPVC spigots.

3.2.5.4.2 Erosion Protection

As erosion protection, the embankments will be provided with concrete slabs to be cast in situ and to be anchored in the slope. The slab shall be of reinforced concrete and at least 10 cm thick. The width of the protection slab shall be 1.50 m fixed at the water level.

3.2.5.5 Constructed wetland

Two constructed wetlands measuring 35m x 9m x 0.5m in depth each have been designed for further treatment of the effluent to acceptable NEMA effluent discharge standards for BOD^5 (50 mg/L) for receiving streams. In the FSTP, the effluent of the Facultative Pond is the influent of the constructed wetland. The sizing of the pond is based on BOD^5 removal from the facultative pond effluent (**Table 3-11**).

Table 3-11: Dimensions of the Constructed wetland

Term	Unit	Buikwe Cluster FSTP
Number of wetlands	No	2
The total volume of FS loaded per day	m^3/day	14.82
Freeboard	m	0.5
Depth of FS in wetland	m	0.5

Term	Unit	Buikwe Cluster FSTP
Wetland length	m	14
Wetland width	m	4
BOD concentration of effluent	mg/l	50
The efficiency of BOD reduction	%	60
Source: *Project Estimates,*		

3.2.5.6 Water supply, Electrical Installations and Sanitary Facilities

The treatment plant shall be provided with a water connection. Sanitary facilities shall be provided as well as electrical installations. The operation building, the roads and lanes of the treatment plant and the corners of the ponds are to be supplied with electrical installations for illumination purposes.

3.2.5.7 Ancillary works

An administration building containing an operational staff office, store, and laboratory will be provided at the FS treatment facility. The operations building shall be constructed of reinforced concrete and hollow core concrete blocks for the walls. A generator structure will be constructed near the pump house to accommodate a standby generator.

Fencing, security lighting and site water supply system are to be installed together with drainage ditching and 2-coat bitumen and chip surface dressing of access road to and within the site. Other facilities shall include roads, walkways and parking areas. Open areas shall be covered with lawns and flowers. Trees, ornamental plants and bushes shall be selected from those species, which do not shed too many leaves nor require too much maintenance. Tall trees, which would cut down wind access to the ponds, shall be avoided.

3.2.5.7.1 Laboratory Facilities

To ascertain the performance of the faecal sludge treatment plant, it is prudent that there is a laboratory facility at the site. Considering the proposed treatment unit processes and unit operations, routine monitoring will be required for the following parameters: pH, TS, TSS, COD, BOD5, Nutrients (Total Nitrogen and Total Phosphorus) and Total nitrogen of the faecal sludge.

In addition, ascertaining the quality of the dried faecal sludge will necessitate the determination of pH, Moisture content, Nutrients (N & P), Calorific value (possibility for use as an energy source), Ascaris eggs (for safety) and heavy metals (Cd, Pb and Cr). It suffices to point out that except for calorific value, heavy metals and Ascaris eggs, it is proposed that the rest of the parameters be undertaken at the site laboratory facility using the proposed equipment and consumables.

To avoid cross-contamination, the laboratory facility must be constructed in such a way that it is with separate sections for physical/chemical and microbiological analyses. There should be

provision for appropriate storage of chemicals/reagents and consumables, sterilization of used glassware/containers and pertinent accessories and safe disposal of materials.

The operators at the plant and also within the laboratory should wear appropriate personal protective equipment at all times with hygiene safety given priority.

Table 3-12: Proposed Equipment for laboratory facility at the faecal sludge treatment plant

S/N	Equipment/ Consumables	Description	Purpose
1	pH/EC meter	Hach HQ30d flexi model with pH and EC probe. Calibrations solutions for pH and EC	For in-situ determination of pH, EC, ORP and temperature
2	Incubator	LEEC C157 incubator, with internal dimensions (HxWxDmm) = 573x550x500, chamber capacity 157litres, 4 shelves, power rating (Max 280), Temperature range at least more than 5ºC above ambient to +60ºC. Temperature control is typically ±0.1ºC at 37ºC.	For determination of Faecal coliforms
3	Dry Oven	Memmert Universal oven Model UFB 500; Interior Heating Concept (with English manual) • Size: w x h x d = 560 x 480 x 400 mm, 108 l • easy-to-clean interior, made of stainless steel, reinforced by deep-drawn ribbing with integrated and protected large-area heating on four sides • 2 stainless steel grids Temperature Range: • from +30 °C (however, at least 10 °C above ambient) up to +220 °C Voltage / Power Rating: • 230 V (+/- 10%), 50/60 Hz • ca. 2.000 W (during heating)	For the determination of total solids and total dissolved solids
4	BOD measurement system (3 sets)	BD 600 BOD measurement system 6 place - Product No.1200199 or 2444460. Each set includes; • BD 600, complete unit with 6 sensor heads and control unit with batteries • Power supply unit incl. Y-cable for common power supply of BD 600 and stirring unit	For determination of BOD_5

S/N	Equipment/ Consumables	Description	Purpose
		• 1 x USB-cable • 1 x remote control • Inductive stirring unit • 6 sample bottles • 6 rubber gaskets • 6 magnetic stirring rods • 1 overflow flask, 157 ml • 1 overflow flask, 428 ml • 1 bottle, 50 ml potassium hydroxide solution • 1 bottle, 50 ml nitrification inhibitor solution • 1 instruction Manual (in English) Include the BOD system test set calibrations tablets for testing the manometric measurement BOD system above (Product No. 1151979 or 418328)	
5	Incubator	**ET637-6** with 6 sockets Net capacity: 280 Ltr. Power consumption: 240 VA; 2,05 kWh / 24h (ambient temperature 25 °C, target temperature 20 °C with interior lighting switched on (15 W)) Weight: 82.0 kg Order Code: 2 42 82 35 Overall dimensions: 1590 H x 600 W x 600 D mm Inside dimensions : 1450 H x 515 W x 415 D mm (with 5 retractable grids and 1 bottom grid) Door with double glazed insulated in ABS frame Order code: 2 43 82 35	For determination of BOD_5
6	Spectrophotometer	DR 6000™ UV VIS Spectrophotometer without RFID; Product no. LPV441.99.00002 Includes Cuvette compatibility 2: 1 inch rectangular and round cell Cuvette compatibility 3: optional 100 mm rectangular cell with additional adapter Data Logger: 5000 data points (result, date, time, sample ID, user ID) Dimensions (H x W x D): 215 mm x 500 mm x	For readings of nutrients (N & P), Ammonium nitrogen and COD

S/N	Equipment/ Consumables	Description	Purpose
		460 mm Display: TFT 7" WVGA colour touch Enclosure Rating: IP20 with closed lid Includes: 1 x Power Cord (US, EU) with English manual	
7	Analytical and precision balances, 2 No. (200g capacity and 4500g capacity)	Analytical balance with a capacity of 200g, readability of 0.1mg, pan size 3.5inch platform, 3 door draft shields, with dimensions 8.5"Wx1.3" Hx13.5"D (Product no. 1759 M 76). Precision balance, capacity 4500g, readability 0.01g, platform size mm (192Wx192L) with 18 weighing units including 2 user programmable custom units, automatic temperature compensation function, below pan weighing facility and with external calibration (Product no. B043-633), supplied with weigh below hook (Product no. B043-683), in-use cover (Product no. B043-689) and dust cover (Product no. B043-687).	For dependable mass measurement for solution preparation and quantitative analysis
8	Still, water, Automatic	Barnstead/Thermolyne FI-Streem II 2S Glass still with vapour trap. It May be wall or bench-mounted, with fully automatic controls, a level sensor, and dual feed capability, pressure 10-80psi. Dimensions 79x26x32.5cm, shipping weight 15kg, Electric supply 220Vac, 50/60Hz (Product no. 2615902)	For providing high-quality distilled water for various laboratory applications
9	Autoclave, Electrical model	Autoclave complete self-contained unit with an immersion heating element, automatic thermostatic control, automatic release valve and pilot light. Model 75X (A774-356) with 1650Watt element for fast start-up times, more accurate TPI thermocouple, snaps switch and pilot light, 60-minute mechanical bell timer, with a gross capacity of 39litres, internal diameter 356mm, Internal useable height 260mm, power rating 240,50/60Hz, standard working temperature 120ºC, supplied with support stand (Product no. A774-365)	For laboratory sterilizing applications

S/N	Equipment/ Consumables	Description	Purpose
10	COD reactor	Model 45600 COD Reactor, a 25-well, a dry-bath incubator that provides the 150 °C temperature environment required for chemical oxygen demand (COD) determinations. Supplied with a dial gauge thermometer, power cord and safety shield (15inch high, 3/16-inch-thick polycarbonate attached to a heavy steel base). Is with a 2-hour timer.	For digestion of samples for COD determination
11	Refrigerator	Lab cold Refrigerator with digital display with re-circulated air cooling, lockable door, spark-free interior, automatic defrost, CFC and HCFC free, temperature set point range 0 to 8ºC, capacity 490L, with internal air circulation powered by external motor for much-improved temperature uniformity, dimensions mm (760wx720dx1775h), white enamel exterior and interior, supplied with 6 plastic coated wire mesh, electric supply 230V, 50/60Hz. Supply with power surge protectors.	For laboratory storage of samples, chemicals and reagents
12	Freezer	Liebherr freezer, upright with a capacity of 520L, temperature range -9 to 26ºC, 7 fixed shelves with 14 baskets, Dimension external mm (753wx720dx1705h), Electric supply 230V, 50Hz single phase. Supply with power surge protectors.	For storage of samples.
13	Stirrer, Magnetic Hotplate, Digital	For the preparation of solutions/reagents for various analyses. Magnetic stirrer with heating, alarm, time and set point indicators, temperature and time control options (variable 0-999minutes), chemically resistant splash proof, wipe clean panel, aluminium hot plate material, hot plate dimension: 140mm diameter, overall dimensions mm (200wx295dx135h), heater: 400watts, voltage: 230V and a digital LED display, speed: 100-1500rpm, supplied with PTFE stirring rods (1x20mm and 1x40mm) (S519-125). Supply with star bar magnetic retriever (polyethene pick-up rod with powerful magnet sealed in one end and hand-up grip on other, 31cm long) (Product No.	For the preparation of solutions/reagents for various analyses

S/N	Equipment/ Consumables	Description	Purpose
		1523200)	
14	Blender, Electric	Household (Kitchen) blender (not exceeding 2litres).	For faecal sludge sample preparation (homogenization) before analysis

3.2.6 Geotechnical Investigations

A geotechnical investigation was carried out to determine the soil type underlying the proposed site, its bearing capacity and the foundation depth. From the investigation results, the following conclusions and recommendations are drawn (A detailed separate report provided):

- Generally, the site is predominantly underlain by sandy CLAY and clayey GRAVEL,
- The ground is slightly corrosive with a pH value of > 5.5. The sulphate and chloride contents are less than 0.1%,
- The allowable bearing capacities of the soil based on the DPL test range from 58.0 to 482.23kPa for depths between 0.0m and 8.0m.
- The allowable bearing capacities for square footings from the geotechnical model vary from 189.08 to 206.12kpa at depths varying from 1.5m to 3.0m for foundation widths between 1.0 and 3.0m respectively,
- The groundwater table was not encountered within the exploration depth.

- Based on the results of the investigation, the following recommendations were made;
  - The shallow footing can be placed at a minimum depth of 1.5m for square footings from the ground surface level.
  - A resistivity test is recommended before construction to confirm the corrosive nature of the soil
  - Since the ground is underlain by a highly plastic layer of clay, no footing should be founded on it. A fill material composed of granular materials is recommended below the founding depth of each pad or combined foundation. The thickness of the fill material is recommended to be 300mm, as a minimum value.
  - Once excavations to accommodate the foundations have been completed, the bottom of the excavation shall be protected in all cases with a thin layer of lean concrete (f'c=100 kg/cm2), with a thickness of at least 50mm before proceeding to

place concrete for foundation construction. The foundation should be cured for 14 days (minimum) and thereafter left undisturbed for a period not less than 30 days.

4 POLICY, LEGAL, AND INSTITUTIONAL FRAMEWORKS

4.1 Introduction

In this chapter, the policy, legal and institutional framework within which this Environmental and Social Impact Assessment was conducted is discussed. National laws are discussed along with relevant multilateral environmental agreements to which Uganda is a party.

The proposed faecal sludge treatment facility development in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, and Buikwe District may have serious impacts on the environment from three perspectives: first, the effects of construction and the resulting disturbance on ecological and social systems especially impacts on property rights; and secondly, the operational phase impacts of the faecal sludge treatment facility, as well as socio-economic activities it creates, may have both have negative and positive impacts on the environment and social setting of the residential area and finally the decommissioning phase impacts. These environmental and social effects/impacts must be managed within a legal framework.

Uganda has various laws, policies and institutional setup governing the management of its natural environment as discussed in the following sub-sections. These shall be strictly adhered to during all activities relating to the faecal sludge treatment facility.

4.2 Policy Framework

4.2.1 The National Environment Management Policy, 1994

This policy aims at promoting sustainable economic and social development mindful of the needs of future generations and EIA is one of the vital tools it considers necessary to ensure environmental quality and resource productivity on a long-term basis. It calls for the integration of environmental concerns into development policies, plans and projects at the national, district and local levels. Hence, the policy requires projects or policies likely to have significant adverse ecological or social impacts to undertake an EIA before implementation and thereafter periodic Environmental Audits. This is also reaffirmed in the National Environment Act, 2019 which makes EIA and Environmental Audits requirements for eligible projects including the development of the proposed faecal sludge Management facility.

Relevance:

The developer MoWE appointed NEMA-certified EIA Experts to conduct the ESIA Study to seek approval before commencing with the development of the faecal sludge management facility in the Buikwe cluster.

4.2.2 Uganda Vision 2040

The Uganda National Vision 2040 while encouraging improved water resources management and utilization provides that efforts will be undertaken to attain a green and clean environment with no water and air pollution while conserving the flora and fauna and restoring and adding value to the ecosystems. Sustainable utilization of the environment will be addressed in line with Uganda's

commitment to the principles of the Rio Declaration on Environment and Development, the Programme for the Further Implementation of Agenda 21 and the Plan of Implementation of the World Summit on Sustainable Development (Johannesburg Declaration on Sustainable Development) among others.

Relevance:

The Government of Uganda actively takes all requisite measures to protect the environment and natural resources and ensure their future sustainability as part of the international obligations, treaties and agreements. Therefore, the ESIA practice continues to be one of the ways how environmental and social impacts are minimised thus ensuring environmental sustainability.

4.2.3 National Development Plan III (2020)

The environment sector is said to contribute to the productivity of other sectors especially agriculture, industry and fisheries by providing natural assets from a sustainable natural resource base. The NDP III highlights some of the strategic objectives for the environment as highlighted below;

1. Ensure availability of adequate and reliable quality freshwater resources for all uses;
2. Increase forest, tree and wetland coverage, restore bare hills and protect mountainous areas and rangelands;
3. Strengthen land use and management;
4. Maintain and/or restore a clean, healthy, and productive environment;
5. Promote inclusive climate resilient and low emissions development at all levels;
6. Reduce human and economic loss from natural hazards and disasters;
7. Increase incomes and employment through sustainable use and value addition to water, forests and other natural resources.

4.2.4 National Land Use Policy, 2013

The overall goal of the national land use policy is “To achieve sustainable and equitable socio-economic development through optimal land management and utilization in Uganda”. The Policy calls for the adoption of an open policy on information to the public and seeking the consent of communities and local governments concerning the management of natural resources.

Relevance:

The environmental and social impact assessments are aimed at ensuring sustainable implementation of sanitation projects in conformity with the land use policy.

4.2.5 National Gender Policy 1997

The overall goal of the National Gender Policy 1997 is to mainstream gender concerns in the national development process to improve the social, legal/civic, political, economic and cultural conditions of the people of Uganda, and in particular women. Thus, in the context of the proposed

faecal sludge treatment facility project, it aims to redress the imbalances which arise from the existing gender inequalities, promote the participation of both women and men in all stages of the project cycle, and equal access to and control over economically significant resources and benefits. It also strives to promote recognition and value of women's roles and contributions as agents of change and beneficiaries of the development process recruitment process for workers on the project, provision of sanitary facilities, payments and days off.

Relevance:

In the context of the water and sanitation sector (for which the faecal sludge management facility falls), it aims to redress the imbalances which arise from the existing gender inequalities and promotes the participation of both women and men in all stages of the faecal sludge management facility's project cycle, thus promoting equal access to and control over water resources.

4.2.6 HIV/ AIDS Policy

The National AIDS Policy is one of the most important developments in the fight against the AIDS pandemic. Formulated in 2007, the policy focuses on the workplace and acknowledges that it is the workplace where the working population spends most of its active lifetime. It underscores the ILO estimates of the size of the workforce getting smaller by 10-20% in countries like Uganda with high prevalence rates and that orphaned children will be forced into the job market and thus not only exacerbating child labour but also increasing workers with minimal or no formal education.

It covers all workers including those in the construction sub-sector and their workplaces. The key principles underlying its implementation are non-discrimination, confidentiality; HIV testing, greater involvement of people living with HIV/AIDS (GIPA); promotion of prevention; treatment, care and support as well as gender concerns in the world of work. It provides a framework for the prevention of the further spread of HIV and the mitigation of its social-economic impact within the world of work in Uganda. The policy further defines the roles of key stakeholders namely government, employers, workers and the private sector including the informal sector, people living with HIV/AIDS, civil society organizations and development partners. The policy recognizes that HIV/AIDS has resulted in more widows and children entering the workforce.

Relevance:

There is a need for the developer/contractor to educate his workforce (i.e., both migrant and local) and the general community on HIV/AIDs, especially during the construction of the faecal sludge management facility and its associated infrastructure.

4.2.7 The National Water Policy, 1999

The National Water Policy, of 1999 promotes an integrated approach to the management of water resources in ways that are sustainable and most beneficial to the people of Uganda. It stipulates that the quality of drainage water shall be such as not to pollute the receiving water or groundwater and that all measures must be taken by the users to prevent an increase in salinity

levels in receiving waters, to prevent the accumulation of dangerous or toxic compounds in the subsoil, capable of contaminating underground waters.

Relevance:

The management of the proposed faecal sludge management facility should be in line with this policy especially in ensuring that the community is involved in management right from the design of the project. This will promote sustainability and a sense of responsibility.

4.2.8 National Wetlands Policy, 1995

The government adopted the National Policy for the Conservation and Management of Wetland Resources to promote their conservation to sustain their values for the present and future well-being of the people. In support of this aim, the National Wetlands Policy sets five goals:

a) To establish the principles by which wetland resources can be optimally used now and in the future;

b) To end practices that reduce wetland productivity;

c) To maintain the biological diversity of natural or semi-natural wetlands;

d) To maintain wetland functions and values;

e) To integrate wetland concerns into the planning and decision-making of other sectors.

In particular, the policy aims at:

a) Ensuring that only non-destructive uses are carried out in and around;

b) Ensuring, that no drainage occurs unless more important environment management requirements supersede;

c) Ensuring that wetland developments are subject to environmental impact assessment and audit;

d) Maintaining an optimum diversity of uses and users and consideration for other stakeholders when using a wetland.

Relevance:

The proposed faecal sludge management facility for Buikwe District is to be located in or close to wetlands which are functioning areas for ecosystem and biodiversity. Therefore, these have to be protected following this policy.

4.2.9 Uganda Resettlement / Land Acquisition Policy Framework, 2001

Regarding compensation and resettlement issues, the main pieces of legislation are the Constitution of the Republic of Uganda and the Land Act. The existing legislation emphasizes adequate, fair and prompt compensation:

a) Compensation should be aimed at minimizing social disruption and assisting those who have lost assets as a result of the development of the faecal sludge management facility to maintain their livelihoods. Under Ugandan laws and standards, a disturbance allowance is to be provided to assist the project-affected individual or family to cover the costs of moving and locating to a new holding.

b) Community infrastructure must be replaced and ideally be improved in situations where it was deficient. This includes the installation of sanitary facilities, electricity generation systems, road links and provision of water.

4.2.10 The Environmental Health Policy / National Sanitation Policy, 2005

The Policy aims at ensuring the achievement and maintenance of healthy living conditions in both rural and urban areas in line with the Public Health Act

Relevance: *The provision of access to proper waste (Sludge) management will contribute to the healthy living of people in the project area, thereby improving people's standards of living.*

4.2.11 National Policy on Disability in Uganda, 2006

The government through the Ministry of Gender, Labour and Social Development has the mandate to promote and protect the rights of persons with disabilities (PWDs). The Government is mandated to promote and protect the rights of persons with disabilities and the Constitution of the Republic of Uganda stipulates the need to empower and provide equal opportunities to PWDs. The government has focused on the provision of health services, community-based rehabilitation, vocational training etc.

Relevance: *PWDs shall also be allowed to be hired in sections where they can ably perform as these opportunities arise during project implementation.*

4.2.12 Forest Policy, 2001

The guiding principles in the Forestry Policy, 2001 that are directly applicable to this ESIA include:
Conservation and Sustainable Development: Uganda's forests should be managed to meet the needs of this generation without compromising the rights of future generations.

Livelihoods and Poverty: the improvement of livelihoods should be a major goal in all the strategies and actions for the development of the forest sector to contribute to poverty eradication.
Biodiversity and Environmental Services: forest sector development should safeguard the nation's forest biodiversity and environmental services through effective conservation strategies.

Relevance: *The project management shall act to safeguard the nation's forest biodiversity and environmental services within their environs*

4.2.13 Occupational Health and Safety Policy (OHS)

The policy seeks to:

- Provide and maintain a healthy working environment.
- Institutionalize OHS in the sector policies, programme and plans.
- Promote efficient safety management practices.
- Contribute towards safeguarding the physical environment.

The OHS Policy Statement is guided by the Constitution of the Republic of Uganda and other global, national and sectoral regulations and policies.

Relevance. *The policy also takes into recognition and aims to improve the quality of life for all Ugandans in their living and work settings.*

4.2.14 The National Health Policy, 1999

The overall objective of health sector policy is to reduce mortality, morbidity and fertility, and the disparities therein. Ensuring access to the minimum health care package is a central strategy for this goal.

Relation to the project: *This project is therefore in line with the strategies of this policy though ensuring that all workers and the community have access to health while at the same time making sure that the activities of the project do not endanger the health of the workers and neighbouring community.*

4.3 Legal Framework

4.3.1 Constitution of the Republic of Uganda, 1995

The Constitution is the supreme law of Uganda and it provides for the protection of the environment. It provides for:

a) 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.

b) Take possible measures to prevent or minimize damage and destruction to land, air and water resources resulting from pollution or other causes.

c) Promote the rational use of natural resources to safeguard and protect bio-diversity in Uganda.

d) Under Article 39, the Constitution guarantees the right of every Ugandan to a clean and healthy environment.

Relevance:

The development of the faecal sludge management facility in Buikwe District is aimed at sustainable development for the benefit of the locals and will be done following mitigation measures that are suggested in this ESIA report.

4.3.2 National Environmental Act, No.5 of 2019

The main law relating to the protection of the environment in Uganda is the National Environment Act 2019. This Act states the duty to protect and preserve the environment and also provides for the establishment of measures to manage the environment for sustainable development and promotion of environmental awareness. The National Environmental Management Authority was created under the NEA and is mandated with the responsibility to oversee, coordinate and supervise environmental management in Uganda, including the review of environmental impact assessments carried out for various projects. The Act outlines the principles of environmental management and the right to a decent environment. It also sets out principles for Institutional arrangements; environmental planning; environmental regulations; environmental standards; environmental restoration orders and easements; records, inspection and analysis; financial provisions; offences; judicial proceedings; and international obligations. The third schedule of the Act lists projects to be considered for environmental impact assessment. Section 10 (1) (a) provides for EIA for 'activity out of character with its surroundings.

Relevance:

Subsection 114 of the Act points out the need for an EIA for Waste management facilities including sewage treatment plants, which is listed in the Fifth Schedule under Category 22 (c) of the NEA Act 2019.

4.3.3 Water Act, Cap 152

The objective of the Act is to enable equitable and sustainable management, use, and protection of water resources in Uganda through supervision and coordination of public and private activities that may impact water quantity and quality. Section 18 requires that before constructing or operating any water works or sanitation facilities within or close to water resources, a person should obtain a permit from Water Resources Management Directorate (WRMD). Construction is herein defined to include alteration and improvement of bridges. The Act also aims to control the pollution of water resources (Sections 20 and 31).

The foregoing notwithstanding, Section 19 provides that subject to guidelines established by the Minister from time to time, the Director (of water resources management) may exempt a public authority or a class of persons or works from requirements in Section 18 on such conditions as he or she may deem fit. Since this decision is reached upon evaluation of an application submitted to the Directorate, Section 19 does not automatically preclude works by public agencies from applying for permits prescribed by this Act.

4.3.4 Water (Water Resources) Regulations, 1998

The regulations apply to motorized water abstraction from boreholes or surface watercourses or diverting, impounding or using more than 400 cubic meters of water within 24 hours. Part II,

Regulation 3 requires a water permit for the operation of a motorized water pump from a borehole or waterway. Under Regulation 6, a permit application may be granted on conditions of the projected availability of water in the area, existing and projected quality of water in the area and any adverse effect that the facility may cause among other considerations.

4.3.5 Water (Waste Discharge) Regulations, 1998

Regulation 4 prohibits any person from discharging effluent or waste on land or into the aquatic environment contrary to set standards. In the circumstances that there is an exception, such should be undertaken under a permit issued by the Directorate of Water Resources Management. This applies to discharges likely to come from the development of the proposed faecal sludge treatment plant and its facilities. Mitigation measures will therefore have to be instituted in these areas not to violate the provisions of this law.

Relevance:

The Act provides for the management of water in Uganda and is under the mandate of the Directorate of Water Resources Management in the Ministry of Water and Environment

4.3.6 Public Health Act, Cap 281

Section 7 of the Public Health Act provides local authorities with administrative powers to take all lawful, necessary and reasonably practicable measures for preventing the occurrence of, or for dealing with any outbreak of, any infectious communicable or preventable disease to safeguard and promote public health. Section 105 of the Public Health Act imposes a duty on the local authority to take measures to prevent any pollution that is dangerous to the health to enter any water supply that the public has a right to use for drinking or domestic purposes.

4.3.7 Local Government Act, 1997

This Act provides for decentralized governance and devolution of central government functions, powers and services to local governments that have their own political and administrative set-ups. According to Section 9 of the Act, a local government is the highest political and administrative authority in its area of jurisdiction and shall exercise both legislative and executive powers under the constitution.

Relevance:

Lugazi Municipal Council where the faecal sludge facility is proposed will be responsible for ensuring the faecal sludge treatment facility project is developed in an environmentally sustainable manner.

4.3.8 Land Act, Cap 227

It provides for the ownership and management of land. It gives power to the compulsory acquisition of land for public purposes that are taken to include land required for public water and wastewater facilities. Sections 43, 44 and 45 (1) and (2) of the Land Act (1998), the Government or local government may acquire land under the provisions of Article 26 and clause (2) of Article 237 of the Constitution of the Republic of Uganda.

The Act creates a series of land administration institutions consisting of the Uganda Land Commission (ULC), and District and Land Boards (DLB) Section 78 of the Act gives valuation principles for compensation i.e., compensation rates to be yearly approved by DLBs. The value for customary land is the open market value. Under Section IV, the Land Act describes the different tenure systems as follows: Mailo, Freehold, Leasehold and Customary.

Section 70 of the Act provides that all rights in the water of any natural spring, river, stream, watercourse, pond, or lake on or under land shall be reserved to the Government and no such water shall be obstructed, dammed, diverted, polluted or interfered with except in pursuance of permission in writing granted by the Minister responsible for water and natural resources under the Water Act. These watercourses should not be used except without requisite permission.

Relevance:

The project site for the construction of the proposed faecal sludge management facility belongs to Lugazi Municipal Council.

4.3.9 Historical Monuments Act, Cap 46

Assented to on 21st October 1967 and came into force on 15th May 1968, this Act provides for the preservation and protection of historical monuments and objects of archaeological, paleontological, ethnographical and traditional interest. The historical monuments act, Cap 46 gives a mandate to the Department of Museums and Monuments to collect the document and preserve cultural relics that have value to the community, the nation and the international community.

Relevance:

Chance finds objects that may be found during the construction works for the faecal sludge management facility and will, therefore be reported to the Department of Museums and Monuments for advice and where necessary.

4.3.10 The Physical Planning Amendment Act, 2020

This is the principal Act that regulates physical development in Uganda. It provides for the making and approval of physical development plans, applying for development permission and other related matters. Section 37 of the Act states that the approving authority may grant preliminary approval of a development application for which an EIA is required, subject to an applicant obtaining an EIA certificate, under the National Environmental Act.

Relevance:

The proponent will ensure that the development complies with the Physical Development Plan of Lugazi Municipal Council and that the site is restored to its original condition after the construction of the facility. MWE and or their appointed contractor will be required to ensure the development does not in a way have an injurious impact on the environment.

MWE or its appointed contractor is supposed to submit his/her plans to Lugazi Municipal Council for approval. The site is within an area designated for Waste management by the Lugazi Municipal Council. It's also important to note that the land is owned by Lugazi Municipal Council.

4.3.11 Road Act, Cap 358

This law is important because the project may involve trenching across access roads which leads to disruption and in rear cases temporary closure of access roads.

Relevance:

This Act provides for the maintenance of the access road by empowering the respective Local Governments hosting the faecal sludge management facility.

4.3.12 Occupational Safety and Health Act, 2006

The Act provides for administration and enforcement of the Act, general duties, obligations and responsibilities of employers, general duties of manufacturers, suppliers and transporters, duties, rights and responsibilities of workers, registration of workplaces, general safety requirements, fire preparedness, machinery, plant and equipment, hazardous materials, chemical safety and special provisions and offences, penalties and legal proceedings.

Section 13 (1) stipulates that it's the responsibility of the employer to take, as far as is reasonably practical all measures for the protection of his or her workers and the general public from the dangerous aspects of the employer's undertaking at his or her own cost. The employer should ensure, as far as is reasonably practical, that the working environment is kept free from any hazard due to pollution.

'It shall be the duty of the employer to set up a safety committee for a workplace with at least 20 workers. The committee will review the measures taken to ensure the safety and health of employees (Section 16). Section 19 requires an employer to provide adequate and suitable protective clothing and protective equipment to the workers of his or her undertaking.

Relevance:

- The Developer/contractor shall ensure the safety, health and welfare at work of all persons working on the faecal sludge and associated activities;
- Provide and maintain systems and procedures of work that are safe and without risks to health
- Provide such information, instruction, training and supervision as is necessary to ensure the safety and health at work of every person employed
- Maintain any workplace under the occupier's control, in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks to health
- All persons employed are informed of any risks from new technologies; and imminent danger.

4.3.13 Employment Act, 2006

Employment Act No 6, 2006 repeals Employment Act, Cap 219 enacted in 2000. This Act is the principal legislation that seeks to harmonise relationships between employees and employers, protect workers' interests and welfare and safeguard their occupational health and safety through:

a) Prohibiting forced labour, discrimination and sexual harassment at workplaces (Part II; Part IV)

b) Providing for labour inspection by the relevant ministry (Part III)

c) Stipulating rights and duties in employment (weekly rest, working hours, annual leave, maternity and paternity leaves, sick pay, etc. (Part VI)

d) Continuity of employment such as continuous service, seasonal employment, etc. (Part VIII).

This law revises and consolidates laws governing individual employment relations and matters related to it. Similar to the Constitution, as earlier mentioned, it makes it unlawful to discriminate against people in employment. It defines discrimination as any distinction, exclusion or making a preference based on race, colour, sex, and HIV status or disability amongst others which has the effect of nullifying or impairing the treatment of a person in employment or occupation or prevents an employee from obtaining any benefit under a contract of service. Some of the stakeholders consulted reported that contractors are found of underpaying Uganda workers for a similar job as other employed foreigners. This should be discouraged and monitoring mechanisms be put in place by MoWE to make sure that such discrimination is not happening.

The Employment Act also states that HIV status does not constitute fair reasons for dismissal or the imposition of a disciplinary penalty. The Employment Act, therefore, requires to be made known to the contractor or their representatives and adhered to, to promote a healthy working environment for all those employed. Workers' welfare is one of the issues that require to be regularly monitored by the lead agency (MoGLSD) or any other assigned agency. The Employment Act (2006) gives a provision for a Labour Advisory Board that advises on matters affecting employment and industrial relations.

Ugandan labour laws address matters below which will be important for employee management during the development of the faecal sludge management facility:

a) Contracts of Service;
b) Employment of children/ child labour (A child under the age of 14 years shall not be employed in a business, undertaking, or workplace except for light work carried out under supervision of an adult over 18 years and which does not affect the Childs education)
c) Termination of Contracts;
d) Illness of employees;
e) Sexual harassment;
f) Occupational diseases;

g) First-Aid;
h) Dust and fumes;
i) Meals in certain dangerous trades;
j) Protective clothing and appliances;
k) Protection of eyes in certain processes;
l) Treatment of injuries and sickness;
m) Drugs and medical equipment;
n) Examination of employees; and
o) Failure to provide for the sick.

Relevance: *The Act will govern labour type and conditions under which the person hired by the project work. It prohibits Child labour (a condition the contractor must comply with) as well as guides work rights during the post-construction phase.*

4.3.14 Workers Compensation Act, 2000

The Act provides compensation to workers for injuries suffered and scheduled diseases incurred in the course of their employment. Section 3(1) of the Act sets out the employer's liability as far as compensation for injury to an employee is concerned. It states that: "if personal injury by accident arises out of and in the course of a worker's employment, the injured worker's employer shall be liable to pay compensation under the Act.

The contractor shall make sure that its sub-contractors provide Personal Protective Equipment (PPE) to employees to minimize accidents and injuries. Additionally, compensation will be paid to those affected. Workers Insurance Benefits shall also be provided to all the workers

4.3.15 National Forestry and Tree Planting Act, 2003

The Act ensures that forests and trees are conserved and managed in a manner that meets the needs of the present generation without compromising the rights of future generations. By safeguarding forest biological diversity and the environmental benefits that accrue from forests and trees.

Relevance*. The Act facilitates greater public awareness of the cultural, economic and social benefits of conserving and increasing sustainable forest cover. Revegetation/afforestation of the facility compound shall be done.*

4.3.16 Children Amendment Act 2016

The act stipulates "harmful or hazardous employment" includes work which exposes a child to physical or psychological torture, sexual abuse, work underground, work at dangerous heights or in confined spaces, work with dangerous machinery, equipment and tools, or manual handling or transportation of heavy loads, work with chemicals and dangerous substances, work under extreme temperatures, high levels of noise, or working for longer hours; or any other form of child labour which includes slavery, trafficking in persons, debt bondage and other forms of forced labour, forced recruitment for use in armed conflict, prostitution, pornography and illicit activities.

A person shall not engage a child in any work or trade that exposes the child to activities of sexual nature whether paid for or not. According to the act, section 8: Harmful employment subsection (2) the minimum age of employment of a child shall be 16 years.

***Relevance**. No child shall be engaged to work. All workers shall be required to produce a document showing their age 16 Years above only.*

4.4 Regulations and Standards

4.4.1 The Environment (Environmental and Social Assessment) Regulations, 2020

Regulation 4 (1), all projects that have or are likely to have a significant impact on the environment are required to undergo an environmental impact assessment (EIA) process before implementation.

Relevance:
The Environmental and Social Impact Assessment Regulations, 2020 (Statutory Instruments No. 143/2020), provides for environmental Audits in Part VIII, Section 56 - the Audits can be initiated by the Authority, a petition from a member of the public, or an environmental inspector. The project implementers and owners will keep relevant authorities informed of the status of the implementation of this project, and prepare regular environmental audit reports where need be.

4.4.2 National Environment (Noise Standards and Control) Regulations, 2003

This law is important to the project because the construction or operation of sanitation facilities such as; faecal sludge treatment plants and sludge disposal sites will involve some noise generation.

The regulation provides standards for:

a) The maximum permissible noise levels to which a person may be exposed from a facility, activity or construction site;

b) Control of noise and mitigating measures for the reduction of noise levels; and

c) Giving effect to the provisions of section 29 of the Act.

Regulation 6 (1) provides that the maximum noise levels to which a person may be exposed from any area shall not exceed the level specified in Column 2 of Part 1 of the First Schedule.

Regulation 7 (1) No person shall emit or engage in any activity that emits or is likely to emit noise above the permissible noise level specified in regulation 6 unless permitted by a license under these Regulations.

Regulation 7 (2) any person who emits or engages in any activity that emits or is likely to emit noise above a maximum permissible level specified in sub-regulation (1) commits an offence.

Regulation Section 8 (1) - Duty to control noise. It shall be the duty of the owner or occupier of a facility or premise or machinery, to use the best practicable means of ensuring that the emission of noise from that machinery, facility or premises does not exceed the permissible noise levels.

Sub-regulation (3) states that a person or occupier of a premise or facility or machinery or plant generating noise who fails to comply with this regulation commits an offence.

Part III Section 8 (1) requires machinery operators, to use the best practicable means to ensure that the emission of noise does not exceed the permissible noise levels. The regulations require that persons to be exposed to occupational noise exceeding 85 dBA for 8 hours should be provided with requisite ear protection. The regulatory noise limits at construction activity work sites are presented in **Table 4-1**. At construction sites, corresponding limits are 75 dBA and 65 dBA for day and night time levels respectively.

Table 4-1: Regulatory noise limits

Facility	Noise limits dB (A) (Leq)	
	Day*	Night*
Construction sites	75	65
Residential areas	55	45
*Time frame: Day 6.00 a.m -10.00 p.m; Night 10.00 p.m. - 6.00 a.m.		

Source: *The National Environment (Noise Standards and Control) Regulations, 2003.*

Relevance:

These regulations are relevant to the project if construction activities and operations generate noise above permitted levels.

4.4.3 National Environment (Waste Management) Regulations, 2020

Regulation 12 requires a person who intends to carry out the business of collecting, transporting, storing, treating or disposing of waste and any other person required under these Regulations shall apply to the Authority for a licence.

Regulation 62 (b) & (c) requires that the waste treatment or disposal facility is not located within a wetland or five hundred meters from a riverbank, lakeshore or area immediately adjacent to fragile ecosystems; or at a distance of at least five hundred metres away from human settlements or commercial areas.

Regulation 77 requires a waste handler to put in place appropriate measures to minimise nuisance and hazards arising.

Regulation 97 requires a person who generates hazardous waste and a waste handler to precautionary measures.

Relevance:

Therefore, if the proposed project contractor intends to store the project-generated waste at their premises or transport the project waste or treat waste, they must apply to NEMA for licenses to do so. Otherwise, they must use already licensed companies to transport waste and treat the waste and the waste must be stored in places designated by the authority for that purpose.

The project contractor will therefore be required to adopt these methods to minimize the waste anticipated to be generated by the project and its facilities such as wastewater and domestic wastes.

4.4.4 Guidelines for Environmental Impact Assessment in Uganda, 1997

Environment Management Authority (NEMA) issued Guidelines for Environmental Impact Assessment, in July 1997. The Guidelines list the projects, which are subject to a detailed EIA study. The projects are classified into projects that in the proposed location have negligible environmental impacts and projects that are likely to have significant environmental impacts.

Relevance:

The proposed faecal sludge management facility is listed among projects that are likely to have significant environmental and social impacts and as such adequate mitigation measures shall be provided against any identified negative impacts.

4.4.5 The National Air Quality Standards, 2006

Pollutants such as carbon dioxide, Nitrogen oxides, Sulphur oxides, Volatile Organic Compounds and particulates are expected to be emitted especially by construction vehicles. The national air quality standards provide regulatory limits for these emissions and should be adhered to during the construction of the water and sanitation project.

Construction operations will generate dust and exhaust emissions, mainly from motorized equipment. The draft national air quality standards provide the following regulatory limits for various emissions as presented in **Table 4-2** below.

Table 4-2: Draft regulatory air quality limits

Pollutant	Averaging time for ambient air	Standard for ambient air
Carbon dioxide (CO_2)	8 hrs	9.0ppm
Carbon monoxide (CO)	8 hrs	9.0ppm
Hydrocarbons	24 hrs	5mgm-3
Nitrogen oxides (NO_x)	24 hrs 1-year arithmetic	0.10 ppm
Smoke	Not to exceed 5 minutes in any one hour	Ringlemann Scale No.2 or 40% observed at 6m or more
Soot	24 hrs	500 µg/Nm-3
Sulphur dioxide (SO_2)	24 hrs	0.15 ppm
Sulphur trioxide (SO_3)	24 hrs	200 µg/Nm-3

Source: Draft National air quality standards, 2006. Note: ppm=parts per million, "N' in µg/Nm-3 connotes normal atmospheric conditions of pressure and temperature (250C and 1 atmosphere).

Relevance:

These standards are relevant considering that project construction will require motorised machinery powered by diesel engines hence generating pollutants such as CO2, NOx, SOx and particulates are expected to be emitted. Dust will also be generated during excavation, construction and material/ equipment transport.

4.4.6 National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001

Regulation 3 specifies the purpose of the regulations which is;

a) To establish and prescribe minimum soil quality standards to maintain, restore and enhance the inherent productivity of the soil in the long term;

b) To establish minimum standards for the management of the quality of soil for specified agricultural practices;

c) To establish criteria and procedures for the measurement and determination of soil.

Regulation 12 (1) specifies that every responsible person shall comply with the measures and guidelines for soil conservation for the particular topography, drainage and farming systems prescribed in the Fourth Schedule.

Relevance:

The construction works for the faecal sludge management facility will involve the significant movement of soils from one place to another and probably within the wetlands. The regulations will also be relevant concerning the prevention of contamination of land covered by the project infrastructure. The regulations will apply to the waste disposal practices of contractors during construction, operation and decommissioning.

4.4.7 The National Environment (Standards for discharge of effluent into water or land) Regulations, 2020

Section 6 (2) details the maximum permissible discharge limits for 54 contaminants, that must not be exceeded before the effluent is discharged into water or on land. Through limits on over 54 pollutants, these regulations control discharges in surface watercourses. Examples of some of the regulated pollutants are listed below in **Table 4-3**.

Table 4-3: National Discharge Standards for Selected Pollutant Parameters Associated with the Construction activities

S/N	Parameter	Maximum Permissible Limits	S/N	Parameter	Maximum Permissible Limits
1	1,1,1-Trichloroethane	3.0 mg/l	30	Magnesium	100.0 mg/l
2	1,1,2-Dichloroethyelene	0.2 mg/l	31	Manganese	1.0 mg/l
3	1,1,2-Trichloroethane	1.06 mg/l	32	Mercury	0.01 mg/l
4	1,2-Dichloroethane	0.04 mg/l	33	Nickel	1.0 mg/l
5	1,3-Dichloropropene	0.2 mg/l	34	Natrite-N	20.0 mg/l
6	Aluminium	0.5 mg/l	35	Nitrite-N	2.0 mg/l

S/N	Parameter	Maximum Permissible Limits	S/N	Parameter	Maximum Permissible Limits
7	Ammonia Nitrogen	10.0 mg/l	36	Nitrogen (Total)	10.0 mg/l
8	Arsenic	0.2 mg/l	37	Oil and Grease	10.0 mg/l
9	Barium	10.0 mg/l	38	pH	6.0 - 8.0 mg/l
10	Benzene	0.2 mg/l	39	Phenols	0.2 mg/l
11	BOD5	50 mg/l	40	Phosphate (Total)	10.0 mg/l
12	Boron	5.0 mg/l	41	Phosphate (Soluble)	5.0 mg/l
13	Cadmium	0.1 mg/l	42	Selenium	1.0 mg/l
14	Calcium	100.0 mg/l	43	Silver	0.5 mg/l
15	Chloride	500.0 mg/l	44	Sulfate	500.0 mg/l
16	Chlorine	1.0 mg/l	45	Sulfide	1.0 mg/l
17	Chromium (Total)	1.0 mg/l	46	TDS	1200 mg/l
18	Chromium (VI)	0.05 mg/l	47	Temperature	20 - 35 oC
19	Cirrus-1,2-Dichloroethylene	1.0 mg/l	48	Tetra-Chloroethylene	0.1 mg/l
20	Cobalt	1.0 mg/l	49	Tetra-Chloromethane	0.02 mg/l
21	COD	100 mg/l	50	Tin	5.0 mg/l
22	Clifford Organisms	10,000 counts/100 ml	51	Total Suspended Solids	100.0 mg/l
23	Color	300 TCU	52	Trichloroethylene	0.3 mg/l
24	Copper	1.0 mg/l	53	Turbidity	300 NTU
25	Cyanide	0.1 mg/l	54	Zinc	5.0 mg/l
26	Detergents	10.0 mg/l	38	pH	6.0 - 8.0 mg/l
27	Dichloromethane	0.2 mg/l			
28	Iron	10.0 mg/l			
29	Lead	0.1 mg/l			

Source: The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, S.I. No 5/1999 and NEMA 2003, Environmental Legislation Handbook.

Relevance:

The regulations promote cleaner production methods that enable the recovery and reuse of wastes, reclamation and recycling. Further, the regulations require hazardous waste to be stored in facilities specially designed for that purpose and that such facilities obtain licenses from NEMA.

4.4.8 The National Environment (River Banks, Lake Shores and Wetlands Management) Regulations, 2001

The Regulation provides a list of regulated activities whose implementation in wetlands, riverbanks and lakeshores is subject to the issuance of a permit granted by NEMA in consultation with the Lead Agencies. These include brick making, recreation activities such as sport fishing, maintenance of green spaces, cultivation, drainage, commercial exploitation, sewerage filtration, fishing using fish gear and weirs, fish farming, and other aquaculture, power dam construction, construction of transport and communication facilities such as roads, railways, telephone lines, burning and any other exploitative activity which is of a commercial or trade nature, such as harvesting of papyrus for commercial purposes.

The regulations in section 34 provide that a developer desiring to conduct a project which may have a significant impact on a wetland, riverbank or lakeshore, will be required to carry out an Environmental Impact Assessment under sections 20, 21 and 22 of the National Environment Act. Environmental impact is mandatory for all activities in the wetlands, riverbanks and lakeshores and special measures are essential for the protection of riverbanks, lakeshores and wetlands of international, national, and local importance as ecological systems and habitats for fauna and flora species, and cultural and aesthetic purposes, as well as for their hydrological functions and values for preventing soil erosion, siltation and water pollution.

Table 4-4: Relevant Environmental Quality Standards

Particular	National Standard	International Standard
Ambient air quality	The National Air Quality Standards, 2006	WHO Air Quality Guidelines, Global Update, 2005
Noise	National Environment (Noise Standards and Control) Regulations, 2003	WHO Guideline Values on Noise Level
Drinking water quality	National Drinking Water Quality Standards, 2006	WHO Guidelines for Drinking-water Quality, Fourth Edition, 2011
Discharge of Effluent	The National Environment (Discharge of Effluent into water or on Land) Regulations, S.I.No 5/1999	The Environmental Protection (Standards for Effluent Discharge) Regulations, 2003

Relevance:

The proposed project site for the faecal sludge management facility in Buikwe District is close to a wetland and most activities will be close to it. According to the National Environment (Riverbanks, Lakeshore and Wetlands) Regulations, the Government of Uganda or Local Governments shall hold in the trust of the people and protect wetlands, riverbanks and lakeshores for the common good of the citizens of Uganda. The Government or Local Government shall not lease out or otherwise alienate any wetlands, riverbanks or lakeshore.

4.4.9 National Environment (Audit) Regulations, 2020

These Regulations require an environmental audit for a project or activity for which environmental and social assessment has been undertaken.

Relevance:
The faecal sludge treatment plant involves the construction and operation of waste management facilities which are categorised under schedule 3 to the Regulations and the developer shall carry out an environmental compliance audit.

4.4.10 The National Climate Change Act 2021

The Climate Change Act provides a background to the United Nations Framework Convention on Climate Change (UNFCCC) by building on the Kyoto Protocol, and the Paris Agreement a high consideration within the United Nations Environment Programme (UNEP) and lays the ground in responding to the climate change and providing mitigating measures as a responsibility to participate in climate change mechanisms and emission reporting for verification of information. It provides for institutional arrangements in coordinating and implementing climate change response measures including financing for climate change and related matters. The Act supports the reporting within the National Determined Contributions (NDCs) and these emerge as environment changes. The changes can be anthropogenic or natural systems.

The proposed faecal sludge treatment facility may in a way of establishment; operation and decommissioning activities contribute to the release of emissions. Adaptation measures shall be implemented during.

4.4.11 The Water Supply Regulations, 1999

The Water Supply Regulations, 1999 manage the water supply works including:

I. Permits requirements and procedures for water supply works by authority or connection to the land owner (Division 1, clauses 4 to 6);
II. Application, examination and approval of Water supply plan (Division 2, clauses 7 to 11);
III. Cost of works, security deposit, an inspection of works and plenty for violation (Division 2, clauses 12 to 18);
IV. Metering system and charging rates (Part III, clauses 19 to 21).

Relation to the project: *These will guide the entire water requirements for the construction and operation of the project.*

4.5 Environmental and Social Safeguards of Development Partners

4.5.1 African Development Bank Group Environmental and Social Assessment Procedures

The Bank's existing Environmental and Social Assessment Procedures (approved in 2001) have been revised (2015) to reflect the updated information, upgraded processes and cutting-edge

knowledge embodied in the Integrated Safeguards System (ISS). It also addresses the limitations of the existing Environmental and Social Assessment Procedures (ESAP) and provides a strong procedural basis for the operationalization of the Integrated Safeguards Systems. It details the specific procedures that the Bank and its borrowers or clients should follow to ensure that Bank operations meet the requirements of the operational safeguards (OSs) at each stage of the Bank's project cycle.

The Integrated Safeguards System (ISS) through its five operational safeguards (OS):

Operational Safeguard 1: Environmental Assessment: this operational safeguard is triggered since this is an investment project subject to environmental and social impact assessment;

Operational Safeguard 2: Involuntary Resettlement – this operational safeguard is not triggered since the project doesn't entail any resettlement;

Operational Safeguard 3: Biodiversity, Renewable Resources and Ecosystem Services: this operational safeguard is not triggered since the project does not affect areas with biodiversity or ecosystem services potential.

Operational Safeguard 4: Pollution Prevention and Control, Greenhouse gases, hazardous materials and efficient use of resources: This operational safeguard is triggered since there is a risk of various types of pollution and contamination during the construction works; and

Operational Safeguard 5: Working Conditions, Health and Safety: This operational safeguard is triggered since there are risks to the health and safety of workers during the implementation of site-related works and the health and safety of the community may be affected during operation of the facility if not well managed.

In addition, other relevant policies and guidelines of the Bank shall remain applicable as soon as they are triggered under the ISS. These include: The Bank's Gender Policy (2001); Framework for Enhanced Engagement with Civil Society Organizations (2012); Policy on Disclosure and Access to Information (2012); Handbook on Stakeholder Consultation and Participation in AfDB Operations (2001) Bank's Policy on Population and Strategies for Implementation (2002) and the Bank's Integrated Water Resources Management Policy (2000)

4.6 Institutional Framework

4.6.1 National Environment Management Authority (NEMA)

NEMA was created following the enactment of the National Environment Statute (NES) later Act in 1995. It is responsible for overseeing, coordinating and supervising environmental management in Uganda. Since its formation in 1996, NEMA has put a strong emphasis on developing environmental policies, laws and guidelines as evidenced by the large number of environmental regulations that have been enacted over the last few years.

NEMA's overall goal is to promote sound environmental management and prudent use of natural resources in Uganda through its objectives including:

a) To develop environmental policies, laws and guidelines for regulating the environment;

b) To enforce environmental standards and regulations;

c) To build capacity for environmental planning management and monitoring within partner institutions and districts;

d) To monitor the environment and disseminate accurate and up-to-date environmental information;

e) To ensure integration of environmental concerns into planning at the centre, the district and local levels; and

f) To promote awareness programs and increase public knowledge about environmental issues.

Relevance:

NEMA will review this environmental and social impact statement for consideration for approval and issuance of an EISA Certificate for the project.

4.6.2 Ministry of Water and Environment (MoWE)

The Ministry of Water and Environment is responsible for the management of the water resource development project in Uganda. The ministry also has the overall responsibility for initiating national policies and for setting national standards and priorities for water resources management and environmental regulation. A multidisciplinary team representing stakeholders and constituting the Water Policy advises the Minister on the above functions and is mandated to initiate revisions to legislation and regulations. The key functions of the MWE are to promote the rational and sustainable utilization and/or development of water resources while conserving the relevant surrounding watershed environment in Uganda. They are several divisions within the MWE and these are:

a) The Directorate of Water Development (DWD) is in charge of promoting the rational management and use of water resources in Uganda by coordinating and regulating activities that may impact water quality and quantity.

b) The quality and quantity of water in watercourses are monitored and regulated by the Directorate of Water Resources Management (DWRM), which also issues permits for water abstraction and effluent disposal.

c) The Wetland Department (WD) is another technical unit in the Ministry which advises the government on technical matters and policies related to sustainable wetland conservation and management.

d) The Department of Meteorology is responsible for providing climate and weather information to any stakeholders engaged in national development activities in Uganda.

Wetlands Management Department (WMD)

The WMD falls under the Ministry of Water and Environment (MW&E). It takes the lead on all the day-to-day management issues of Wetland resources in Uganda. It implements the Wetlands Policy in collaboration with other lead agencies notably NEMA.

At the district level, the Department of Environment is headed by the District Environment Officer and Director respectively. The Environmental Officer coordinates wetland work and an attempt has been made in various districts to have a Wetland Officer appointed. Even at the village level, one of the members of the village council takes care of the environment-related issues.

Relevance:

Since some of the project components of the Faecal sludge management facility for Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District will be located in the wetland area, the District Environmental Officer, and Wetlands Officer will be involved in all the project phases as one of the key stakeholders.

4.6.3 The National Water and Sewerage Corporation

The functions that are mentioned in the NWSC Statute include (a) management of water resources in ways which are beneficial to the people of Uganda (b) provision of water and sewerage services (c) development of water and sewerage systems in urban centres and big National Institutions throughout the country.

4.6.4 Ministry of Gender, Labour and Social Development (MoGLSD)

This ministry handles Social Development issues. In collaboration with other stakeholders, MoGLSD is responsible for community empowerment, protection and promotion of the rights and obligations of the specified vulnerable groups for social protection and gender-responsive development. The Department of Occupational Safety and Health in the Ministry is responsible for the inspection of the workplace environment to safeguard occupational safety, the rights of workers and gender equity.

Relevance:

This Ministry handles Social Development issues. In collaboration with other stakeholders, MGLSD is responsible for community empowerment, protection and promotion of the rights and obligations of the specified vulnerable groups for social protection and gender-responsive development. Faecal sludge treatment facilities have several socio-economic issues. The ministry in collaboration with the Contractor and other stakeholders will work towards the implementation of the labour, employment and occupational safety and health provisions as provided for under the regulatory instruments within this Ministry.

4.6.5 District Local Government – Buikwe District

The devolution of power to the local governments through the central government's Decentralization Policy has empowered local governments to enact by-laws that deal with the local situations among which environmental matters are also addressed.

Relevance:

All sub-components of the proposed faecal sludge management facility fall within the jurisdiction of Buikwe District (in the respective host Town Council). Key offices in the administrative area that are relevant to the project include; the Water officer, Environment/Natural Resources directorate/department, Directorate/ Department of Physical Planning/Lands, Community Development Office, Health Directorate/department and Agricultural Office.

Equally important are village-level local council administration (LCIs) within Lugazi Municipality particularly the host village Leaders at these levels of local administration are closer to residents and therefore important in effective community mobilization, sensitization and dispute resolution.

4.6.6 Private Faecal Sludge Emptying Service Providers

The emptying of faecal sludge from pit latrines and septic tanks in Uganda is dominated by the private sector. The private entrepreneurs who engage in the service of emptying are organized in the Uganda Emptiers Association. The need for FS emptying in various towns is rapidly evolving, but no institutions, such as schools, and some urban councils own/operate vacuum trucks to empty faecal sludge from sanitation facilities within the Buikwe cluster towns. Cesspool emptier trucks are hired from Jinja Town and dispose of the waste in Jinja and manual emptying is done by specialized personnel who access the vault and use buckets to collect the faecal matter.

The business of sludge emptying and transportation in Uganda is over 90% done by the private sector. Business owners usually buy vacuum trucks imported from overseas. The crew for each truck normally consists of two employees, a driver and a turn man, who assists during the emptying operation. The owner of the truck is responsible for all major costs and services (e.g. tyres, vacuum pumps, hosepipes, etc.). The sanitation facilities which are not reachable by vacuum trucks are emptied using gulpers. The gulping entrepreneurs are organized into the Gulpers Association of Uganda and their business is also growing country-wide.

5 BASELINE CONDITIONS OF PROJECT AREA

5.1 Bio-Physical Environment

5.1.1 Location

Buikwe District lies in the Central Region of Uganda. The district is bordered by Jinja District in the East, Kayunga District in the North, Mukono District in the West and Lake Victoria in the South.

The proposed site is located within 2 villages, Kasana and Kakubansiri villages, Butinindi parish in Kawolo Division, Lugazi Municipality. The approximate acreage of the proposed Site is 19.7 acres. The site was also designated as a solid waste disposal site. The solid waste is currently dumped on less than 2 acres. The proposed project site is owned by Lugazi Municipal Council. The access road is maintained by the Sugar Corporation of Uganda Ltd. (SCOUL) Sugar Factory.

The project site is surrounded by vegetation and agricultural gardens of cassava, pawpaw trees, grasslands, maize, an access road and a homestead (approximately 500 meters from the project site) in the North direction, vegetation, shrubs and Sugar Corporation of Uganda Ltd. (SCOUL) sugarcane plantations in the West direction, vegetation and a cemetery that is owned by Lugazi Municipal Council in the East direction, vegetation and farmlands of bananas, maize, Eucalyptus *spp* in the South direction

The proposed towns under the Buikwe cluster are Buikwe Town Council, Ngogwe, and Nkonkonjeru Town Council. All the towns are located in Buikwe District (see **Figure 5-1**) and the Google maps in **Figure 5-2** and **Figure 5-3** respectively.

Table 5-1: Location details of the Proposed Faecal Sludge Management Facility

SN.	Site Name	Location Details	GPS Coordinates			
	Central Region		(WGS 84) 36 N			
			Points	Eastings	Northings	Elevation
01.	Buikwe	Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District	Pt.1	491053.37 mE	39463.87 m N	1220 metres above sea level
			Pt.2	491080.31 mE	39655.14 mN	1224 metres above sea level
			Pt.3	490886.82 mE	39701.47mN	1181 metres above sea level
			Pt.4	490702.49 mE	39746.58 mN	1195 metres above sea level
			Pt 5	490674.05mE	39687.02 mN	1200 metres

SN.	Site Name	Location Details	GPS Coordinates			
						above sea level
			Pt. 6	490778.52 mE	39669.20 mN	1195 metres above sea level
			Pt 7	490785.43 mE	39447.12 mN	1220 metres above sea level

Source: *Field data, 2022*

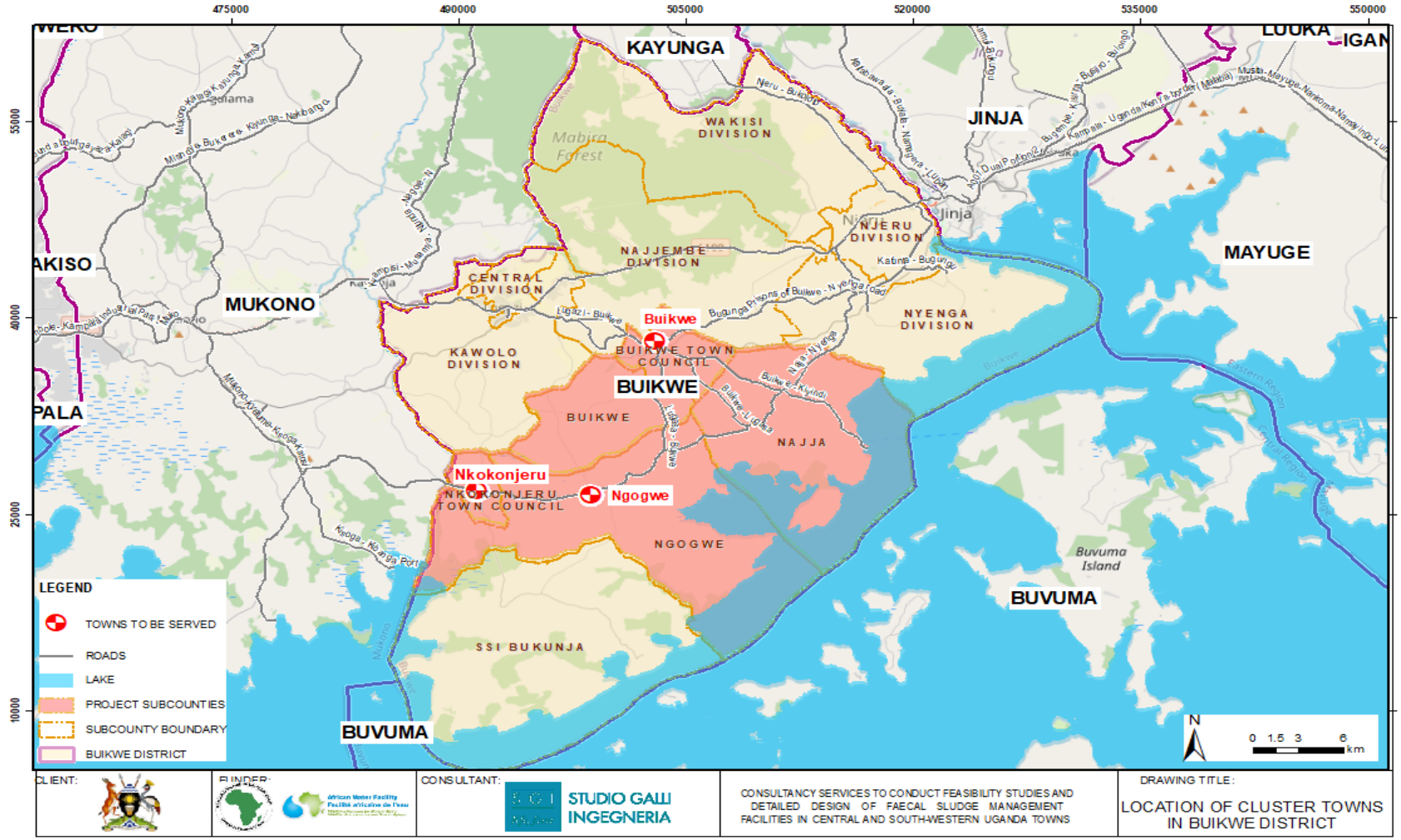


Figure 5-1: Map showing Buikwe Cluster Towns

Figure 5-2: Google Map showing the exact location of the proposed Faecal Sludge Management Facility

Figure 5-3: Google Map showing the exact location of the proposed Faecal Sludge Management Facility

Marrum road that transverses near the site through Meta sugarcane plantations

Farmlands located south of the project site

White arrow showing the project site which is currently being used as a dumping area by Lugazi Municipal Council

The access road to the site, grasslands, and pawpaw trees located in the North direction

Red arrow showing Meta sugarcane plantations in the West direction

	
White arrow showing a homestead located adjacent North to the site	A white arrow shows a cemetery in the East direction

Figure 5-4: Showing the proposed Project site and Neighborhoods

5.1.2 Topography

The northern part of the district is flat but the southern region consists of sloping land with many undulations. The largest part of the district lies on a high plateau (1000 – 1300m) above sea level, with some areas along the Sezibwa River below 760m above sea level. Southern Buikwe is a raised plateau (1220-2440m) drained by River Sezibwa and River Musamya.

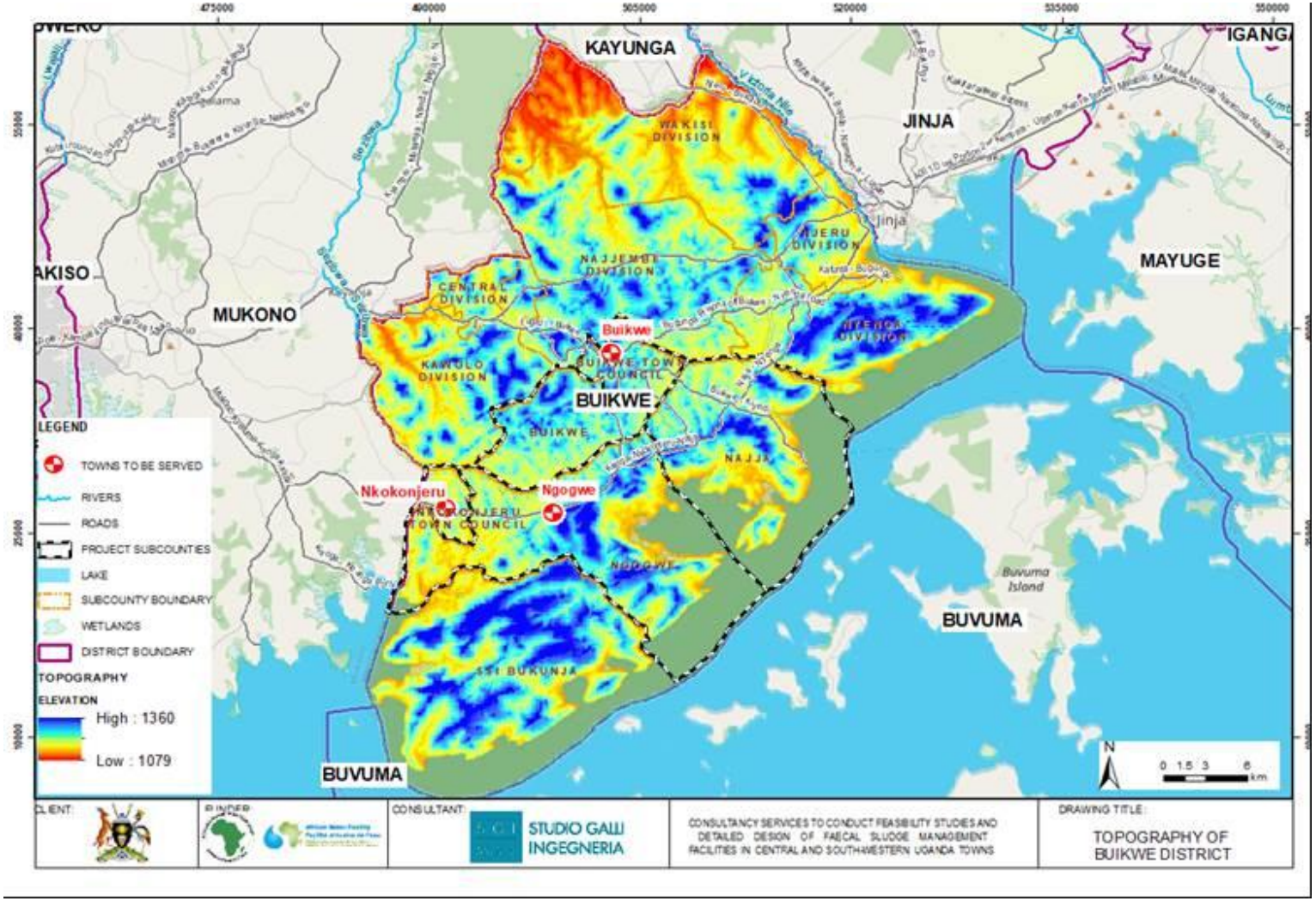


Figure 5-5: Map of Buikwe District showing Topography

5.1.3 Soils

The major soils in the project area comprise the following within the table below:

Table 5-2: Types of soils found in Buikwe District:

Soil types	Location by Sub-County,
Buganda catena	Najjembe, Kawolo and Lugazi
Kyebe catena	Ngogwe, Nyenga, Njeru and Buikwe
Kifu series	Buikwe, Nyenga, Najjembe, Wakisi and Kawolo
Sango series	Buikwe, Najja, Nkokonjeru and Ngogwe

Source: *Buikwe District Development Plan 2020*

5.1.4 Vegetation

Generally, the surrounding vegetation of the faecal sludge treatment plant site comprises farmlands of bananas, maize and shrubs, grasslands, eucalyptus spp to the south, Sugar Corporation of Uganda Ltd. (SCOUL) sugarcane plantations in the East, shrubs, grasslands and farmlands in the North and West.

Figure 5-6: Vegetation found around the project site

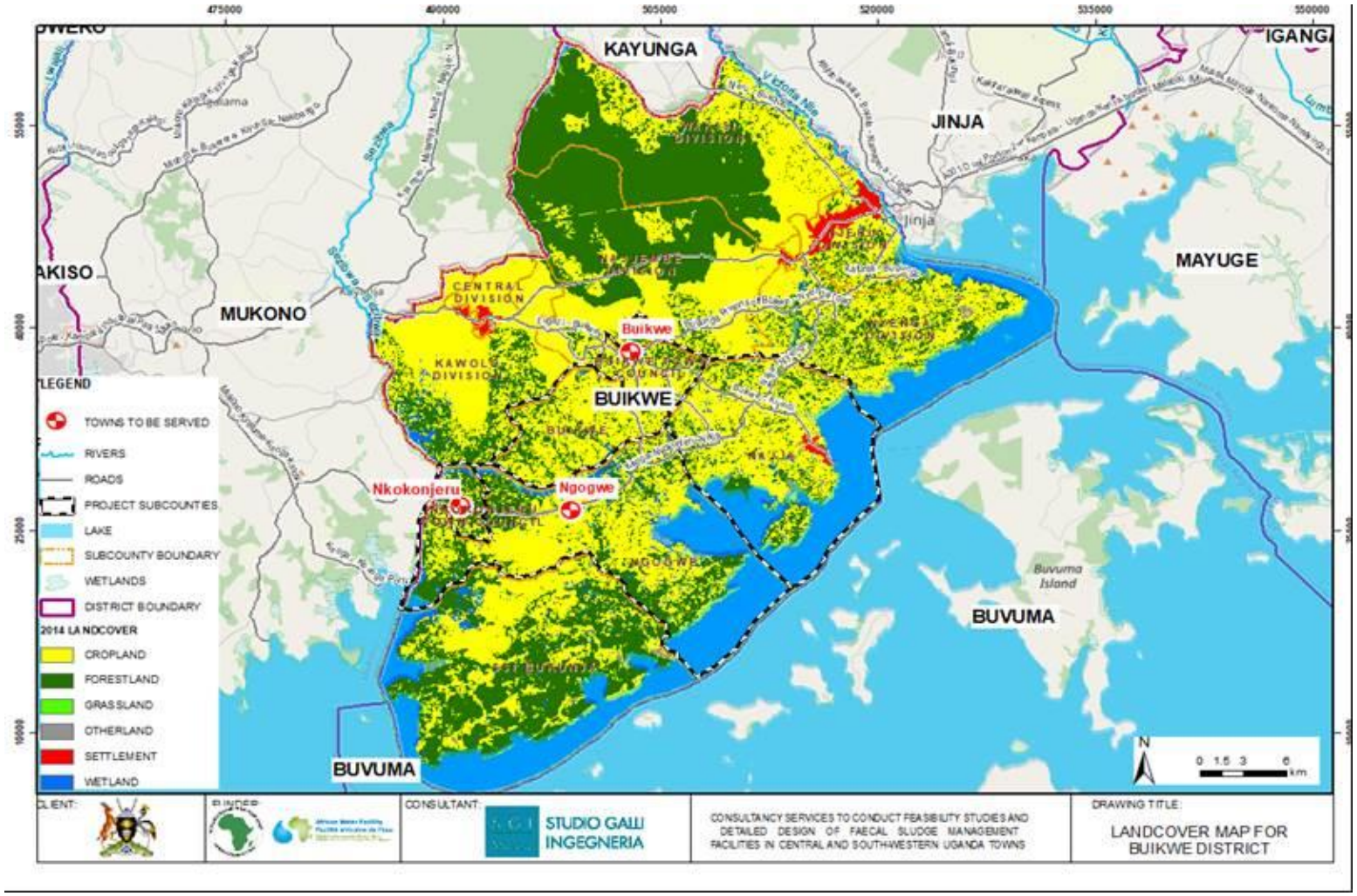


Figure 5-7: Buikwe District showing Land Cover

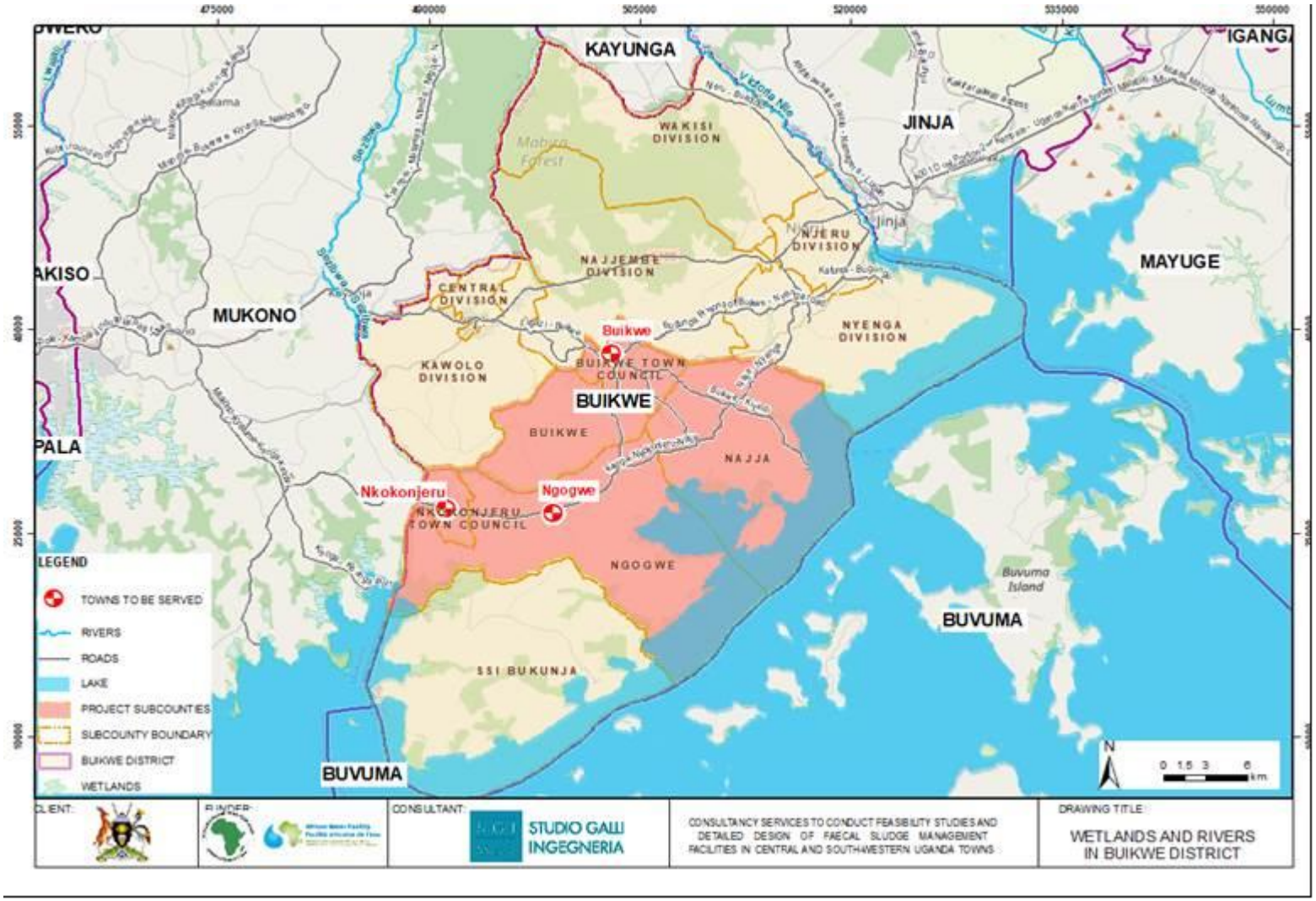


Figure 5-8: Buikwe District showing Wetlands and Rivers

5.1.5 Relief and Climate

The mean annual rainfall is 1100mm distributed over 106 days, with peaks in March-May, and September – November. The temperatures range between 16^{o}C and 28^{o}C throughout the year. Both relief and climate provide good potential for investment in the production of cash and food crops, horticulture, and floriculture on a commercial basis. Existing commercial farms in the district also provides a good background for experience sharing for those investors who want to venture into such areas.

5.1.6 *Air Quality Assessments*

Sampling for particulate matter and gaseous emissions (i.e., Carbon monoxide, Hydrogen Sulphide, Methane, Oxygen, Sulphur dioxide, and Carbon monoxide) was conducted along the project area and the results are as discussed in sections 5.1.6.1 and 5.1.6.2 below;

5.1.6.1 Particulate *Matter*

Particulate matter sampling was carried out at different proposed project facilities and their support facilities to check the extent of PM level concentrations. Below are the findings of Particulate matter concentration levels for specific areas. The findings are influenced by various sources like the existing activities in the place at the time of sampling and daily weather conditions

Observations:

It was observed that:

- ✓ Various sampling points were taken along the proposed project support facility with considerations of project potential receptors and sources. The Particulate matter concentrations were **4.97** for PM 2.5 µg/m3 at all project areas sampled for PM2.5.
- ✓ The PM10 concentrations were **25.93** µg/m3 with most of the areas having Low concentrations below the permissible levels of Suspended particulate matter in the atmospheres due to the ongoing activities in the area for PM10.
- ✓ The existing particulate matter is moderate with many sources from the open ground spaces and pollen grains from the plants in the areas sampled.

5.1.6.2 Noise Levels Assessment

Noise emission sampling was carried out at project potential sources and receptors at the proposed project support facilities to establish the existing baseline Noise levels. Below are the findings of Noise emissions levels for the proposed faecal sludge management facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District with the potential exiting potential Natural and Anthropogenic sources.

Observation:

Noise emissions findings from various projects were sampled areas with considerations of the potential receptor areas revealed that:

- ✓ The average (LAeq) noise level assessment at all the sampled areas ranged from **(39.1-55.6)** dBA. With all areas having Low Noise levels within the permissible levels. However, this Noise level emission is likely to change in this area during the construction phase of the project.

5.2 Socio-economic Environment

5.2.1 Population size, Growth and Fertility Rates

Population Size: Buikwe District has a total population of 436,406 people4. Of these, 213,443 are males and 222,963 are females. The sex ratio is, therefore, 95.7 males per 100 females. There are 99,401 households with an average household size of 4.2 persons

Growth Rate: The District population growth rate stands at 2.33%, which is 0.7% less than the national average of 3.03%.

Fertility Rate: Fertility indicators measure the frequency of childbirth in a given population. Such measures can tell how fast the population of a given country or region would increase. The national average is 6.2 children per woman.

5.2.2 The Administrative Structure

Buikwe District has 1 County (i.e. Buikwe) with 8 rural Sub-counties and 4 Town Councils. The sub-counties are Buikwe, Kawolo, Najja, Najjembe, Ngogwe, Nyenga, Ssi-Bukunja, and Wakisi; while the Town Councils are: Buikwe, Lugazi, Njeru, and Nkokonjeru. Under these Lower Local Governments, there are 64 parishes/wards and 464 Village Councils (refer to **Table 5-3** below).

Table 5-3: Number of Local Governments and Administrative Units

COUNTY	**Number**					
Buikwe	**Sub-counties**	**Town Councils**	**Parishes**	**Wards**	**Villages**	**Zones**
	8	4	64	-	464	-
	-	-		14	-	86
TOTAL	**8**	**4**	**64**	**14**	**464**	**86**

Source: Office of the Chief Administrative Officer / Buikwe District

5.2.3 Local Economy of Buikwe District

The social-economic dynamism being experienced nationally and globally has well affected the communities in Uganda and Buikwe in Particular. Locally developed/adapted policies like liberalization and privatization have had a positive effect on employment, and personal and

household incomes, particularly in the production sector. The economic performance of this District is largely based on the following sectors detailed in the subsequent sections below:

5.2.3.1 Industrialization

The presence of Sugar Corporation of Uganda (SCOUL), Cable Corporation, UGMA producing fabricated spare parts for industries, Tembo Steel Manufacturing industry, Nile Breweries, Picfare Textile Industry, Nalubaale and Bujagaali Energy Limited, Mailbox for packaging material, Gulu Foam Industry and Hoopoe trading company the latest industrial entrant in the District coupled with a railway station have contributed significantly to the socio-economic infrastructural development by bringing closer supporting sectors like banks, telecom and transport service providers. These have translated into employment for skilled and unskilled workers in all these sectors. All these investments indicate that Buikwe District is a suitable place for investment due to the benefits of economies of large-scale production, cheap and easy means of transport to nearby and distant markets (Jinja-Kampala Highway), access to the National power grid, piped water system among other social amenities like Kawolo Hospital.

5.2.4 Water Supply

It has been worldwide observed that water, sanitation and hygiene (WASH) is essential for reducing the spread of waterborne diseases and the Covid-19 pandemic based on its effectiveness as a barrier to the spread of these diseases.

5.2.4.1 Households' Main Water Source

Access to a water supply service is defined as the availability of an improved water source. The golden indicator for access to rural water supplies is defined as % of people within 1.5 km (rural) of an improved water source. An improved water source is not necessarily safe, but an improved source is more likely to provide safe water.

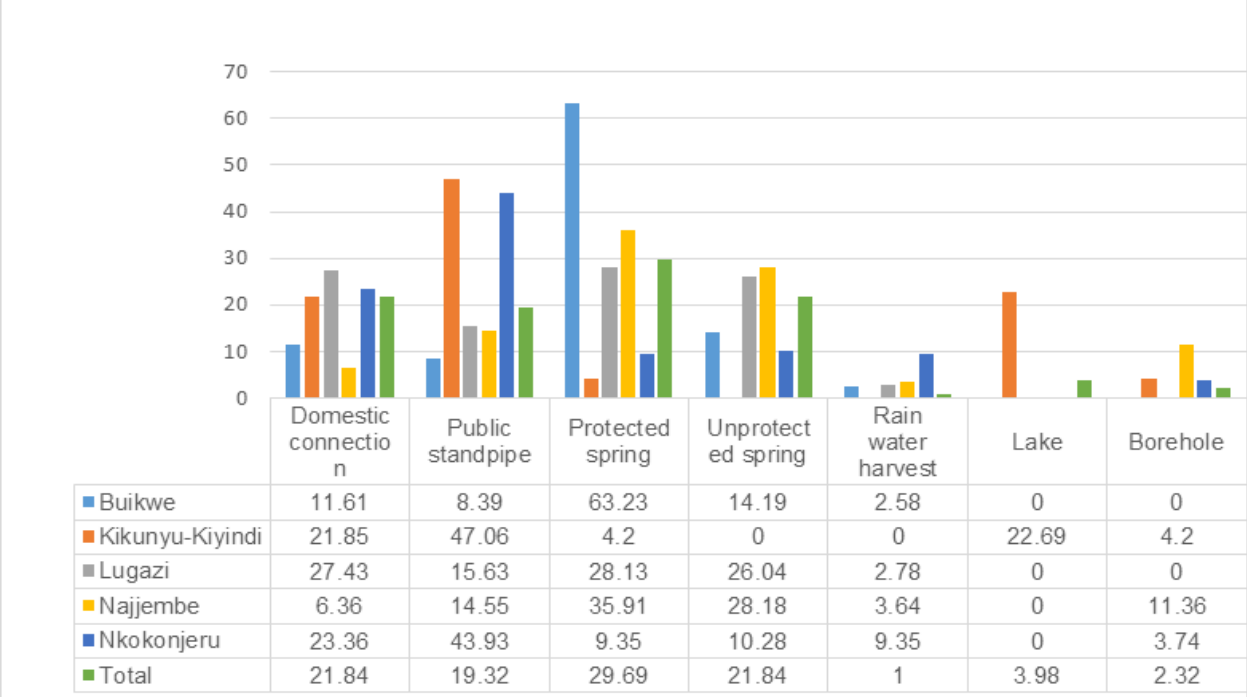
The GoU has prioritized NDP III to improve access to safe water coverage from 77% to 95% in urban areas and from 65% to 79% in rural areas in line with Sustainable Development Goal No. 6.1 which advocates for universal and equitable water access by 2030.

Improved water sources in Uganda include; piped water, public taps, boreholes, protected springs/wells, gravity flow schemes, rainwater harvest and bottled water.

Buikwe District safe water coverage stands at 58%, below the National average of 67%. Furthermore, urban safe water coverage in Buikwe stands at 18% far below the National average of 71%. On the other hand, the functionality of urban water sources stands at 86% slightly above the National average of 85%.

Households in the project area were mainly getting water from safe water sources, the main water source reported were protected springs (29.7%), this was followed by Domestic connection (21.8%), and public standpipes (19.3%) and rainwater harvest (1%). On the downside, a significant number of HHs (21.8%) reported getting water from unprotected springs

while 4% of the HHs reported getting water from the Lake both sources are not safe water sources (see **Figure 5-9**).



	Domestic connection	Public standpipe	Protected spring	Unprotected spring	Rain water harvest	Lake	Borehole
Buikwe	11.61	8.39	63.23	14.19	2.58	0	0
Kikunyu-Kiyindi	21.85	47.06	4.2	0	0	22.69	4.2
Lugazi	27.43	15.63	28.13	26.04	2.78	0	0
Najjembe	6.36	14.55	35.91	28.18	3.64	0	11.36
Nkokonjeru	23.36	43.93	9.35	10.28	9.35	0	3.74
Total	21.84	19.32	29.69	21.84	1	3.98	2.32

Figure 5-9: Main Sources of Water for the HHs

From **Figure 5-9** above, it is observed that there are a significant number of HHs with domestic water connections (21.84%), these were fairly spread in all the towns (with exception of Najjembe) HHs with domestic water connections are potential clients of safe pit emptying, the assumption is that many of these can afford the construction of septic tanks that support safe pit emptying.

Figure 5-10: Main Sources of Water in the Project Area

5.2.5 Sanitation (Faecal Sludge Containment)

Safe sanitation is a human need and access to safe sanitation is a human right. However, many people, especially in rural areas, live in extreme poverty and hence they are faced with an inadequate supply of sanitation services, poor hygiene behaviours and inadequate sanitation in public places including hospitals, schools and markets.

Availability of sanitation facilities in the home is one of the key ingredients to sanitation and hygiene thus all HHs in the project area must improve sanitation facilities.

Unsafely managed excreta harm human health overall and child health in particular. They damage the quality of air, soil, surface water, and groundwater. Inadequate access to basic sanitation facilities prevents the realization of a range of human rights and gender equality. The absence of safe and accessible sanitary facilities affects women and girls.

5.2.5.1 Existence of Sanitary Facilities

Overall, findings in **Figure 5-11** indicated that the majority of households (83.3%) had sanitation facilities, on the downside, a significant number of households (16.72%) did not have sanitation facilities. Most of the HHs that did not have sanitation facilities were found in Lugazi (24%) and Nkokonjeru (18.7%) as shown in the figure below.

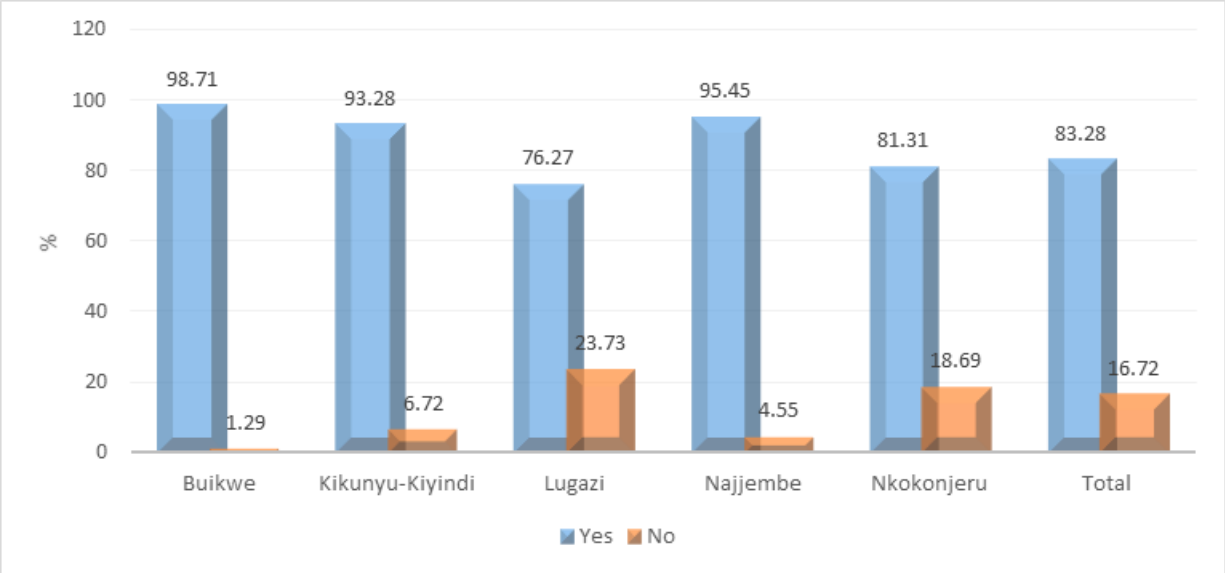


Figure 5-11: Ownership of Sanitation Facilities

6 STAKEHOLDER ENGAGEMENT AND PUBLIC DISCLOSURE

6.1 Introduction

Consultation with relevant stakeholders and regulatory institutions was carried out by the ESIA team to ensure the participation of relevant stakeholders, as recommended by the National Environment Act, 2019, the National Environment (Environmental and Social Assessment) Regulations 2020 and Conduct of Environmental Practitioners (2001) and guidelines for EIAs/Project Brief in Uganda.

These consultations aimed to identify and take note of environmental 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 faecal sludge treatment facility.

Informal conversational interviews and observations were the key data collection methods applied. The consultation process ensured that their concerns were captured and will be addressed.

As such, Stakeholder Consultation and Engagement for the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District was undertaken following the NEMA guidelines to gather opinions and views on the environmental aspects of the proposed project.

Some of the key steps taken in the consultation and engagement process included:

- Stakeholder consultative meetings; and
- Site Visits

6.2 Notifying Stakeholders of the ESIA

Consultations with various lead agencies, institutions and key personnel were conducted before the commencement and during the ESIA assignment as part of building support and gathering views for guidance on the designs and Environmental aspects to critically examine during the studies for the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District.

6.3 Methodology and Approach

The key stakeholders which included government entities with persons around the proposed faecal sludge treatment facility and potential PAPs and local leaders, engagement meetings and dialogues on issues that involved the construction and operation phases of the faecal sludge treatment facility, were conducted following different agreed-upon methodologies between the local leaderships of the affected communities and the ESIA team depending on the different dynamics encountered in those communities. Participatory approaches and methodologies were used which enabled potential PAPs and their leaders to open up, raised their concerns and actively participated in the sensitization and dialogue activities. The delivery methods included question-and-answer sessions which generated consensus on all issues raised by the participants

6.3.1 Objectives of Stakeholder Engagement

The objectives of stakeholder participation include the following:

a) To provide sufficient, balanced, objective, accurate and consistent information to assist stakeholders to understand the project.

b) To obtain feedback from stakeholders on project-related issues

c) To work directly with stakeholders throughout the process to ensure that their grievances, concerns and needs are consistently understood, addressed or considered.

d) To partner with the stakeholders in the implementation of resettlement activities or compensation matters.

e) To create an enabling environment through which the project will smoothly operate in friendly co-existence with other stakeholders

The SEP should be reviewed and updated regularly during project implementation. This SEP largely considers the stakeholders who have either: interest, impact, or influence over the construction and implementation activities of the project, stakeholders are therefore categorized based on their impact and their influence on the project construction and implementation activities. The approach, the strategies for handling the stakeholders, and communication frequencies will be differing from one to the other based on the categorization concerning impact and influence.

6.3.2 Stakeholder Engagement Strategy

The engagement of stakeholders is vital in the understanding of project environmental and social risks, impacts and opportunities. The project will involve stakeholders and keep good communication practices throughout the lifetime of the project. According to this approach, the aim of information disclosure/communication will be:

a) To provide local communities with a schedule and information on activities that will be arranged, together with the mechanisms for their feedback.

b) To improve the knowledge of what a project for a proposed faecal sludge treatment facility involves, in all stages of the project life cycle.

c) To make public the commitment of the company to ensure the best practices in terms of environment protection and health and safety for workers and contractors.

d) To make available to the public a grievance procedure, to collect the negative feedback and act in correcting the causes that may lead to a negative opinion as a result of the development or operations of the faecal sludge treatment facility.

To ensure transparency and availability of information regarding the proposed faecal sludge treatment facility at all phases (planning, construction and operation stages), MoWE will undertake the following:

- Project boards (in English) – will be prepared and hoisted at the project site and key roads leading to the project area. The board will include the most important information about the faecal sludge treatment facility project as well as indicate MoWE's telephone information lines for communication.
- Website information – MoWE will disclose the project's information on its website. Information will be available in English languages and, in case of any relevant project changes, they will be publicly disclosed as well as their impacts

6.3.3 Sharing of reports and Documents

The following documentation shall be made available to the public on the website and in hard copies, upon request;

a) Project's Non-Technical Summary (NTS);

b) Stakeholder Engagement Plan (SEP), including Grievance Mechanism; and

c) Environmental and Social Impact Statement (ESIS).

6.3.4 Grievance Mechanism

I. A Grievance Mechanism shall be set up to respond to any concerns, and complaints, particularly from project neighbours and stakeholders. Special care will be focused on training project staff involved in the grievance mechanism management regarding the functioning of the grievance mechanism, particularly the stakeholder's opinion and communication mechanism.

Grievances during the project construction phase as a result of the following

a) Accidents involving some community members;
b) Communities exposed to high dust levels & noise;
c) Security-related grievances;
d) Conflicts between community members and the construction workers;
e) Dumping of overburdened/spoil material in people's gardens during access road maintenance or site clearance and debris extending beyond the bounds of the site;
f) Slope failure and soil erosion causing property damage;
g) Water resource quality impairment;
h) Low employment opportunities for the local communities;
i) Poor working conditions and terms of employment;
j) Houses close to the construction area develop cracks and likely damage due to construction works such as vibrations; and

Grievance during operations such as;

a) Injurious affection (unforeseen post-project impacts);
b) Accidents from project traffic (trucks, lorries and cars),
c) Fire accidents/emergencies;

d) Bad odour
e) Fuel spills;
f) Noxious Fumes;
g) Noise;
h) Social disruption/influx issues;
i) Employee strikes or grievances/Poor working conditions and terms of employment;
j) Low employment opportunities for the local communities; and
k) The reckless conduct of project-associated material truck drivers

A Project Grievance Committee (PGC) will be set up to resolve grievances during the construction and operation phases and will consist of the MoWE project manager and Community Liaison Officer, the Employer's representative, and the local authorities. The activities of this committee will cease upon project completion.

6.3.5 Grievance Register

A Grievance Register (GR) will be made available to record all the grievances, complaints and issues the stakeholders would wish to make for consideration by MoWE. It shall be kept at a place where all will have easy access, preferably project offices onsite or at village offices to enable complainants to lodge their complaints.

The register will contain the following details: 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.

6.3.6 Grievance Handling Procedure

A two-stage procedure to carry out grievance redress is proposed

Stage 1

The grievances shall be first lodged verbally or in writing to the Project Grievance Committee or the village LC office. When the Project Grievance Committee receives grievances, they will be reviewed and categorized. If the complainant is not affected the case will be ignored but in case there are justifiable reasons, the case shall be reviewed and resolved within 3 working days.

While resolving the grievances, the Project Grievance Committee or LC will always consult the relevant Buikwe District technocrats depending on the issue e.g. Community Development Office, Environment Office, DISO/RDC etc. MoWE's project manager will be consulted by the local leaders from time to time on these matters.

Stage 2

<u>Lodging compliant with Courts of Law</u>

The constitution of Uganda gives a right to all persons if they are aggrieved and their issues are not resolved amicably or to their satisfaction to go to courts of law for proper redress. Just like

aggrieved external parties, MoWE also has a right to complain to any persons or community members that cause trouble to the implementation of the project. For example, the community vandalises signposts, connives with their workers to steal project materials but has not been arrested, community members harassing the workers or using derogative and abusive language, etc.

6.4 Stakeholder Analysis Matrix

A Stakeholder analysis matrix and mapping for the proposed Faecal Sludge Management Facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District was prepared following the NEMA guidelines to seek opinions and views on the environmental aspects of the project and the related impacts. This included the local legal framework of consultation activities and project disclosure requirements, particularly in respect of public consultation activities that are directly required, were also consulted. In this regard, the key steps within the overall stakeholder consultation and engagement process include: -

a. Identifying and notifying stakeholders of the ESIA;
b. Holding meetings (formal and informal);
c. Making provision for stakeholders to review and comment on all reports; and
d. Making a record of responses to comments and concerns available to stakeholders.

A stakeholder analysis exercise was conducted to identify the potential interests of different stakeholders (excluding the project proponent) as well as opportunities and threats and possible linkages they may have about the proposed project.

The stakeholder analysis matrix is provided in **Table 6-1**.

Table 6-1: Stakeholder analysis matrix of the proposed faecal sludge treatment facility in Buikwe Cluster

Stakeholder	Interests	Opportunities	Threats	Linkages/Involvement with the proposed project
Central Government entities	Sectoral guidance and policies Input to environment management plans Monitoring of environmental and social issues	Institutional support and coordination	Limited resources for monitoring A bureaucracy may delay the progress of operations thus costing the project more time and money	Give guiding policies and government regulations Monitoring of works Technical support to Buikwe District staff for restoration activities Issue approvals/permits/certificates to the project
Local Government entities	Responsible for the planning and development of infrastructure (roads, sanitation and water supply) Representing project-affected persons Technical guidance during data collection Accountability for development in their areas of jurisdiction	Can provide information about population trends and their dynamics in the project area Political support and mobilization Can be utilized as the contact persons in the project area Can help in spreading information from sensitization meetings	Political interference Lack of resources to participate fully	Share information on compensation modalities Witness the land acquisition and compensation process For purposes of facilitating the process of information among the stakeholders, district officials can participate in project progress and site meetings Can take up the role of liaising with the local communities since they are on the ground through the Environmental Officer, the district can take on the role of environmental monitoring in collaboration with consultants
Local	How will they be affected	Assistance in	Misinterpret project	A good channel for information

Stakeholder	Interests	Opportunities	Threats	Linkages/Involvement with the proposed project
communities	by the project? Good source of information on the trends and dynamics within the project area In some cases, particularly the landowners, their livelihood might be affected by the proposed project Can provide casual labour for the project	information transfer Labour supply (Unskilled)	intentions and therefore sabotage which eventually results in project delays If not sensitized, they might disrupt project activities	transfer and sharing Need for compensation Supply chain linkages

KEY:

Central Government Entities: Ministry of Water and Environment, Occupational Health and Safety Department (OHSD), National Environment Management Authority (NEMA), Wetlands Management Department (WMD),

Local Government Entities: Lugazi Municipal Council Environment Officer, Lugazi Municipal Physical Planner, Lugazi Municipal Council Engineer, Lugazi Municipal Town Clerk, Lugazi Community Development Officer, Lugazi Municipal Council Health Inspector.

Local Communities: Residents of Kakubansiri Village,

6.5 Consultative Meetings

Consultation meetings were held with the project-affected persons as identified during the stakeholder mapping. This was conducted between the **21st and 22nd of April 2022** to establish the likely environmental and social concerns.

Figure 6-1: Meetings at Kakubansiri Village with the project area Local leaders

Figure 6-2: Meeting at Kakubansiri Village with the local communities

6.6 Comments Register

A record of all comments and observations made during the exercise for ESIA has been provided in **Table 6-2** with a summary of the key issues and concerns raised during the consultation and engagement by some of the key stakeholders.

Table 6-2: Stakeholder Consultations for the Proposed proposed Faecal Sludge Management Facility

DESIGNATION	WHEN AND WHERE	CONCERNS	REMARKS
Ssebidde Joseph **Town clerk Lugazi Municipal Council** **Tel: +256772335732**	22nd/April/2022 Meeting held at Lugazi Municipal Council offices	✓ We welcome the project because the proposed faecal sludge facility will be used by the whole district ✓ The faecal sludge facility will help us reach levels of towns such as Lira ✓ The proposed project is located in an area that was planned for such projects within our area	• Noted
Mwebe Joyce **Senior Physical Planner Lugazi Municipal Council** **Tel: +256782747522**	22nd /April/2022 Meeting held at Lugazi Municipal Council offices	✓ The proposed project falls within the planned development of the Municipal Council because its where the dumping site is also located ✓ Buffers should be located on that project site since it has various projects going on.	• Noted
Kazibwe Yusuf **Health Inspector Lugazi Municipal Council** **Tel: +256782170158**	21st/April/2022 Meeting held at Lugazi Municipal Council offices	✓ The proposed project is beneficial to our communities regarding sanitation and also the employment of our youth during the construction phase and operation phases of the project. ✓ The project will also solve a huge problem of management of sludge, there is no system to handle the faecal matter at the moment in the	• Noted

DESIGNATION	WHEN AND WHERE	CONCERNS	REMARKS
		entire town since the population is increasing ✓ There will be a reduction of water-borne diseases since there is a high risk of water contamination without the faecal sludge treatment plant ✓ The project will encourage more planned developments in the future ✓ Toilets constructed near water sources during rainy seasons, faecal matter flows in the water contaminating it	
Nahone Ruth **Lugazi Municipal Council Community Development Officer** **Tel: +256788683863**	21st /April/2022 Meeting held at Lugazi Municipal Council offices	✓ We welcome the project to our area ✓ Engage the community so they can own it ✓ Farmers who are carrying out agriculture have to be notified and given a tentative time to leave the project site ✓ The issue of smell should be handled so it doesn't affect the community ✓ There is a cemetery on site that belongs to the Municipal council where unclaimed bodies are buried and at the moment, bodies are just thrown, with the proposed project coming in place, I hope it will help us demarcate it so the bodies are buried properly	• Noted

DESIGNATION	WHEN AND WHERE	CONCERNS	REMARKS
David Mugisa	26th/April/2022	✓ There is a need to address underlying occupational health and safety issues of the facility including odour, existing water facilities, and other construction impacts ✓ The use of PPE is important ✓ Need to engage with the district health inspectors for continuous monitoring	• Noted
Kabogga Abdul **LCI Kakubansiri Cell** **Tel: +256752896897/776896897**	22nd/April/2022 Community meeting held in Kakubansiri Cell	✓ We welcome the project in our area since Kikubansiri belongs to the Municipal Council, this will help bring development in our area with utilities such as water and electricity coming to our area	• Noted
Kampi Fazira **Women Councillor Kikubansiri Cell village** **Tel: +256756991678**	22nd/April/2022 Community meeting held in Kakubansiri Cell	✓ We welcome the project in the project area because it will benefit our community by improving sanitation and hygiene because water and sanitation go hand in hand	• Noted
Mubiko Fred **News person in Kikubansiri Cell village** **Tel: +256705924870**	22nd/April/2022 Community meeting held in Kakubansiri Cell	✓ We welcome the project ✓ We have a problem of water scarcity in our area, will this project provide us with water?	• Noted
Naluboowa Margaret **A resident of Kikubansiri cell**	22nd/April/2022 Community meeting held in	✓ The project will provide employment opportunities for us, especially women and youth during construction and operations.	• Noted

DESIGNATION	WHEN AND WHERE	CONCERNS	REMARKS
village **Tel: +256754373109**	Kakubansiri Cell		
Kisolo Karim **A resident of Kikubansiri cell village** **Tel: +256752249297**	22nd/April/2022 Community meeting held in Kakubansiri Cell	✓ Most contractors in our area have not been providing the youth jobs, how different will this project be?	• Noted
Kavuma Milton **Councillor Kikubansiri village** **Tel: +256703486754**	22nd/April/2022 Community meeting held in Kakubansiri Cell	✓ There is a water source downstream of the project site that people use, I hope the contractor finds an alternative for the communities that are using it ✓ There is land scarcity in our area, can the contractor construct public toilets for us? ✓ The issue of smell from the facility is our worry, especially during windy days	• Noted

7 ANALYSIS OF PROJECT ALTERNATIVES

One of the objectives of an EIA is to investigate alternatives to the proposed development. There are two types of alternatives - Fundamental Alternatives and Incremental Alternatives. Alternatives are "*different means of meeting the general purpose and requirements of the activity"* which include alternatives to:

1. The property on which or location where it is proposed to undertake the activity;
2. The type of activity to be undertaken;
3. The design or layout of the activity;
4. The technology to be used in the activity; and
5. The operational aspects of the activity.

7.1 A Different Type of Development

The main interest of the project developer, the Ministry of Water and Environment (MoWE) is to develop a faecal sludge management facility in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District. The fundamental alternative of development other than to undertake a project that would allow the developers to construct the faecal sludge treatment facility and operate the facility is therefore not viable in this case, and will not be considered further in this Environmental and Social Impact Statement.

7.2 A Different Location

The proposed project location was selected by the Ministry of Water and Environment-Water and Sanitation Development Facility- Central after an in-depth needs assessment; as a result, alternative locations/sites were not technically feasible to meet the needs of the Buikwe cluster towns for the proposed development.

7.3 Suitability of the proposed Site

There were two sites in the Buikwe cluster available for selection. Both sites are located in Lugazi Municipality and these include:

7.3.1 Lugazi M/C Site 1

The proposed site is located at 2No. villages, Kasana and Kakubansiri villages, Butinindi parish in Kawolo Division, Lugazi Municipality.

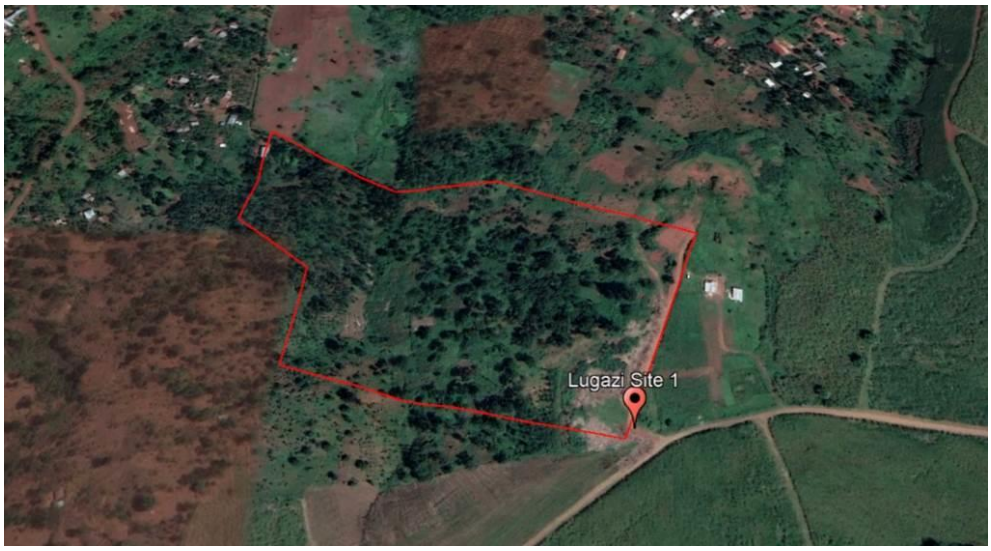


Figure 7-1: Overview Map of Lugazi Site 1

The approximate acreage of Lugazi Site 1 is 19.7 acres. The site was also designated as a solid waste disposal site. The solid waste is currently dumped on less than 2 acres. The access roads to the cluster towns are a combination of gravel and tarmac roads.

Notes on Lugazi Site 1

The following was noted from the field visit:

- The land is owned by the Municipal Council
- The access road is maintained by the Sugar Factories
- The acreage of the site is approximately 19.7 acres.
- The ground profile steep
- The site has a stream in the valley
- The site has access to electricity and piped water supply system located approximately 1.4km away.

7.3.2 Lugazi M/C Site 2

The proposed site is located in Hospital village, Lugazi Central parish in Central Division in Lugazi Municipality.

The available acreage of Lugazi Site 2 is expansive. The land is owned by Buikwe District Local Government. The land was leased to Mehta Group but the lease expired. Mehta Group intends to renew the lease for the land but the District is willing to renew the lease excluding the land required for a potential treatment plant. The access roads to the cluster towns are a combination of gravel and tarmac roads.

Figure 7-2: Overview Image of Lugazi Site 2

Notes on Lugazi Site 2

The following was noted from the field visit:

- The land is owned by Buikwe District Local Government and leased to the Mehta Group. The District is willing to set aside land for a treatment plant.
- The site is surrounded by farmland.
- The ground profile is mainly flat.
- The site has access to electricity and piped water supply system, both located less than 1km away.

7.3.3 Assessment of Buikwe Sites

The location of the proposed sites to the cluster sites is summarized in Table 7-1. The average distance to the cluster towns is the shortest for Lugazi Site 2.

Table 7-1: Distance of Sites from Cluster Towns

Project Areas		Distance from Sites	
		Lugazi Site 1	Lugazi Site 2
Lugazi	Lugazi	2.6	2.4
	Kigenda	11.0	13.3
	Nsakya	11.6	6.7
Buikwe	Buikwe	14.1	12.7
	Najja	23.9	22.4
	Kiyindi	30.4	29.0
Nkonkonjeru	Nkonkonjeru	36.3	34.8
	Ngongwe	28.3	26.9
Average Distance		**19.8**	**18.5**

The distance travelled on a roundtrip is shown in **Figure 7-3**. The longest roundtrip to the proposed treatment plant site is for Lugazi Site 1.

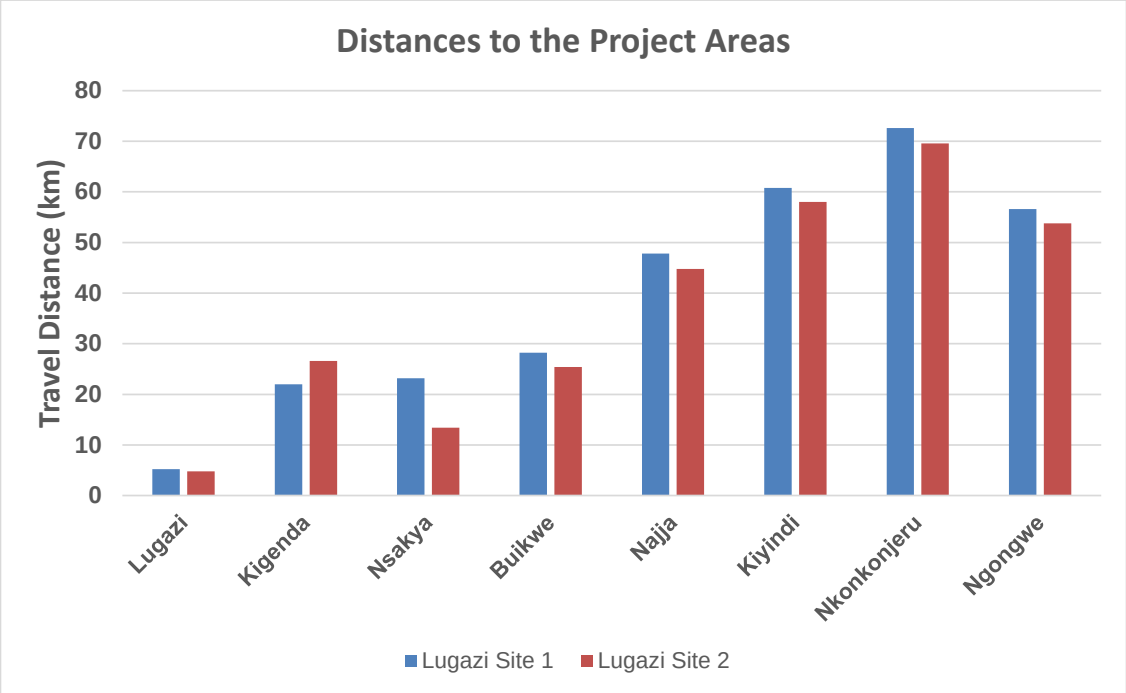


Figure 7-3: Distance Travelled in Round Trip

The various parameters used in assessing the site suitability were assigned a criterion, with a score for each parameter ranging from 1 to 5, where 1 is the worst and 5 is the best. The various parameters and their score are shown in **Table 7-2**.

Table 7-2: Parameters for Site Assessment, with their scores

No.	Parameter	Score Criteria (1-5)
1	Access road	**1** - No access road / Access Road doesn't reach the site; **2** - Existing gravel access road in poor condition; **3** - Existing gravel road in good condition; **4** - Existing tarmac road in poor condition; **5** - Existing tarmac road in good condition
2	Acreage	**1** - Acreage unknown; **2** - Acreage between 1 - 2a; **3** - Acreage between 2 - 4a; **4** - Acreage ~ 4a; **5** - Larger acreage available
3	Ownership of the land	**1** - Privately owned with the uncertainty of willingness to sell; **2** - Privately owned with a willingness to sell (with restrictions on acreage);

No.	Parameter	Score Criteria (1-5)
		3 - Privately owned with a willingness to sell; **4** - Privately Owned, agreements with T/C in place; **5** - Owned by T/C
5	Topography	**1** - Over 90% Flat, Need for fill material; **2** - Over 50% of the land is Flat, and Need for fill; **3** - 60 - 30% Flat, Need for fill; **4** - Steep Topography, Need for cut; **5** - Gentle slope, minimal earthworks
4	Ground Water	**1** - Waterlogged or partially floods; **2** - Waterlogged seasonally; **3** - GW table estimated within 1m below GL; **4** - GW table estimated >1m below GL; **5** - GW table estimated >> 1m below GL
6	Effluent Disposal / Proximity to Swamp / Wetland	**1** - Stream, limited acreage for constructed wetland; **2** - Seasonal wetland/swamp; **3** - Stream, available acreage for constructed wetland; **4** - Limited wetland/swamp with acreage for constructed wetland; **5** - Sizeable wetland/swamp
7	Access to Utilities (Piped Water)	**1** - The T/C doesn't have piped water; **2** - T/C has piped water but with limited coverage/production; **3** - Site has piped water > 10km away; **4** - Site has piped water 5 - 10km away; **5** - T/C has piped water < 5km away
8	Proximity to settlements / Urbanization	**1** - HHs / Settlements within 200m ra; **2** - HHs / Settlements within 200 - 500m ra; **3** - HHs / Settlements within 500 -1000m ra; **4** - HHs / Settlements > 1000m ra; **5** - No HHs / Settlements in sight
9	Proximity to Project Area	**1** - Site > 80km ra of PA; **2** - Site within 60 - 80km of PA; **3** - Site within 40 - 60km of PA; **4** - Site within 20 - 40km of PA; **5** - Site within 20km of PA

No.	Parameter	Score Criteria (1-5)
10	Access to electricity	**1** - The T/C doesn't have electricity; **2** - T/C has electricity but with limited coverage; **3** - Site has electricity > 10km away; **4** - Site has electricity 5 - 10km away; **5** - T/C has electricity < 5km away
11	Reuse the potential of sludge	**1**- No gardens in the vicinity, No UDDTs **2**- Farming over 5 km **3**- Farming 2 -5km **4**- Farming 500m - 2km **5**- Farming <500m, UDDTs in TC
12	Demand (Presence of emptiable facilities)	**1**- No emptiable facility **2**- <10% emptiable **3**- 10 - 30% emptiable **4**- 30 - 50% emptiable **5**- Over 50% emptiable facilities
13	Organization and coordination of Town leadership / Enabling environment for CWIS	**1**- Mode CSDA Score <5 points **2**- Mode CSDA Score 5-10 points **3**- Mode CSDA Score 10-15 points **4**- Mode CSDA Score 15-20 points **5**- Mode CSDA Score >20 points
14	Environmental and Social issues	**1**- Closeness to the homesteads Score 5-10 points **2**- Project activities to disturbance of habitat- 15-20 points **3**- Occupational health and safety issues15-20 points **4**- Impact on the wetland and water resources 15-20 points **5**-Impact on other landuse activities 5-10

To evaluate the sites, weight was attached to each of the parameters owing to its level of relevance to site selection. The score for each parameter was multiplied by the weighting factor, which is summed to give a final score for the site.

From the assessment, the most suitable site for location of the FS treatment facility is **Lugazi Site 1**, located in Kasana and Kakubansiri villages (**Table 7-3**). The site scored 78%, against the other site which scored 63%.

Table 7-3: Site scores

Site	Score value (%)
Lugazi M/C Site 1	71
Lugazi M/C Site 2	63

7.4 Emptying and Transportation Options in Buikwe cluster Towns

When selecting an emptying and transportation option for the generated/accumulated FS, several factors such as road access to the treatment plant, access to sanitation option to be emptied, distance to the treatment plant, type of facility to be emptied, nature/characteristics of FS and affordability of the services, need to be considered.

Pit emptying technologies can be categorized into three: (i) fully mechanized, (ii) semi-mechanized, and (iii) manual. Fully mechanized technologies involve the use of power obtained from a motor to empty FS and these include vacuum trucks, micravac, vacutags, trash pumps, motorized pit screw auger and Gobbler. The semi-mechanized technologies include Manual pit emptying technologies (MAPET), Gulper and Nibbler. Finally, manual emptying systems involve the application of manual power only with the use of hands through either lifting cartridge containers for container-based sanitation or direct lifting of FS from the pits into containers, which is often illegally practised. Due to the difference in the characteristics of FS to be emptied and the nature of housing units, more than one category of emptying technology was recommended.

7.4.1 Selection of fully mechanized technology

This is one of the technologies that must be available in a given town since they potentially have a larger capacity of tanks and can transport FS over long distances to the treatment facility. The comparison of the fully mechanized technologies is represented in **Table 7-4**.

Table 7-4: Comparison of emptying and transportation technologies

Criteria	Vacuum truck	Micravac/ vacutags/ eVac	Pit screw auger/Gobbler
Local availability	Highly available in Uganda	Scarce in Uganda	Not available
Access to emptying site	Can empty in a range of 50 m away from the toilet	Has to be at the toilet	Proximity to the toilet
Risk of contact with FS	Low	High	High
Capital, operation and maintenance costs.	High	Low	Low
Availability of spare parts	Highly available	Difficult to source	Difficult to source
FS with high total solids content (thick sludge)	Not easily emptied	Not easily emptied	Can be emptied
Ease in operation	Easy	Easy	Heavy to lift and difficult to manoeuvre
Storage/container device	Present	Present	Needs an external

Criteria	Vacuum truck	Micravac/ vacutags/ eVac	Pit screw auger/Gobbler
			storage device
Transportation over long distances	Very good	Poor	Good for an external storage facility
Emptying and transportation of large volumes	3 to 20 m^3	Blow 1m^3	Varies according to the truck used (up to 5 m^3)
Presence of organisation body in Uganda	Private Emptiers Association of Uganda	None	None
Profitability	High	Low	Low
Opportunities for private sector involvement	Very high	Low	Low
Potential of emptying from slum areas	Low	High	High
Sanitation technology	Better with septic tanks and lined pits	Better with septic tanks and lined pits	Can work with unlined pits
Potential of emptying in Institutions such as schools	Very high	Low	Low

The analysis in **Table 7-4** shows that the use of ***vacuum trucks*** would be more preferred in Buikwe cluster towns for several positive reasons, among them a high potential for private sector involvement. This is important because such businesses are relevant drivers of improved sanitation. However, this has limitations of not being able to empty sanitation facilities with thick sludge and lined pit latrines with high solid waste content, as observed in several facilities in Buikwe cluster towns. Therefore, an additional semi-mechanized technology to work along with the vacuum truck is selected based on the criteria in **Table 7-5**.

7.4.2 Selection of semi-mechanized/manual technologies

The comparison of different semi-mechanized and manual technologies is presented in **Table 7-5**. The manual emptying category (direct lifting in particular) was not considered to deal with FS from pit latrines and septic tank containments due to its limitation of not working with PPEs and dumping of FS in the nearby environment due to a lack of transport mechanisms. This also presents a need to train the existing manual emptiers and help them upgrade to semi-mechanized. However, the exception will only be limited to emptying dried sludge from UDDT toilet technology option, since this is the only way of maintaining the facility.

Table 7-5: Selection of semi-mechanized/manual methods for FS emptying

Criteria	Gulper	Nibbler	Manual emptying
Local availability	Highly available in Uganda	Scarce in Uganda	Direct lifting is practised but with indiscriminate disposal.
Risk of environmental pollution	Low	Low	Very high
Risk of contact with FS	High	High	Very high
Capital, operation and maintenance costs.	Relatively cheap	Relatively cheap	Very low
Availability of spare parts	Highly available	Difficult to source	Often-used containers and tools are available.
Storage/container device	Use of tricycles or pick-up trucks	Use of tricycles or pick-up trucks	Organized manual emptying can employ carts or tricycles.
Presence of organisation body in Uganda	Gulper Association of Uganda (GAU)	None	None
Potential of emptying from slum areas	High	High	High
Sanitation technology	All	All	All
Potential of emptying in Institutions such as schools	Low	Very low	None
Emptying thick sludge	High	High	High
Potential for private sector involvement	High	Low	Very low
Business potential	High	Low	Low

The analysis in **Table 7-5** shows the potential of using ***Gulper technology*** as an alternative to vacuum trucks to empty FS from slums and unlined pit latrines. The distances to the proposed FS treatment site would not necessitate the use of transfer stations. Instead, the gulper should be used together with a pick-up truck, which would transport FS direct to the treatment facility.

The truck capacity for use in the Buikwe cluster is 6 m^3. This is because of considering on-demand emptying services where there are high chances of a truck working on one household per emptying event. Secondly, these can have wider access to most of the households in the area.

Given the short distances to the treatment facility, there is no consideration of providing a transfer station, hence the number of vehicles required. Therefore, the number of 6-cubic meter trucks required for the Buikwe cluster is 10 vacuum trucks and 8no.

7.5 Faecal sludge Treatment Options in Buikwe cluster towns

To fulfil the requirements concerning the quality of the effluent of the FS treatment plant and the percentage of clarification, different treatment technologies were investigated. However, taking into consideration the prevailing temperatures in the Buikwe cluster as well as the economic and operational aspects of the project, it was concluded that the use of the below listed processes is the most appropriate system for the treatment of the FS. This treatment process requires little maintenance and has a considerable advantage concerning the initial capital investment and maintenance costs. The faecal sludge treatment process involves the following units:

1) Inlet works
    a. Bar screens
    b. Grit chamber
2) Settling tank
3) Unplanted drying beds
4) Facultative ponds
5) Constructed wetland
6) Ancillary works
    a. Administration Building with a laboratory
    b. Storage bunker for dried faecal sludge
    c. Fencing

Grit chambers

The FS treatment plant shall be equipped with two parallel open-channel grit chambers. FS contains high concentrations of suspended solids and large amounts of inorganic/sand particles. These require a grit chamber for their removal before joining settling-thickening tanks. One chamber shall be used, with the second closed. For large flows at the same time, both channels shall be in use.

Settling Tank

A two-compartment settler will be provided of 12m total length, 4.0m width and 1.8 m depth (Table 3 4). A desludging interval of 2 months has been considered. Desludging will be done by vacuum tank through the inspection manholes and the sludge will be placed on the sludge drying

beds. The FS is retained in the settling tank for 3 hours at the design horizon, the retention period will be longer in the first years of operation.

Sludge Drying Beds

7 No reinforced concrete sludge drying beds have been provided each measuring 12.3m x 12.3m and 1.1m deep. Each sludge drying bed shall have ramp access for vehicular access or pedestrian access for moving sludge. Each bed shall be fed by DN 110mm UPVC pipe with a gate valve to allow the choice of beds to fill

Facultative pond

Effluent from the settling-thickening tanks and sludge drying beds is collected for treatment in the facultative waste stabilization pond. One facultative pond measuring 42.0m x 21.0m x 1.5m depth has been provided. The BOD is reduced from 875.11 mg/L to 136.9 mg/l and the faecal coliforms reduced from 1.10 x 106 to 9258.4 Faecal Coliforms/100 ml, all these figures are above the NEMA acceptable limits of 50mg/l and 5000 FC/100ml respectively for receiving streams, hence a need for further treatment of the wastewater using the constructed wetland.

Constructed wetland

Two constructed wetlands measuring 35m x 9m x 0.5m in depth each has been designed for further treatment of the effluent to acceptable NEMA effluent discharge standards for BOD5 (50 mg/L) for receiving streams. The sizing of the pond is based on BOD5 removal from the facultative pond effluent

7.6 Faecal Sludge Chain management options

Based on the survey results and stakeholder consultations, the following technology recommendations were made across the sanitation service chain:

Faecal sludge containment facilities: Due to differences in user preferences and environmental conditions, even within the same town, no one technology can be promoted to the users. However, a wide range of technologies is recommended at both the household and institutional levels. These include; lined VIP latriness, flush toilets connected to septic tanks, urine diversion dry toilets (UDDT) and Bio-toilet.

Emptying and Transportation: We assessed various available technologies and zeroed down to the use of vacuum trucks and semi-mechanized emptying technologies such as gulper. The semi-mechanized will be relevant when it comes to sanitation facilities that are not lined or located in places that cannot be accessed by vacuum trucks.

FS treatment options: The assessment based on three levels of technology development and other various factors yielded the treatment units. To realize effluent that meets the required discharge standards, the FS from these cluster towns should be treated through a combination of several unit

processes and operations, namely; screening, grit removal, Settler, Anaerobic Baffled Reactor (ABR), drying beds, waste stabilization ponds and constructed wetland.

The selected technologies were grouped into the following categories as described in the "*Feasibility and Preliminary Design Report for Buikwe Cluster Towns*".

i) Preliminary treatment technologies,

ii) Solid-liquid separation,

iii) Solids dewatering, and

iv) Liquid treatment.

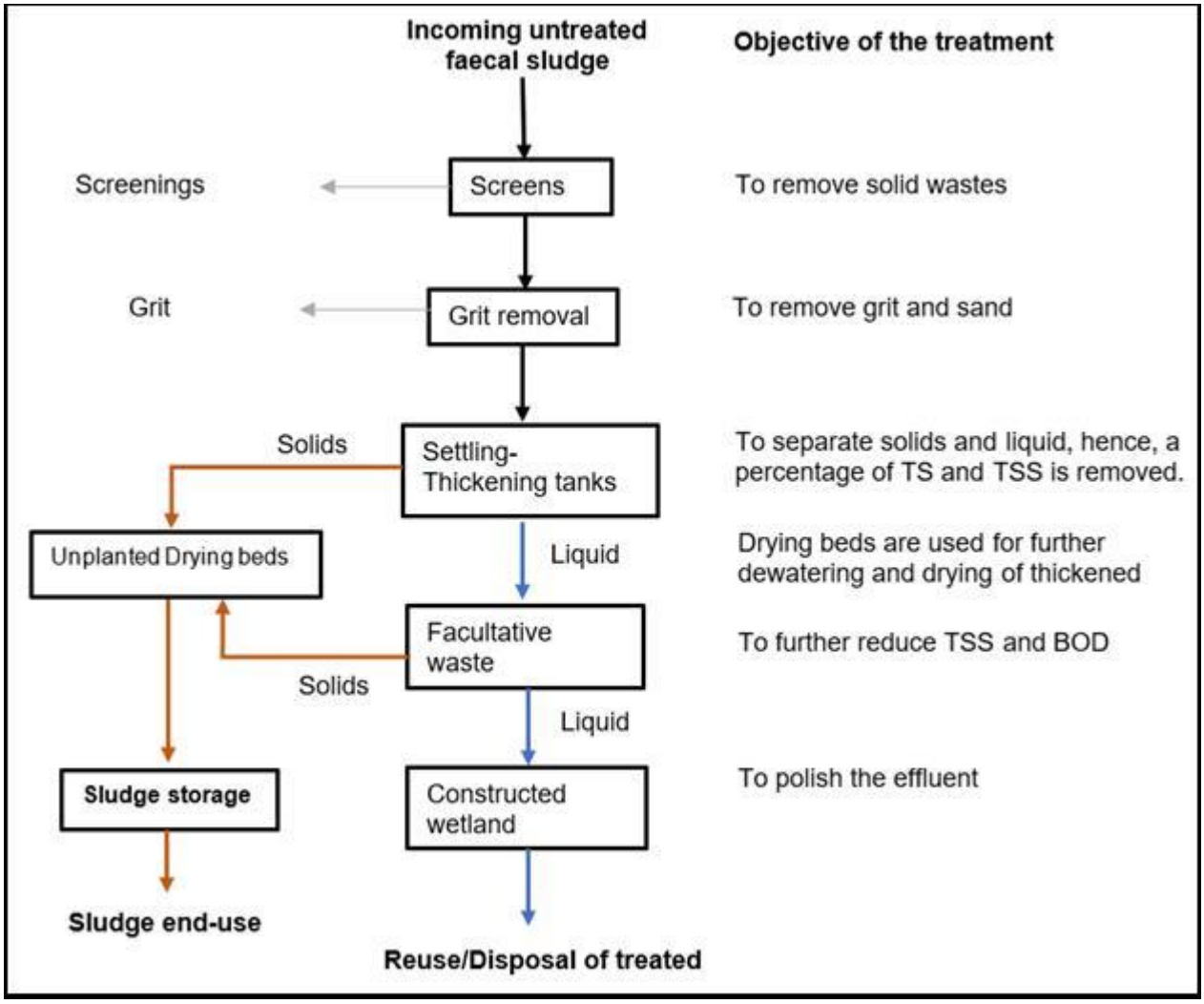


Figure 7-4: Proposed treatment processes for the FS sampled from the Buikwe Cluster towns

7.7 Faecal sludge End-use or Disposal Options in the Buikwe cluster

After treatment, dried FS solids and liquid effluent are the key products. Various products can be obtained from the solid fraction and

the liquid effluent is usually used for irrigation purposes or discharged. There are different options for FS use, particularly as a soil conditioner (land application in raw form or as compost or co-compost), building material (cement mixture), biofuel (gas, char briquettes) and in the production of protein (e.g., animal feed and via the black soldier fly) (*Ward et al., 2017, Appiah-Effah et al., 2014, Gitau et al., 2020*).

Figure 7-3 illustrates different products from dewatered sludge using different treatment options. However, inappropriate disposal in soils and leach fields is discouraged for use in Uganda due to the potential contamination of water resources.

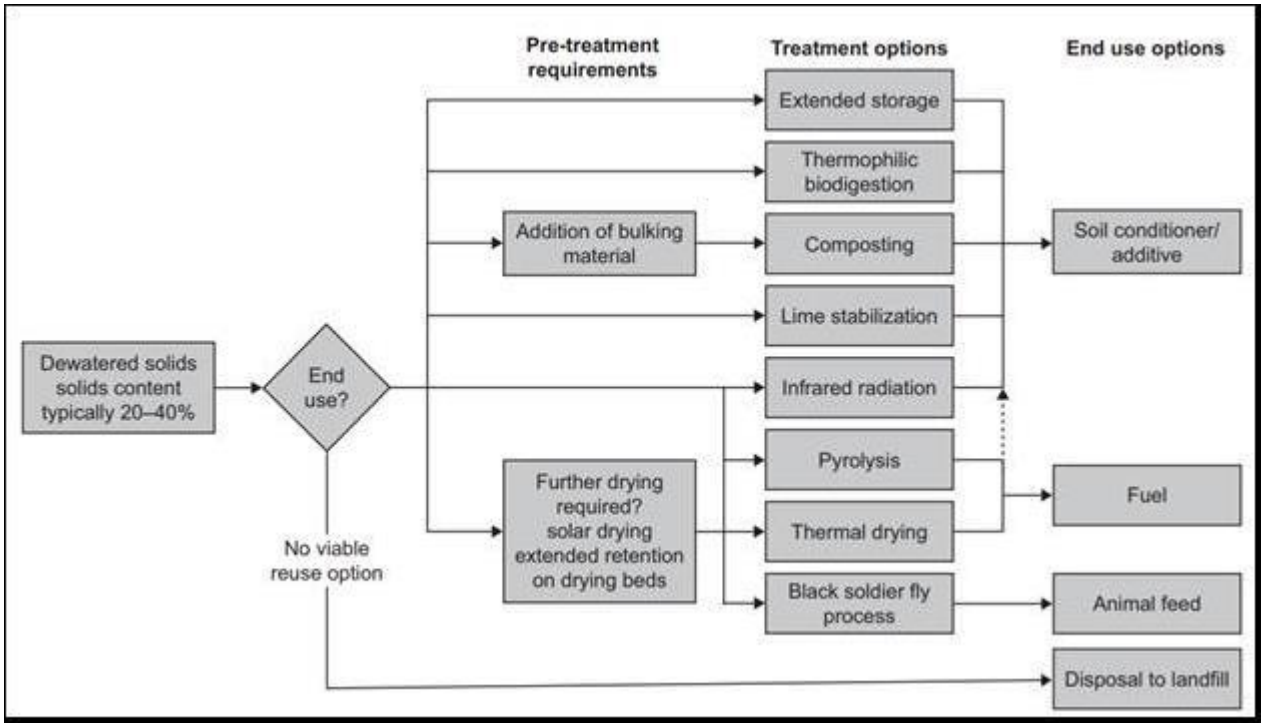


Figure 7-5: End-use options for faecal sludge management (Tayler, 2018)

The situational assessment in the cluster towns shows the potential need to use FS solids as a soil conditioner and not the other end-use options. However, the potential of the alternative end-uses can easily be understood when samples are produced or see others using them.

The most common and easily understood product is/was the use of dried FS as a soil conditioner since this is assimilated to the commonly used cow dung or chicken droppings for a similar purpose. **Therefore, the end-user option considered in Buikwe cluster towns is the use of dried FS as a soil conditioner**. Therefore, the required treatment technology is the use of extended storage in a composting shade where FS is stored for six months for complete sanitization before being used by the farmers. However, there is no difference in technology requirements if there is a need to change or diversity end-use options. For example, the use of dried FS as solid fuel needs separate additions of equipment that require dried FS as a raw material.

7.8 The Action options

If the project is implemented, then the benefits that would arise from its implementation would be realised. Its implementation would cause some adverse impacts on the environment, however, measures to mitigate/ eliminate these impacts have been proposed.

7.9 The "No-Action Option"

If the project is not implemented, then any benefits, presented in the next chapter including improved public health, employment opportunities, and investment attraction among others that would otherwise result from the construction of the Faecal sludge drying beds/ treatment plant would not be realised. However, the adverse impacts of the proposed project on the environment such as loss of vegetation, noise pollution, and odour among others presented under chapter 8 would be eliminated. However, because of the dire need to improve sanitation in Buikwe District, this option was not considered as it would hinder development and accelerate the poor sanitation situation in the Project Area.

8 EVALUATION OF ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

8.1 Introduction

This section identifies and analyses the potential positive and negative impacts likely to emerge from the proposed construction of the faecal sludge treatment plant. The impacts of the major components of the project were assessed following NEMA guidelines. The impacts have been structured into the construction and operation phases.

The Project will be implemented to improve the sanitation conditions within Buikwe Cluster. The works will include the construction of sludge drying beds. Currently, the area lacks a dedicated faecal sludge treatment plant and this has resulted in the indiscriminate dumping of faecal sludge into the environment, potentially causing public health disasters.

This practice is likely to contribute to groundwater pollution, one of the main sources of town water supply and as a result, could lead to a high disease burden within the cluster towns targeted. Improving the sanitation system for Buikwe Cluster will therefore improve hygiene and reduce health hazards associated with poor faecal sludge management. As a result, the proposed sanitation project is highly relevant and will have substantial positive environmental and social impacts on improved public health conditions in Buikwe Cluster and beyond.

8.2 Anticipated Positive Impacts

Specifically, the proposed sanitation project is envisioned to have the following positive environmental and social impacts:

8.2.1 Reduced Sewage spills, Infiltration to soils and groundwater

The provision of a proper faecal sludge treatment facility in the Buikwe cluster will reduce or eliminate any significant potential for infiltration of sewage into the soil and groundwater as well as into the nearby surface water streams. The spill over of sewage into the urban space, soils and natural waters can be caused by the overload of septic tanks and toilet facilities.

Since the neighbourhood of the proposed site comprises urban centres, agricultural gardens and several streams within the Buikwe Cluster which are a potential for potable water use, any infiltration that may occur is anticipated to be a problem.

8.2.2 Improved Household Health Status

The provision of treatment facility lines will greatly minimize localized exposure to water pollution at points of use associated with the indiscriminate dumping of faecal matter. This will lead to improved sanitation of the Cluster towns as a whole since they have no faecal sludge treatment facility and sewerage network.

8.2.3 Improved Public Health

A key objective of fecal sludge treatment is often pathogen reduction to protect public health. Pathogens are bacteria, viruses, protozoa and helminths that cause disease. The level of pathogen reduction required depends on the final use or disposal of the fecal sludge

The implementation of the sanitation project will directly contribute to improved public health in and around the Buikwe cluster. The establishment of the sludge drying beds will enable cesspool emptier operators to have a centrally managed discharge area than is currently the case with indiscriminate dumping within and around the Buikwe cluster. The establishment of the treatment plant will also lead to cesspool emptying services becoming cheaper and more affordable to a large section of the community. This will in turn minimize the current practice where toilets once full are emptied into the neighbouring water bodies at night or released during the rainy days without mitigation practices.

The project is likely to lead to decreased cases of water contamination and water-borne diseases as a result of onsite sanitation measures often prone to leakages responsible for contamination of water aquifers.

8.2.4 Improved Household income

There will be improved household income due to the employment of local labour during the construction of the faecal sludge treatment plant. It is generally anticipated that about 70 local labourers will be employed especially for casual activities. This anticipation is very high on the side of community leaders and members in the project area.

The increase in employment will temporarily lead to an overall increase in income directly and indirectly (through increased demand for other local services). Consequently, the local traders will also benefit from higher income levels as the workers will be buying from their shops.

Other additional positive impacts include:

- The project will also provide an opportunity for project local authorities to widen its tax base, especially from compost sludge sold to the farmers and sanitation local taxes;
- Improved access especially the access road to where the faecal sludge treatment plant is to be located. The access road is currently narrow and cannot be accessible by heavy transportation trucks. The road is proposed to be well maintained and upgraded to accommodate heavy trucks transporting materials; and
- While overall improved sanitation facilities will lead to improved standards of living in the project area in terms of the reduction of diseases.

8.3 Negative Impacts during Construction Phase

8.3.1 Vibration, Noise

Traffic, machinery, excavation and material transportation activities will produce dust, particularly during the dry seasons, an impact that will affect predominantly the workers at the sludge treatment site and people living near the site. Air pollution by the exhaust of the vehicles used to transport the materials is a further negative impact which is anticipated. However, most of the work activities will generate much lower amounts of dust. Therefore, this impact is expected to be temporary and will be site-specific. The magnitude of this impact would be Medium.

Mitigation Measures

- Maintain construction vehicles and machinery in good condition to minimize noise and dust emissions;
- Use appropriate means for minimizing dust through dust dispersion during construction, especially during dry spells. These may include; sprinkling water to keep dust levels low whenever dust generation exceeds acceptable levels and water sprinkling of roads used by trucks to transport construction materials with water bowsers in the dry period; and
- Strict control under a construction contract to limit noise and air pollution levels to within the set acceptable national standards.
- Use protective clothing like dust masks on the construction crew
- Good maintenance and proper operation of construction machinery to minimize noise generation
- Where possible, ensure non-mechanized construction to reduce the use of machinery

8.3.2 Soil-Related Impacts

The construction activities of the faecal sludge treatment plant will have some minor impacts on the soil. However, these are localised and restricted locally to each site. It is expected that these impacts are also short-lived during construction and mitigation measures are recommended. The key impacts will revolve around soil erosion, contamination, disturbance of the natural soil structure and thus reducing the ecological function of the soil.

Mitigation Measures

- In cases where it is identified that during construction there is a danger of increased run-off or at the project site, drainage channels with stone pitching or holding ponds can be employed
- After completion of the construction works, restoration of the ground by sowing adequate grass cover and planting of trees will be followed, therefore the impact is temporary and reversible

- Demarcate the access routes to be used by vehicles and machinery to minimise the affected areas
- Plan emergency response measures in case of accidental oil spills.
- Vehicle maintenance should be done in designated places. Drip trays should be employed to prevent spills

8.3.3 Oils and Gasoline Spillage

The Storage of construction material, oil and gasoline for machinery will be critical during the construction of the Faecal Sludge Treatment Plant. This is because this exercise will require machinery for excavation, loading off-loading of heavy pipes and construction materials.

Mitigation Measures

- Strict control by Supervising engineers to ensure acceptable storage practices; and
- The disposal of oils shall be restricted to particular areas like the service bays and the used oil cans should be disposed of in approved sites by the Lugazi Municipal Council.

8.3.4 Excavated Materials

Disposal of excavated material especially topsoil and excess material is likely to be a challenge during construction. However, interaction with the project design team indicates that quantities of surplus material will be low (only about 1%), as most of the excavated material will be used for backfilling. Nevertheless, this impact needs attention in case of occurrence although it is expected to be Site Specific, Short-Term consequence and of Low Magnitude.

Mitigation Measures

- Excavations portions of the site have to be reinstated to original condition as provided for under the contract and design to achieve a balanced cut and fill balance;
- Earthworks have been designed such that cut and fill balance will be maintained (zero mass balance) to avoid disposal of or need for extra material; and
- Surplus material is to be disposed of as directed e.g., in abandoned material sites or areas which need levelling.

8.3.5 Socio-Economic Impacts

The possible negative impact will be that the migration of people from different areas may have social risks which include but are not limited to; increased illicit behaviour and crime, increased risk of the spread of diseases such as HIV/AIDS and communicable diseases, etc

Mitigation Measures

- Sensitize workers and the surrounding community on awareness, prevention and management of HIV / AIDS through staff training, awareness campaigns, multimedia, and workshops

- The Contractor should enforce and maintain a code of conduct for his employees

8.3.6 Health and Safety concerns

During construction, there is a likelihood of occurrence of workforce accidents, especially as a result of unsafe working practices, negligence and lack of adequate Personal Protective Equipment (PPEs). The project works will expose workers to occupational risks due to handling heavy machinery, construction noise, electromechanical works etc. Some of these health risks may result in permanent injuries or death. The extent of this impact if mitigated would be Site Specific (within a 1 km radius of the site). The duration of the impact would be Long-term and the magnitude of this impact would be Medium.

Mitigation Measures

- Awareness workshops for the workforce on safe working practices should be held periodically;
- At the construction site, safety procedures should be complied with following the safety guidelines by the department of occupational health and safety under the Ministry of Gender, Labour and Social development. Some of these measures will require work permits and safeguards against fire and accidents;
- First Aid kits should be provided at the site and all the workers trained on how to use them;
- Ensure that all construction machines and equipment are in good working condition;
- Provision of personal protective gear (e.g. helmets, boots, gloves, overalls etc.) to every worker especially those working in accident-prone sections during construction; and
- Strict control by Supervising engineers to limit safety hazards.

8.3.7 Impacts on Cultural Heritage

The project site is located near a graveyard site that can potentially be affected. Therefore, provisions must be made in case of any graveyards and/or individual graves are dismantled during excavation or construction.

Mitigation Measures

- No historical or archaeological finds are expected on site, however, if encountered the Contractor is to inform the local authority for further action
- Use of “chance finds” procedures by the contractor

8.3.8 Temporary Interruption of Traffic during Construction

During the construction of the FSTP, there is a likelihood of temporary interference along the main access route to the project site as a result of heavy trucks transporting construction materials to and from the site. The extent of this impact if mitigated would be Site Specific (within a 1 km radius of the site). The duration of the impact would be Limited/ short term and the magnitude of this impact would be Medium.

Mitigation Measures

- The contractor should provide diversion access to the faecal sludge site while working on the sludge treatment plant to minimise traffic effects; and
- It is also advisable that the contractor widens and improves the existing access road since the existing access route is narrow.
- Use reflective signage to direct traffic to designated areas.
- Use flagmen to give directions to traffic.
- Sensitize drivers to observe speed limits

8.3.9 Air Pollution

Pollution through gaseous emissions in the project area will emanate from exhaust pipes for vehicles and machinery used in the construction works. Though to a less extent, they are a contributing factor to the general greenhouse gases and subsequent global warming. The generation of air emissions at the site will be a particular concern for workers employed in various site operations, especially during excavation and site levelling activities. Nuisance dust, odours and hazardous dust are also important to analyse and mitigate. The extent of this impact would be Site Specific. The duration of the impact would be Short Term and the magnitude of this impact would be Low.

Mitigation Measures

- The developer will be required to ensure the provision and use of Personal Protective Equipment (dust masks and/or respirators) for workers employed in pollution-related activities. The study recommends an Occupational Health and Safety risk assessment before commencement be carried out to identify and address process-specific health risks; and
- The developer shall also ensure the proper mechanical condition of project vehicles to minimize exhaust emissions.

8.3.10 Increased Incidences of Diseases

The influx of over 70 workers who are required to be involved in the project's activities especially labourers from outside the residential areas will increase the potential risk of sexually transmitted diseases including the Human Immune-deficiency Virus/ Acquired Immune- Deficiency Syndrome (HIV/AIDS) among the program workers and local communities. The extent of this impact would be spread and maybe Long-term if not controlled at the beginning of the project. The magnitude of this impact would be high.

Mitigation Measures

- The workers and the resident community should be cautioned to avoid immoral behaviours as may lead to HIV/AIDs;

- The contractor will be required to conduct massive sensitization both to the workers and the resident community and also put in place proper guiding and educative signage at the site to keep the workforce informed and aware of their obligations;
- Where necessary, the contractor should distribute condoms to all workers; and
- All workers, contractors and sub-contractors to recruit staff with proven morals and with recommendable records.

8.3.11 Solid Wastes generation

On-site construction will generate substantial amounts of construction waste. These solid wastes will include; excavated earth/debris which will be a result of excavation activities (Some excess material will be left over which needs to be disposed of appropriately although the quantities will be relatively low); waste oils from servicing; medical wastes from injuries and domestic wastes (e.g., food stuff, polythene and plastics). A clear understanding of potential sources and types of waste generated will help in developing appropriate mitigations. This impact is likely to be Site Specific (within a 500 metres radius of the site), Low and Short-Term occurring specifically during construction.

Mitigation Measures

- A site Waste Management Plan should be prepared by the contractor before the commencement of the faecal sludge project in conformity with what is proposed in this report under **chapter nine section; 9.5.1**. This should include the designation of appropriate waste storage, collection, removal schedule and identification of approved disposal sites. Preparation and implementation of the plan will be the responsibility of the project contractor with the system being monitored independently or by the Lugazi Municipal Council (Environmental Officer and Health Inspector);
- The contractor and proponent should ensure good housekeeping practices to minimize the accumulation of solid wastes at construction sites. They should also provide waste collection containers within the project construction site to avoid littering domestic wastes;
- The debris from excavation activities should be used for refilling or immediately removed and dumped in an approved area;
- The developer will carry out regular fumigation of the construction areas to minimise vermin infestations;
- Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted; and
- Use licensed recycling companies to externally collect and recycle, recover or dispose of waste.

8.3.12 Disturbance and interruption of commercial and social activities

No residents are currently on site. The site was also designated as a solid waste disposal site. The solid waste is currently dumped on less than 2 acres out of the approximate 19.7 acres of the project site which will not be affected during project implementation. No need for mitigation.

8.3.13 Social Disharmony

The potential for social disharmony only exists between the residents and immigrant project employees who may come with some new behaviours and cultures, not in harmony with the norms of the residents. The sudden influx of new faces into the project area will raise social concerns, particularly in Kakubansiri Cell. The extent of this impact with mitigation would be Site Specific. The duration of the impact would be Short-Term. The magnitude of this impact would be Negligible/Low.

Mitigation Measures

- The priority for employment should be given to the locals of the area, especially those living within the project areas.
- Employment emphasis should be placed on gender balance where about 30% of all workers should be women;
- The Contractors and Lugazi Municipal Council should endeavour to inform and sensitize both the new employees and the residents on the importance of respecting local customs and norms;
- The contractor should provide his workers with proper identification and uniforms during the activities so that it is simple to identify and weed out those with social problems; and
- The new workers should be registered with the L.C chairperson of the area so that in case of any wrongdoing they are easily tracked down.

8.4 Negative Impacts during Operation & Maintenance.

8.4.1 Anaerobic Conditions

During the operation of the faecal sludge treatment plant, there is the likelihood of the generation of anaerobic conditions in sewer pipes and stormwater flooding of basements and leakage of faecal pipes. This impact if not well managed, can have long-term consequences on the environment especially the lower streams within the Kakubansiri area.

Mitigation Measures

- Proper maintenance of sewer system in operation.

8.4.2 Odour Nuisance / obnoxious smell from the treatment plant area

There is likely to be an odour nuisance from Inlet Works and Anaerobic Ponds if not well managed during operation. This impact may be of great concern to the public especially those neighbouring the treatment plant.

Mitigation Measures

- Trees should be planted along the sludge treatment plant boundary; and
- Periodic maintenance and monitoring of the air quality along the proposed faecal sludge treatment Plant.
- Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills.

8.4.3 Mosquito breeding and disease transmission

Mosquito larvae generally live in small, shallow water bodies where disturbance of the surface layer is uncommon.

As the water in the Faecal Sludge Management Facility will be flowing, there is not expected to be significant mosquito breeding in the facility. Steps should however be taken to ensure that any potential of vectors breeding in the facility is eliminated since the facility is located near residents

Mitigation measures

- Eliminate spillage and all unnecessary standing water.
- All floating vegetation should be removed from the water to avoid the disruption of drainage channels.
- Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills.

8.4.4 Public Health Risk

There is likely to be a health risk of pathogens for potential users of the wetland/ stream by liquid effluent discharge from the faecal sludge plant. This may lead to the transmission of water-borne diseases and vector-transmitted diseases if the faecal sludge treatment is not well handled.

Mitigation Measures

- No cattle grazing or irrigation to be allowed to use water from the ponds/ wetlands created on site for treatment purposes;
- Fencing of 100m from the wetland to the discharge point, provision of disinfecting facility, if found necessary;
- A Vector control program should be put in place, i.e. fish & frogs feeding on insect larvae; and
- For use of insecticides, environmentally best practices will be used, e.g. bacillus thuringiensis (bacterial toxin).

8.4.5 Solid Waste from Screens

There is likely to be solid waste generated from the screening process. If these solid wastes get into the environment, especially the neighbouring wetland, they may be a source of pollution.

Mitigation Measure

- Screenings should be contained and disposed of in approved areas,
- Other solid wastes generated at the site will be minimal and should be stored on site until they are collected by the Municipal council or other authorized service providers for disposal.

8.4.6 Impact of Sludge on nearby wetland/Stream Water Quality

The operation of the Treatment Works will produce some sludge. As Aluminum Sulphate (AlSO4) is used for the treatment of raw water, sludge from Chemical Mixing Tanks, Flocculation Basins and Sedimentation Tanks contain some amount of aluminium. If washed into any nearby wetland/stream without proper cleaning the aluminium may kill small water creatures and fish.

Mitigation Measures

- It is proposed to remove this sludge by filtration in Sludge Drying Beds to be constructed at the Treatment Works. The sludge will be removed in Soak away Pits. Sludge wastewater will be and the pH of the soil should be monitored continuously;
- Arrange a facility to provide stabilised sludge to farmers for agricultural purposes. If there is surplus sludge, disposal at a controlled solid waste disposal site; and
- Requires monitoring for pollutants and pathogens as provided under the Environmental Management Plan.

8.4.7 Health and Safety Concerns for Workers

There are many specific health and safety concerns associated with the collection, transport, and discharge of FS. The primary hazard is pathogen exposure from untreated or insufficiently treated faecal excreta transmitted via the faecal-oral route. Excreted urine may also contain pathogens, however, to a lesser extent and in a lesser range of etiological agents. The excreta may contaminate food or water. Several helminths in excreta may also infect humans through the skin. Direct contact with contaminated material and subsequent accidental ingestion from contaminated fingers or utensils are major transmission pathways. Contact may occur before treatment, during treatment, including handling or when the material is used/applied to the soil. As a result, service providers are at a high risk of exposure to physical, chemical and biological hazards.

Physical hazards

The following physical hazards can exist in the handling of faecal sludge:

i) The low bearing capacity of the soil surrounding an unlined pit can lead to the collapse of its sidewalls during emptying (in particular for manual emptying);

ii) slips, trips and falls; iii) Exposure to sharp objects contained in the sludge (e.g. glass, metals); iv) carrying heavy loads (e.g. containment structure cover or sludge-filled containers); and

v) Traffic (particularly relevant during transport).

Chemical hazards

The following chemical hazards are known to exist:

i) Direct and indirect oral, nasal and dermal exposure to chemicals (e.g. hydrocarbons that are

ii) Introduced as odour suppressants, although this practice is not recommended);

iii) Working in confined spaces in the presence of harmful gases (e.g. methane, ammonia, sulphur dioxide), in an oxygen-depleted environment (in particular during manual emptying).

Biological hazards

The following biological hazards can exist in the handling of faecal sludge:

i. Direct and indirect oral, nasal and dermal exposure to multiple types of pathogens in faecal sludge (e.g. bacteria, viruses, protozoa, and helminths)

Mitigation Measures

The first and best line of defence for mitigating risks is by limiting exposure to previously defined hazards. This includes:

- Provide and wear the appropriate personal protective equipment (PPE) to avoid direct and indirect exposure to FS (e.g. gloves, coveralls, rubber boots with a metal sole, safety glasses and safety masks);
- Develop and provide training on the use of tools customised for local conditions and local containment systems to avoid direct contact with faecal sludge;
- Provide a training programme on standard operating procedures including the proper use of PPE, tools and equipment; and
- Preventative measures related to personal health care are recommended including immunisation and a deworming program. The latter is recommended particularly for service providers transitioning from unsafe to safe practices.

8.4.8 Traffic Concerns

It is important to take the traffic patterns and the management of truck traffic in and out of the faecal sludge treatment plant into consideration to maximise the efficiency of the receiving and off-loading processes. Lack of proper traffic management may lead to inconveniences with other access road users and also lead to accidents. Receiving faecal sludge loads at the faecal sludge treatment plant involves:

- ✓ Traffic control; and
- ✓ Approving the faecal sludge for discharge into the facility.

Mitigation Measures

- Traffic control will be simplified through a well-designed facility layout. Access roads that allow vehicles to drive through after discharge rather than turn around will be encouraged as they are not only more efficient but also safer;
- Mechanized unloading stations that record the driver's identification and discharge volume can also reduce traffic problems and costs at busy facilities;
- The turning radius and weight of the largest trucks that will utilise the facility will be considered when planning roads and driveways; and
- In addition, off-loading and truck parking areas will be level, and access roads shall not have more than a 3% gradient.

8.4.9 Approving Faecal Sludge for Discharge

Wastes from different sources can have widely differing characteristics, which may impact the operation of the faecal sludge treatment plant. Residential faecal sludge (e.g., from pit latrines or septic tanks) is often relatively free of toxic chemicals. Restaurant faecal sludge, however, may have significant quantities of fats, oil and grease, especially if grease traps or interceptors are absent or not functioning properly. Similarly, faecal sludge from auto repair shops, dry cleaning establishments, hospitals, or other commercial or institutional settings may contain toxic materials that are detrimental to the treatment process.

Mitigation Measures

- Depending on the institutional framework, and the arrangement between the stakeholders in charge of the collection, transport and treatment, a manifest system can be utilised to record the origin, volume and special characteristics of faecal sludge. Where the trucks frequently contain faecal sludge from several onsite technologies, the form should include this information. The manifest is then carried out by the driver and presented at the faecal sludge treatment plant for review by operations employees before off-loading. Once the load is approved, the manifest is then signed by the operator and returned to the driver as proof that the waste load was discharged into the facility; and
- Operators of faecal sludge treatment plants should be trained in the physical inspection of sludge samples. If there is any doubt as to the origin of the load, samples should be drawn and inspected for colour, odour, and the presence of grease or oil. Faecal sludge from residential sources has a distinct visual appearance, as do loads contaminated with excessive oil and grease. Loads that do not conform to standards that have been established for the treatment process shall be rejected if segregation is not possible.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP)

9.1 Introduction

Environmental and Social Management involves the implementation of measures to eliminate or reduce significant adverse environmental and social-economic impacts of a project to acceptable levels.

Monitoring is a long-term process, which should begin at the start of construction and should continue throughout the life of the project. The purpose of monitoring is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. The overall objective of environmental and socio-economic monitoring is to ensure that recommended mitigation measures are implemented during the project construction and operation. Monitoring is also conducted to determine the effectiveness of proposed mitigation measures, to check if the magnitude of anticipated impacts is in line with predicted and to establish if any project unforeseen impacts would require addressing. Monitoring hence enables corrective actions to be undertaken in good time.

An Environmental and Social Management and Monitoring Plan (ESMMP) has been developed for the proposed faecal sludge treatment plant.

9.2 Purpose of the ESMMP

The purpose of the ESMMP is to ensure that the both biophysical and social environment is protected from the adverse impacts of the proposed project. The ESMMP is to serve as a reference/guidance tool for all those who will be involved in environmental and social management and monitoring throughout the project lifecycle.

9.3 Scope of the ESMMP

The ESMMP covers all activities to be undertaken under the proposed construction of the Buikwe cluster towns' Faecal sludge plant. It covers all significant adverse environmental and social impacts anticipated to accrue from the implementation of the proposed project.

The ESMMP specifically spells out the parties responsible for Environmental and Social Management and monitoring, the roles to be played by each party and the general requirements for environmental management and monitoring, and decommissioning/restoration/rehabilitation plan.

9.4 Stakeholders in Faecal Sludge Management and their Roles

The implementation of this ESMMP requires the involvement of several stakeholders, each fulfilling a different but vital role to ensure sound environmental management during the implementation of the project. The key stakeholders include National Environmental Management Authority, MoWE (the developer) and the Buikwe Cluster (Beneficiary).

9.4.1 National Environmental Management Authority (NEMA)

National Environmental Management Authority is the designated authority responsible for authorizing or approving the ESIS and this ESMMP contained therein. NEMA has overall responsibility for ensuring that the developer, Contractor, and beneficiary comply with the conditions of approval of the environmental aspects of the project contained in the ESIS and subsequently the conditions of the certificate.

9.4.2 Funder (AfDB)

The Bank shall be responsible for the following;

- Overall supervision and provision of technical support and guidance.
- Recommend additional measures for strengthening the management framework and implementation performance;
- Supervising the application and recommendations of ESMP

9.4.3 The Developer (MoWE)

The Ministry of Water and Environment as a developer shall be responsible for;

- Collate environmental baseline data on relevant environmental characteristics of the selected project site;
- Analyze potential community/individual sub-project activities and their environmental impacts;
- The developer is accountable for the potential impacts of the activities that are undertaken and are responsible for managing these impacts. MoWE, therefore, has overall environmental and social responsibility to ensure that this ESMP is implemented.
- Ensure that project activities that are implemented will be in accordance to best practices and guidelines set out in the ESMP;
- Identify and liaise with all stakeholders involved in environment related issues in the project; and be responsible for the overall monitoring of mitigation measures and the impacts of the project during implementation.
- Develop, coordinate and ensures the implementation of the social aspects of the ESMP
- Identify and liaise with all stakeholders involved in social related issues in the project;
- Conduct impact evaluation and beneficiaries' assessment
- As required by the National Environment Audit Guidelines, MoWE should submit the first Environmental audit report for the project to the Executive Director, NEMA within not less than twelve months and not more than thirty-six months after the commencement of the project.

- The developer should obtain any necessary permits including water abstraction permits, waste discharge permits among others if required.

9.4.4 The Contractor

The contractor will be contracted through open bidding and this will be done with the support of MoWE.

- The contractor has the responsibility of executing the ESMMP on behalf of the funder and beneficiary. The Contractor shall have the liberty to have a site environmentalist who will assist in guiding and interpreting the requirements stipulated in the ESMP and who will also supervise the implementation of the ESMP.
- Compliance to BOQ specification in procurement of material and construction and implementation of CESMP and other required plans and programmes as stipulated in ESMP

9.4.5 Buikwe District (Beneficiary)

Buikwe District will be charged through the Environmental officer, Town engineer and Heath inspector at ensuring that the work carried out by the contractor is as per the specifications of the detailed design and that the contractor is adhering to the ESMMP and the conditions of the NEMA certificate. Generally, the beneficiary through the professional staff will supervise the contractor to ensure adherence.

9.4.6 The Community of Buikwe District

Faecal Sludge Management requires collective actions reaching beyond households or individual initiatives of a latrine technology. Usually, the communities decide what type of on-site sanitation system they build in their houses. Participation of the local population in the decision-making process of faecal sludge management is therefore fundamental and awareness and confidence have to be built. The community decides on the following;

- ✓ Which toilet facilities to adopt;
- ✓ When they want their pits/tanks to be emptied and call for emptying services; and
- ✓ Pay for the emptying services.

9.4.7 Community-Based Organisations/Non-Governmental Organisations

Community-based organisations (CBOs) and non-governmental organisations (NGOs) play a significant role in the field of water supply, sanitation and hygiene education and funding. Concerning faecal sludge management, the aforementioned organisations are mainly active in promoting the following areas;

- Raise awareness (hygiene, health and sanitation) among the population and other actors;
- Assist the informal private sector (training, equipment etc.);

- Increase the capacity of stakeholders through specific courses, training materials and guidelines;
- Represent the community and express its needs and concerns at hygiene, health and sanitation meetings (gathering representatives from the authorities, the private sector etc.); and
- Promote sustainable solutions in the water and sanitation sector.

Table 9-1: Environmental and Social Management and Monitoring Plan (ESMMP)

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
Pre-Construction Phase					
Vegetation loss	• Restrict vegetation clearance to those areas where the permanent structures and beds for the faecal sludge plant are to be located; and • Re-vegetate, landscaping and restoration vegetation to the affected areas after construction to allow regeneration	• Type of vegetation lost	During site clearing	Contractor MoWE	9,000,000
Construction Phase					
Soil Related Impacts	• In cases where it is identified that during construction there is a danger of increased run-off or at the project site, drainage channels with stone pitching or holding ponds can be employed • After completion of the construction works, restoration of the ground by sowing adequate grass cover and planting of trees will be followed, therefore the impact is temporary and reversible • Demarcate the access routes to be used by vehicles and machinery to minimise the affected areas	• Records of vehicle maintenance • Vegetation restored • Site routes demarcated • Stockpiles of topsoil • Written down soil protection measures and record of implementation • Results of chemical analysis of treated soils Monitoring for	During construction	Contractor MoWE	9,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• Carry out work under mild weather (not strong rains or winds). • Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type. • Remove and store topsoil in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation. • Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. • Installing leak-proof fuel storage on a concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. • Strictly enforce and monitor standard procedures for storing and handling hazardous wastes and raw materials (e.g., fuel or chemicals). • Place strong drums for oil storage on impermeable floors in the stores. • Provide appropriate hoses for re-fuelling of pumps and vehicles.	storage reports, • Designated sanitary containers Monitoring reports on the parking of vehicles and the status of fuel storage			

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• Parking vehicles on paved platforms whenever possible • Sites for cleaning, fuelling and maintaining equipment and vehicles should be able to prevent leakage (e.g., paved or with settlers).				
Air pollution	• Maintain vehicle and equipment according to manufacturers' specifications. • Use standard fuel and lubricants • Sprinkle water to work areas to reduce and prevent dust during dry weather periods. • Clean access routes in the surrounding area daily to prevent dust. • Collect and hold sanitary and cleaning wastes in appropriate containers. • Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust.	• Record of repairs • Fuels and lubricants conforming to specifications • Record of water sprinkling • Record of cleaning • Designated sanitary containers • PPEs Distribution list/stores, percentage of workers using nose and ear masks	During construction	Contractor MoWE	3,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
Vibration and Noise pollution	• Minimize noise according to NEMA, Uganda standards. • Control noise and vibration on site. • Install adequate noise prevention devices, *e.g.* mufflers on noise-generating sources. • Maintain vehicle and equipment according to manufacturers' specifications • Switch off the engines of vehicles and machinery while not in use. • Provide information to the local communities (e.g. through the LC system or local radio (FM) stations) concerning work programmes, and strict adherence to such • Workers who may unavoidably have to work with noise-generating equipment, *e.g.* earthmoving equipment should be provided with ear plugs and advised/monitored to put them on with punitive measures to those who don't oblige.	• Noise-making machines/equipment fitted with mufflers • Record of noise measurements • Record of vehicle and equipment maintenance • Equipment log sheets • Receipts from radio stations for announcements made • Workers with PPEs including • helmets, boots, nose and ear masks	During construction	Contractor Buikwe Environment officer MoWE NEMA	As per Civil works-Contractor BOQ

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
Solid waste generation	• The Contractor should prepare a Solid Waste Management Plan • The contractor should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste • Any waste including excess soil should be disposed of at gazetted sites. The solid waste shall not accumulate on site, to cause odour, fly, or rodent problems. • Excavated soils should be reused as much as possible as filling material. • Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted. • Use licensed recycling companies to externally collect and recycle, recover or dispose of the waste	• Written down Solid Waste Management Plan (SWMP) and implementation schedule. • Records of types of wastes generated, transported and delivered to gazette sites • No visible soil stockpiles • Depressions filled • Sealed storage containers on site • Contracts with licensed waste disposal/recycling firms	During construction	Contractor Engineer Buikwe district Environment officer Buikwe district and Lugazi Municipal Council	7,000,000
Occupational Health and Safety concerns	• Fill up all depressions to avoid pools of stagnant water that may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes which cause malaria. • Mark all dangerous areas and fence them off. • Restrict access to work areas by unauthorized persons	• All excavated potential depressions were re-instated, filled and re-vegetated. • All excavated potential depressions were re-instated, filled and re-vegetated.	During construction	Contractor District medical officer-Buikwe Uganda Police-Buikwe	31,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• Ensure that work sites (especially excavation works), have proper protection with a clear marking of safety borders and signals and fence off all dangerous areas. • Confine access to restricted work sites (including those with the operation of mechanical and electric equipment) to persons with permits. • Provision of personal protective equipment i.e. safety clothing and equipment for the workforce (70 workers) • Provision of first aid kits and health personnel • Capacity building needs. Training will be required to ensure the implementing agency/proponent etc. can implement the ESMP and monitor it successfully	• All dangerous areas are fenced off and warning signs • Written communication to neighbouring communities • Security guards to restrict access • Demarcated work sites and signals • Receipts from radio stations for the announcement			
	• Employment of Environmental Health and Safety supervisors	• Monthly Progress Reports	Monthly	MoWE Consultant Contractor Buikwe &Lugazi Environment and Health Officers	40,000,000
Socio-Economic Impacts	• The workers and the resident community should be cautioned to avoid immoral behaviours as may lead to HIV/AIDs;	• Community awareness of HIV programmes	During construction	Contractor Health	5,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	• Awareness programmes on the ongoing construction activities, HIV /AIDs and STDs among construction workers and condom distribution • The contractor will be required to conduct massive sensitization both to the workers and the resident community and also put in place proper guiding and educative signage at the site to keep the workforce informed and aware of their obligations; • Where necessary, the contractor should distribute condoms to all workers; and • All workers, contractors and sub-contractors to recruit staff with proven morals and with recommendable records	• Community sensitization programs		Inspector Buikwe Environment officer	
Temporary Interruption of Traffic during Construction	• Inform local communities about the construction programme in advance. • In case access roads have to be closed, inform local communities and road users in advance • Use reflective signs to direct traffic to designated areas. • Use flagmen to give directions to traffic. • Install speed reduction humps at crossings of many people, *e.g.*, at a school, or market. • Sensitize drivers to observe speed limits	• Written communication to neighbouring communities • Receipts from radio stations for announcements • Traffic Management Plan (TMP) in place • Record of vehicular accidents and incidents • Sensitization reports	During construction	Contractor Traffic Police - Buikwe	3,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
Disturbance and interruption of commercial and social activities	• Inform local communities about the construction programme in advance. • In case access roads have to be closed, inform local communities in advance. • Clean and maintain access roads in the neighbourhood of earth and sand daily. • Provide temporary access ways with the approval of local authorities where access roads are closed. • Carry out work under mild weather (not strong rains or winds). • Reduce obstruction of access to and use and occupation of roads and footpaths • Protect any items and/or sites of archaeological or cultural value (e.g., private graveyards) discovered during works with the aid of the appropriate authorities.	• Written communication to neighbouring communities • Presence of access roads • Record of protection and/or compensation of items of cultural values	During construction	Contractor Lugazi Municipal Council – Buikwe District	
Social Disharmony	• The priority for employment should be given to the locals of the area, especially those living within the project areas. • Employment emphasis should be placed on gender balance where about 30% of all workers should be women; • The Contractors and Lugazi Municipal Council should endeavour to inform and sensitize both the new employees and the residents on the importance of respecting	• Record of sensitization sessions • Register of workers	During construction	Contractor Local councils	

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	local customs and norms; • The contractor should provide his workers with proper identification and uniforms during the activities so that it is simple to identify and weed out those with social problems; and • The new workers should be registered with the L.C chairperson of the area so that in case of any wrongdoing they are easily tracked down				
Operation and Maintenance					
Odour Nuisance / obnoxious smell from the treatment plant area	• Trees should be planted along the sludge treatment plant boundary; and • Periodic maintenance and monitoring of the air quality along the proposed faecal sludge treatment Plant. • Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills.	• Fenced area of waste stabilization pond • A well-maintained and operated sewage treatment plant	During operations	NEMA District Environmental Office	
Mosquito breeding and disease transmission	• Eliminate spillage and all unnecessary standing water. • All floating vegetation should be removed from the water to avoid the disruption of drainage channels. • Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills.	• All excavated potential depressions re-instated, filled and re-vegetated.	During operations	NEMA Health Inspector – Buikwe District Health Inspector – Lugazi Municipal	

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
				Council	
Public Health Risk	• No cattle grazing or irrigation to be allowed to use water from the ponds/ wetlands created on site for treatment purposes; • Fencing of 100m from the wetland to the discharge point, provision of disinfecting facility, if found necessary; • A Vector control program should be put in place, i.e., fish & frogs feeding on insect larvae; and • For use of insecticides, environmentally best practices will be used, e.g., bacillus thuringiensis (bacterial toxin).	• All dangerous areas are fenced off and warning signs • Written communication to neighbouring communities • Security guards to restrict access	During operations	NEMA Health Inspector – Buikwe District Security guards	
Impact of Sludge on nearby wetland/Stream Water Quality	• To realize effluent that meets the required discharge standards, the FS from these cluster towns should be treated through a combination of several unit processes and operations, namely; screening, grit removal, Settler, drying beds, waste stabilization ponds and constructed wetland. The pH of the receiving water and soil shall be monitored continuously; • Arrange a facility to provide stabilised sludge to farmers for agricultural purposes. If there is surplus sludge, disposal at a controlled solid waste disposal site; and • Requires monitoring for pollutants and pathogens as provided under the	• Written down Solid Waste Management Plan (SWMP) and implementation schedule. • Records of types of wastes generated, transported and delivered to gazetted sites • No visible soil stockpiles • Depressions filled • Sealed storage	During operations	Health Inspector (Buikwe District and Lugazi Municipal Council) Engineer- / Environment officer Buikwe District	70,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	Environmental Management Plan. • Monitoring of effluents and waste water	containers on site • Contracts with licensed waste disposal/recycling firms			
Solid Waste from screens	• Screenings should be contained and disposed of in approved areas, • Other solid wastes generated at the site will be minimal and should be stored on site until they are collected by the Municipal councils or other authorized service providers for disposal	• Written down Solid Waste Management Plan (SWMP) and implementation schedule. • Records of types of wastes generated, transported and delivered to gazette sites • Contracts with licensed waste disposal/recycling firms	During operations	Environmental Officer – Buikwe District Licensed Waste Handler	Operation and Maintenance Budget
Health and Safety Concerns for Workers	• Provide and wear the appropriate personal protective equipment (PPE) to avoid direct and indirect exposure to FS (e.g. gloves, coveralls, rubber boots with a metal sole, safety glasses and safety masks); • Develop and provide training on the use of tools customised for local conditions and local containment systems to avoid direct contact with faecal sludge; • Provide a training programme on standard	• Appropriate PPE provided to workers • Records on training undertaken • A written Health and Safety Management Plan (H&SMP) • Medical records	During operations	Health and Safety Inspector	60,000,000

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	operating procedures including the proper use of PPE, tools and equipment; and • Preventative measures related to personal health care are recommended including immunisation and a deworming program. The latter is recommended particularly for service providers transitioning from unsafe to safe practices • Training of workers on Environmental Health and Safety issues				
	• Environmental and Social Audit	• Audit Reports • Records of compliance	During operations	MoWE Buikwe and Lugazi Environment and Health Inspectors	30,000,000
Traffic Concerns	• Traffic control will be simplified through a well-designed facility layout. Access roads that allow vehicles to drive through after discharge rather than turn around will be encouraged as they are not only more efficient but also safer; • Mechanized unloading stations that record the driver's identification and discharge volume can also reduce traffic problems and costs at busy facilities; • The turning radius and weight of the largest trucks that will utilise the facility	• Records of the daily number of transportation trucks moving in and out of the site • The access road to the site worked on	During operations	Traffic supervisor onsite	

Impact	Mitigation measures	Monitoring indicator	Monitoring timeframe	Responsible Party	Cost
	will be considered when planning roads and driveways; and • In addition, off-loading and truck parking areas will be level, and access roads shall not have more than a 3% gradient.				
Total ESMP Costs					**267,000,000**

9.5 Management Plans

9.5.1 Waste Management Plan

The contractor will design a *Waste Management Plan* in line with this one to ensure the effective collection, storage, management and disposal of non-hazardous and hazardous wastes. The plan will contain the methods to be used in preventing adverse effects occurring during construction and operation.

The plan will cover activities that could result in the generation of wastes (both hazardous and non-hazardous) and the potential adverse effects. For this ESIA, domestic waste is defined as kitchen, biological, and general waste (e.g., food waste (i.e., any food remains or wastes that have been in direct contact with food such as containers, wrappers); paper and cardboard some plastics; office supplies, liners, broken glass, insulation and timber and scrap metals).

9.5.2 Waste Hierarchy Approach

This management plan aims to reduce the amount of waste generated through design, use of approved suppliers for materials, contract arrangements, minimisation of over-ordering etc. Under the waste management hierarchy, management options will be evaluated in the following sequence to minimise the amount of waste generated for final disposal:

Reuse: as far as practicable, wastes will be reused.

- Segregation: segregation of inert, hazardous and non-hazardous wastes will be carried out at the site. Segregation of materials such as wood, metal, plastic and inert materials will be the initial target as this may provide benefits such as cost savings for waste disposal.
- Recovery: if neither reuse nor recycling can be carried out, materials should be considered for recovery as a last resort.
- Send for disposal: where none of the above is practicable the waste can be sent for disposal at a controlled on-site disposal location.

Only hazardous materials such as oil filters and oilcans may be buried in concrete-lined pits. Burial will be in pits and the location, size and depth of which will be approved by the NEMA, Lugazi Municipal Council and Buikwe district environmental officers. The pits will be covered by at least 0.6 meters of earth material before abandonment. Materials to be buried must be listed before burying. Filters and alike will only be stored for later use with approval from the project supervisor or supervising consultant.

All wastes will be removed from the construction area as soon as required to avoid contamination. The contractors, Lugazi Municipal Council and Buikwe District Environmental Officer will be responsible for ensuring that the construction area is clean

and maintained in a healthy state. Solid wastes will be disposed of off at an approved landfill site designated by Lugazi Municipal Council.

9.5.3 Development of a Waste Management Plan

The contractor will develop a project waste management Plan. The Waste Management will include but not be limited to the following;

- How wastes will appropriately be segregated into categories such as; inert, domestic, non-hazardous or potentially hazardous, metal, plastics, biodegradable, non-biodegradable etc.).
- Waste storage areas should be hygienic to prevent nuisance odours, vermin and dust, loss of waste materials and scavenging.
- Waste should be removed from the Faecal sludge works construction areas in a manner consistent with national regulations (e.g. use of a licensed waste transporter). While transporting the waste, care should be taken to prevent waste from spreading by covering the containers.
- Keeping used oil in drums with lids. Licensed petroleum waste disposal companies should collect the used oil for disposal.
- Sanitation facilities like eco-san toilets and rubbish bins should be provided in the works areas.
- Plastic water bottles should be twisted to reduce volume and kept on-site for transportation to a recycling plant. Tins, cans and scrap metal should be kept in lid-covered containers on site and delivered to steel rolling dealers.
- General waste should be burned weekly. Any burning undertaken should however be supervised by the safety/environment officer on site. Fire extinguishers should be placed at the location of burning.

9.5.4 Roles & Responsibilities

Overall responsibility for the implementation of this Waste Management Plan will rest with the contractor who will report periodically on the progress to NEMA, Lugazi Municipal Council and Buikwe District.

9.5.5 Training

All the workers involved in the faecal sludge treatment works construction should be provided with basic training in waste management (i.e. the importance of separation and not littering anywhere). Additional, specialist training will be provided to key personnel involved in activities which involve hazardous waste management like oiling and service bays for equipment.

9.5.6 Monitoring & Reporting

Waste monitoring procedures will be as follows:

1. The contractor will report every month to the District/ Lugazi Municipal Environmental Officer on the implementation of this Management Plan including:
2. Construction of waste storage facilities; Vermin and litter control; and
3. Status of waste inventory.

9.6 Petroleum and Oils Management Plan

The Petroleum and Oils Management Plan is designed to ensure the effective storage, management and disposal of petroleum and oils by the contractor. The plan contains methods that will be used to prevent adverse effects from occurring during the construction of the faecal sludge treatment works.

This plan covers all planned activities that could result in adverse effects on human health and safety and environmental quality during the construction of mainly the sludge drying beds.

9.6.1 Petroleum and Oil Management Procedures

The contractor will be required to develop a project Oil spill prevention and countermeasure plan for review and approval by the supervising Buikwe District/ Lugazi Municipal environmental officer. The Oil spill prevention and countermeasure plan will include but not be limited to the following;

- Institute stringent fuel storage and refuelling procedures during the construction of the Faecal sludge drying beds;
- The concrete casing of fuel storage facilities;
- Concrete bunding of fuel storage areas;
- Installation of oil interceptors at fuel storage areas; and
- Stock adequate supplies of oil/fuel spill control kits and training of staff in oil spill prevention and control.

9.6.2 Design, Construction and Installation of Appropriate Storage Facilities

The following provisions have been built into the Project design to minimise the potential for spills during the project construction: Appropriate signage will be placed to identify potential spill risks and other hazards; all storage facilities for hydrocarbons and oils will be provided with suitable secondary containment and spill detection devices; Secondary containment will comprise non-permeable, chemically resistant material. All transfer and filling operations will be undertaken in designated areas with impervious surfaces and fitted with drainage systems that include oil-water interceptors; all drum storage of fuel and

lubricants will be under cover from both rain and sun, and Smoking will be strictly prohibited from any areas where fuel loading operations take place.

9.6.3 Roles & Responsibilities

Overall responsibility for the implementation of this Management Plan rests with the contractor who shall report on the progress to NEMA and Buikwe District/ Lugazi Municipal Environmental Officer. The contractor is committed and willing to ensure the implementation of the plan.

All the workers involved in handling petroleum products will be provided with training in the management and handling of fuels and lubricants. Additional, specialist training will be provided to key personnel involved in activities which involve frequent contact with, and use of, fuels and lubricants.

9.6.4 Monitoring & Reporting

The contractor will maintain an inventory of all chemicals purchased, delivered, and stored during the construction. The contractor will collect and maintain records on fuels and lubricants in consultation with the Buikwe / Lugazi Municipal environmental office.

9.7 Environment, Health and Safety (EHS)

Environment, Health and Safety (EHS) is concerned with the state of the working environment, tools/equipment and the biotic environment. It is an essential tool in determining the ESIA study. The main objective of the EHS on the proposed project is to develop guidelines for protecting, managing and responding, to processes, situations/conditions that might compromise the health, safety and security of workers and ecological well-being. It aims at:

- ✓ Avoiding occupational injuries,
- ✓ Providing a safe and healthy working environment for workers, Limiting loss or damage to ecological resources, and
- ✓ Promoting environmental sustainability.

9.7.1 Guidelines for EHS

To effectively achieve EHS goals, the contractor and his workers will do the following:

- Commit themselves to promoting and maintain high levels of safety and health standards;
- Ensure that the Faecal sludge project activities protect the environment and natural resources; and
- Employees will be expected to take personal responsibility for their safety, the safety of colleagues and the general public as it relates to the EHS management plan.

Obligations in Environment, Health and Safety

The Contractor

The contractor will ensure that:

- Safe means of entry and exit exist in the working areas;
- Ensure adequate briefing of the job at hand on the safe system of work before the commencement of work;
- The EHS coordinator must be in attendance at all times throughout the project;
- The EHS coordinator must maintain constant assessment of the risk involved as the work progresses; and
- Safety gear must be worn before entry into all accident-prone project areas.

Note: In addition to the development of the above management plans, the contractor will have a well-laid-out HIV/AIDS Prevention Plan.

9.8 Environmental Monitoring

The maintenance of an FSTP involves a detailed understanding of the treatment processes and performance requirements. This understanding should not only be based on the theoretical information concerning the treatment mechanisms and the design of the technology, but also on a monitoring procedure that requires specific planning, infrastructure (e.g. laboratory), employees, and finance.

Monitoring is a legal requirement in the National Environment Act 2019, developers of projects for which EIA is to be carried out are required to carry out periodic monitoring to ensure that the mitigation and environment management measures identified and recommended through the EIA are adhered to and implemented. It is further required, under the law, that such developers keep and maintain monitoring records which should be made available during inspections and that monitoring reports should be submitted to the appropriate authorities on an annual basis.

As a starting point, it is recommended that monitoring indicators should be identified under the main thematic areas covered under this ESIA i.e.:

a) Treated Effluent,
b) Water quality impacts,
c) Biophysical Impacts,
d) Social impacts,
e) Impacts related to the construction and operational phases; and
f) Health and Safety Impacts

The monitoring programme should be structured to provide the operations employees with adequate information to continuously optimise the plant performance and to provide control over the effluent quality. Monitoring may include a range of different methods such as:

a) visual or sensory inputs: this includes visual observations of plant conditions, such as scum on a treatment lagoon, the colour of the sludge, or odours emanating from a pump tank;

b) analysis or measurement at source: this includes test strips or kits that can be utilised in the field for measuring pH, dissolved oxygen, or temperature; and

c) Laboratory testing of samples (either onsite or offsite).

There must be continuous monitoring and follow-up on the project activities to ensure that the environmental social management plan (ESMP) is implemented and that its objectives are achieved. The implementing (MoWE) staff, the community, and the Contractor should ensure that the mitigation measures are put in place as outlined in the ESMMP in the above section. The monitoring activities are based on the following parameters:

9.9 Monitoring and Evaluation of Treated Effluent

9.9.1 Responsibilities

For the environmental monitoring of treated faecal sludge and liquid waste effluent, two levels can be distinguished in line with the emission approach, which also defines the responsibilities, these are:

At the first level, the operator of the Treatment Plant has to monitor the treatment process efficiency and effluent quality on a routine basis. It should also monitor periodically the stabilised faecal sludge and any industrial wastewater discharged into the sewer system, to ensure compliance with NEMA requirements and to ensure that they will not impede the treatment process, final effluent quality and sludge quality.

9.9.2 Treated Effluent

To ensure that the discharge of treated effluent will not pollute the neighbouring water streams, and to comply with /Effluent discharge standards, the following parameters for the treated effluent should be monitored:

1. Physical Parameters: Temperature, pH value, Electrical Conductivity, TSS, dissolved oxygen as well as flow
2. Organic Pollution Parameters: BOD5 and COD
3. Microbiological Parameters: Total and Faecal Parameter
4. Nutrient Parameters: Total Phosphorous and Total Nitrogen

9.9.3 Monitoring of Physical-Chemical and Microbiological Parameters

Planning an efficient laboratory analysis programme provides the data necessary for making operational decisions and reporting findings. The more accurate and timelier the information

is, the better the operational decisions that can be made. For example, the load and residence time in a waste stabilisation pond or an anaerobic digester can be adjusted based on the results of the laboratory analysis. If the laboratory analyses reveal biochemical oxygen demand and suspended solids values above the discharge standards, the residence time in the basins can be increased, and the treatment performance improved.

The parameters that will be frequently analyzed for the Faecal sludge treatment plant will include:

a) **Solid and Suspended Matter Content:** this analysis will assist in the evaluation of the settling and solid/liquid separation performances;

b) **Moisture content of the end products:** this parameter will provide an estimation of the drying performances;

c) **Biological and chemical oxygen demand in the liquid fraction**: these parameters will be essential in monitoring the available oxygen which has a direct impact on aquatic life.

d) **Nutrient content** (i.e. nitrogen and phosphorus) which influences the potential for resource recovery in agriculture, as well as the risk of eutrophication of water bodies, will also be analyzed periodically; and

e) **Pathogen content:** this will involve an evaluation of the presence and number of E-Coli, faecal coliforms or helminth eggs which allows control of the risks related to waterborne diseases.

9.9.4 Frequency of Monitoring for Effluent Discharge

The physical and organic pollution parameters should be sampled every month for the first year. The incoming and discharge flow should be monitored daily at the same time. Microbiological and nutrient parameters should be monitored at a bi-weekly frequency in the first year. If the water quality results in the receiving wetland are within a constant range, the monitoring frequency can be reduced to monthly measurements.

Micro pollution parameters should be monitored 3 times for the first year. If the results are within the same range, the frequency can be reduced to 1 to 2 times a year. However, this should be adjusted to the previous monitoring frequency in case major changes occur.

9.9.5 Stabilised Sludge from the Treatment Plant

For the use of stabilised sludge for agricultural purposes, environmental standards should be established by the relevant Authority.

a) Micropollutants Parameter: Heavy Metals, Cd, Cr, Cu, Hg, Ni, Pb, Zn

b) Microbiological Parameter: worm eggs, i.e. helminth (nematode) eggs

9.9.6 Frequency of Monitoring, Evaluation and Responsibility for Stabilised Sewage Sludge

The stabilised sewage sludge should be monitored every half year for the first year of stabilised sludge production. If the results of the analyses do not vary significantly over a full year, the sludge can be analysed once yearly. Stabilised sludge does not normally contain any harmful bacteria. However viable pathogen eggs could be transmitted and should be monitored.

9.9.7 Monitoring of Physical-Chemical and Microbiological Parameters

Planning an efficient laboratory analysis programme provides the data necessary for making operational decisions and reporting findings. The more accurate and timely the information is, the better the operational decisions that can be made. For example, the load and residence time in a waste stabilisation pond or an anaerobic digester can be adjusted based on the results of the laboratory analysis. If the laboratory analyses reveal biochemical oxygen demand and suspended solids values above the discharge standards, the residence time in the basins can be increased, and the treatment performance improved.

The parameters that will be frequently analysed for the proposed Faecal sludge plant will include:

a) **Solid and Suspended Matter Content:** this analysis will assist in the evaluation of the settling and solid/liquid separation performances;

b) **Moisture content of the end products:** this parameter will provide an estimation of the drying performances;

c) **Biological and chemical oxygen demand in the liquid fraction**: these parameters will be essential in monitoring the available oxygen which has a direct impact on aquatic life, especially in the receiving wetland**;**

d) **Physical Parameters:** Temperature, pH-value, Electrical Conductivity, TSS, dissolved oxygen.

9.9.8 Organic Pollution Parameters: BOD_5 and COD

a) **Nutrient content** (i.e. nitrogen and total Phosphorous, Ammonia, Nitrite and Nitrate) which influences the potential for resource recovery in agriculture, as well as the risk of eutrophication of water bodies, will also be analysed periodically;

b) **Pathogen content:** this will involve an evaluation of the presence and number of E-Coli, faecal coliforms or helminth eggs which allows control of the risks related to waterborne diseases.

9.9.9 Odour Monitoring

The ideal goal for a faecal sludge facility would be to have an undetectable odour level at the property line as measured by the odour panel or a buffer zone specifying minimum distances to the nearest occupied residences.

9.10 Other Monitoring Activities

a) Litter, health and safety monitoring is achieved continuously or weekly through visual inspections and recording of accidents.

b) Noise monitoring is achieved by measuring noise levels in the facility and surrounding area only after complaints since the facility is fairly distant from residential areas.

9.11 Operation & Maintenance Plans

The proposed faecal sludge treatment plant will require ongoing and appropriate operation and maintenance (O&M) activities to ensure long-term functionality. Having skilled workers perform the tasks promptly and following best practices will maximise the value of the FSTP and ensure its long-term performance.

Many FSTPs fail the following construction due to low operational capacity and the lack of financial means to accomplish O&M tasks, therefore O&M must be considered as an integral component of the full life cycle costs of the facility, and that ongoing training and capacity building will be essential for the operator. The O&M plans will therefore include information on:

a) The procedures for receiving and off-loading faecal sludge (FS) at the FSTP;

b) Maintenance programmes for plant assets to ensure long-term operation and minimise breakdowns;

c) The monitoring and reporting procedures for the FSTP O&M activities as well as the management of treatment end products;

d) Management of health and safety aspects for the protection of the workers and the environment;

e) The organisational structure, distribution and management of administrative aspects; and

f) Procedures for the onsite storage of FS and off-site transportation.

The O&M plans will be required to also include an operation manual, containing the following information:

a) The engineering drawings and FSTP specifications;

b) The manufacturer's literature and equipment operation guidelines;

c) The responsible person for each task;

d) The frequency of each activity;

e) The operation procedures and tools required to perform the task;

f) The safety measures required; and

g) The information is to be monitored and recorded.

The maintenance plan shall be guided by the local context, the climate, and asset-specific monitoring information. Frequent maintenance tasks will include:

a) Corrosion control – scraping rust, painting metal surfaces, and repairing corroded concrete;

b) Sludge and coarse solids extraction from the basins and canals;

c) Repacking and exercising valves (i.e. locating and maintaining fully operational valves);

d) Oiling and greasing mechanical equipment such as pumps, centrifuges or emptying trucks; and

e) Housekeeping activities include picking up refuse and vegetation control.

An effective O&M programme for the FSTP will require that accurate records be kept of all activities, monitoring as well as any malfunctions. A review of the effectiveness of mitigation measures that may have been used to correct past operating problems will be periodically done. The records will therefore be easily accessible to the FSTP operator.

Some examples of recordkeeping that are useful and will be required for the proposed Buikwe Cluster Towns FSTP include:

a) Information on the operation of the FSTP including daily operating records, the operator's logbook, the treatment unit operating data sheet, and other records related to FS deliveries to the plant;

b) Disaster response and emergency recovery records;

c) Preventative and corrective maintenance records including the equipment maintenance log books and store room supply reports;

d) Compliance reports including field and analytical data, and correspondence from regulatory officials; and

e) Employee records, such as employee schedules, time sheets and injury reports.

9.12 Statutory Requirements and Implementation

Each project subject to the Third Schedule of the National Environmental Act 2019 needs to meet several statutory requirements and regulations, as well as the Regulatory Framework. MoWE shall submit annual Environmental Audits (or as shall be stipulated by NEMA).

9.13 Documentation

Documentation is an important step in implementing Environmental Social Management and Monitoring Plan. All statutory norms should be kept in one place for quick reference. All monitoring results should be kept in selected folders which can be easily accessed. The presentation of the results should also be planned.

Documentation will include:

a) Major technical information in operation;
b) Organizational Charts;
c) Environmental Monitoring Standards;
d) Environmental and related legislation;
e) Operational Procedure;
f) Monitoring Records;
g) Quality Assurance Plan for Monitoring; and
h) Emergency plans.

9.13.1 Decommissioning and Closure Phase

Decommissioning of the proposed project will become necessary when the project completes its life cycle. In a situation where the faecal sludge drying beds complete their lifecycle, decommissioning process will typically involve the demolition of structures, clearing of the site and reclaiming or restoring the affected land into a natural condition.

Restoration of the affected land may involve the filling in of the open pits and grading the land to its natural contours, then planting appropriate tree species and undercover vegetation to hold the soil in place and prevent flooding. Planting of trees, however, may not be necessary if the site is immediately taken over for another development.

During decommissioning, the debris resulting from the demolition will either be transported by a licensed waste transporter for dumping at an approved site or used as a base material for new construction work.

The demolition process will entail the removal of walls and reinforced slabs using sledge hammers and/or jackhammers, which utilize compressed air and lowering of materials from high to low levels.

The exercise will therefore entail working at a high level and all the necessary health and safety measures will need to be implemented including the provision of personal protective equipment such as safety harnesses, helmets, gloves, respirators, safety shoes, coveralls, goggles and ear protectors.

Generally, the developer will need to follow the necessary safety guidelines and precautions during the demolition process.

The Environmental Costs for the Environmental Social Management and Monitoring Plan (ESMMP) is approximately 267,000,000/= (Two Hundred Sixty-Seven Million Uganda Shillings Only.

CONCLUSIONS AND RECOMMENDATIONS

9.14 Introduction

This report presents a comprehensive (full) environmental and social impact assessment for the proposed construction and operation of the Buikwe cluster towns faecal sludge treatment plant, and proposed measures for mitigating the adverse impacts while enhancing the positive ones during the phases of construction, operation and maintenance. An evaluation of the possible alternatives for the project activities was also performed.

9.15 Conclusion

The anticipated benefits of the construction and operation and maintenance of the Buikwe cluster town faecal sludge drying bed are immense. The project will result in an improvement in public health conditions, spur social economic development, and provide employment to residents.

However, just like most developments, the immense benefits of the project do not necessarily insulate it from negative impacts. To evaluate the project so that its undesirable impacts on the environment and social-economic set-up are minimised, an evaluation of the possible project alternatives was also conducted. The planning and design of the treatment plant were found to be so specific that no alternative was proposed.

For both the project components, which are suggested to be maintained and proposed alternatives, an evaluation of the positive and negative impacts was performed, and an Environmental Social Management and Monitoring Plan (ESMMP) was drawn. All negative impacts can be mitigated following the ESMMP. Suggestions were also proposed for the enhancement of the positive impacts. The project should be developed in conformity with all legal requirements. The developer should ensure that the wastes are handled and disposed of following the ESMMP, and must comply with the protection measures for the safety of all persons interfacing with the project and the environment. If the project is developed following the suggestions given in the ESMMP of this ESIA, we contend that there will be minimal negative impacts to deter the implementation of the project.

The developer (Ministry of Water and Environment) and beneficiary (Buikwe Cluster towns) have all expressed willingness and commitment to carry out development in an environmentally sustainable manner and implement all the suggested mitigation measures to minimise the negative impacts of the proposed Faecal sludge treatment plant/drying bed.

9.16 Recommendations

Based on the immense project benefits of the sanitation Project to the people of Buikwe cluster towns, which have been stated above, and the fact that the identified negative impacts can be mitigated following the proposed ESMMP, the study recommends the project to be implemented provided that the recommended mitigation measures are adequately and timely implemented.

REFERENCES

a) Scoping Report and Terms of Reference for the Environmental and Social Impact Assessment for the proposed Faecal Sludge management facilities in Kakubansiri Cell, Butininidi Ward, Kawolo Division, Lugazi Municipality, Buikwe District – February 2022

b) Feasibility and Preliminary Design Report – Buikwe Cluster Towns- February 2022

c) African Development Bank Group's Integrated Safeguards System. December 2013

d) Environmental and Social Assessment Procedures (ESAP), Volume 1 - Issue 4 (November 2015)

e) Doulaye Koné and Sylvie Peter, 2008. Faecal Sludge Management (FSM). *Sandec Training Tool 1.0 –*

f) *Module 5.* Eawag/Sandec (Department of Water and Sanitation in Developing Countries), P.O. 611, 8600 Dübendorf, Switzerland

g) Encyclopaedia of Occupational Health and Safety (1998) Part VII: The Environment; Ch. 55: Air Pollution Control.

h) Environment Management Authority (2004). State of Environment Report for Uganda

i) Linda S, Mariska R, and Damir B. 2014. Faecal Sludge Management. *Systems Approach for Implementation and Operation.* IWA Publishing Alliance House 12 Caxton Street-London SW1H 0QS, UK *Ministry* of Health Report, July 2005

j) National Policy for the Conservation and Management of Wetland Resources in Uganda, 1995

k) National Water Policy, 1995, Uganda

l) NEMA (2003). The National Environment (Noise Standards and Control) Regulations, Government of Uganda.

m) Occupational Safety and Health Act, 2006, Uganda

n) State of Uganda Population Report 2010, by United Nations Population Fund

o) The Constitution of the Republic of Uganda, 1995

p) The Constitution of the Republic of Uganda, as of 15th February 2006, Government of Uganda.

q) The Environmental Audit Guidelines (1999), Uganda

r) The National Environment (Environmental and Social Assessment) Regulations, 2020

s) The National Environment (Standards for discharge of effluent into Water or on land) regulations, 2020

t) The National Environment (Wetlands, River Banks Ad Lake Shores Management) Regulations, 2000, Uganda

u) The National Environment Act No.5 of 2019

v) The National Environment Management Policy, 1994, Uganda

w) Uganda Human Development Report 2007

x) Uganda Population and Housing census 2014

y) Urban Development in Uganda Report 2010

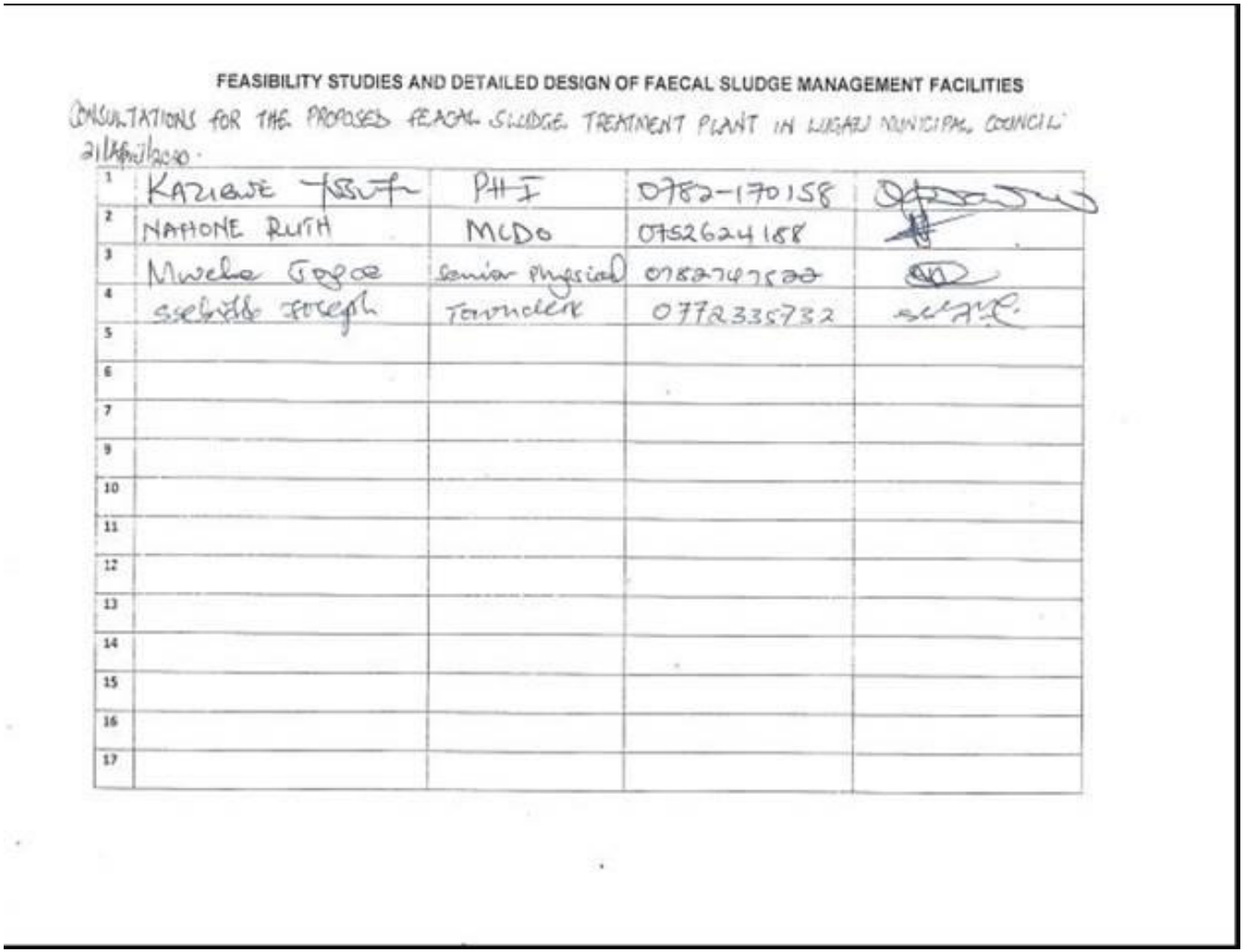
z) Buikwe District Development Plan (DDP) 2015/16 – 2019/20

APPENDICES

Appendix 1: Approved Terms of Reference

Appendix 2: Stakeholder Consultations

Appendix 2 (a): Consultations at Lugazi Municipal Council



FEASIBILITY STUDIES AND DETAILED DESIGN OF FAECAL SLUDGE MANAGEMENT FACILITIES

CONSULTATIONS FOR THE PROPOSED FEACAL SLUDGE TREATMENT PLANT IN LUGAZI MUNICIPAL COUNCIL
21/April/2020.

1	KAZIBWE [illegible]	PHI	0782-170158	
2	NAHONE RUTH	MCDO	0752624188	
3	Mweha Gogoe	Senior Physical	0783747522	
4	[illegible] Joseph	Technician	0772335732	
5				
6				
7				
9				
10				
11				
12				
13				
14				
15				
16				
17				

FEASIBILITY STUDIES AND DETAILED DESIGN OF FAECAL SLUDGE MANAGEMENT FACILITIES

Stakeholder consultation List

DATE: 22/April/2022

No	Name	Designation	Phone	Signature
1	MUBIIKO FRED	WARMAMRE	0705-924870	
2	NAMUGOSA ROSE	MEMBER	0703814425	
3	TIBAGALIKA OLIVIA	MEMBER	0704492004	
4	NAGUBDOWA SHARIFAH	MEMBER	0772010959	
5	KASAJJA JOEL	TEACHER	0751359689	
6	Nalule Lozia J.	Member	0753663623	
7	NAKATO JESCA	MEMBER	0758507799	
8				
9				
10				
11				
12				
13				
14				
15				

Compiled by: CHAIRPERSON
KAKUBANSIRI CELL
BUTIKINDI WARD
LUGAZI DIVISION
LUGAZI MUNICIPALITY
Date: 22-04-2022

FEASIBILITY STUDIES AND DETAILED DESIGN OF FAECAL SLUDGE MANAGEMENT FACILITIES

Stakeholder consultation List

DATE: 22/APRIL/2022

No	Name	Designation	Phone	Signature
1	Kisolo Hakim	Citizen	0752492497	
2	MUWANGA GEORGE WILLIAM	RESIDENT	0752467128	
3	Nansereko Joanita	Citizen	0702983451	
4	Nabatta Agness	Citizen	0781118584	
5	KIVUMBI MASP		0770780611	
6	Wanga Hamis	Citizen	0703154934	
7	Kimbugwe Edward	Citizen	0754343953	
8	Ssebigono Wagen	Resident	0707360514	
9	Maniraguha Samuel	Citizen	0777926137	
10	KENYI IVAN	Citizen	0757658401	
11	NTABAZI IBRAHIM	Citizen		
12	NAMAKAJO HENRY	Citizen		
13	LUBEGA Ge Julius		0706425470	
14	Okwa Robert	Citizen.	0701162747	
15	NABUKENYA BRENDA	CITIZEN	0755921478	

Compiled by: Kabega

CHAIRPERSON
KAKUBANSIRI CELL
BUTINDI WARD
NAMUGONGO DIVISION
LUGAZI MUNICIPALITY
Date: 22-04-2022

FEASIBILITY STUDIES AND DETAILED DESIGN OF FAECAL SLUDGE MANAGEMENT FACILITIES

Stakeholder consultation List

DATE: 22nd March 2022.

No	Name	Designation	Phone	Signature
1	Nabaggala Annet	V.H.T. Women R.	0758056520	
2	Kabogoza Abdu	C/PERSON L'CT	0752-596897	
3	Bujana Paul	citizen	0708744260	
4	Nakuwa Paskazia	Citizen	-	
5	Nantale Sawuya	"	0752076950	
6	Nakuwoza Perina	"	-	
7	Matovu Joseph	Executive member	0758175517	
8	Kaggwa Enock	VHT	0752600049	
9	Kituuma Yusufu	=	0708768870	
10	Kiconya Godfrey	member	0758151188	
11	Ssebadduke Jose	citizen	0752795	
12	Mugambe Solomon	member	0705772288	
13	Angula medius	member	0706197794	
14	Lubanga Fredrick	citizen	0702508058	
15	Kateregga Ismael	member	0755515466	

Compiled by

Kabogoza Abdu

CHAIRPERSON
KAKUBANSIRI CELL
BUTININDI WARD
KAWOLO DIVISION
LUGAZI MUNICIPALITY
Date: 22-04-2022

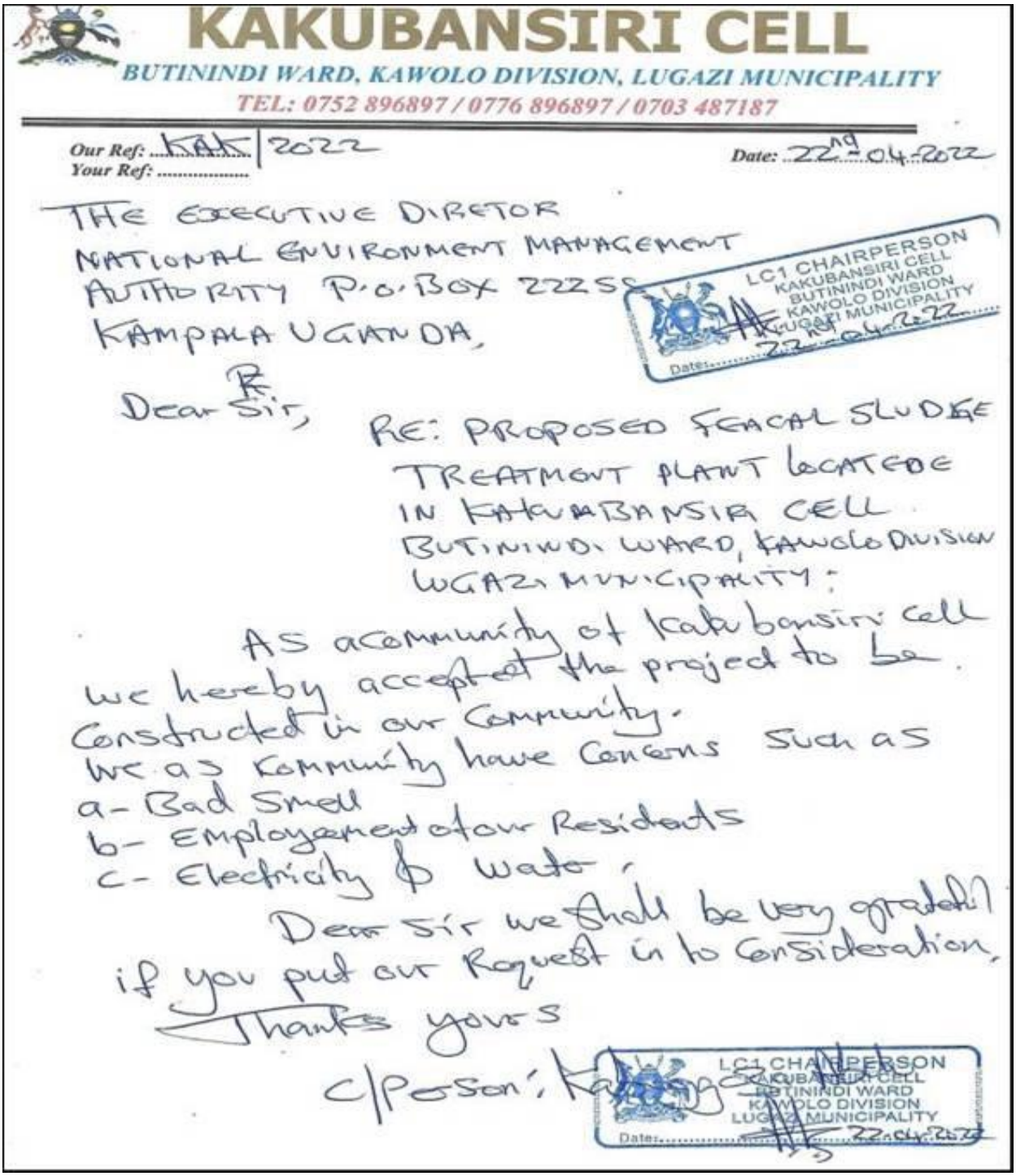
FEASIBILITY STUDIES AND DETAILED DESIGN OF FAECAL SLUDGE MANAGEMENT FACILITIES

	Name			
1	MUBIRU FRED	WAMAMBE	0705-924870	
2	NAKALUNGI CHRISTINE K.	ENVIRONMENT	078857 0459	
3	NABIGGALA ANNET	VHT/Women R.	0758056520	
4	EHOCK KAGGWA	VHT	0752600049	
5	NALUWADDA FLORENCE	SECRETARY WOMEN	0100534182	
6	KIBUKA GRAVAS	male-councillor	0758806612	
7	Kampi gazirah	w/councillor	0756991678	
9	Nalagire Bitijuma	councillor	0706574548	
10	Kawuma Mohm	Councillor	0703486752	
11	Lwanga		07Ho970252	
12	KAGGO CISSY	MEMBER	0753818330	
13	NALWOOMA BEULAH	MEMBER	–	
14	VICENT Mbiri	Musubuzi	0783041559	
15	MUWUGUMYA BARRA	TEACHER	0783473568	
16	Balukuza Ekutaz	MEMBER	–	
17	NALUBOOWA MARGREAT	MEMBER	0754373109	

Compiled by

SECY CHAIRPERSON
KAKUBANSIRI CELL
BUGUNDI WARD
NAMULO DIVISION
LUGAZI MUNICIPALITY
Date: 22-04-2022

Appendix 2 (b): LC1 Letter pertaining to the Proposed Faecal Sludge Treatment Plant in Kikubansiri Cell in Buikwe District



KAKUBANSIRI CELL
BUTININDI WARD, KAWOLO DIVISION, LUGAZI MUNICIPALITY
TEL: 0752 896897 / 0776 896897 / 0703 487187

Our Ref: KAK/2022
Your Ref: .....
Date: 22nd-04-2022

THE EXECUTIVE DIRETOR
NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY P.O.BOX 22255
KAMPALA UGANDA,

LC1 CHAIRPERSON
KAKUBANSIRI CELL
BUTININDI WARD
KAWOLO DIVISION
LUGAZI MUNICIPALITY
Date: 22-04-2022

Dear Sir,

RE: PROPOSED FEACAL SLUDGE TREATMENT PLANT LOCATEDE IN KAKUBANSIRI CELL BUTININDI WARD, KAWOLO DIVISION LUGAZI MUNICIPALITY:

AS a community of kakubansiri cell we hereby accepted the project to be Constructed in our Community.
We as Kommunity have Concens Such as
a- Bad Smell
b- Employement of our Residents
c- Electricity & Wate.

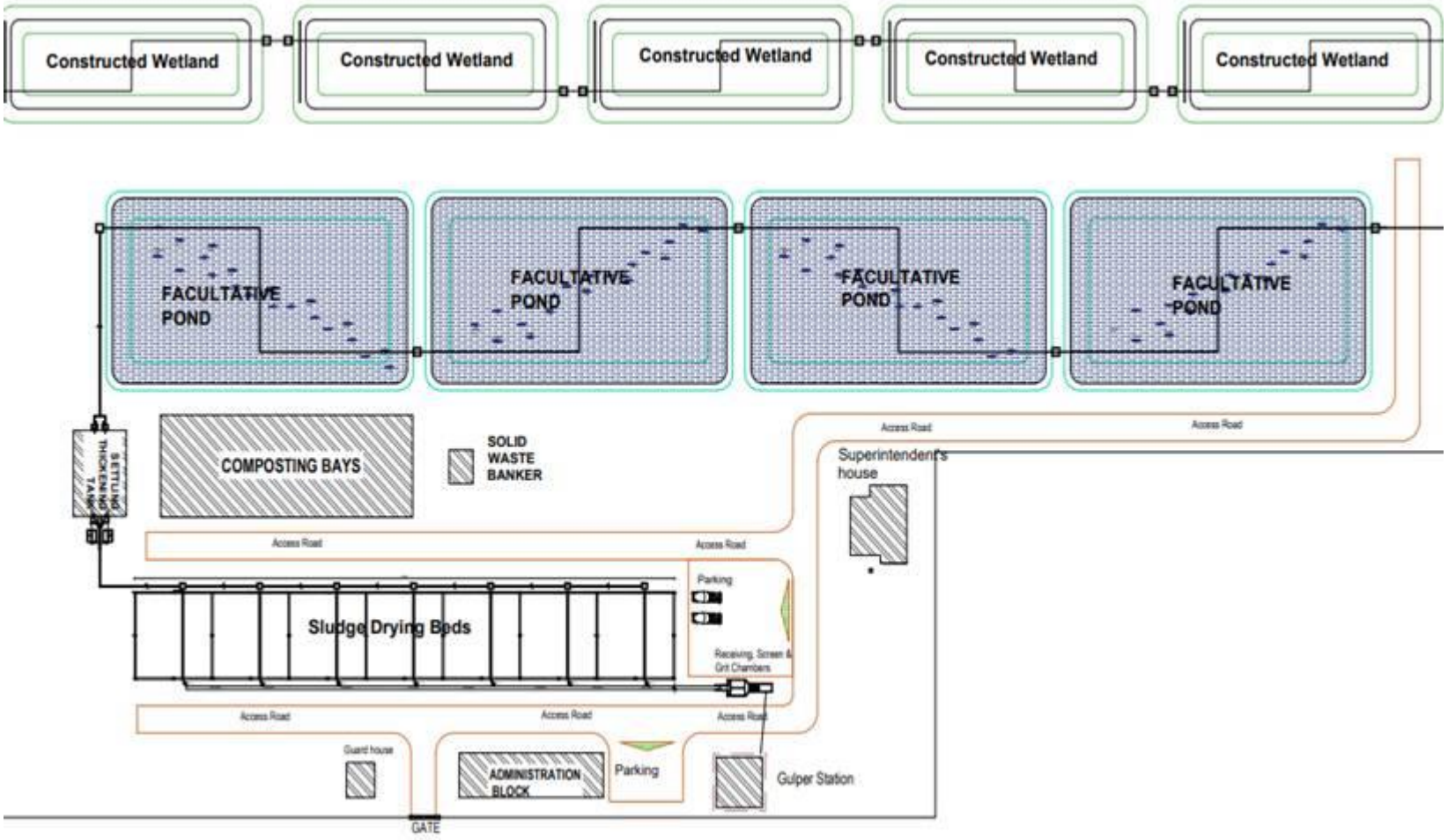
Dear Sir we shall be very grateful if you put our Rquest in to Consideration,

Thanks yours

C/Person: Kakubansiri

LC1 CHAIRPERSON
KAKUBANSIRI CELL
BUTININDI WARD
KAWOLO DIVISION
LUGAZI MUNICIPALITY
Date: 22-04-2022

Appendix 3: Project Site layout for Buikwe Cluster Towns



Appendix 4: Geotechnical Site Investigations

R S V
ENGINEERING GROUP
(Civil Consulting, Structural and Construction, Geophysical, Laboratory Testing and Geotechnical Engineering)

Geotechnical Investigation Report

Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo Sub County in Buikwe District

Date: April 22, 2022

To: SGI Studio Galli Ingegneria

Website: www.rsvegroup.com

4.5. Results of the Geotechnical Analysis

It is worth mentioning that as of the date of preparation of this report, there was not any detailed information to evaluate the settlements as well as the design of foundations for each structure in a particular way, however, the range of loads provided was taken to provide various foundation solutions. The specialist in charge of detailed engineering will be responsible for defining the specific foundation sizes that will be adapted to the needs and specific requirements of the project based on the load bearing capacity information presented in the following tables and graphs.

As an outcome of the geotechnical analysis of the classified zones, the values of admissible load capacity, elastic settlements and modulus of subgrade reaction of the soil were obtained and the results are presented as follows:

Table 9: Load bearing capacity results.

ALLOWABLE SOIL BEARING CAPACITY FOR SQUARE FOOTINGS (kN/m^2 or kPa)				
FOOTING WIDTH (m)	FOUNDING DEPTH (m)			
	Df = 1.50 m	Df = 2.00 m	Df = 2.50 m	Df = 3.00 m
1.00	189.08	194.45	199.81	205.18
1.50	189.32	194.68	200.05	205.41
2.00	189.56	194.92	200.28	205.65
2.50	189.79	195.16	200.52	205.89
3.00	190.03	195.39	200.76	206.12

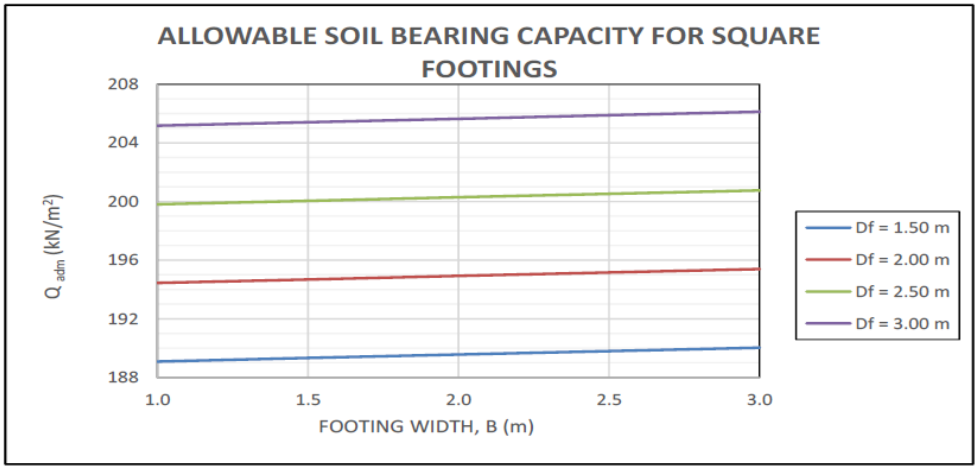


Figure 11: Results of load bearing capacity vs. foundation width

Table 10: Results of short-term settlement analysis.

SETTLEMENTS FOR SQUARE FOOTINGS - SHORT TERM (cm)				
FOOTING WIDTH (m)	FOUNDING DEPTH (m)			
	Df = 1.5	Df = 2.0	Df = 2.5	Df = 3.0
1.00	0.68	0.67	0.66	0.66
1.50	1.05	1.01	0.99	0.99
2.00	1.41	1.35	1.31	1.30
2.50	1.73	1.66	1.61	1.59
3.00	2.02	1.94	1.88	1.85

Table 11: Modulus of Subgrade Reaction

MODULUS OF SUBGRADE REACTION (k=q/δ) SQUARE FOOTINGS (t/m³)				
FOOTING WIDTH (m)	FOUNDING DEPTH (m)			
	Df = 1.5	Df = 2.0	Df = 2.5	Df = 3.0
1.00	2814.57	2972.28	3080.45	3158.82
1.50	1833.79	1959.65	2051.96	2121.77
2.00	1374.36	1475.63	1554.56	1616.78
2.50	1117.84	1200.45	1268.30	1323.86
3.00	959.28	1027.77	1086.55	1136.34

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

This investigation was carried out to determine the soil type underlying the proposed site, determine its bearing capacity and determine the founding depth. From the investigation results, the following conclusions are drawn:

i. Generally, the site is predominantly underlain by sandy CLAY and clayey GRAVEL,
ii. The ground is slightly corrosive with a pH value of > 5.5. The sulphate and chloride contents are less than 0.1%,
iii. The allowable bearing capacities of the soil based on the DPL test range from 58.0 to 482.23kPa for depths between 0.0m and 8.0m.
iv. The allowable bearing capacities for square footings from the geotechnical model vary from 189.08 to 206.12kpa at depths varying from 1.5m to 3.0m for foundation widths between 1.0 and 3.0m respectively,
v. Groundwater table was not encountered within the exploration depth.

5.2 Recommendations

Based on the results of the investigation, the following recommendations have been made;

i. The shallow footing can be placed at a minimum depth of 1.5m for square footings from the **ground surface level**.

ii. A resistivity test is recommended before construction to confirm the corrosive nature of the soil

iii. Since the ground is underlain by a highly plastic layer of clay, no footing should be founded on it. A fill-material composed of granular materials is recommended below the founding depth of each pad or combined foundation. The thickness of the fill material is recommended to be 300mm, as a minimum value.

iv. Once excavations to accommodate the foundations have been completed, the bottom of the excavation shall be protected in all cases with a thin layer of lean

concrete (f'c=100 kg/cm^2), with a thickness of at least 50mm before proceeding to place concrete for foundation construction.

v. The foundation should be cured for 14 days (minimum) and thereafter left undisturbed for a period not less than 30 days,

Service Built to Perfection

R S V
ENGINEERING GROUP
(Civil Consulting, Structural and Construction, Geophysical and Geotechnical surveys)

FIELD SOIL PROFILE RESULTS

Project:	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.			
Client:	SGI Studio Galli Ingegneria	Trial pit No:	TP01	
Location:	Kikambwe village, Buikwe District	Date Entered:	4/15/2022	
Field work date:	4/11/2022	UTM Coordinates (WGS 84 Zone 36)	Easting	Northing
Elevation (m):	1197		491089	39654

Depth (m)	Soil Profile	Soil Description	Colour Photo of Soil Profile
0.4		Loose to medium dense yellowish to reddish brown clayey GRAVEL with grass roots	
3.0		Stiff to very stiff reddish brown sandy CLAY	

NOTE:

1. Test pit was excavated by the use of hand tools up to 3.0m depth
2. No water table was encountered in the excavated trial pit
3. Two disturbed samples were obtained at 1.0m & 3.0m.
4. One undisturbed sample was obtained at 3.0m.

Logged By *(Signature)* :
Kabuye Marvine

Checked and Approved by *(Signature)* :
Eng. Robert Tumwesige

Service Built to Perfection

R S V
ENGINEERING GROUP
(Civil Consulting, Structural and Construction, Geophysical and Geotechnical surveys)

FIELD SOIL PROFILE RESULTS

Project:	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.			
Client:	SGI Studio Galli Ingegneria	Trial pit No:	TP02	
Location:	Kikambwe village, Buikwe District	Date Entered:	4/15/2022	
Field work date:	4/11/2022	UTM Coordinates (WGS 84 Zone 36)	Easting	Northing
Elevation (m):	1203		491000	39668

Depth (m)	Soil Profile	Soil Description	Colour Photo of Soil Profile
0.2		Loose darkish brown clayey GRAVEL	
1.6		Medium dense to very dense reddish brown clayey GRAVEL with cobbles	
3.0		Stiff to very stiff reddish brown sandy CLAY	

NOTE:

1. Test pit was excavated by the use of hand tools up to 3.0m depth
2. No water table was encountered in the excavated trial pit
3. Two disturbed samples were obtained at 1.0m & 3.0m.
4. One undisturbed sample was obtained at 3.0m

Logged By *(Signature)* :
Kabuye Marvine

Checked and Approved by *(Signature)* :
Eng. Robert Tumwesige

Service Built to Perfection

R S V
ENGINEERING GROUP
(Civil Consulting, Structural and Construction, Geophysical and Geotechnical surveys)

FIELD SOIL PROFILE RESULTS

Project:	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.			
Client:	SGI Studio Galli Ingegneria	Trial pit No:	TP03	
Location:	Kikambwe village, Buikwe District	Date Entered:	4/15/2022	
Field work date:	4/11/2022	UTM Coordinates (WGS 84 Zone 36)	Easting	Northing
Elevation (m):	1197		490913	39572

Depth (m)	Soil Profile	Soil Description	Colour Photo of Soil Profile
0.2		Soft to firm greyish brown organic clayey SILTS with roots	
1.5		Firm to stiff reddish brown gravelly CLAY	
3.0		Stiff to very stiff reddish to yellowish brown gravelly sandy CLAY	

NOTE:

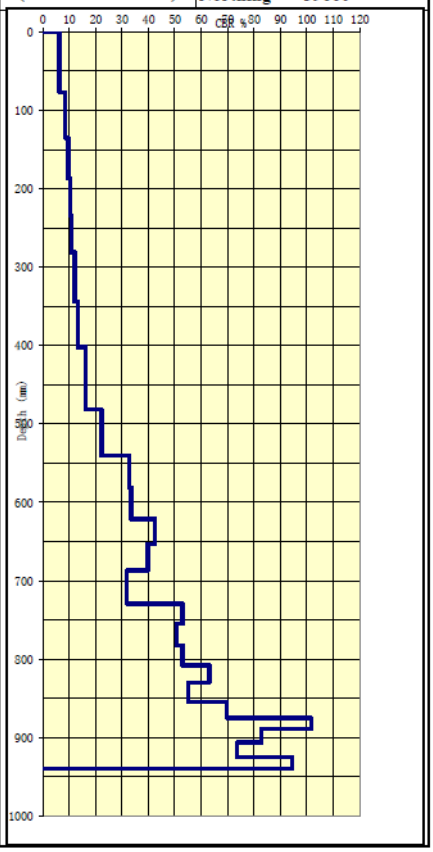
1. Test pit was excavated by the use of hand tools up to 3.0m depth
2. No water table was encountered in the excavated trial pit
3. Two disturbed samples were obtained at 1.0m & 3.0m.

Logged By *(Signature)* :
Kabuye Marvine

Checked and Approved by *(Signature)* :
Eng. Robert Tumwesige

Project:	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.		
Client:	SGI Studio Galli Ingegneria	**Date:**	11/Apr/22
		Point no:	DCP-01
Location:	Kikambwe village, Buikwe District	**Zero Reading (mm):**	40
Level:	Surface	**UTM Coordinates (WGS 84 ZONE 36)**	**Easting** 491068
Elevation:	1209m		**Northing** 39660

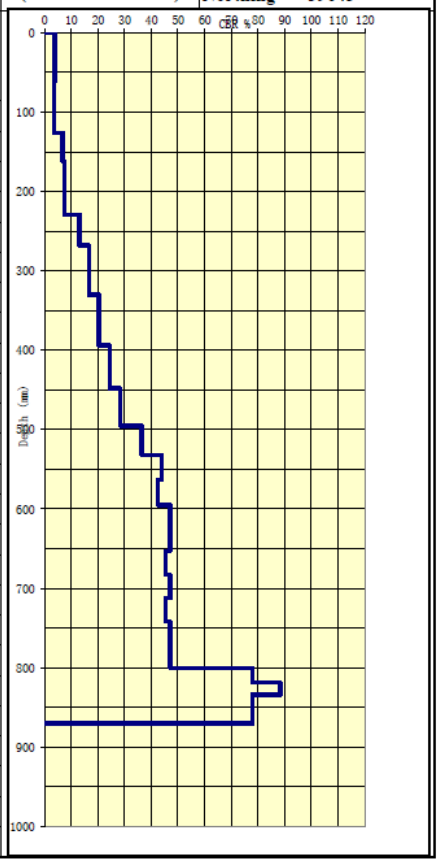
No of Blows	Total Blows	Reading (mm)	Depth Corrected for Zero reading (mm)	Penetration rate (mm/blow) for each no of blows	CBR (%)
0	0	40	0	0	0.0
2	2	117	77	38.5	6.4
2	4	175	135	29.0	8.6
2	6	227	187	26.0	9.6
2	8	275	235	24.0	10.5
2	10	321	281	23.0	11.0
3	13	384	344	21.0	12.1
3	16	442	402	19.3	13.2
5	21	521	481	15.8	16.3
5	26	580	540	11.8	22.2
5	31	621	581	8.2	32.7
5	36	661	621	8.0	33.5
5	41	693	653	6.4	42.4
5	46	727	687	6.8	39.8
5	51	769	729	8.4	31.8
5	56	795	755	5.2	52.9
5	61	822	782	5.4	50.8
5	66	848	808	5.2	52.9
5	71	870	830	4.4	63.1
5	76	895	855	5.0	55.1
5	81	915	875	4.0	69.8
5	86	929	889	2.8	101.7
5	91	946	906	3.4	82.8
5	96	965	925	3.8	73.6
5	101	980	940	3.0	94.6



R S V ENGINEERING GROUP

Project:	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.		
Client:	SGI Studio Galli Ingegneria	**Date:**	11/Apr/22
		Point no:	DCP-02
Location:	Kikambwe village, Buikwe District	**Zero Reading (mm):**	109
Level:	Surface	**UTM Coordinates (WGS 84 ZONE 36)**	**Easting** 490983
Elevation:	1191m		**Northing** 39643

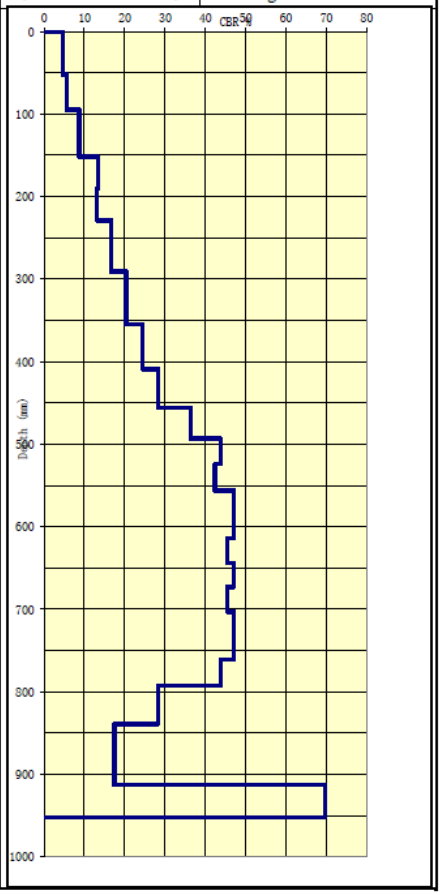
No of Blows	Total Blows	Reading (mm)	Depth Corrected for Zero reading (mm)	Penetration rate (mm/blow) for each no of blows	CBR (%)
0	0	109	0	0	0.0
1	1	171	62	62.0	3.8
1	2	235	126	64.0	3.7
1	3	271	162	36.0	6.8
2	5	338	229	33.5	7.4
2	7	377	268	19.5	13.1
2	9	408	299	15.5	16.7
2	11	439	330	15.5	16.7
5	16	503	394	12.8	20.4
5	21	557	448	10.8	24.4
5	26	604	495	9.4	28.3
5	31	641	532	7.4	36.4
5	36	672	563	6.2	43.9
5	41	704	595	6.4	42.4
5	46	733	624	5.8	47.1
5	51	762	653	5.8	47.1
5	56	792	683	6.0	45.4
5	61	821	712	5.8	47.1
5	66	851	742	6.0	45.4
5	71	880	771	5.8	47.1
5	76	909	800	5.8	47.1
5	81	927	818	3.6	78.0
5	86	943	834	3.2	88.3
5	91	961	852	3.6	78.0
5	96	979	870	3.6	78.0



R S V ENGINEERING GROUP

Project:	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.		
Client:	SGI Studio Galli Ingegneria	**Date:**	11/Apr/22
		Point no:	DCP-03
Location:	Kikambwe village, Buikwe District	**Zero Reading (mm):**	48
Level:	Surface	**UTM Coordinates (WGS 84 ZONE 36)**	**Easting** 490882
Elevation:	1210m		**Northing** 39543

No of Blows	Total Blows	Reading (mm)	Depth Corrected for Zero reading (mm)	Penetration rate (mm/blow) for each no of blows	CBR (%)
0	0	48	0	0	0.0
1	1	100	52	52.0	4.6
1	2	143	95	43.0	5.7
2	4	200	152	28.5	8.8
2	6	238	190	19.0	13.4
2	8	277	229	19.5	13.1
2	10	308	260	15.5	16.7
2	12	339	291	15.5	16.7
5	17	403	355	12.8	20.4
5	22	457	409	10.8	24.4
5	27	504	456	9.4	28.3
5	32	541	493	7.4	36.4
5	37	572	524	6.2	43.9
5	42	604	556	6.4	42.4
5	47	633	585	5.8	47.1
5	52	662	614	5.8	47.1
5	57	692	644	6.0	45.4
5	62	721	673	5.8	47.1
5	67	751	703	6.0	45.4
5	72	780	732	5.8	47.1
5	77	809	761	5.8	47.1
5	82	840	792	6.2	43.9
5	87	887	839	9.4	28.3
5	92	961	913	14.8	17.5
5	97	980	932	3.8	73.6
5	102	1000	952	4.0	69.8



R S V
ENGINEERING GROUP
(Civil Consulting, Structural and Construction, Geophysical, Laboratory Testing and Geotechnical Engineering)

Service Built to Perfection

CLIENT: SGI Studio Galli Ingegneria

PROJECT: Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe

Date: 20-Apr-2022

LOCATION Kikambwe village, Buikwe District

SUMMARY OF CLASSIFICATION TEST RESULTS FROM TEST PITS

TP No.	Soil Description	Depth (m)	Moisture Content (%)	Soil Index Properties																				
				% Passing Sieve (mm)															GM	PLASTICITY				USCS
				75.0	50.0	37.5	20.0	14.0	10.0	6.3	4.75	2.0	1.18	0.600	0.425	0.300	0.212	0.150	0.075		LL	PL	PI	LS	
TP1	Sandy CLAY	1.0	25.2	100	100	100	100	100	96	94	92	82	80	78	77	76	75	75	74	0.67	69	30	39	14.4	CH
	Sandy CLAY	3.0	25.8	100	100	100	100	100	100	98	97	94	93	92	92	91	90	90	90	0.24	62	29	33	8.3	CH
TP2	Clayey GRAVEL	1.0	15.4	100	100	100	88	82	73	58	49	37	36	35	35	35	35	35	34	1.94	82	34	48	14.7	GC
	Sandy CLAY	3.0	27.8	100	100	100	100	100	100	99	98	96	95	94	94	93	93	93	92	0.18	71	30	41	16.8	CH
TP3	Gravelly CLAY	1.0	20.1	100	100	100	94	88	81	72	66	55	54	54	53	53	53	52	52	1.39	73	28	45	14.7	CV
	Gravelly sandy CLAY	3.0	31.2	100	100	100	100	98	95	91	89	84	83	81	80	79	78	77	77	0.59	58	23	35	8.3	CH

Keys:

LL	Liquid Limit
PL	Plastic Limit
PI	Plasticity Index
LS	Linear Shrinkage

CI	Clay with intermediate plasticity
CH	Fat clay
SM	Silty Sand
ML	Silt of Low plasticity
GC	Clayey GRAVEL
CL	Clay of low plasticity
SC	Clayey SAND

Approved By:
Eng. Robert Tumwesige

R S V ENGINEERING GROUP

DETERMINATION OF THE UNDRAINEGD STRENGTH IN TRIAXIAL COMPRESSION
Tested in accordance to BS: 1377:1990: Part 7: Clause 8
TEST REPORT

Project Location	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.		
Client	SGI Studio Galli Ingegneria	Sample Depth (m)	3.0
BH/TP Location	TP 01	Sample Type	U -Sample
Project Refrence:		Sampled by	K.M
Tested by	A.M	Sampling Date	Monday, April 11, 2022
Sample No.	208	Test Date	Saturday, April 16, 2022

DETERMINATION OF MOISTURE CONTENT

CONTAINER NO.	Mass of Wet Soil + Container	Mass of Dry Soil + Container	Mass of Container	Mass of Moisture	Mass of Dry Soil	Moisture Content	Average
SH	441.0	362.2	53.5	78.8	308.7	25.5	25.8
MW	472.8	387.7	60.1	85.1	327.6	26.0	

SPECIMEN DETAILS		***Specimen 1***		***Specimen 2***		***Specimen 3***		***Average***
Height [mm]	76	Mass (g)	157.5	Mass (g)	152.6	Mass (g)	158.7	150.8
Diameter [Do]	38	Volume (cm^3)	86.2	Volume (cm^3)	86.2	Volume (cm^3)	86.2	86.2
Initial Length [Lo]	76	Bulk Density (Mg/m^3)	1.827	Bulk Density (Mg/m^3)	1.770	Bulk Density (Mg/m^3)	1.840	1.812
Area [Ao]	1134.6	Unit Weight (KN/m^3)	17.9	Unit Weight (KN/m^3)	17.4	Unit Weight (KN/m^3)	18.1	17.78
Rate of Strain ε, (%/min)	2	Dry Density (Mg/m3)	1.453	Dry Density (Mg/m3)	1.407	Dry Density (Mg/m3)	1.464	1.441

SPECIMEN 1

Force	Displacement	ΔL	ΔL/L	ε	1−ε	Area	$\sigma_1-\sigma_3$	ε
N	mm	mm	mm	mm	mm	mm^2	Kpa	%
0	0.0	0.0	0.0000	0.0000	1.000	1134.6	0.0	0.0
110	1.6	1.6	0.0211	0.0211	0.979	1159.0	94.9	2.1
135	3.2	1.6	0.0211	0.0421	0.958	1184.4	114.0	4.2
147	4.8	1.6	0.0211	0.0632	0.937	1211.1	121.4	6.3
156	6.4	1.6	0.0211	0.0842	0.916	1238.9	125.9	8.4
164	8.0	1.6	0.0211	0.1053	0.895	1268.1	129.3	10.5
169	9.6	1.6	0.0211	0.1263	0.874	1298.6	130.1	12.6
173	11.2	1.6	0.0211	0.1474	0.853	1330.7	130.0	14.7
179	12.8	1.6	0.0211	0.1684	0.832	1364.4	131.2	16.8
182	14.4	1.6	0.0211	0.1895	0.811	1399.8	130.0	18.9
184	16.0	1.6	0.0211	0.2105	0.789	1437.1	128.0	21.1

SPECIMEN 2

Force	Displacement	ΔL	ΔL/L	ε	1−ε	Area	$\sigma_1-\sigma_3$	ε
N	mm	mm	mm	mm	mm	mm^2	Kpa	%
0	0.0	0.0	0.0000	0.0000	1.000	1134.6	0.0	0.0
103	1.6	1.6	0.0211	0.0211	0.979	1159.0	88.9	2.1
129	3.2	1.6	0.0211	0.0421	0.958	1184.4	108.9	4.2
138	4.8	1.6	0.0211	0.0632	0.937	1211.1	113.9	6.3
154	6.4	1.6	0.0211	0.0842	0.916	1238.9	124.3	8.4
161	8.0	1.6	0.0211	0.1053	0.895	1268.1	127.0	10.5
185	9.6	1.6	0.0211	0.1263	0.874	1298.6	142.5	12.6
192	11.2	1.6	0.0211	0.1474	0.853	1330.7	144.3	14.7
201	12.8	1.6	0.0211	0.1684	0.832	1364.4	147.3	16.8
210	14.4	1.6	0.0211	0.1895	0.811	1399.8	150.0	18.9
210	16.0	1.6	0.0211	0.2105	0.789	1437.1	146.1	21.1

SPECIMEN 3

Force	Displacement	ΔL	ΔL/L	ε	1−ε	Area	$\sigma_1-\sigma_3$	ε
N	mm	mm	mm	mm	mm	mm^2	Kpa	%
0	0.0	0.0	0.0000	0.0000	1.000	1134.6	0.0	0.0
148	1.6	1.6	0.0211	0.0211	0.979	1159.0	127.7	2.1
183	3.2	1.6	0.0211	0.0421	0.958	1184.4	154.5	4.2
200	4.8	1.6	0.0211	0.0632	0.937	1211.1	165.1	6.3
210	6.4	1.6	0.0211	0.0842	0.916	1238.9	169.5	8.4
217	8.0	1.6	0.0211	0.1053	0.895	1268.1	171.1	10.5
225	9.6	1.6	0.0211	0.1263	0.874	1298.6	173.3	12.6
230	11.2	1.6	0.0211	0.1474	0.853	1330.7	172.8	14.7
232	12.8	1.6	0.0211	0.1684	0.832	1364.4	170.0	16.8
235	14.4	1.6	0.0211	0.1895	0.811	1399.8	167.9	18.9
237	16.0	1.6	0.0211	0.2105	0.789	1437.1	164.9	21.1

Prepared by;
A.M

Checked by;
K.M

Approved by;
Eng. Tumwesige Robert

R S V ENGINEERING GROUP

DETERMINATION OF THE UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION
Tested in accordance to BS: 1377:1990: Part 7: Clause 8
TEST REPORT

Project Location	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.		
Client	SGI Studio Galli Ingegneria	Sample Depth (m)	3.0
BH/TP Location	TP 01	Sample Type	U -Sample
Project Refrence.	0	Sampled by	K.M
Tested by	A.M	Sampling Date	Monday, April 11, 2022
Sample No.	208	Test Date	Saturday, April 16, 2022

CONDITIONS AT FAILURE

STRESSES	*Specimen 1*	*Specimen 2*	*Specimen 3*
Cell pressure (Kpa)	50	100	200
Corr. Deviator Stress (Kpa)	131.2	150.0	173.3
Shear strength (Kpa)	65.6	75.0	86.6

The Cell Confining Pressures of 50Kpa,100kpa & 200Kpa have been used while conducting the Test

EFFECTIVE STRESS (σ_3) 53.33 (Kpa)

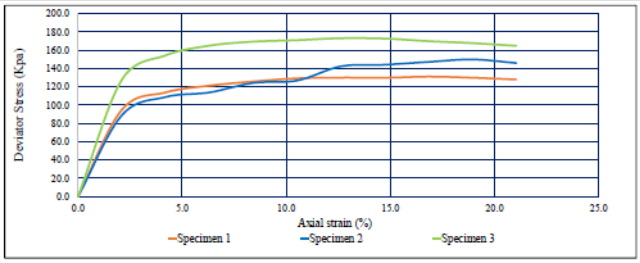
	Specimen 1	*Specimen 2*	*Specimen 3*
			
Mode of failure	Bulging	Bulging	Bulging & Inclined Plane

DEVIATOR STRESS (Kpa) AGAINST AXIAL STRAIN (%)

From the Stress -Strain Relationship Graph

Initial Tangential Elastic Modulus E_u: 6000 Kpa

Secant Elastic Modulus E_s: 1371.66 Kpa

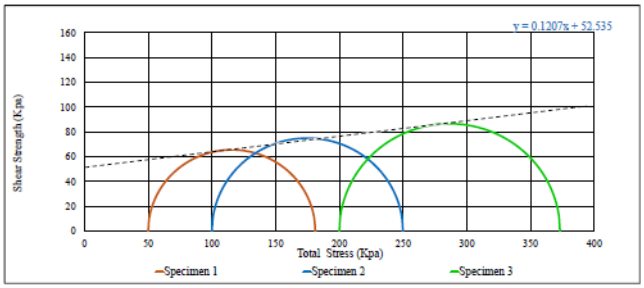


Poissons Ratio for Soils Completely under Undrained conditions

v_u=0.5

SHEAR STRENGTH (Kpa) AGAINST TOTAL STRESS (Kpa)

Failure occurred at a Critical Combination of Shear Strength & the Total Stress in line with the **Mohr - Coulomb frictional Model** for Soil Behaviour in Shear.



A curvilinear **Failure Envelope** as a result of an increase in Solubility of Void air in Void water is approximated as a Straight Line.(for Soils of partial Saturation)

UNDRAINED PARAMETERS

C	52.5
ϕ	6.9

COMMENT	Explanation of the Failure creterion
1. The Stress is uniformly distributed on the failure plane	*a) The soil will experience punching shear failure with veticle drag Down of the footing*
2. Soil failed at the weakest plane	*b) Failure is characterised in terms of very large settlements*
3. The soil sample simulates the actual Insitu conditions of the Site,	*c) There is no bulging of soil around the footing*
4. The soil is partially Saturated i.e contains air which is compressible	*d) There is no titlting around the foundation*
	e) The failure pattern will follow the Perimeter base of the footing

Prepared by; **A.M**

Checked by; **K.M**

Approved by; **Eng. Tumwesige Robert**

R S V ENGINEERING GROUP

DETERMINATION OF THE UNDRAINEGD STRENGTH IN TRIAXIAL COMPRESSION
Tested in accordance to BS: 1377:1990: Part 7: Clause 8

TEST REPORT

Project Location	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.		
Client	SGI Studio Galli Ingegneria	Sample Depth (m)	3.0
BH/TP Location	TP 02	Sample Type	U -Sample
Project Refrence:		Sampled by	K.M
Tested by	A.M	Sampling Date	Monday, April 11, 2022
Sample No.	209	Test Date	Saturday, April 16, 2022

DETERMINATION OF MOISTURE CONTENT

CONTAINER NO.	Mass of Wet Soil + Container	Mass of Dry Soil + Container	Mass of Container	Mass of Moisture	Mass of Dry Soil	Moisture Content	Average
LM	422.2	341.8	58.5	80.4	283.3	28.4	27.8
KB	425.2	346.1	55.9	79.1	290.2	27.3	

SPECIMEN DETAILS		*Specimen 1*		*Specimen 2*		*Specimen 3*		*Average*
Height [mm]	76	Mass (g)	146.0	Mass (g)	152.6	Mass (g)	152.4	150.8
Diameter [Do]	38	Volume (cm^3)	86.2	Volume (cm^3)	86.2	Volume (cm^3)	86.2	86.2
Initial Length [Lo]	76	Bulk Density (Mg/m^3)	1.693	Bulk Density (Mg/m^3)	1.770	Bulk Density (Mg/m^3)	1.767	1.743
Area [Ao]	1134.6	Unit Weight (KN/m^3)	16.6	Unit Weight (KN/m^3)	17.4	Unit Weight (KN/m^3)	17.3	17.10
Rate of Strain ε, (%/min)	2	Dry Density (Mg/m3)	1.325	Dry Density (Mg/m3)	1.385	Dry Density (Mg/m3)	1.383	1.364

SPECIMEN 1

Force	Displacement	ΔL	ΔL/L	ε	1−ε	Area	$\sigma_1-\sigma_3$	ε
N	mm	mm	mm	mm	mm	mm^2	Kpa	%
0	0.0	0.0	0.0000	0.0000	1.000	1134.6	0.0	0.0
106	1.6	1.6	0.0211	0.0211	0.979	1159.0	91.5	2.1
133	3.2	1.6	0.0211	0.0421	0.958	1184.4	112.3	4.2
143	4.8	1.6	0.0211	0.0632	0.937	1211.1	118.1	6.3
155	6.4	1.6	0.0211	0.0842	0.916	1238.9	125.1	8.4
160	8.0	1.6	0.0211	0.1053	0.895	1268.1	126.2	10.5
161	9.6	1.6	0.0211	0.1263	0.874	1298.6	124.0	12.6
165	11.2	1.6	0.0211	0.1474	0.853	1330.7	124.0	14.7
165	12.8	1.6	0.0211	0.1684	0.832	1364.4	120.9	16.8
167	14.4	1.6	0.0211	0.1895	0.811	1399.8	119.3	18.9
167	16.0	1.6	0.0211	0.2105	0.789	1437.1	116.2	21.1

SPECIMEN 2

Force	Displacement	ΔL	ΔL/L	ε	1−ε	Area	$\sigma_1-\sigma_3$	ε
N	mm	mm	mm	mm	mm	mm^2	Kpa	%
0	0.0	0.0	0.0000	0.0000	1.000	1134.6	0.0	0.0
106	1.6	1.6	0.0211	0.0211	0.979	1159.0	91.5	2.1
134	3.2	1.6	0.0211	0.0421	0.958	1184.4	113.1	4.2
147	4.8	1.6	0.0211	0.0632	0.937	1211.1	121.4	6.3
159	6.4	1.6	0.0211	0.0842	0.916	1238.9	128.3	8.4
168	8.0	1.6	0.0211	0.1053	0.895	1268.1	132.5	10.5
175	9.6	1.6	0.0211	0.1263	0.874	1298.6	134.8	12.6
187	11.2	1.6	0.0211	0.1474	0.853	1330.7	140.5	14.7
193	12.8	1.6	0.0211	0.1684	0.832	1364.4	141.5	16.8
201	14.4	1.6	0.0211	0.1895	0.811	1399.8	143.6	18.9
211	16.0	1.6	0.0211	0.2105	0.789	1437.1	146.8	21.1

SPECIMEN 3

Force	Displacement	ΔL	ΔL/L	ε	1−ε	Area	$\sigma_1-\sigma_3$	ε
N	mm	mm	mm	mm	mm	mm^2	Kpa	%
0	0.0	0.0	0.0000	0.0000	1.000	1134.6	0.0	0.0
173	1.6	1.6	0.0211	0.0211	0.979	1159.0	149.3	2.1
208	3.2	1.6	0.0211	0.0421	0.958	1184.4	175.6	4.2
228	4.8	1.6	0.0211	0.0632	0.937	1211.1	188.3	6.3
246	6.4	1.6	0.0211	0.0842	0.916	1238.9	198.6	8.4
259	8.0	1.6	0.0211	0.1053	0.895	1268.1	204.3	10.5
265	9.6	1.6	0.0211	0.1263	0.874	1298.6	204.1	12.6
275	11.2	1.6	0.0211	0.1474	0.853	1330.7	206.7	14.7
279	12.8	1.6	0.0211	0.1684	0.832	1364.4	204.5	16.8
281	14.4	1.6	0.0211	0.1895	0.811	1399.8	200.7	18.9
288	16.0	1.6	0.0211	0.2105	0.789	1437.1	200.4	21.1

Prepared by;
A.M

Checked by;
K.M

Approved by;
Eng. Tumwesige Robert

R S V ENGINEERING GROUP

DETERMINATION OF THE UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION
Tested in accordance to BS: 1377:1990: Part 7: Clause 8
TEST REPORT

Project Location	Geotechnical Investigation for the Proposed Faecal Sludge Treatment Plant at Kikambwe Village, Kawolo sub county in Buikwe District.		
Client	SGI Studio Galli Ingegneria	Sample Depth (m)	3.0
BH/TP Location	TP 02	Sample Type	U -Sample
Project Refrence:		Sampled by	K.M
Tested by	A.M	Sampling Date	Monday, April 11, 2022
Sample No.	209	Test Date	Saturday, April 16, 2022

CONDITIONS AT FAILURE

STRESSES	*Specimen 1*	*Specimen 2*	*Specimen 3*
Cell pressure (Kpa)	50	100	200
Corr. Deviator Stress (Kpa)	126.2	146.8	206.7
Shear strength (Kpa)	63.1	73.4	103.3
The Cell Confining Pressures of 50Kpa,100kpa & 200Kpa have been used while conducting the Test			
EFFECTIVE STRESS (σ_1)		51.31	(Kpa)
Mode of failure			

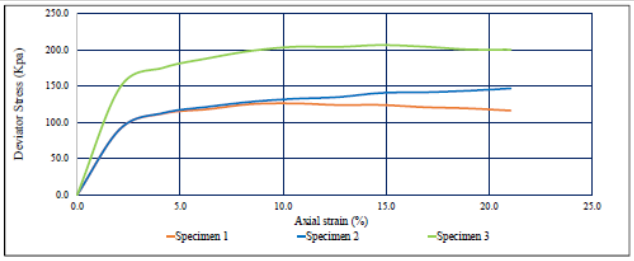
Specimen 1	*Specimen 2*	*Specimen 3*
		
Bulging	Bulging	Bulging & Inclined Plane

DEVIATOR STRESS (Kpa) AGAINST AXIAL STRAIN (%)

From the Stress -Strain Relationship Graph

Initial Tangential Elastic Modulus E_u	
7500	Kpa

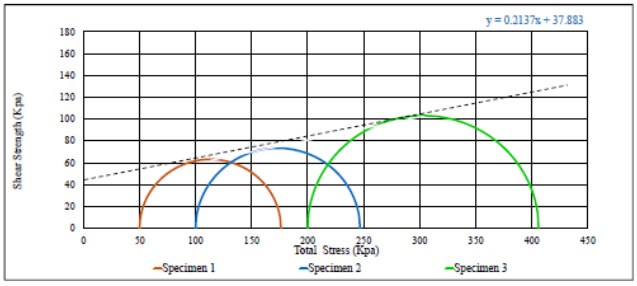
Secant Elastic Modulus E_s	
1402.35	Kpa



Poissons Ratio for Soils Completely under Undrained conditions
v_u=0.5

SHEAR STRENGTH (Kpa) AGAINST TOTAL STRESS (Kpa)

Failure occurred at a Critical Combination of Shear Strength & the Total Stress in line with the **Mohr - Coulomb frictional Model** for Soil Behaviour in Shear.



A curvilinear **Failure Envelope** as a result of an increase in Solubility of Void air in Void water is approximated as a Straight Line.(for Soils of partial Saturation)

UNDRAINED PARAMETERS

C	37.9
ϕ	12.1

COMMENT	Explanation of the Failure creterion
1. The Stress is uniformly distributed on the failure plane	*a) The soil will experience punching shear failure with veticle drag Down of the footing*
2. Soil failed at the weakest plane	*b) Failure is characterised in terms of very large settlements*
3. The soil sample simulates the actual Insitu conditions of the Site,	*c) There is no bulging of soil around the footing*
4. The soil is partially Saturated i.e contains air which is compressible	*d) There is no titlting around the foundation*
	e) The failure pattern will follow the Perimeter base of the footing

Prepared by;
A.M

Checked by;
K.M

Approved by;
Eng. Tumwesige Robert