ENVIRONMENTAL IMPACT STATEMENT

FOR

THE PROPOSED CONSTRUCTION OF WASTEWATER STABILIZATION PONDS AT UTOFU AREA, AMBONI MTAA, KIOMONI WARD WITHIN TANGA CITY

Proponent

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EXECUTIVE SUMMARY

Introduction and Background

Tanga Urban Water Supply and Sanitation Authority (Tanga UWASA) is autonomous entity responsible for provision of water and sanitation services in Tanga City. Tanga UWASA was established in July 1998 after the amendment of Water Works Ordinance in 1997 and currently operates under Water Supply and Sanitation Act No.5 of 2019.

With the need to improve its water supply and Sanitation services, the Authority implement different types and sizes of water supply and Sanitation improvement projects and to extend services to customers within the City.

Ministry of Water through Tanga Urban Water Supply and Sanitation Authority (Tanga UWASA) intends to develop wastewater treatment system which will manage wastewater generated within the City. The City focus to construct waste stabilization ponds as an economical and very accurate system for treatment of wastewater in area of large population like Tanga City.

Waste stabilization ponds (WSP) is the most preferable technology in treating wastewater because it is economical in term of designing, construction and operation process. The final effluent of wastewater stabilization ponds is suitable to be disposed to the environmental, this drive many engineers to recommend this type of technology on treating wastewater.

Ponds may be designed to reduce the organic, nutrient and pathogen loadings in effluent, thus producing an effluent that is more suitable for reuse than raw effluent, Wastewater stabilization ponds can remove 95% of BOD and reduce the concentration of nutrients and pathogen in raw wastewater

Project Description

Tanga City is situated on the North East Coast of Tanzania along the Indian Ocean. Lying between longitudes 38.53´ and 39.10´ East and latitudes 5 and 5.10´ South, the city covers an area of approximately 600 sq. kms. of which 62 sq. kms. Is covered with water. It also extends 20 kms. Inland from the coast.

The proposed project is classified as construction project in which Tanga UWASA plans to construct waste stabilization ponds (WSP) for wastewater treatment purposes collected within Tanga City. This project will create a prosperous population living in a healthy and sustainable managed environment and providing equitable opportunities and benefits.

Tanga UWASA intends to construct Waste Stabilization Ponds (WSP) with related sewer lines from various customers within Tanga City, as the construction will involve the following Facilities:

- Gravity sewers, including trunk mains and reticulation sewers
- Junctions and property connections
- Manholes and other structures
- Pumping mains
- Pump stations, including odor control facilities, emergency storage, emergency backup power, monitored emergency relief structure, and other ancillary facilities to affect a fully operational pump station.

The proposed WSP will be located along the Utofu River and treated effluent will be discharged into the Utofu River and finally into the Indian Ocean via the Utofu Bridge located near the site, See Appendix II which shows proposed sewer networks with pump stations and WWTP and the proposed pumping main with pump stations and WWTP locations respectively

Legal Framework

Important laws that have relevance to water supply and Sanitation projects development in respect environmental management include:

- Environmental Management Act Cap. 191
- The Water Resources Management Act No. 11 of 2009
- The Energy and Water Utilities Regulatory Authority Act, 2001
- The Urban Planning Act (2007)
- Occupation Health and Safety No. 5(2003)
- Employment and Labour Relations Act No. 6 0f 2004
- Engineers Registration Act and its Amendments 2007
- The Contractors Registration Act (1997)
- The HIV and AIDS (Prevention and Control) Act of 2008
- The Standards Act No. 2 of 2009
- The Industrial and Consumer Chemicals (Management and Control) Act, 2003
- The workers Compensation Act no 20 of 2008
- The Public Health Act, No. 1 of 2009
- The water supply and Sanitation Act No. 5 of 2019

Collection of Baseline Data

Both primary and secondary data were collected. Primary data were collected by direct measurement, observations and using semi-structured interviews with respective and targeted parties such as air quality, noise and vibration. Secondary data were obtained from various relevant sources of information such as City profiles, education and health reports and many other official and non-official documents.

Information and data collected include water supply situation, water quality, hydrology, land use, ecosystems and human habitat, demography, and other indicators related to environmental and socio-economic trends of the project area. Other information was collected through key informant's interviews and experts' observations.

Public participation

The fieldwork for this study was carried out in March 2022 within Tanga City. The team met central and local government officials, institutions, Ward leaders, NGOs and individuals forming the core stakeholder basket for the project. Information and data were collected by direct observation, through consultations and secondary data sources. The broader consultations with stakeholders formed key strings for public participation and involvement during the study.

During these consultations, every stakeholder had an opportunity to express concerns, which were addressed by the study team in this study and discussions were made with Tanga-UWASA, Tanga City Council, and Pangani Water Basin Offices. Apart from various comments received from the discussions, secondary data pertinent to the project were collected.

Meetings with the community were conducted in Kiomoni ward of Tanga City Council in which the proposed project will be established. The meetings were part of the participatory approach of the study.

Environmental and Social Impacts and their Mitigation Measures

The development of water supply and sanitation systems usually cause a wide range of environmental and social impacts on a number of receptors. The impacts are of both positive and negative nature. The significant negative environmental and social impacts and their respective mitigation measures identified

Soil Erosion and sediment transfer

- The site shall be fenced
- Unnecessary ground clearance shall be avoided.
- Controlled tree clearance

Noise and vibration pollution

- The contractor shall provide working gear to workers
- The contractor shall provide Proper choice of equipment which offer environmental advantages
- Controlled stone blasting

Air quality pollution

- Watering construction site
- Proper choice of equipment which offer environmental advantages
- Workers shall be provided with Protective gears ie Masks
- Advance notice to local communities
- Controlled stone blasting

Safety and health risks

- Regular maintenance of construction machinery to minimise accidents during construction period.
- Safety, Health and Environment (SHE) induction course
- Comply with the Occupation Health and Safety Act (2003)
- Provision of safety gears.
- Availability of First Aid Kit
- All mechanical excavations shall be carried out only in the presence of an authorized banks man.
- Good housekeeping shall be practiced within material storage compounds or vehicle maintenance yards where the possibility of spillage is great.

Increased wastes

- Disposal wastes shall be done in accordance to clause 1713 of the Standard Specifications for Road Works 2000.
- Only inert materials or readily decomposable materials shall be disposed by burial.
- No burning of waste materials which produces black smoke shall be approved. Plastics shall not be burned.
- No open burning of oils shall be approved by the engineer
- All waste that is to be removed from site of production will be taken to the Approved dumpsite within Tanga
- The harvested timber shall be given to local communities for use.

Scenic quality deterioration

- The water treatment sites shall be well landscaped. Local vegetation species shall be used in the landscape to minimize species import in this ecological niche.
- Cut and fills sections shall be designed so as to minimize net materials import. Appropriate work method employed will minimize material import.

Disruption and destruction of Public utilities

- Permits to destruction/interfere the public utilities from the respective authority should be acquired
- Notice should be given to the water and electricity users prior to any interruption
- Proper plan to reinstate the disruption intended should be in plan as per respective standard

- Consult, engage and inform the surrounding community on the activities to be carried out within respective area
- Consult and engage traffic officers for advice on any alternative route to be used

Increased Spread of HIV/AIDS

- Safety, Health and Environment (SHE) induction course
- Support HIV/AIDS campaigns
- Provision of condoms
- Deployment locally available labour to reduce risk of spreading of communicable diseases (especially STDs).

Soil and water pollution

- Vertiver grasses may be used to control areas prone to erosion
- Silt fences may be used to reduce suspended solids from surface water runoff
- Proper storage of fuels and other chemicals shall be ensured.
- Contingency plan to manage accident fuel and chemical spillages shall be developed by the contractor and approved by Tanga UWASA. The plans shall be part of the contractual clauses
- The contractor shall apply for the water right from Pangani Water Basin Office

Reduced Residual flow

- Any water abstraction shall consider maintaining minimum environmental flows established by Pangani Water Basin Office.
- Basin Offices before abstracting water from any water courses in the project area.
- Contractor to look for alternative water sources during the dry season

Increased Wastewater

- The construction of Wastewater Treatment plant shall minimize this Impact to a large extent
- Tanga UWASA shall buy cesspit emptier for wastewater collection in Tanga City
- Sludge treatment Units shall be part and parcel of the water treatment plant designed
- Tanga UWASA and City Environmental Officer shall oversee proper disposal of sludge after treatment.
- Final dried sludge shall be disposed of at the authorized dumpsite
- The WSPs shall be well maintained and close monitoring of the effluent shall be done every day.

Increased Population Influx

- Capacity building of Municipal police (immigration) officers

Environmental and Social Management and Monitoring Plans

The intended plan to minimize or prevent the identified adverse social and environmental impacts as well as a monitoring plan have been suggested in this report and are contained in the ESMP. Many of them are based on good engineering practices. It defines roles and responsibility of different actors of the plan.

Cost Benefit Analysis

Several benefits are associated with the proposed development both at local and national level in terms of revenue generation and the multiplier effects associated with linkages with local and national economy.

Similarly, there are costs that must be incurred in order to gain the expected benefits. the analysis of the benefits and costs of the project from the environmental, social and economic point of view shows that all the Environmental and Social Costs can be mitigated properly, and the benefits of having the improved water supply system outweigh by far the costs that shall be incurred for implementing this project.

Decommissioning

Decommissioning is not anticipated in the foreseeable future. However, if this will happen, may entail change of use (functional changes) or demolition triggered by change of land use.

Summary and Conclusion

Implementation of the undertaking Water supply and Sanitation Service Improvement for Tanga City will entail no deterrent impacts provided the recommended mitigation measures are adequately and timely put in place.

The identified adverse impacts shall be managed through the mitigation measures and implementation regime laid down in this Environmental and Social Management Plan (ESMP). Tanga UWASA is committed in implementing all the recommendations given in this ESMP.

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LIST OF ABBREVIATION

ADO	Administration Officer
AOI	Area of Interest
AIDS	Acquired Immunodeficiency Syndrome
BO	Billing Officer
dBA	Decibel Adjusted
CBD	Central Business Development
CBO	Community Based Organisation
CDM	Clean Development Mechanism
CCO	Credit and Control Officer
CO2	Carbon Dioxide
CSO(S)	Customer Service Officer (Swahili)
CSO(P)	Customer Service Officer (Pongwe)
DOE	Director of Environment
EAC	East African Community
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMA	Environmental Management Act (Act No. 20 of 2004)
EPFI	Equator Principles Financial Institutions
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EWURA	Energy and Water Utilization and Regulatory Authority
HIV	Human Immunodeficiency Virus
HSE	Health, Safety and Environment
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
LO	Legal Officer
LGA	Local Government Authority
MoW	Ministry of Water
NAP	National Action Programme
NAPA	National Adaptation Programme of Action

NBSAP	National Biodiversity Strategy and Action Plan
NEP	National Energy Policy
NEMC	National Environment Management Council
NFP	National Forest Policy
NGO	Non-governmental Organisation
NSGRP	National Strategy for Growth and Reduction of Poverty
NSSF	National Social Security Fund
OP	Operational Manual
OSHA	Occupational Safety and Health Act
PCE	Planning and Construction Engineer
PM	Particulate Matter
PME	Plant and Maintenance Engineer
RAS	Regional Administrative Secretary
RDO	Research and Development Officer
SAN	Sanitary System
SEP	Stakeholder Engagement Plan
SO	Supplies Officer
SNE	Sewerage Network Engineer
TAC	Technical Advisory Committee
TGC	Total Graphitic Carbon
TNRF	Tanzania Natural Resources Forum
ToR	Terms of Reference
TRA	Transportation Route Assessment
TZS	Tanzanian Shillings
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
VPO - DOE	Vice President's Office – Division of Environment
VOC	Volatile Organic Compound
WPE	Water Production Engineer
WNE	Water Network Engineer

LIST OF ENVIRONMENTAL EXPERTS INVOLVED IN THIS AUDIT

Experts	Specialty	Signatures
Lusako Raphael	Environmentalist (Team Leader)	
Eng. Anamary Philemon	Municipal and Industrial Services Engineer	
Eng. Gwakisa Mwakyusa	Environmental Management System Engineer	

CHAPTER ONE

1 INTRODUCTION

1.1 Background

Tanga Urban Water Supply and Sanitation Authority (Tanga UWASA) is autonomous entity responsible for provision of water and sanitation services in Tanga City. Tanga UWASA was established in July 1998 after the amendment of Water Works Ordinance in 1997 and currently operates under Water Supply and Sanitation Act No.5 of 2019.

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Waste stabilization ponds (WSP) is the most preferable technology in treating wastewater because it is economical in term of designing, construction and operation process. The final effluent of wastewater stabilization ponds is suitable to be disposed to the environmental, this drive many engineers to recommend this type of technology on treating wastewater.

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1.2 EIA Objectives

According to Environment Management Act of 2004, and its Environmental Impact Assessment and Audit Regulation of 2005 objectives for carrying out EIA include:

- To ensure that environmental considerations are explicitly addressed and incorporated into the decision-making process, with the aim to anticipate and avoid, minimize, or offset the adverse significant biophysical and social effects of the proposed project; and to protect the capacity of natural systems and ecological processes to maintain their functions.

- To promote development that is sustainable and optimizes resources use and management opportunities.

1.3 Environmental Compliance status

Referring to Environmental Management Act (EMA) 2004, and the first schedule of Environmental Impact Assessment and Audit Regulations (United Republic of Tanzania, 2005) which details types of projects requiring and not requiring EIA, this project falls in Type A which are requiring a mandatory EIA.

Type A Projects are likely to have significant adverse environmental impacts and that in-depth study is required to determine the scale, extent, and significance of the impacts and to identify appropriate

mitigation. In the list of Type, A Projects, the proposed construction of Wastewater Treatment Plant fits descriptions in number 20 (a) iii. Construction of Wastewater Treatment Plant.

According to the letter of guidance issued by National Environmental Management Council (NEMC) with Ref: CD/145/244/02 dated 10th February, 2022 that notifies Tanga UWASA to register the project component for Waste Stabilization Pond and then to be subjected to Environmental Impact Assessment study accordingly.

1.4 Land Ownership

The proposed project area is owned by Tanga UWASA and is already marked for implementing the project as shown in Figure 1-1 with the area of 15 acres. The Tanga – UWASA acquired the area and the community have been compensated and resettled from the area.

Figure 1-1: Proposed area for construction of wastewater stabilization Ponds

1.5 Project Location

The project is located within at Utofu Area, Amboni Mtaa, and Kiomoni Ward within Tanga city, along Mombasa Road.

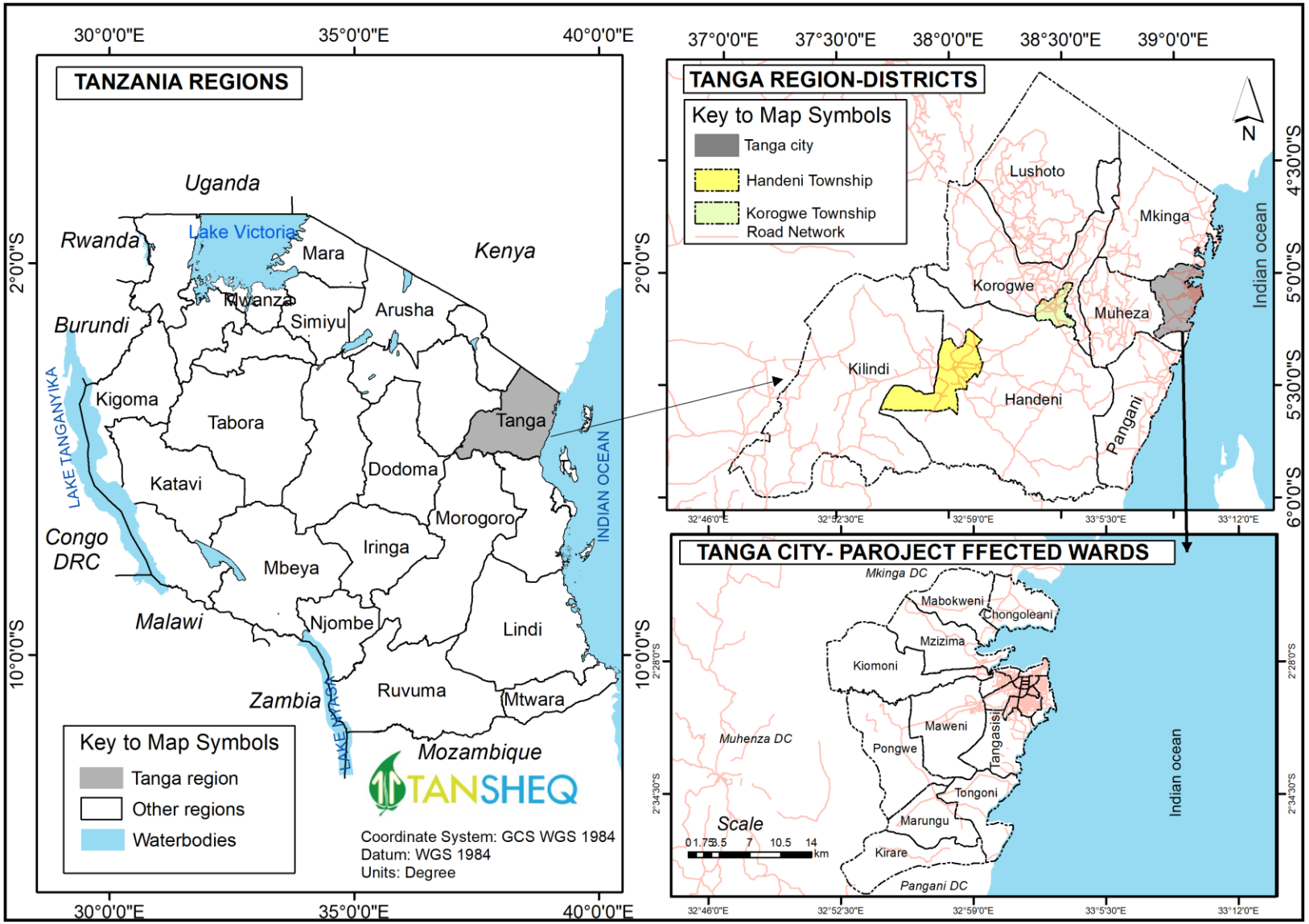


Figure 1-2: Coverage of the improvement of Water Supply and Sanitation Facilities within Tanga City (Tansheq: March, 2022

Figure 1-3: Project Location (Google Earth)

1.6 Study Approach and Methodology

The approach to this exercise is structured to cover the requirements under the Environmental Management Act (EMA) (United Republic of Tanzania, 2004). Broadly it involves an understanding of the project background, the preliminary design and implementation plans as well as the phases of commissioning.

In addition, baseline information was obtained through physical investigation of the project site, desktop studies, and public consultations with members of the community living in the project areas, survey, photography, and discussions with the project Proponent.

1.6.1 Study Methodology

The methodology used in this study follows procedures set by the EMA (Tanzania Mainland, 2004) and specific guidelines for conducting Environmental Impact Assessment, 2016. The process for conducting this ESIA is closely related to the flowchart presented in Figure 1-4

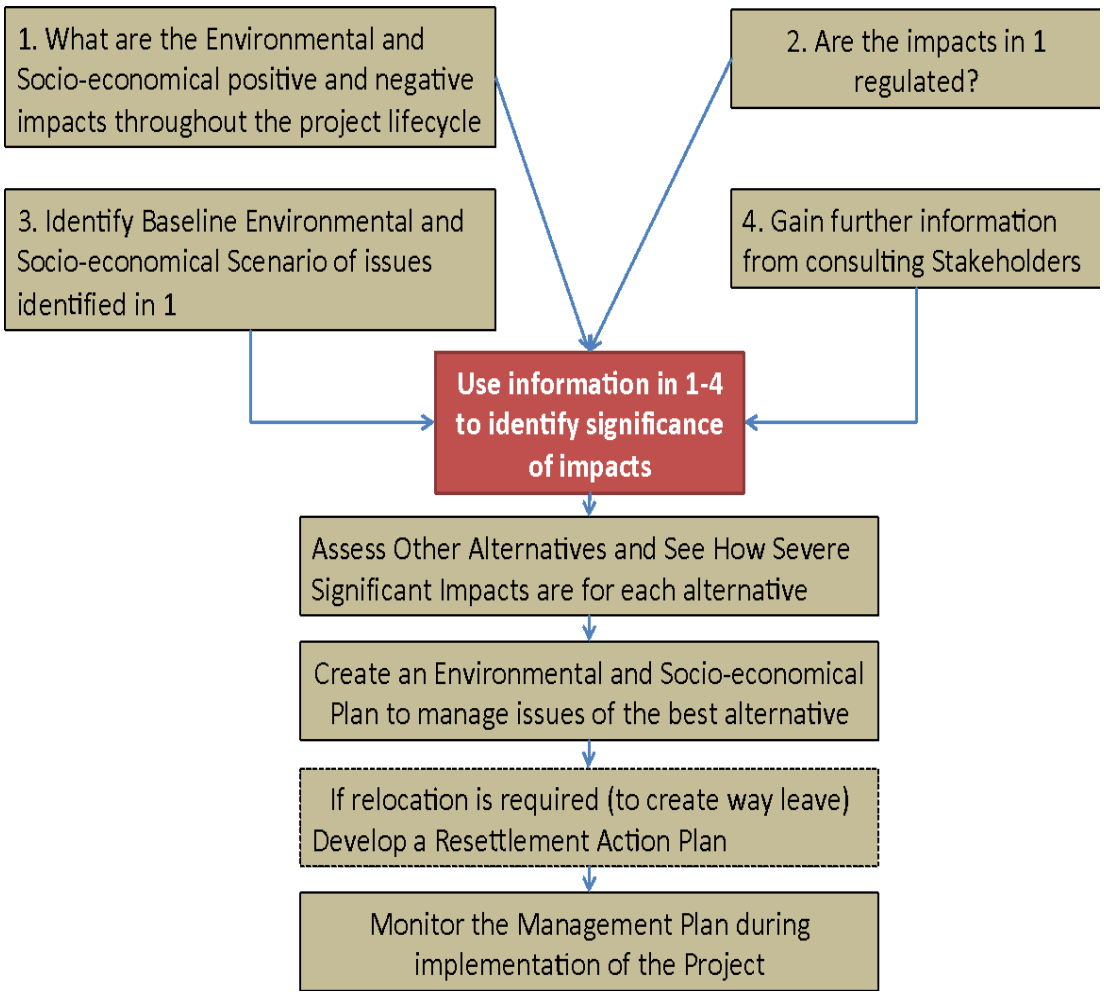


Figure 1-4: Overview of the Impact Assessment Process (EMA Tanzania Mainland, 2004)

1.6.2 Issues Associated with the Proposed Project

Key issues associated with the proposed construction of waste treatment facilities in both environment, human lives were identified based on the existing environmental setup, detailed project activities, and description is in Chapter 2 while associated issued in Chapter 6.

1.6.3 Regulatory Framework with Associated Issues

Description of the relevant regulations and standards governing environmental quality, health and safety, protection of sensitive areas and land use control are detailed in Chapter 3.

1.6.4 How the Situation is Currently (Baseline Situation?)

To gauge the extent of impact, it is crucial to establish the status quo (Chapter 4). The consulting team conducted a baseline analysis of the current level of impacts. This involved a survey on flora and fauna, air, soil and water.

It also covered socioeconomic issues, noise etc. The aim of ascertaining the baseline it to appreciate to what extent the proposed project can alleviate or exacerbate the current situation.

1.6.5 Issues from Key Stakeholders

This EIS also reports on the following:

- A stakeholder engagement plan (SEP) (detailing involved stakeholders and how they will be engaged throughout the project phases)
- A list of stakeholders consulted together with a stakeholder analysis.
- The method used to get their views and issues of concern raised.
- Issues raised by the stakeholders and the way they will be addressed.
- Records of stakeholder meetings, communications and comments.

1.6.6 Assessment of Positive and Negative Impacts

Chapter 6 of this report critically reviews and analyses interaction between the proposed project and the existing environment. In this analysis, the consultant distinguished between significant positive and negative impacts, direct and indirect impacts, and immediate and long-term impacts. Impacts, which are unavoidable or irreversible, are also identified.

Wherever possible, impacts are described quantitatively in terms of environmental costs and benefits.

1.6.7 Consideration of Alternatives

This environmental assessment also involved an analysis of reasonable alternatives to meet the ultimate project objective. This analysis included any alternatives examined while developing the proposed project, and that from an environmental, socio-cultural or economic point of view may be more viable than the proposed project.

This also includes the ‘no action’ alternative, which assesses environmental conditions without project. It is described how the alternatives compare in terms of potential impacts, costs, suitability under local conditions, as well as institutional, training, and monitoring requirements.

To the extent possible, costs and benefits of each alternative are quantified, incorporating the estimated costs of any associated mitigating measures. Finally, this report described the reasons for selecting the proposed project plan and routes over the other alternatives.

1.6.8 Developing an Environmental Management Plan

This report recommends feasible and cost-effective measures to prevent or reduce any significant negative impacts to levels that are acceptable. This involves:

- Estimating the impacts and costs of those measures, and of the institutional and training requirements to implement them.
- Preparing a management plan including proposed work programs, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measures.
- A management plan also covering the decommissioning phase of the project.

1.6.9 Developing an Environmental Monitoring Plan

This report contains a detailed plan to monitor the implementation of mitigation measures and the impacts of the project during its execution. This plan includes a cost estimate for carrying out the proposed monitoring plan.

1.7 Structure of the Report

This report is structured to follow the outline of Section 18 of the Environmental Impact Assessment and Audit Regulation of 2005 as amended 2018. Details of the content of the report are in
Table 1-1

Table 1-1: Structure of EIA Report

Chapter	**Description**
Executive Summary	Provides a short summary of each chapter in the EIA report
Acknowledgement	Express the appreciations and gratitude of the proponent in completion of the study
Abbreviations and acronyms	Provides the list of word used in the EIA Report in short term
Chapter 1	**Introduction** Provides a background to the proposed project, summarizing the rationale of the project
Chapter 2	**Project Background and Description** Describes the proposed project and its nature, together with the planning, design and activities of the project
Chapter 3	**Policy, Administrative and legal framework;** Describes the legal and regulatory framework for the ESIA, including relevant international conventions and Vedanta's policies. Describes the authorized bodies that will be involved in the ESIA process
Chapter 4	**Baseline or Existing Conditions** Describes the existing biophysical and socio-economic environment that could be

Chapter	Description
	affected by the project.
Chapter 5	**Stakeholder involvement and Analysis** This chapter describes how the people affected by the project either positively or negatively were involved in the project
Chapter 6	**Impact Identification and Assessment** This chapter describe on how impacts identified and how will be characterized to be compatible to the environment
Chapter 7	**Environmental Impact Mitigation Measures** In this chapter, solutions for reducing the severity of the negative impacts and enhancing the positive are being discussed.
Chapter 8	**Project Alternatives and Analysis** This discusses the alternatives of the project that were compared to identify the most cost effective and environmental friendly proposal.
Chapter 9	**Environmental and Social Management Plan;** This chapter describes the systematic plan on how to implement the measures provided in chapter six and responsible personnel and cost of implementation
Chapter 10	**Environmental and Social Monitoring Plan;** In this chapter describes on how to control the parameters of elements which seems to be more adverse to both environment and community
Chapter 11	**Resource Evaluation or Cost Benefit Analysis;** This chapter provides compilation of a comprehensive list of all direct and indirect costs, intangible costs, opportunity costs and the cost of potential risks and direct and indirect revenues and intangible benefits, such as increased production from improved employee safety and morale, or increased sales from customer goodwill associated with the project or decision
Chapter 12	**Decommissioning** Provides the formal process on how to remove or to stop the proposed project with environmentally friendly procedures
Chapter 13	**Conclusion and Recommendation** Provides the outcomes or results of the proposed project and final judgment and decision
References	**References** Provides a list of the sources used to compile this report
Appendices	**Appendices** Provides a list of evidence about the ESIA process and the Proponent.

CHAPTER TWO

2 PROJECT DESCRIPTION

2.1 Introduction

The proposed project is classified as construction project in which Tanga UWASA plans to construct waste stabilization ponds (WSP) for wastewater treatment purposes collected within Tanga City. This project will create a prosperous population living in a healthy and sustainable managed environment and providing equitable opportunities and benefits.

2.2 Proposed Project Description

Tanga UWASA intends to construct Waste Stabilization Ponds (WSP) with related sewer lines from various customers within Tanga City, as the construction will involve the following Facilities:

I. Gravity sewers, including trunk mains and reticulation sewers
II. Junctions and property connections
III. Manholes and other structures
IV. Pumping mains
V. Pump stations, including odor control facilities, emergency storage, emergency backup power, monitored emergency relief structure, and other ancillary facilities to affect a fully operational pump station.

The proposed WSP will be located along the Utofu River and treated effluent will be discharged into the Utofu River and finally into the Indian Ocean via the Utofu Bridge located near the site. Appendix II which shows proposed sewer networks with pump stations and WWTP and the proposed pumping main with pump stations and WWTP locations respectively

2.2.1 Project Preliminary Conceptual Design

The sewerage system is proposed to be comprised of the following elements;

2.2.2 Gravity Sewer

A gravity sewer is a conduit utilizing the energy resulting from a difference in elevation to remove unwanted water. The term sewer implies removal of sewage or surface runoff rather than water intended for use; and the term gravity excludes water movement induced through force mains or vacuum sewers. Most sewers are gravity sewers; because gravity offers reliable water movement with no energy costs wherever grades are favourable.

Gravity sewers may drain to sumps where pumping is required to either force sewage to a distant location or lift sewage to a higher elevation for entry into another gravity sewer, and lift stations are often required to lift sewage into sewage treatment plants. Gravity sewers can be either sanitary sewers, combined sewers, storm sewers or effluent sewers.

The proposed WSP to be constructed will serve 27 wards of Tanga City which include Central, Chongoleani, Chumbageni, Duga, Kiomoni, Kirare, Mabawa, Mabokweni, Magaoni, Majengo, Makorora, Marungu, Masiwani, Maweni, Mnyanjani, Msambweni, Mwanzange, Mzingani, Mzizima, Ngamiani Kaskazini, Ngamiani Kati, Ngamiani Kusini, Nguvumali, Pongwe, Tanga Sisi, Tongoni and Usagara. However, wards that is located within the Central Business District (CBD) will be connected directly to the

sewer line. The other wards will be using the emptier trucks in dislodging their septic tanks and the being transported to the treatment plant.

2.2.2.1.1 Design of Sewer System

I. For sanitary sewer

Equation 1: Q design= Peak sewage flow + infiltration

II. For partially combined sewer (WASA Criteria)

Equation 2: Q design = 2 x Peak sewage flow + infiltration
The maximum depth of flow in a circular sewer shall be restricted to 0.8 in diameter at ultimate peak flow.

2.2.2.1.2 Minimum Pipe Diameter

I. A minimum pipe size is dictated in gravity sewer design to reduce the possibility of clogging. The sewerage network is designed by using plastic pipes that are being manufactured in Tanzania. The following criteria as per DCOM manual have been used in deciding the pipe diameter.

II. Any new sewer connection should use plastic pipes of diameter not less than 150 mm or (6") for further extensions (limited number of connected customers not more than 5 in number for domestic use only). However, for one household, 110 mm dia. pipe can be used.

III. Lateral sewers, incorporating more than five sewer connections and that may need further extensions in the future should involve plastic pipes of diameter not less than 200 mm or (8").

IV. Commercial and public sewer connections at lodges, hotels, business centres, institutions, industries, apartments, and others should use plastic pipes of not less than 200 mm (8").

V. All main sewers should start with pipes not less than 200 mm (8").

2.2.2.1.3 Velocity

The velocity of wastewater is an important parameter in a sewer design. A minimum velocity is maintained to reduce solids deposition in the sewer, and DCOM manual also specifies a minimum velocity that must be maintained under low flow conditions. The typical design velocity for low flow conditions is 0.60 m/s.

During peak dry weather conditions, the sewer lines must attain a velocity greater than 0.6 m/s to ensure that the lines will be self-cleaning (i.e., they will be flushed out once or twice a day by a higher velocity). Velocities higher than 2.4 m/s are avoided because they may cause erosion and damage to sewers and manhole.

Equation 4: Pipe velocity =1/n $R^{2/3}$ $S^{1/2}$
For Circular Cross Sections:

Hence:

R: Hydraulic radius = Area / Wet perimeter = $\prod D^2/4 \prod D = D/4$

A: Area for the pipe = $\prod D^2/4$

Table 2-1: Limits of design velocities

	Minimum velocity	**Maximum velocity**

Gravity Sewers	0.6 m/s	2.4 m/s
Pressure Mains	1 m/s	3 m/s

2.2.2.1.4 Extraneous Flow Allowance- All Land Uses

In computing the total peak flow rates for the design of sanitary sewers, the allowances specified below to account for flow from extraneous sources are used.

2.2.2.1.4.1 General Inflow/Infiltration Allowance

A general allowance of 0.28 L/s/ha was applied, irrespective of land use classification, to account for wet-weather inflow to manholes not located in street sags and for infiltration flow into pipes and manholes. In addition, a separate allowance for inflow to manholes located in street sags should be added as per the next section.

2.2.2.1.4.2 Inflow allowance

Manholes in Sag Locations – When sanitary sewer manholes are located within roadway sags or other low areas, and are thus subject to inundation during major rainfall events, the sanitary design peak flow rate should be increased by 0.4 L/s for each such manhole, which is applicable for manholes which have been water proofed. For new construction, all sanitary manholes in sag locations are to be waterproofed.

For planning purposes and downstream system design, where specific requirements for an area are unknown, the designer should make a conservative estimate of the number of such manholes, which may be installed in the contributing area based on the nature of the anticipated development, and include an appropriate allowance in the design.

2.2.2.1.4.3 Inflow

Allowances are made for the leakage of groundwater into the sewers and building sewer connections (infiltration) and for other extraneous water entering the sewers from such sources as leakage through manhole covers, foundation drains, roof down spouts, etc. for the design of sanitary sewer system.

Due to the extremely high peak flows that can result from the roof down spouts, they should not, in any circumstances, be connected directly, or indirectly via foundation drains, to sanitary sewers. Studies have shown that flows from this source can result in gross overloading of sewers, pumping stations, and sewage treatment plants for extended periods.

2.2.2.1.4.4 Infiltration

The amount of ground water leakage directly into the sewer system (infiltration) will vary with the quality of construction, type of joints, ground conditions, level of groundwater in relation to pipe, etc. although such infiltration can be reduced by proper design and construction, it cannot be completely eliminated and an allowance must be made in the design sewage flows to cover these flow contributors. Even though these allowances are generally referred to as infiltration allowances, they are intended to cover the peak extraneous flows from all sources likely to contribute non-waste flows to the sewer system.

The infiltration allowances used for sewer design should not be confused with leakage limits used for acceptance testing following construction. The latter allowances are significantly lower and apply to a sewer

system when the system is new and generally without the private property portions of the building sewers constructed.

Table 2-2: Summary of Extraneous Sewage Flow

Commercial and institution land use	40m^3/day/ha or 0.46L/s/ha
Industrial Land use	30m^3/ha/day or 0.35 l/s/ha
Inflow/Infiltration	5%
Manholes in Sag Locations	0.4 l/s

2.2.2.1.5 Minimum Slopes

All sewers are designed to give mean velocities, when flowing full, of not less than 0.6 meters per second or greater than 4.5 meters per second based on Kutter's or Manning's formula using “n " value of 0.013. Use of other practical “n “values may be permitted by the reviewing agency if deemed justifiable. Velocities above 4.5 m / s may be permitted with high-velocity protection. The following are the minimum slopes that will provide a velocity of 0.6 m / s when sewers are flowing full:

Table 2-3: Minimum Sewer Line Slopes

Nominal Sewer Size	Minimum Slope m/100m
200mm	0.40
250mm	0.28
300mm	0.22
350mm	0.17
375mm	0.15
400mm	0.14
450mm	0.12
525mm	0.10
600mm	0.08
675mm	0.067
750mm	0.058
825mm	0.052
900mm	0.046
975mm	0.041
1050mm	0.037

2.2.2.1.6 Depth.

The depth of sewers is generally 1-2 m below the ground surface. Depth depends on the water table, lowest point to be served (ground floor or basement), and topography.

2.2.2.1.7 Appurtenances (Associated Facilities)

Sewer appurtenances include manholes, building connections, junction chambers or boxes, terminal cleanouts, and others.

2.2.2.1.7.1 Manholes.

Manholes for small sewers are generally 1.2m in diameter. For larger sewers (exceeding 600mm in diameter) larger manhole bases are provided, although a 1.2-m barrel may still be used. Manholes should be of durable structure, provide easy access to the sewers for maintenance, and cause minimum

interference to the sewage flow. Manholes should be located at the end of the line (called "terminal clean out"), at the intersection of sewers, and changes in grade and alignment except in curved sewers."

The maximum spacing of manholes is 70-150 m, depending on the size of the sewer and the available size of sewer-cleaning equipment. Manholes, however, should not be located in low places where surface water may enter. If such locations are unavoidable, special watertight manhole covers should be provided. The table below detail the manhole-related design and construction.

2.2.2.1.7.2 Drop manholes.

The purpose of a drop manhole is to reduce the turbulence in the manhole if the elevation difference between incoming and outflow sewers is greater than 0.5m. The turbulence caused by a sudden drop of wastewater may cause splashing and release of gases that are corrosive and odorous and can damage the manhole.

2.2.2.1.7.3 Building Connections.

The building sewers are generally 100-150 mm in diameter and constructed on a slope of 0.02 m/m. Building connections are also called house connections, service connections, or service laterals. Service connections are generally provided in the municipal sewers during construction. While the sewer line is under construction, the connections are conveniently located in the form of wyes or lees and plugged tightly until service connections are made. In deep sewers, a vertical pipe

2.2.2.2 Material and Products commonly used in Sewerage construction

The table below shows materials and product commonly used in sewerage construction;

Table 2-4: Materials and products commonly used in sewerage construction

Relevant standards	**Material product**	**Notes**
BS EN 206-1	Concrete	Specification, performance production, and conformity Complementary standard to BS EN 206
BS 8500		Specifies structural use of concrete
BS 8110		
BS EN 197	Cement	
BS EN 12620	Aggregates for concrete	BS 8500-2 specifies requirements for recycled aggregates
BS EN 13242, PD 6682-6: 2003, BS EN 13055-2	Bedding materials for pipes	WIS 4-08-02 [41] and the Specification for Highway Works [42] give guidance on the selection of pipe bedding materials
BS EN 295, BS 65	Clay pipes, fittings, and joints, perforated pipes manholes jacking pipes gullies, and extra chemically resistant pipes	
BS EN 1916, BS EN 1917, BS 5911	Precast concrete pipes, inspection chambers, manholes, and gullies	
Relevant standards	**Material product**	**Notes**
BS 437, BS EN 877, BS 416	Grey iron pipes and gullies	

BS EN 598	Ductile iron sewer pipes and fittings	
BS EN 1852	PP pipes	
BS EN 12666	PE pipes	
BS EN 14364	GRP (UP) pipes	
BS EN 14758	Mineral-modified PP pipes	
BS EN 13476	Thermoplastics structured wall pipes	
BS 4660	Ancillary underground drainage thermoplastics products	
BS 7158	Manholes and inspection chambers (plastic)	
BS EN 124	Manhole covers and frames and gully gratings for roads	
BS EN 1433	Linear drainage channels	
BS 7099		BS 7097 is the complementary standard to BS EN 124
BS EN 13101	Manhole steps	
BS EN 14396	Manhole ladders	

2.2.3 Pumping Stations (PS)

Two pumping stations will be constructed to lift the collected sewage to the proposed Waste Stabilization Ponds at Utofu Area, Kiomoni

- Pump Station 1 (PS 1) located at the existing waste receiving block and
- Pump Station 2 (PS 2) located at the Junction to Nguvumali

Pump Station 1 will be positioned at the lowest possible location so as to be able to catch all incoming sewage at the same time minimizing the depth of the sump. In case the pumps are not functioning, the total flow will be by-passed to the outflow of the pumping station through an emergency by-pass chamber provided within the pump well. The pump station shall be equipped
with 2 submersible pumps, one duty and the other standby.

From the pump station, wastewater will be pumped to a transfer manhole, from where it can flow by gravity to Pump Station PS 2. From PS 2 the sewage shall be pumped to the proposed WSP at Utofu.

In case the pumps are not functioning, the flow will be by-passed to the outflow of the pumping station through an emergency by-pass chamber provided within the pump well. The pump station shall be equipped with 2 submersible pumps, one duty and the other standby.

It is important to choose a pumping plant of the highest reliability that is appropriate and easily serviced and maintained. Experience shows that, submersible pumps are increasingly becoming the most common type constructed and show reliability in operation. Two standby generators of capacity 7kVA and 5kVA to supply electric power in case of power outage will be installed at each pumping station. **Appendix II** shows the proposed sewer network and pumping station of Sanitary system one up to eight (SAN-1 to SAN 8)

2.2.3.1 Location of pumping stations

A comprehensive study of the area to be served was made to identify the location of pumping stations in the project area to ensure the entire area can be adequately drained. For a very large quantity of sewage is to

be pumped, the site should be near a stream, a nallah, or a storm water drain, into which the sewage could be discharged during emergencies, such as break - down of the pumping plant, failure of power, etc. All precautions are taken so that the proposed pump stations are not flooded with possible damage to machinery, especially to the electrical equipment. The pumping stations are located and to be constructed in such a manner that it will not be flooded at any time. The pump stations are also located so that it is easily accessible under all weather conditions.

2.2.3.2 Elements of pumping stations.

Apart from the structure of the pump house, a sewage pumping station will be consisting of the following elements:

I. Grit channel or detritus pit,

II. Coarse and fine screens

III. Sumps or wet well

IV. Pump room or dry well.

V. Pumps with driving engine or motor.

VI. Miscellaneous accessories such as pipes, valves, float-switch arrangements, flow recorders, emergency overflows, ventilation arrangements such as extraction

2.2.3.2.1 Pump house structure

The pump house structure is designed to withstand flotation forces to which it may be subjected. The substructure of the pumping station will be of mass concrete or R.C. C. while the superstructure may be constructed of any material. The internal walls and floors are structurally designed to take the weight of machines along with a live load of 5 kN/m^2. The building is also planned and designed keeping in view the future requirements and for enough space/ scope for future expansion.

The building will contain wide passages, without any abrupt changes in levels. The building will possess enough ventilation so that foul gases, moisture etc. are easily carried out of the building. The ventilating equipment will have a minimum capacity of six air changes per hour.

The components of the building will be safe against vibrations caused due to pumping machinery. In designing the substructure due allowance will be made for earth pressure, water pressure, and uplift pressure. In case of internal water pressure, the internal walls and floors will be designed to bear this load. To minimize corrosion, it is desirable to control humidity. Natural and artificial illumination of the interior of the building should be adequate. Dust proof, vapour-proof, fireproof, and explosion prof fixtures and luminaries provisions shall be made.

2.2.3.2.2 Grit chamber or detritus pit.

The sewage entering into a pumping station contains a lot of indestructible solid matter such as grit, rags, sticks, faeces etc. all of which are in suspension as long as the sewage is flowing. It is therefore essential to remove as much of this matter as possible before pumping to minimize the wear and tear of the pump impeller and the rising main

The grit is separated from the sewage by the provision of grit or detritus pit before or after the screens. A grit channel is a long basin with an enlarged cross-section. This results in the reduction of the velocity of flow to 0.15 to 0.3 m/sec. The bottom of the pit is kept below the inverted line of the sewer to allow the deposition of the grit that will not interfere with sewage flow through the pit.

The channel or pit should have a minimum capacity of 1 percent of daily dry weather flow. The channel or pit is designed to have a detention period of about 30 seconds and a grit storage capacity of 0.013 to 0.028 m^3 per million liters of sewage for 2 weeks. There will be two such units, each of which can be used, allowing the other to be cleaned. The grit collected is removed manually once in a week in small installations, while in large installations, the removal is a continuous daily process through a series of perforated buckets mounted on an endless chain which is power-driven

2.2.3.2.3 Screens

After the removal of grit from the sewage, it is made to pass through screens to trap the floating matter such as rags, sticks, papers, etc. It is necessary to remove these, otherwise, they will choke and damage the pumps

Screens. Are of two types: Course and fine.

In large installations, it is usual to provide both, the coarse screen being the first to intercept the flow. The coarse screen is made up of wrought iron bars kept parallel to each other and has a clear spacing of 50 to 100 mm in between them.

The material trapped by the coarse screen can be removed by hand raking. Fine screens have an opening of less than 25 mm and intercept all except very fine particles of sewage. The fine screen will not trap any organic matter as far as possible. The screenings trapped by fine screens are removed by mechanical rakes.

2.2.3.2.4 Sump well (wet well and dry well)

Pumping stations are provided with two separate wells: a wet well for receiving the incoming sewage and a dry well for housing the pumps. The functions performed by a sump or wet well are to act as a suction pit from which pumps draw sewage and as an equalizing basin to minimize the load - fluctuations on the pumps. The sump (or wet well) is provided either below the floor of a pump house or by the side of the dry well, depending upon the depth of the main sewer below the ground level.

In the latter case, the wet and dry wells may be of the following types:

I. Rectangular, with dry and wet wells adjacent to each other

II. Circular with central dry well and peripheral wet well, and

Circular with a dividing wall to separate the wet and dry well

2.2.4 Rising Mains, Valves, and Fittings

The pumped sewage is led to high levelled gravity sewer through rising mains. The rising mains are made up of steel, cast iron, spun iron, or asbestos–cement pressure pipes. Generally, cast iron pipes with flanged joints are provided. The flanged joints provide easiness in dismantling and repair of the pumping station equipment.

The length of the discharge pipe (i.e., rising main) should be kept as small as possible because. Long detention of sewage in closed pipes under pressure causes anaerobic deterioration. As far as possible, the rising main should rise steadily from the pumping station to the point of discharge.

The velocity of flow in the rising main should not be less than. 0.75 m per second. At the same time velocities higher than 2 m / sec should be avoided. For economic design, the velocity of 0.85 m/sec. for a normal rate of pumping is desirable reflux or non-return valve is fitted on the rising main, just next to the pump, to prevent backflow through the pump when the pump is stopped. A check valve should be provided in the sewer line discharging the sewage, to prevent the backflow of sewage during floods in the river or discharge area. When the pump is to be dismantled for repairs etc., the rising main may be isolated by providing a hand-operated sluice valve next to the reflux valve.

Gate valves should be provided on the sewer line just before the wet well and on the suction and discharge pipe to close the flow of sewage during maintenance, inspection, and repair of the pumps. For cleaning out the rising main, chambers with hatch - boxes should be provided at intervals so that drain cleaning apparatus could be worked through them. Pressure gauges should be installed at the appropriate position to record the suction and delivery pressure.

2.2.5 Wastewater and Faecal Sludge Treatment Proposed Solutions

Wastewater produced by the Tanga population shall be treated by biological processes in a simple non-mechanical treatment plant, with waste stabilization ponds. It is considered three different ponds: anaerobic, facultative, and maturation, with two parallel series. In essence, anaerobic and facultative ponds are designed for BOD removal and maturation ponds for pathogen removal, although some BOD removal occurs in maturation ponds and some pathogen removal in anaerobic and facultative ponds.

Generally, in waste stabilization pond systems, effluent flows from the anaerobic pond to the facultative pond and finally, if necessary, to the maturation pond. For better results wastewater flowing into an anaerobic pond shall be preliminarily treated in order to remove coarse solids and other large materials often found in raw wastewater. Thus, a preliminary treatment was considered, where operations typically include coarse screening and grit removal

Treatment facilities shall also include a treatment line for faecal sludge. This line shall comprise a faecal sludge inlet (including screening), settling ponds, and sludge drying beds. Considering the retention periods in the settling ponds and given that faecal sludge comes from septic tanks or latrines, it is believed that the pathogen levels in dry sludge won't be high.

However, for sanitation motives, additional local composting should be done. The outflow will be routed to the start of the liquid phase line. This solution is characterized by including extensive treatments, both for liquid and solid phases, with low operation costs, in terms of energy, chemicals, and demand for qualified personnel. However, it requires extensive areas

2.2.5.1 The proposed Waste Stabilization Pond

This facility shall comprise a combination of anaerobic, facultative and maturation ponds. Anaerobic and facultative ponds are designed for BOD removal, and maturation ponds for pathogen removal, although some BOD removal occurs in maturation ponds and some pathogen removal in anaerobic and facultative ponds. The Figure 2-1 shows how waste stabilization pond is arranged during construction.

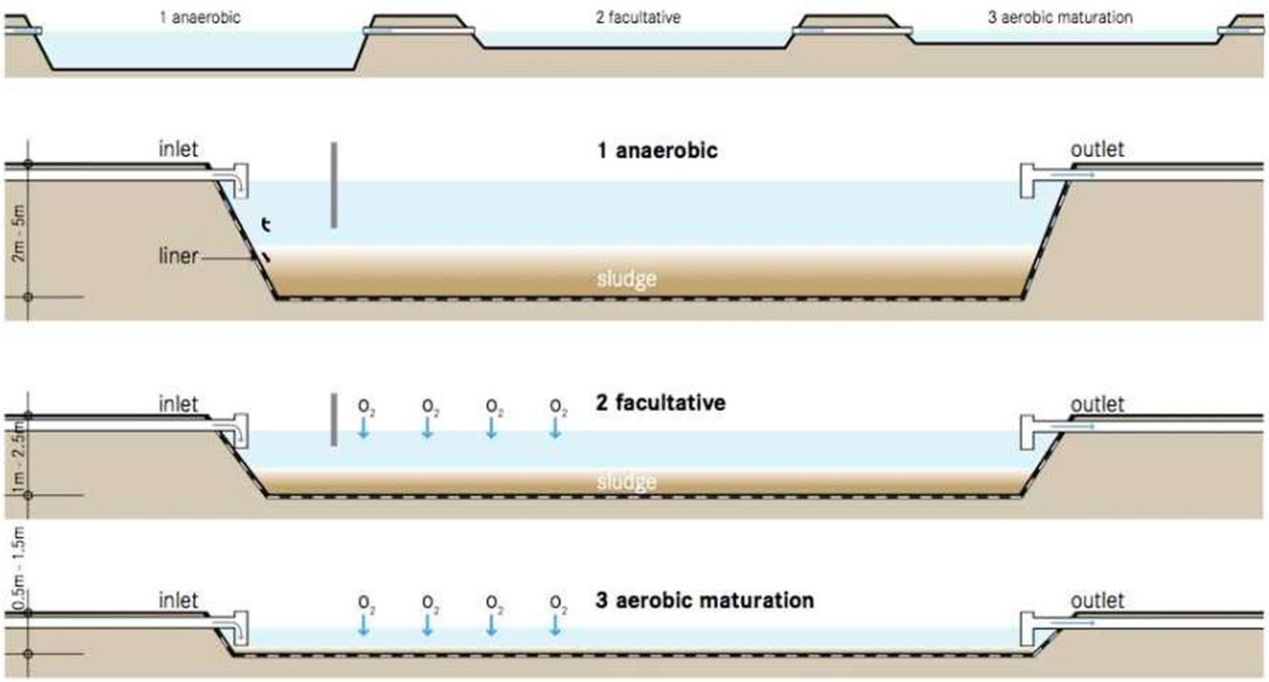


Figure 2-1: Waste Stabilization Ponds arrangement

2.2.5.1.1 Anaerobic Ponds

Anaerobic wastewater treatment is the biological treatment of wastewater without the use of air or elemental oxygen. Many applications are directed toward the removal of organic pollution in wastewater, slurries, and sludge. The organic pollutants are converted by anaerobic microorganisms to a gas containing methane and carbon dioxide, known as "biogas".

Anaerobic ponds function as open, non-mixed, unheated, single-stage anaerobic digesters (somewhat like a septic tank). They are designed to conserve heat and maintain anaerobic conditions effective in bringing about rapid stabilization of strong organic waste. They can receive very high organic loading, usually greater than 100g BOD per cubic meter per day. (100g BOD/m^3/day), (which is equivalent to greater than 3000 kg/ha d.

Their primary function is BOD removal and they work extremely well in warm climates. A properly designed and not significantly under-loaded anaerobic pond will achieve around 60% BOD removal at 20℃ and as much as 75% at 25℃. However, and because they are not enclosed, they do not prevent the escape of gases such as methane and CO_2, nor facilitate their capture.

These are designed based on volumetric BOD loading (v, g /m^3 d), which is given by:

Equation 9: V= Li × Q/v_a

Where;

Li = influent BOD, mg /l (= g/m^3)
Q = flow, m^3/d
V_a= anaerobic pond volume, m^3

The permissible design value v increases with temperature and the values in the table below may be safely used for design purposes

Table 2-5: Design values of permissible volumetric BOD loadings on and percentage BOD removal in anaerobic ponds at various temperatures

Temperature (℃)	**Volumetric loading (g/m^3d)**	**BOD removal (%)**
<10	100	40
10-20	20T-100	2T + 20
20-25	10T + 100	2T + 20
>25	350	70

2.2.5.1.2 Facultative Ponds

A facultative pond is usually the second stage and main unit in a WSP system receiving effluent from the aerobic stage and treating wastewater of moderate strength. These ponds are designed mainly for BOD removal based on a relatively low surface loading of 100 - 400 kg BOD/ha d. The pond's depths should be in the range of 1m to 2.4m. The operating depth of liquid should be from 0.6 to 1.5 m with 0.9 m freeboard above the high-water level.

The upper region is maintained in aerobic condition while anaerobic conditions prevail towards the bottom of the pond due to the fermentation of settled sludge. The conversion of organic carbon to methane in the benthal deposits contributes significantly to the reduction of BOD in a facultative pond.

A pond depth of at least 1m is necessary to prevent the growth of vegetation from the pond bottom and a depth of water over 1.5m tends to lead to predominantly anaerobic conditions in the pond contents

Since a pond approximates a complete mixed reactor and as part of the influent organic matter is converted to algae, it is not possible to reduce the effluent BOD to values less than about 60mg /l.

Indeed, the design objective should be to obtain a relatively high degree of BOD removal, while maintaining a stable balance between aerobic and anaerobic zones during all seasons of the year

The wind has an important effect on the behaviour of facultative ponds as it induces a vertical mixing of the pond liquid. Good mixing ensures a more uniform distribution of dissolved oxygen, bacteria, and algae and hence a better degree of waste stabilization.

In the absence of wind-induced mixing, the algal population tends to stratify in a narrow band, some 20 cm thick, during daylight hours. This concentrated band of algae moves up and down through the top 50 cm of the pond in response to changes in incident light intensity and causes large fluctuations in effluent quality (DO and suspend solids) if the effluent take-off point is within this zone.

Facultative ponds are designed based on the surface BOD loading equation;

Equation 11: $S = 10 \times Li \times Q/Af$

Where;

A_f = facultative pond area, (m^2)

S = Surface BOD loading (kg / ha d)

Q = Inflow wastewaters (m^2 / d)

Li = Influent BOD (mg/l)

The permissible design value of 's' increases with temperature (T, ℃).

Table 2-6: values of permissible bod surface loading on facultative ponds at various temperatures (for equation 11)

T (℃)	(kg/ha/ d)	T (℃)	S (kg/ha d)
11	112	21	272
12	124	22	291
13	137	23	311
14	152	24	331
15	167	25	350
16	183	26	369
17	199	27	389
18	217	28	406
19	235	29	424
20	253	30	440

2.2.5.1.3 Maturation Ponds

These are the last stage of a WSP system and 1m to 1.5m deep, designed mainly for pathogen removal. They receive effluent from facultative ponds. The size and number of maturation ponds in the system are determined by the required bacteriological quality of the final effluent. These ponds usually show less vertical biological and physiochemical stratification and remain well-oxygenated throughout the day.
The algal population is much more diverse than in facultative ponds and diversity increases from pond to pond along any series.

2.2.5.1.3.1 Faecal Coliform Removal

The assumption is made that faecal coliform removal can be modelled by first-order kinetics which is given by;

Equation 13: $Ne = Ni/(1 + KT \times \theta)$

Where;

Ne = number of FC per 100 ml of effluent

Ni = number of FC per 100 ml of influent

K_T = first order rate constant for FC removal, per day.

Θ = retention time in days

2.2.5.1.3.2 BOD Removal

Maturation ponds are not designed for BOD removal. However, it is estimated that each pond can remove 25% of BOD after 90% removal by Anaerobic and Facultative ponds cumulatively

For a series of anaerobic, facultative, and maturation ponds, the equation becomes:

Equation 14: $\mathbf{Ne = Ni[(1 + KT \times \theta a) \times (1 + KT \times \theta f) \times (1 + KT \times \theta m)]}$

Θa = anaerobic retention time in days

Θf = facultative retention time in days

Θm = maturation retention time in days

n= number of maturation ponds

Table 2-7: Summary of wastewater treatment units

Waste characteristics	Suitable treatment
High solids content (i.e., night soil with minimum water added)	a) A+F b) A+F+M
Water-carried waste-water (domestic only)	a) A+F+M b) F c) F+M
Water-carried waste-water (domestic and industrial)	a) A+F+M b) F c) F+M d) MA+F+M

F: Facultative ponds
A: Anaerobic ponds
M: Maturation ponds

2.2.5.2 Process Design of Waste Stabilisation Ponds

The process design of WSP has become well-established over the years and is indicated in the following sections

2.2.5.2.1 Effluent Quality Requirements

Effluent requirements are generally expressed in terms of:

I. Organic matter (commonly as BOD and COD)
II. Suspended solids Nitrogen (total N, ammonia, Oxidized N)
III. Total phosphorus
IV. Numbers of faecal coliform bacteria
V. Numbers of human intestinal nematode eggs (Ascaris lumbricoides, trichuriasis trichiura, and the human hookworms)
VI. Numbers of human trematode eggs (Schistosoma spp)

The ultimate standard of effluent to be achieved will vary depending on whether or not the effluent is used for irrigation or dilution of the receiving waters. The required standards are summarized in the Table 2-8

Table 2-8: Standards for effluent from sewage treatment works

DISCHARGE	BOD (mg /l)	TSS (mg / l)	E.Coli / 100 ml
To Rivers	25	50	5,000
Unrestricted Irrigation (WHO)	25	50	1,000

2.2.5.2.2 Temperature and Net Evaporation

The usual design temperature is the mean air temperature in the coolest month. This provides a small margin of safety as pond temperatures are 2-3℃ warmer than air temperatures in the cool season (the reverse is true in the hot season).

Net evaporation (= evaporation minus rainfall) has to be considered in the design of facultative and maturation ponds (Shaw, 1962), but not in anaerobic ponds, as these generally have a scum layer that effectively prevents significant evaporation. The net evaporation rates in the months used for the selection of the design temperatures are used; additionally, a hydraulic balance should be made for the hottest month

2.2.5.2.3 Domestic Wastewater Flows

The mean daily flow should be measured very carefully, since the size of the ponds, and hence their cost is directly proportional to the flow. A suitable design value for sanitary sewage with respect to Tanzania is 80 % of the in-house water consumption, and this can be obtained from records of the Water Undertaker

Domestic wastewater flows are commonly determined from domestic water consumption:

Equation 5; $Q_{ww} = 10^{-3}kqP$

Where;

Q_{ww} is the wastewater flow, m^3/day;

q is the water consumption l/ person day;

P is the population connected to the sewerage system, and

k is the 'return factor', the fraction of the water consumed that becomes wastewater The value of k is usually 0.8-0.9

It is lower in rich areas where water is used for car washing and garden watering. The equation above gives the domestic wastewater ' dry weather flow ' (DWF) - a term used principally from the time when ' combined ' sewers (i.e., sewers receiving both sanitary and stormwater flows) were common. (Combined sewers do exist in developing countries, especially in city centres, but the current preference is to separate sanitary and stormwater flows.).

Dry weather flow is the average wastewater flow per day over seven consecutive days without any rain that follow seven days with no more than 0.25 mm of rain on any one day. The mean daily flow is often taken as 1.3 x DWF

2.2.5.2.4 Infiltration

Sewer joints are often imperfect; over time, they allow groundwater to enter the sewer. This increases the wastewater flow (and decreases the wastewater BOD). For concrete pipes, infiltration is ~20m^3/ha day.

Thus, taking infiltration into account, the equation above:

Equation 6: $Q_{ww} = 10^{-3}kqP+I$ where I is the infiltration flow,m^3/day

2.2.5.2.5 Industrial wastewaters

In a municipal wastewater treatment project, the flow of industrial wastewater must also be considered. The above equation becomes Equation 7: Q ww = 10^{-3}kqP+I + E where E is the industrial wastewater flow, m^3/day.

2.2.5.2.6 4. BOD

BOD may be measured using 24 - hour flow - weighted composite samples. It can also be estimated from the following equation;

Equation 8: Li = $^{1000B}/_{q}$

Where;
Li Wastewater BOD, mg/l B = BOD contribution, g/capital d

q = Waste water flow, 1/capital d

2.2.5.2.7 Faecal coliform

Grab samples of the wastewater may be used to measure the faecal coliform concentration the usual range is 10^7 -10^9 faecal coliform per 100 ml, and in the absence of more specific information, a suitable design value is 1x 10^8 per 100 ml

2.2.5.2.8 Helminth Eggs

Grab samples may be used to count the number of human intestinal nematode eggs. The usual range is 100-1000 eggs per litre, the latter serving as a conservative value for design.

2.2.5.3 Construction of Stabilization Ponds

The length and width determined in the pre - dimensioning are at mid-depth. The dimensions of the ponds at the bottom, at the water level (WL), and the crest of the slope depending on the inclination of the internal slope. Assuming that the internal embankment has a slope of 1: d (vertical/horizontal), the referred to dimensions will be:

Length

- length at the bottom = length at mid-depth - 2d (H /2)
- Length at the water level = length at mid-depth + 2d. (H/2)
- Length at the crest of the slope = length at water level + 2d. (freeboard)

- **Width:**

- Width at the bottom = width at mid-depth - 2d. (H / 2)
- Width at the water level = width mid depth + 2d. (H /2)
- Width at the crest of the slope = width at water level + 2d. (freeboard)

2.2.5.3.1 Bottom of the Ponds

The bottom of the stabilization ponds should not lead to excessive seepage, which could cause one of the following problems:

- Contamination of the groundwater

- Difficulty in maintaining the liquid level in the ponds

The permeability of the soil and the possible interference with the groundwater should be investigated by means of boreholes. It is worth mentioning that the sites usually available for possible construction of wastewater treatment plants are frequently located in swamps, marshy areas, or with a high groundwater level.

The permeability of the bottom tends to decrease as time goes by, as a result of the clogging caused by solids from the sewage and by biomass. According to Arceivala (1981), under favorable conditions, the losses by infiltration amount to less than 10 % of the flow from the pond, being frequently lower than 1 %.

2.2.5.4 Inlet Devices

The influent wastewater should undergo a preliminary treatment consisting of:

2.2.5.4.1 Screen.

The screens are usually manually cleaned in most of the ponds. The adoption of mechanized screens is justifiable in ponds of large dimensions or special situations

2.2.5.4.2 Grit chamber.

Although the amount of sand is relatively small compared with all the sludge volume accumulated at the bottom of the pond, the sand tends to settle close to the inlet, which may cause localized problems. As the grit chamber is a small unit of easy maintenance, its inclusion is recommended in all pond systems.

2.2.5.4.3 Flume or weir for flow measurement.

The flow measurement is essential for the operational control of the pond. The flume also carries out the function of regulating the velocity in rectangular grit chambers. A convenient

Table 2-9: Design summary for SAN 1 TO SAN 4

<table>
<tr><th>SN</th><th>TYPE OF WORKS/ACTIVITIES</th><th>SAN 1
Usagara North Central Ngamiani</th><th>SAN 2
Majengo Ngamiani kusini, Usagara south Mwanzange</th><th>SAN 3
Nguvumali Chumbageni</th><th>SAN 4
Kiomoni Mizizima</th></tr>
<tr><td>1.</td><td>Construction of faecal sludge and wastewater treatment plant, with stabilization ponds, including preliminary works, execution of the accesses, headworks, operator building, wastewater treatment plant infrastructures: anaerobic ponds; facultative ponds, maturation ponds, and sludge drying beds and supply, by-pass and supply the necessary equipment and all associated ancillary works. (Lump Sum)</td><td colspan="4"><table><tr><th>Stage at UTOFU</th><th>Average flow (m^3/day)</th><th>Discharge point</th></tr><tr><td>Phase I (2025)</td><td rowspan="2"></td><td>Mkulumuzi river</td></tr><tr><td>Phase II (2040-45)</td><td>Mkulumuzi river</td></tr></table></td></tr>
<tr><td>2.</td><td>Construction of decentralized wastewater treatment plant, with stabilization ponds, including preliminary works, execution of the accesses, headworks, operator building, wastewater treatment plant infrastructures: anaerobic ponds; facultative ponds, maturation ponds, and sludge drying beds and supply, by-pass
and supply the necessary equipment and all associated ancillary works. (Global value) for the future New Community Centres (Lump Sum)</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>3.</td><td>Gravity main sewer lines construction, including earthworks, pipes laying and supply, manholes construction/installation as well as all associated ancillary works (linear meters)</td><td>681m (to uPVC DN 200 mm)
108m (to uPVC DN 315 mm)
328m (to HDPE CORRUGATED DN 350 mm)
765m (to HDPE CORRUGATED DN 400 mm)
1966m (to HDPE</td><td>68m (to uPVC DN 200 mm)
497m (to HDPE CORRUGATED DN 400 mm)
542m (to HDPE CORRUGATED DN 400)
1687m (to HDPE CORRUGATED DN 500)</td><td>215m (to uPVC DN 200 mm)
245m (to HDPE CORRUGATED DN 350 mm)
1884m (to HDPE CORRUGATED DN 500)</td><td>626 m (to HDPE CORRUGATED DN 600 mm)</td></tr>
</table>

SN	TYPE OF WORKS/ACTIVITIES	SAN 1 Usagara North Central Ngamiani	SAN 2 Majengo Ngamiani kusini, Usagara south Mwanzange	SAN 3 Nguvumali Chumbageni	SAN 4 Kiomoni Mizizima
		CORRUGATED DN500 mm)			
4.	**Pumping main sewer** lines construction, including earthworks, pipes, and fittings laying and supply, as well as all associated ancillary works (linear meters)	4100 m (to Steel 600 mm)	648m (to steel 400mm)	1314m (to steel 400mm)	-
5.	Construction of **pumping station**, including civil, electric, and mechanic works as well as all associated ancillary works (Lump Sum)	PS02 (Q=399.06l/s; He=31.65m)	PS01(Q=153.9l/s; He=11.48m)	PS03(Q=414l/s; He=14.2m)	
6.	**Gravity secondary sewer networks** construction, including earthworks, pipes laying and supply, manholes construction/installation as well as all associated ancillary works (linear meters)	28765m (to PVC DN200 mm) 740m (to PVC DN250 mm) 876m (to PVC DN315 mm) 107m (to HDPE CORRUGATED DN 350 mm) 1170m (to HDPE CORRUGATED DN500 mm)	17205m (to uPVC DN200 mm) 887m (to uPVC DN250 mm) 63m (to uPVC DN315 mm)	37910m (to uPVC DN200mm) 1733m (to uPVC DN250 mm) 463m (to uPVC DN315 mm)	5046m (to uPVC DN200 mm)
7.	Gravity secondary sewer networks construction, including earthworks, pipes laying and supply, manholes construction/installation as well as all associated ancillary works, for the future New Community Centres with a covered service of 40% (inhabitant)	NA	NA	NA	NA

SN	TYPE OF WORKS/ACTIVITIES	SAN 1 **Usagara North Central Ngamiani**	SAN 2 **Majengo Ngamiani kusini, Usagara south Mwanzange**	SAN 3 **Nguvumali Chumbageni**	SAN 4 **Kiomoni Mizizima**
8.	Gravity secondary sewer networks rehabilitation, regarding renewal and replacement of the existing sewers, including verification of existing conditions, earthworks, pipes laying and supply, **rehabilitation**/new manholes, as well as all associated ancillary works (linear meters)	20038m (to uPVC DN 200 mm) 108m (to uPVC DN 315 mm) 328m (to HDPE CORRUGATED DN 350 mm) 765m (to HDPE CORRUGATED DN 400 mm) 1966m (to HDPE CORRUGATED DN500 mm)	3083m (to HDPE CORRUGATED DN 200mm) 125m (to HDPE CORRUGATED DN 350mm) 542m (to HDPE CORRUGATED DN 450 mm)	1286m (to uPVC DN315 mm) 1884m (to HDPE CORRUGATED DN 500)	
9.	Manholes of different types.	Existing: 440 no Rehabilitation: 85 no Newly Proposed :100 no	Existing: 20 no Rehabilitation: 2 no Newly Proposed :487 no	Existing: 46 no Rehabilitation: Nil Newly Proposed :911 no	Newly Proposed :124 no
10.	Eventual relocation of some residents	No	No	No	No

Table 2-10 : Design summary for SAN 5 TO SAN 8

<table>
<tr><th>SN</th><th>TYPE OF WORKS/ACTIVITIES</th><th>SAN 5
Maweni, Mwazange Tangasisi</th><th>SAN 6
Msingani, Makorora Msambweni, Duga Mabawa</th><th>SAN 7
Mabawa, Duga</th><th>SAN 8
Tangasisi</th></tr>
<tr><td>1.</td><td>Construction of faecal sludge and wastewater treatment plant, with stabilization ponds, including preliminary works, execution of the accesses, headworks, operator building, wastewater treatment plant infrastructures: anaerobic ponds; facultative ponds, maturation ponds, and sludge drying beds and supply, by-pass and supply the necessary equipment and all associated ancillary works. (Lump Sum)</td><td colspan="4"><table><tr><th>Stage at MACHUI</th><th>Average flow (m^3/day)</th><th>Discharge point</th></tr><tr><td>Phase I (2025)</td><td>20,000</td><td>Mushui river</td></tr><tr><td>Phase II (2040-45)</td><td>11,000</td><td>Mushui river</td></tr></table></td></tr>
<tr><td>2.</td><td>Construction of decentralized wastewater treatment plant, with stabilization ponds, including preliminary works, execution of the accesses, headworks, operator building, wastewater treatment plant infrastructures: anaerobic ponds; facultative ponds, maturation ponds, and sludge drying beds and supply, by-pass and supply the necessary equipment and all associated ancillary works. (Global value) for the future New Community Centres (Lump Sum)</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>3.</td><td>Gravity main sewer lines construction, including earth, works, pipes laying and supply, manholes construction/installation as well as all associated ancillary works (linear meters)</td><td>4752m (to uPVC DN 200 mm)
2359m (to HDPE CORRUGATED DN 350 mm)</td><td>344 (to uPVC DN200 mm)
1035 (to DN HDPE CORRUGATED 450 mm)
4170m (to DN500mm) - HDPE CORRUGATED</td><td>1,590m uPV DN200 (to C mm)</td><td>4,012m (to HDPE CORRUGATED DN 600 mm)</td></tr>
<tr><td>4.</td><td>Pumping main sewer lines construction, including earthworks, pipes, and fittings laying and supply, as well as all associated ancillary works (linear meters)</td><td>2148m (steel DN200)</td><td>2979m (steel DN 600)</td><td>-</td><td>2496 m (to Steel DN 250mm)
2048 m (to steel DN 250mm)
2230m (steel DN 900mm)</td></tr>
</table>

SN	TYPE OF WORKS/ACTIVITIES	SAN 5	SAN 6	SAN 7	SAN 8
		Maweni, Mwazange Tangasisi	**Msingani, Makorora Msambweni, Duga Mabawa**	**Mabawa, Duga**	**Tangasisi**
5.	Construction of pumping station, including civil, electric, and mechanic works as well as all associated ancillary works (Lump Sum)	PS01(Q=14.77l/s; He=12.61m PS02(Q=25.09l/s; He=8.29m	PS06(Q=650.5/s; He=30.03m -	-	PS03 (Q=26.37/s; He=15.09m) PS04(Q=30.8l/s; He=30.37 PS05(Q=720/s; He=22.49m
6.	Gravity secondary sewer networks construction, including earthworks, pipes laying and supply, manholes construction/installation as well as all associated ancillary works (linear meters)	47715 (to uPVC DN200 mm)	143656 (to uPVC DN200 mm) 6574m (to DN250 mm) 10565m (to HDPE CORRUGATED DN350mm)	38.644m (to uPVC DN200 mm) 3400m (to uPVC DN250 mm)	51860 (to uPVC DN 200) 4300m (to uPVC DN250 mm)
.7.	Gravity secondary sewer networks construction, including earthworks, pipes laying and supply, manholes construction/installation as well as all associated ancillary works, for the future New Community Centres with a covered service of 40% (inhabitant)	NA	NA	NA	/NA
8.	Manholes of different types.	Newly Proposed :624 no	Newly Proposed :3135 no	Newly Proposed :781 no	Newly Proposed :891 no
9.	Gravity secondary sewer networks rehabilitation, regarding renewal and replacement of the existing sewers, including verification of existing conditions, earthworks, pipes laying and supply, rehabilitation/new manholes, as well as all associated ancillary works (linear meters)	NA	NA	NA	NA

2.2.6 Nature of Works

The works involve the installation of sewer pipes to service the areas. The major activities will include excavation works, laying of pipes and the backfilling of the pipes. In some cases, like major road crossings, trenchless excavation will be done where pipe jacking will be employed. This will help reduce traffic disturbances.

The pipe sizes to be installed range from 160mm to 1200mm in various material types ranging from unplasticised Polyvinyl Chloride (uPVC), Concrete pipes and High-density polyethylene (HDPE) pipes. Precast concrete sections shall also be used in the construction of manholes.

2.2.7 Process and technology

The process will involve excavation works, blasting where necessary pipe laying and backfilling. Excavation will be done using both mechanical and manual means. Controlled blasting using explosives will be used to break hard rock along the trenches. This process will require traffic control to avoid accidents.

2.3 Project activities

2.3.1 Mobilization

Since the proposed project includes Environmental and Social Impact Assessment, the project activities will be assumed to follow the project routines whereby there are pre-construction activities, construction activities and finally operations and maintenance activities.

This stage will involve mobilization of the construction human resource, construction equipment and plant and construction materials. Also, as required, the Contractor will hire labour and erect necessary temporary facilities to cater for offices and storage yards within the construction site or outside the site as it may be agreed and permitted by the authorities.

At this stage, wastes (solid, liquid and gaseous) will be generated from storage yards and temporary workers camp and offices. The staff camp like any other domestic place will generate, garbage, packaging, sacks, papers, cardboard boxes, plastic, wood crates, bottles, glass, metal cans and the like. Such wastes will need to be segregated for recycling or incinerating at designated project sites.

All project activities are supposed to be carried out along the streets and roads within the boundaries of the identified project sites without disturbing or obstructing the neighboring facilities and offices.

Mobilization phase will also involve purchase and stockpiling of the materials such as aggregates, sand, cement, timber and reinforcing steel. Other construction equipment such as scaffolding, sheet pile driving equipment, crane, will be mobilized to the site of works as need arises.

2.3.2 Construction phase of the project

Upon completion of preliminary activities involving erection of site offices, storage facilities and services (water, temporary wastewater facilities and electricity) as required, the actual construction work of waste stabilization ponds will start which will involve;

- Setting out to demarcate rights of way, work areas, clearing limits. Access roads, detours, bypasses and protective fences or barricades should all be in place before sanitary sewer construction begins
- Sites preparation –clearing and grubbing to remove unsuitable soils, construction of bypasses and possible modification of existing drainage structures
- Excavation for trenches in case of sewer lines and excavation of foundations in case of pumping stations, operators house and WSP.
- Trench sheeting and bracing to protect trench side walls.
- Concreting bases of foundations
- Laying of pipe sanitary sewers
- Backfilling, disposal of overburden and surface restoration to at least match the condition that existed prior to the sanitary sewer construction

Once the substructures of pumping stations and operators' houses are completed, works for the superstructures will start with walls up to roofing stage, Installation of services including water, wastewater and electricity reticulation and finally finishing ready for handing over the pumping station.

Various wastes, ranging from solid to liquid and gaseous materials will be generated. The staff camp like any other domestic place will generate wastes in form of garbage, packaging, sacks, papers, cardboard boxes, plastic, wood crates, bottles, glass, metal cans and the like. Such wastes will need to be segregated for recycling or incinerating at site.

However, burning or incineration should be done with great care excluding materials with poisonous emissions. In case of trenches, and excavated sewer lines proper barricades have to be applied to warn and protect the people of impending dangers of falling into open trenches.

2.3.3 Operation Phase

Once construction of sanitary sewer, rising main and waste stabilization ponds is completed, the actual purpose of the sewerage system will start, that is draining the sewage from the houses towards the pumping station, then lifting the sewage to the wastewater treatment plants (waste stabilization ponds) where the waste water will be retained in the ponds for a substantial time while natural purification processes taking place. The treated wastewater will be then being allowed to drain in the Ocean through the outfall.

2.4 Project Requirements, Waste Generation and Disposal Methods

The project is going to require various locally available materials at different phases of the project implementation. Such locally available materials required include aggregates, gravel or crushed stone, sand and water.

2.4.1 Mobilization phase materials

2.4.1.1 Site Preparation

Preparation of the site for proposed laterals, primary and secondary sewer lines, pressure main and waste stabilization pond will automatically result into removal of existing few exotic trees and other vegetation around the site. These practices remove protective plants cover over the existing ground. The sites proposed for pumping stations and pressure main will equally be cleared of vegetation.

These activities will result into generation of wastes like tree debris and other solid wastes like plastics all of which will be collected and disposed of in designated municipal waste disposal site preferred. Decomposable materials may be buried; plastics and other recyclable materials will be collected and sent out for recycling.

2.4.2 Construction Phase Materials and Equipment

Since the pumping station and waste stabilization ponds will be mainly of plain or reinforced concrete structure, the main construction materials will be aggregates, cement, sand, reinforcing steel and water. Other requirements such as timber, formwork, scaffolding etc. will also be required as included.

Borrow materials to be used for construction will be collected from the identified borrow areas such as those used for road construction or new ones opened on agreement with the municipal authorities.

Once these borrow pits are no longer in use, they will be backfilled with the spoil or these pits may be turned into water storage points for livestock on agreement with the respective local communities. Steep edges of these pits will be smoothened to avoid posing risks to children and livestock. The estimate of construction materials for the proposed project will be detailed in the EIA Study.

2.4.3 Waste Management

The project will generate waste during the construction phase. Some of the solid wastes which are likely to be generated by the project will include waste rocks/sands, dust, as well as remains of construction materials like timber, cement and steel used during the construction. Solid wastes will have to be dumped in a designated area, which will be designed to contain the waste from leakage and contaminated soils.

Other solid wastes are expected to be generated from the workers' camps during construction and from residential/commercial and industrial areas during the operation phases. These will include garbage, redundant raw materials, bottles and containers that need to be disposed of. Dust bins and collection points will be provided to cater for these different types of wastes that are generated from staff house.

Waste collected from dust bins will be sorted at the main collection point where a prescribed agent/service provider will collect the waste to dispose it in the designated sites as located by the City. It is highly recommended that waste separation as well as decomposition of organic waste and recycling of solid waste be practiced.

Biodegradable materials wastes such as food leftovers, cardboards, papers will be collected and disposed of along with other municipality wastes in sanitary landfills in Chongoleani. Other materials such as plastics, metal straps, reinforcing bars, unusable timber crates, steel cable pieces, pipes, etc., will be collected and transported to recycling centres within the town premises.

2.4.3.1 Wastewater Drainage and Treatment

During the construction and operation phases of the project, the anticipated liquid waste from the project will consist of domestic grey water emanating from residential

There is currently no central sewer system running along the streets in the project area. Therefore, any waste water generated as the result of the proposed works will be lead to the septic tanks. The waste water from the construction site, particularly the toilets will be linked to the nearby septic tanks or improved pit latrines.

2.4.4 Demobilization Material wastes

Upon completion of construction activities, all construction waste materials such plastics, glass and metal plates ideal for recycling will be collected and delivered at recycling centres. Unusable aggregates with concrete debris, chippings, sand will be sieved and the good one will be separated for reuse at other sites by the contractor.

Natural grass to match the existing will be planted in all areas around the pumping stations, along the rising main to ponds and around the waste stabilization ponds.

2.5 Decommissioning Phase

It is envisaged that the project will be operational for a number of decades. In case the development comes to an end, decommissioning of the facility will be undertaken in accordance with the laws and regulations that will be prevalent at the time. This phase will mainly involve demolition of the structures and other associated infrastructures.

A written plan detailing how construction related equipment, materials and wastes will be decommissioned and disposed of on completion of their use will be prepared. The decommissioning and disposal plan will be reviewed by the project proponent prior to mobilization of the contractor to the site, and the proponent will maintain ultimate responsibility for the proper management of equipment, materials and wastes within the project area.

Prior to demobilization, the contractor will prepare a detailed list of all remaining equipment, unused materials, and wastes transported to the project area or generated as a result of work they performed. The equipment, unused materials and waste list will contain a description of the following:

- How each piece of equipment will be prepared for off-site shipment and the type and quantity of waste materials that will be generated during the equipment demobilization effort;
- The quantities and types of all unused materials, and the planned disposition of those materials; and
- The types, quantities and disposal plan for all wastes generated by the contractor which still remain within the project area.

The equipment, unused materials and waste list will be submitted to the Tanga UWASA prior to demobilization of the Contractor to ensure that all equipment, unused materials and wastes are managed and disposed of in accordance with good practices, applicable regulatory requirements, and the procedures

2.6 Source of Energy

The proposed treatment plant will use electricity from TANESCO. The standby generator is recommended to be installed and operated during power shortages. The possibility to use solar energy system for lightening and other minor operation is strongly recommended as well.

CHAPTER THREE

3 POLICY ADMINISTRATIVE AND LEGAL FRAMEWORK

3.1 Introduction

There are many number of policy and legislation in Tanzania which set out the legal and regulatory requirements which are relevant to the proposed project. Also there are relevant standards governing environmental management and protection, health and safety.

The proposed EIA shall be in compliance with the following policies, legislation, and standard identified during this scoping study. The following section list down relevant policies and legislation which will be synthesized further during the EIA.

3.2 Relevant Policies

The following are relevant sectoral and cross – sectoral policies which provide directives on how projects should be operated in/on concerned natural resources and sensitive ecosystems, Tanga UWASA needs to adhere to these policies in the design, construction/mobilization and operation of the Wastewater stabilization ponds

Tanga UWASA shall adapt the following environmental policy: Assess and decide policies based on the principles of 'Rethink (product and function), Repair, replace (harmful things), Re-use, Reduce, Re-cycle.'

Land:

- Environmentally sensitive designs for all Ponds.
- Protect the area around the WSP from erosion and degradation.
- Protect the indigenous and endemic species.

Water:

- Minimize the impact on the environment from water discharged.
- Avoid any contamination of water sources.

Energy:

- Reduce dependence on fossil fuels.
- Convert to reusable energy sources.
- Minimize consumption

3.2.1 National Environmental Policy (1997)

The overarching governing Tanzania's environmental management are the National Environmental Policy (NEP) of 2021 and the Environmental Management Act (EMA) of 2004.

This Policy is a supreme national framework for environmental management in the country. It recognizes the role of sectoral policies in pursuit of effective environmental conservation and sustainable socio-economic development. In view of that, the envisioned achievements of this Policy depend on mainstreaming and implementation of relevant environmental measures in the respective sectoral policies.

The Overall Objective of this policy is to provide a national framework for guiding harmonized and coordinated environmental management for the improvement of the welfare of present and future generation
While by undertaking EIA, Tanga UWASA has observed one of the requirements of this policy during the whole lifecycle of the project. Furthermore, the EIA study has taken on board all environmental issues pointed out in the policy i.e. public consultations, protection of public health to mention few.

3.2.1.1 Relevance to the Project

The policy is relevant to the project because the project addresses lack of access to good quality water as one of the key environmental problems in the country as stipulated in the policy document.
The policy is also relevant to the project because the project is likely to cause some negative environmental impacts and therefore according to the policy the project should be subject to an EIA study. In general, the project will be required to address environmental policy objectives by ensuring that environmental degradation is minimized

3.2.2 National Land Policy (1995)

The overall aim of National Land Policy is to promote and ensure a secure land tenure system, to encourage the optimal use of land resources, and to facilitate broad-based social and economic development.

The National Land Policy emphasizes the importance of undertaking EIA for the management of land based development. Additionally, the policy advocates the protection of land resources from degradation for sustainable development.

Tanga UWASA will take into consideration the land capability and will ensure proper management of land resources. Tanga UWASA shall conduct this study by complying with the policy.

3.2.3 The National Water Policy (2002)

The main objective of this policy is to develop a comprehensive framework for sustainable development and management of the Nation's water resources, in which an effective legal and institutional framework for its implementation will be put in place.

The policy aims at ensuring that beneficiaries participate fully in planning, construction, operation, maintenance and management of community based domestic water supply schemes.

This policy seeks to address cross-sectoral interests in water, watershed management and integrated and participatory approaches for water resources planning, development and management.

Also, the policy lays a foundation for sustainable development and management of water resources in the changing roles of the Government from service provider to that of coordination, policy and guidelines formulation, and regulation.

Relevance to the Project: The project management will be required to ensure that water abstraction takes into consideration downstream water flow for environmental purposes and protection of ecosystems.

3.2.4 The Construction Industry Policy

This policy promotes among other things, application of cost effective and innovative technologies and practices to support socio-economic development including utilities and ensure application of practices, technologies and products which are not harmful to both the environment and human health.

This EIA is undertaken to ensure that the project proponent uses technologies and products not harmful to both the environmental and human health by providing visible alternatives and appropriate mitigation measures.

3.2.5 National Human Settlements Development Policy (2000)

The policy provides for the coordination of the land policy, land development, human settlements development, surveys, valuation, sites and services, land registration of documents, chattels transfer, formulation and implementation of National Housing Policy, building research, urban physical structure policy, town planning, master plans, maps and regional physical planning. Since the project will involve the construction works, however.

The proposed area for Construction of Waste Stabilization Pond (WSP) at Utofu area is undisturbed and it is within the community, therefore company will abide to the relevant provisions of the policy to ensure complies with other developments.

3.3 Legal Framework

3.3.1 The Environmental Management Act Cap 191

The Act is a single comprehensive environmental law, which became operational from 1 July 2005. According to Part VI, Section 81-(1), any person, being a proponent or a developer of a project or undertaking of a type specified in the Third Schedule to this Act, for which environmental impact assessment is required, shall undertake or cause to be undertaken, at his own cost, an environmental impact assessment study prior to the commencement or financing of a project or undertaking.

This constitutes a comprehensive framework for environmental management at all levels, in all sectors, and for coordination of environmental interventions both horizontally at local, regional and national levels and vertically between the administrative levels within the sectors.

Also it introduces a concept of right of Tanzanians to clean, safe and health environmental and right of Tanzanians to access to various segment of environment for recreational, educational, health, spiritual, cultural and economic purpose (Section 4 (1) and (2).

Under this Act, NEMC is mandated to undertake enforcement, compliance, review and monitoring of environmental impact assessment and has a role of facilitating public participation in environmental decision making, exercise general supervision and coordinating over all matters relating to the environment.

The Act also requires the council to determine whether a proposed project should be subjected to an EIA, approves consultants to undertake the EIA study, invites public comments and also has the statutory authority to issue the certificate of approval. This act imposes an obligation on developers to conduct an EIA prior to the commencement of the project to determine whether the project may/or is likely to have, or will have a significant impact on the environment.

Section 82 makes EIA mandatory to all projects that fall under the EIA mandatory list (schedule 3). NEMC is currently the designated authority to carry out the review of EIA, monitoring and auditing of environmental performance of the project (periodic and independent reassessment of the undertaking). As such Tanga UWASA will have to work closed with NEMC for the entire life cycle of the project.

Furthermore, to curb emissions to the air, water and soil, the following Regulations shall be applicable:

- Environmental Management (Air Quality Standards) Regulations, 2007;
- Environmental Management (Soil Quality Standards) Regulations, 2007; and
- Environmental Management (Water Quality Standards) Regulations, 2007

3.3.2 The EIA and Environmental Audit Regulations, 2005 amended 2018

Part IV of the regulations section 12-17, prescribes the procedures to be followed in carrying out the environmental assessment, and part V gives the format of the environmental impact assessment. According to these regulations, the developer first registers the project, by submitting form EIA to NEMC, with outline details of the project and its likely impacts.

The regulations advocates for periodic and independent reassessment and that the outcome of such assessment will serve to provide instructive feedback into the environmental management process. Environmental impact statement (EIS) will be submitted to the technical advisory committee (TAC) coordinated by NEMC for review. The proponent shall meet the costs of the review. In carrying out this EIA, these regulations have been followed.

3.3.3 The National Land Act, 1999

The purpose of this Law is to make sure that the general ideas and aims of the National Land Policy are acted on. The land Acts makes clear that all land in Tanzania is public land which the president holds in trust on behalf of all the citizens. All land in Tanzania is divided in three types which are reserved land, village land and general land.

The Area category is categorised as Village lands under the Land Act No. 4 of 1999 and the act regulate its administration, use, planning and development. The Land Acts introduces “fundamental principles of land policy” including the principle of ensuring “*that land is used productively and that any such use complies with the principles of sustainable development”.*

3.3.4 Village Land Act, 1999

This Act gives Village Councils responsibility for looking after village lands on behalf of the Village Assemblies. Villagers hold rights called *“customary rights of occupancy”* which means that if they have lived on the land for many years they have rights to it.

The Village Land Act gives people who have customary rights of occupancy the same legal protection as those who have what are called *“granted rights of occupancy”.* People who have granted rights of occupancy have already been given legal status.

According to the Act, Village Councils must manage village lands by the following provisions:

- The land must be used in such a way that it can continue to support people’s livelihoods and resource uses

- The trees, water supply and other resources in and around the village must be looked after properly
- There are other public bodies which have power over the village land and its surroundings and their decisions and orders can influence the village's use of land
- Village land lies within a local authority so that local authority must be asked for its views in certain instances

3.3.5 Village Governance and the Local Government Act of 1982

This law gives village governments the authority to use, manage and own land and other property. It also gives the village government responsibility for the affairs and business of villages. This act gives village governments a lot of power to enter into agreements and enterprises which provide for the well-being of villagers.

The land where the WSP located is at Utofu which owned by ministry of water. The system of village land ownership in Tanzania is governed by Village Land Act, 1999, Local Government Act No.7 (District Authorities) of 1982, Land Tenure Act No 27 (Village Settlements) of 1965, and Land Act 1999.

3.3.6 Occupational Health and Safety Act, 2003

This Act requires registration of factories or workplaces. It further requires workplaces to offer safety provisions such as offering Medical examination, provisioning of Safety devices, Training, supervision and research and precaution in respect to explosive or inflammable dust, gas vapour or substance as well as prevention of fire. The Act also requires the owner to supply First Aid facilities

3.3.7 Land Act Cap. 113, (No. 4 of 1999)

The Land Act, Cap 113, replaces the previous basic land law of 1923, and establishes three categories of land: general, village and reserved. In addition, land may be declared 'hazard land' where its development might lead to environmental damage, e.g. locations such as wetlands, mangrove swamps and coral reefs, steep lands and other areas of environmental significance or fragility. The Act recognizes customary tenure as of equal status to granted rights of occupancy.

Importantly the land Act promotes gender equality by recognizing equal access to land ownership and use by all citizens- men and women – and giving them equal representation on the land committees.

Under this project the proposed scheme development activities are to be carried out in the land mainly along the access roads all of which is owned by the government through existing country legislations.

However, any land which will be interfered with, that does not belong to the Tanga UWASA will be taken in observance of the requirements of the Land Act, Cap, 113.

3.3.8 The Land (Forms) Regulation 2001

The Land Regulations were made under section 179 of the Land Act 1999, and provide all specific forms required for Management and Administration, Granted Right of Occupancy, Mortgage, Lease, Easement, Co-occupancy and others including compensation forms (Forms 69 and 70).

Some land acquisition such as land for the waste stabilization ponds was done by the Tanga UWASA (government) hence no any kind of compensation will be required, but in case there are areas that belong the private people, appropriate measures of land acquisition and corresponding compensation will be undertaken as provided for in the said regulations.

3.3.9 The Land Acquisition Act, Cap 118 R.E. 2002

The Land Acquisition Act Cap 118 Revised Edition 2002 requires the minister responsible for land to pay compensation as may be agreed upon or determined in accordance with the provisions of the Act.

The Act stipulates that no compensation shall be awarded in respect of land, which is vacant ground, or to be limited to the value of the un-exhausted improvement of the land, in case the development of the land is deemed inadequate.

The Act defines the circumstances in which public interest could be invoked, e.g., for exclusive government use, public use, for or in connection with sanitary improvement of any kind or in connection with laying out any new city, municipality, township or minor settlement or extension or improvement of any existing city.

Other purposes are in connection with development of any airfield, port or harbour; mining for minerals or oils; for use by the community or corporation within community; for use by any person or group of persons as the President may decide to grant them such land.

The acquisition of the land for the public use as well as for the resettlement sites is within the provision of this Act. Further the Act specifies other requirements prior to the acquisition of the land such as investigation for the land to be taken, issuing notice of intention to take land and mode in which notices will be served. It further defines the requirements for and restrictions on compensation.

3.3.10 Land Use Planning Act No. 6 of 2007

This Act repeals the National Land Use Planning Commission Act No. 3 of 1948 that established a National Land Use Commission (NLUC) as the principal advisory organ of the government on all matters related to land use.

Among other things, it recommends measures to ensure that the government policies, including those for development and conservation of land, take adequate account of their effects on land use, seek the advancement of scientific knowledge of changes in land use and encourage development of technology to prevent, or minimize adverse effects that endanger human's health and welfare.

The Act also specifies standards, norms and criteria for the protection of beneficial uses and the maintenance of the quality of the land.

The Land Use Planning Commission, currently, does not have any bearing on the sewerage system development activities proposed by Tanga UWASA as the proposed site is located in open space where other land use development activities cannot be interfered with. Although about 4 residential houses are encroached the area.

3.3.11 Forest Act No. 14 of 2002

This Act deals with the protection of forests and forest products in forest reserves and the restrictions and prohibitions in forest reserves. Any contravention of the restrictions and prohibition is considered an offence under this ordinance and subject to enforcement.

The law was repealed in 2002 to meet the new requirements under the Forest Policy. The new Forest Act No. 14 of 2002 requires that for any development including mining development, construction of dams, power stations, electrical or telecommunication and construction of building within a Forest Reserve, Private Forest or Sensitive Forest, the proponent must prepare an Environmental Impact Assessment for submission to the Director of Forestry.

The law also requires licenses or permits for certain activities undertaken within the national or local forest reserves, such as, among others, felling or removing trees, harvesting forest produce, entering a forest reserve for the purpose of tourism or camping, mining activities, occupation or residence within the reserve, cultivation, erecting any structures.

The proposed project does not touch any of the forest reserves, however the requirement of this Act will be observed through limiting use of the forest products such as timber for sustainability of the forests.

3.3.12 Wildlife Conservation Act, No. 5 of 2009

The Wildlife Conservation Act establishes protected areas with restriction on access and utilization of wildlife resources. Among these protected areas include Game Reserve, Wetlands, Wildlife corridor, Dispersal areas and species management areas.

The Act state clearly restrictions applying to game reserves, wetlands and game controlled area that any person shall not dig, lay, or construct any pitfall, net trap, snare or use any other device capable of killing, capturing or wounding any animal and conduct crop cultivation within any game reserve, wetlands reserve or game controlled area.

The proposed project area particularly the area earmarked for waste stabilization ponds is purely not used. It is reserved for wastewater treatment facilities, there might be some snakes and other wildlife living within the area, since the area is not meant for protection, then these “uninvited guests” will find their way out during construction activities; therefore, the legislation has no significant bearing on the project activities.

3.3.13 The Mining Act No. 14 of 2010

This Act provides for prospecting of minerals, mining and dealing in minerals. It also provides for building materials including all forms of rock, stones, gravel, sand, clay, volcanic ash or cinder or other minerals being used for the construction of buildings, roads, dams, and aerodromes or similar works.

The Legislation makes EIA mandatory as a precondition for granting various categories of mining licenses. In this project borrow material and all forms of rock stones, gravel, clay and sand will be mined from existing borrow area or new ones developed whereby all the requirements of the Act will be met in parallel to other development projects in Tanga City all in agreement to respective authorities and owners.

3.3.14 The Water Resources Management Act No. 11 of 2009

Water legislation has been updated to bring it in line with the National Water Policy 2002. This current Water Resources Management Act No. 11 of 2009 provides for institutional and legal framework for sustainable management and development of water resources; outlines principles for water resources management; provides for the preventions and control of water pollution; provides for participation of stakeholders and the general public in implementation of the National Water Policy; repeals the Water Utilization (Control and Regulation) Act, 1974 and vests all water in the country to the Government of United Republic of Tanzania and sets procedures and regulations for the extraction of water resources, but does not provide for the wetland resource management.

Section 63 of the Act states that the discharge of any effluents from any commercial, industrial, or agricultural source or from any sewage works or trade waste systems or from any other source into surface water or underground strata requires a “Discharge Permit” from the Basin Water Board.

In accordance with section 65, the water quality and effluent standards to be applied to the discharge permit shall be made and published by the Minister in accordance with the requirements of the Environmental Management Act Cap 191. A provisional discharge permit may be granted in cases where pollutants are already being discharged, subject to conditions and terms of issued as per requirements of clause 67.

The sewerage system project being located closer to Indian Ocean, where any failure of its actions is likely to cause a significant pollution to the Ocean, will comply with all provisions of this Water Management Act in order to ensure efficient management of the Ocean near the project area. Compliance with the requirements of this Act will be through implementation of the Environmental Management and Monitoring Plans set as part of this EIS.

Relevance to the Project

In general, the project deals with water resource development and therefore the project proponent has to adhere to all provisions given under this Act. Specifically, the project involves groundwater abstraction, rainwater harvesting and dam construction.

In this regard, the project proponent has to adhere to the provisions of Section 12 for rainwater harvesting; Section 54 for groundwater abstraction and Section 93 for dam construction.

3.3.15 The Environment Management (Water Quality Standards) Regulations, 2007

These environmental management regulations were made under section 143, 144, and 230(2) (s) of the EMA Cap191 with the following objectives:

a. protect human health and conservation of the environment
b. enforce minimum water quality standards prescribed by the National Environment Standards Committee (NESC)
c. Enable NESC to determine water usages for the purposes of establishing environmental quality standards and values for each usage and
d. Ensure all discharges of pollutants take account the ability of the receiving waters to accommodate contaminants without detriment to the uses specified for the waters concerned

Under the first schedule, the regulations give the permissible limits for municipal and industrial effluents for both physical, inorganic organic and microbiological components.

Since these limits are now readily available the project proponent will ensure that the objectives of regulations are totally observed to safeguard the environment around the project area. The

3.3.16 Water Resources Management (Water Abstraction, Use and Discharge) Regulations, 2010

Among other things, these regulations contain forms that are used for application for permit to discharge wastewater to the Basin Water Officer. The information required on the discharge application include the volume of discharge during the dry weather, maximum rate of discharge, average daily volume of trade effluent, method of measurement of flows from the works (Vnotch/weir/current meter etc., maximum temperature of effluent discharge and maximum concentrations of any contaminants known to be present in the discharge.

The above submission shall also include the plan of the discharging facility and the adjoining properties, body of water referred to; and the point on the body of water where it is desired to discharge effluent.

These are standard requirements components of such a similar project. Therefore, the project proponent will apply for the discharge permit according to the laid down procedures.

3.3.17 Water Supply and Sanitation Act No. 5 of 2019

The Water Supply and Sanitation Act No. 5 of 2019 has been enacted to provide for sustainable management and adequate operation and transparent regulation of water supply and sanitation services with a view to give effect to the National Water Policy (2002).

It further provides for the establishment of water supply and sanitation authorities as well as community owned water supply organizations. The project will be implemented in total observance of the requirements of this Act.

Relevance to the Project

Sub-section 9(1) of the Act is relevant to the project because the project is being implemented by Tanga UWASA, which deals with provision of water supply and sanitation services. Sub Section 21(2) is also relevant to the project because it will involve acquisition of way leaves for water supply and sewer pipelines.

Tanga UWASA shall be required to adhere to and take into account the needs of the disadvantaged groups when providing water supply and sanitation services as specified in Subsection 22(1).

3.3.18 Energy and Water Utilities Regulatory Authority Act No. 11 of 2001

The Energy, Water Utilities Regulation Authority (EWURA) was established under the EWURA Act, 2001, with responsibility inter alia for regulation of the water and sewerage services. Section 28 of the Water Supply and Sanitation Act confers EWURA among others powers to exercise licensing and regulatory functions in respect of water supply and sanitation services; establishment of guidelines on tariffs chargeable for provision of water and sanitation services; monitoring water quality and standards of performance for provision of water supply and sanitation services.

Relevance to the Project

The project deals with provision of water supply and sewerage services, which are regulated by EWURA. In this regard the project has to comply with the requirements of EWURA with respect to

the welfare of customers, protection of environment and provision of efficient, high standards and good quality services to consumers

3.3.19 The Public Health Act, 2009

This is an Act to provide for the promotion, preservation and maintenance of public health with a view to ensuring the provisions of comprehensive, functional and sustainable public health services to the general public and to provide for other related matters. Part IV section 93 to 125 of this Act describes on sewerage and drainage service to the public requirements.

The project proponent will observe all the requirements of this Act in order to have smooth execution of its sewerage system development activities.

3.3.20 The Engineers Registration Act No.15 of 1997, R.E. 2002

This is an Act which formed the Engineers Registration Board, a statutory body with the responsibility of monitoring and regulating engineering activities and the conduct of engineers and engineering consulting firms in Tanzania through registration of engineers and engineering consulting firms. Under the law, it is illegal for an engineer or an engineering firm to practice Engineering profession if not registered with the board.

The board has also been given legal powers and has the obligation to withdraw the right to practice from registered engineers if found guilty of professional misconduct or professional incompetence. Registration with the board is, thus, a license to practice engineering in Tanzania.

Sewerage system construction project is an engineering assignment and the project proponent is observing all the requirement of this Act through engaging the services of personnel and firms that are registered with the Engineers Registration Board.

3.3.21 The Contractors Registration Act No. 17 of 1997 R.E. 2002

This is an Act which provides for registration of contractors and also establishment of the Contractors Registration Board, the body responsible for regulating the conduct of contractors in Tanzania.

The project proponent will equally abide by all requirements of this Act in terms of supporting the activities of the board during inspection of any site for access road patching, installation, erection or demobilizing works for the purpose of verifying and ensuring that the works are being undertaken by registered contractors; and that the works comply with all governing regulations and laws of the country.

3.3.22 The Occupational Health and Safety Act No. 5 of 2003

This Act sets provisions for the safety, health and welfare of persons at work in factories and other places of work. It is also meant to provide for the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with activities of persons at work; and to provide for connected matters.

The sewerage system construction project will eventually be a place of work to be registered as per OSHA regulations that govern the places of work and observe all safety and health practices at work sites by its consultants, contractors and sub-contractors.

3.3.23 The Surface and Marine Transport Regulatory Authority Act No. 9 of 2001

This is an Act which established the Surface and Marine Transport Regulatory Authority (SUMATRA) mainly dealing with surface and marine transport sectors. The Act presents a "regulated sector" environment in which SUMATRA executes its duties.

This regulated sector includes rail transport, ports and maritime transport, public passenger road transport and commercial road transport. The Act gives the duties of SUMATRA to include:

a. Perform, the functions conferred on the Authority by sector legislation;
b. subject to sector legislation
    i. to issue, renew and cancel licenses;
    ii. to establish standards for regulated goods and regulated services;
    iii. to establish standards for the terms and conditions of supply of the regulated goods and sources;
    iv. to regulate rates and charges;
    v. to make rules.
c. To monitor the performance of the regulated sectors, including, in relation to-
    i. levels of investment;
    ii. availability, quality and standards of services;
    iii. the cost of services;
    iv. the efficiency of production and distribution of services, and
    v. other matters relevant to the Authority;

Since all these elements are core to the success of the proposed sewerage system construction project, any transportation elements of construction equipment will follow the set requirements.

3.3.24 The Roads Act No. 13 of 2007

This Roads Act provides for road financing, development, maintenance, management and other related matters. Since the project intends to construct the access roads to the waste stabilization ponds, then the important clauses of the Roads Act will be observed in totality.

The Act also provides for offences, penalties and recovery on destroying bridges, causing damage to public roads, obstructions on roads, nuisance on roads, stretching of ropes over public roads etc.

The fines are also prescribed under the offences committed on the public roads. The project proponent will observe all the requirements of this Act in order to have smooth execution of its sewerage system development activities.

3.3.25 Local Government (Municipal/District) Authorities Act No. 7 of 1982

The Act provides for; inter alia, the establishment, composition, functions and legislative powers of district, township councils and village authorities. At the village level, the government structure is comprised of a village assembly consisting of all persons aged 18 and above.

There are also village committees covering such matters as planning, finance, economic affairs, social services, security, forest protection, water resources etc. [Section 35].

The village council's functions and roles include planning and coordinating activities, rendering assistance and advice to the villagers engaged in agriculture, forestry, horticultural, industrial or any

other activity, and to encourage village residents to undertake and participate in communal enterprises.

As an administrative subdivision between the village and the district, the ward reviews the proposed village council's projects in its jurisdiction and approves them for passage up the line to the District Development Committee.

3.3.26 Local Government (District) Authorities Act of 1982 as amended by Act No. 6 of 1999

establishes the Ward Development Council (hereinafter referred to as "WDC). The WDC is responsible for developing general development plans for the ward. Further, the WDC must manage disasters and environmental related activities within its ward.

Local Government (District) Authorities Act, No. 7 of 1982 also provides for the protection and management of the environment on the part of the district council.

This is deduced from section 111 of the Act, which promotes social welfare and economic well-being of all residents within its area of jurisdiction. Protection and management of the environment is further provided for under section 118 of Act number 7 of 1982.

District councils are required to take the necessary measures to control soil erosion and desertification; to regulate the use of poisonous and noxious plants, drugs or poison; regulate and control the number of livestock; maintain forests; manage wildlife; ensure public health; provide effective solid and liquid waste management protect open spaces and parks etc.

The Act also has provisions for a scheduled timetable and management of the environment.
Since the project will be touching the areas where the local government authorities have roles to play, the village will work hand in hand with City Council and other local government structures for the success of the project.

3.4 Other Relevant International Treaties and Conventions

Tanzania has ratified a number of Multilateral Environmental Agreements (MEAs) and consequently has duties under those agreements. In this sewerage system project, work will be carried out in environments likely to be affected if mitigation measures are not strictly applied. Table 3-1 below presents some of these agreements, treaties and conventions.

Table 3-1: Multilateral Environmental Agreements (MEAs), Treaties and Conventions to which Tanzania is a party

Type of Convention	Name of Convention	Relevance to the Project
Bio diversity related Conventions	1. Convention of Biological Diversity, (1992) ratified by Tanzania in 1996). Project activities involve clearing of vegetation. The City Council will work with the respective communities in conservation of available plant and animal species. 2. Convention to combat, desertification, particular Africa, Paris 1994 3. The Cartagena Protocol on Bio safety to the	Project activities involve clearing of vegetation. Tanga UWASA will work with the respective communities in conservation of available plant and animal species.

Type of Convention	Name of Convention	Relevance to the Project
	convention on Biological Diversity (2000)	
Other Conventions	1. The convention on International Trade and Endangered species of Wild Fauna and Flora (CITES), Washington (1973)	The project operations are likely to encounter area with endangered flora and fauna species, though no such species were observed during the study. The project staff, villagers and the Contractors staff will in no event involve themselves with trade of these species
	2. The convention concerning the Protection of World Cultural and Natural Heritage, Paris, (1972)	
	3. The convention of Wetlands of International Importance especially as water fowl Habitat (The Ramsar Convention) (1971) ratified by Tanzania in 1998).	
Climatic change Conventions	1. The United Nations Framework convention on climatic change (1992)	The project will prevent further clearance of vegetation in order to improve and maintain carbon dioxide consumption
	2. Kyoto Protocol (1997)	
Regional conventions	1. The Convention on the conservation of Nature and Natural Resources, 1968 Algiers, (1968)	The project operations are likely to encounter area with endangered flora and fauna species. The project staff, local communities and the contractors staff will in no event involve themselves with trade of these species
	2. The Bamako convention on the Ban of the import into Africa and the control of Trans boundary movement of Hazardous Wastes within Africa, 1990	
	3. Nairobi Convention for the protection, management and development of the Marine and Coastal environment of Eastern African Region, 1985 and the related protocols.	
	4. Lusaka Agreement on cooperative enforcement operations Directed at illegal Trade in Wild Fauna and Flora (1994)	

3.5 The World Bank's Safeguard Policies

The World Bank has keen interest in protection of the environment, particularly for investment projects supported by the Bank; they have to be in line with its safeguards policies.

These policies provide guidelines, aimed at preventing and mitigating undue harm to people and the environment, when implementing development projects. The safeguard policies provide a platform for the participation of stakeholders in project design and implementation and the relevant policies to this project.

The construction of the sewerage system project triggers some of these operational policies of the World Bank as presented in Table 3-2

Table 3-2: Summarized World Bank's Safeguard Policies

Safeguard Policies	Description
Environmental Assessment Policy (OP/BP 4.01)	The objective of this policy is to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. This policy is triggered if a project is likely to have potential (adverse) environmental risks and impacts on its area of influence. OP 4.01 covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources; and trans-boundary and global environment concerns. Depending on the project, and nature of impacts a range of instruments can be used: EIA, environmental audit, hazard or risk assessment and environmental management plan (EMP). When a project is likely to have sectoral or regional impacts, sectoral or regional EIA is required. The Borrower is responsible for carrying out the EIA. Under this project, the proponent Ministry of Water has facilitated the undertaking of Environmental and Social Impact Assessment to assess the social and environmental impacts of the project.
Natural Habitats (OP/BP 4.04)	This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. The Bank therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and most native species. This policy is triggered by any project (including any sub-project under a sector investment or financial intermediary) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project). The policy is slightly triggered as it is going to use some of the natural habitat which might be supporting other ecosystems. Environmental Impact Assessment has identified these natural habitats and mitigation measures are

Safeguard Policies	Description
	presented
Forests (OP/BP 4.36)	The objective of this policy is to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development and protect the vital local and global environmental services and values of forests. Where forest restoration and plantation development are necessary to meet these objectives, the Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank assists borrowers with the establishment of environmentally appropriate, socially beneficial and economically viable forest plantations to help meet growing demands for forest goods and services. This policy is triggered whenever any Bank-financed investment project (i) has the potential to have impacts on the health and quality of forests or the rights and welfare of people and their level of dependence upon or interaction with forests; or (ii) aims to bring about changes in the management, protection or utilization of natural forests or plantations. The policy is slightly triggered as some of the areas where forests would have developed are the ones that will be used for construction of the proposed sewerage system.
Involuntary Resettlement (OP/BP 4.12)	The policy acknowledges that development projects that displace people generally give rise to economic, social and environmental problems. Its objective therefore, is to avoid or minimize involuntary resettlement where feasible, by exploring all viable alternative project designs. OP 4.12 is intended to assist displaced persons in maintaining or improving their living standards. It encourages community participation in planning and implementing resettlement; and in providing assistance to affected people, regardless of the legality of title to the land they possess, which has to be acquired for project activities. The Bank guidelines therefore, prescribe measures to minimize the negative impacts to ensure that the displaced community benefits from the project and to ensure that the affected persons are: o compensated for their losses at full replacement costs prior to the actual move; o assisted with the move and supported during the transition period in the resettlement site; o assisted in their effort to improve (or at least restore) their former living standards, income earning capacity and production levels;

Safeguard Policies	Description
	○ Integrated socially and economically in the host communities, so that adverse impacts in the host communities are minimized. This is best achieved through appropriate planning and consultation, involving affected people. In addition; land, housing, infrastructure and other compensation should be provided to the adversely affected population, indigenous groups, ethnic minorities, and pastoral people who may have customary rights to the land and other resources taken for the project. The absence of legal title to land by such groups should not be a bar to compensation. The policy is triggered not only if physical relocation occurs, but also by any loss of land resulting in relocation or loss of shelter; loss of assets or access to assets; loss of income sources or means of livelihood, whether or not the affected people must move to another location. The existing policies, land laws and regulations regarding land acquisition and compensation in the country should be generally consistent with the World Bank Operational Guidelines Therefore, if necessary at all, compensation could still be handled within the existing regulations, without contradicting the World Bank Policy requirements. Even though this respective policy is triggered but fortunately the sewerage system project was identified by the city having realised the impacts exerted on surrounding environment and later into Utofu river then Indian Ocean. Also the effected people are the residents of the City who are now suffering with others and they are equally going to benefit from the proposed project.
Indigenous Peoples (OP/BP 4.10)	The objective of this policy is to (i) ensure that the development process fosters full respect for the dignity, human rights, and cultural uniqueness of indigenous peoples; (ii) ensure that adverse effects during the development process are avoided, or if not feasible, ensure that these are minimized, mitigated or compensated; and (iii) ensure that indigenous peoples receive culturally appropriate and gender and inter-gene rationally inclusive social and economic benefits. The policy is not triggered as it is not expected that indigenous peoples will be affected by the proposed sewerage system project and above all the project was initiated by the respective Authority.
Pest Management (OP 4.09)	The objective of this policy is to (i) promote the use of biological or environmental control and reduce reliance on synthetic chemical pesticides; and (ii) strengthen the capacity of the country's regulatory framework and institutions to promote and support safe, effective and environmentally sound pest management. More specifically, the policy aims to (a) Ascertain that pest management activities in Bank-financed operations are based on integrated approaches and seek to reduce reliance on synthetic chemical pesticides (Integrated Pest

Safeguard Policies	Description
	Management (IPM) in agricultural projects and Integrated Vector Management (IVM) in public health projects. (b) Ensure that health and environmental hazards associated with pest management, especially the use of pesticides are minimized and can be properly managed by the user. (c) As necessary, support policy reform and institutional capacity development to (i) enhance implementation of IPM-based pest management and (ii) regulate and monitor the distribution and use of pesticides. The policy is triggered if: (i) procurement of pesticides or pesticide application equipment is envisaged (either directly through the project, or indirectly through on-lending, co-financing, or government counterpart funding); (ii) the project may affect pest management in a way that harm could be done, even though the project is not envisaged to procure pesticides. This includes projects that may (i) lead to substantially increased pesticide use and subsequent increase in health and environmental risk; (ii) maintain or expand present pest management practices that are unsustainable, not based on an IPM approach, and/or pose significant health or environmental risks. Under the construction of the sewerage system project, the policy will not be triggered as the project will not involve any pesticides.
Physical Cultural Resources (OP/BP 4.11)	The objective of this policy is to assist countries to avoid or mitigate adverse impacts of development projects on physical cultural resources. For purposes of this policy, “physical cultural resources” are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. The cultural interest may be at the local, provincial or national level, or within the international community. This policy applies to all projects requiring a Category A or B Environmental Assessment under OP 4.01, project located in, or in the vicinity of, recognized cultural heritage sites, and projects designed to support the management or conservation of physical cultural resources. The policy may be triggered during excavation of fill materials at both existing and new borrow sites however it is not expected that physical cultural resources will be affected

3.5.1 Other relevant International Conventions Ratified by Tanzania

- International Labour Organization (ILO) Convention: C138 Minimum Age Convention, 1973 (Ratified by Tanzania (United Republic of) on 16:12:1998) which prohibits Child labour. VGT shall

ensure no child is employed in its activities.

- International Labour Organization (ILO) Convention: C148 Working Environment (Air Pollution, Noise and Vibration) Convention, 1977 (Ratified by Tanzania (United Republic of) on 30:05:1983) which protects Workers against Occupational Hazards in the Working Environment Due to Air Pollution, Noise and Vibration. VGT have a responsibility to provide a safe working place.

- International Labour Organization (ILO) Convention: C182 Worst Forms of Child Labour Convention, 1999 (Ratified by Tanzania (United Republic of) on 12:09:2001). VGT shall ensure no child is employed in its activities.

3.6 Administrative Framework

The Tanzania EIA practice allocates different functions and responsibilities to parties involved in the EIA process for any proposed development to which EIA is obligatory. Table provides a list of institutions and organisations and activities that have a bearing on this project.

In the United Republic of Tanzania, ministries are responsible for environmental monitoring of projects under their jurisdiction. However, the Vice President's Office (VPO) has overall responsibility for environmental policy formulation – including coordination and monitoring of NEMC activities.

Table 3-3: Relevant Key Institutions of the Construction of WSP Project

Level	Institution	Role and Responsibility
National Level	Ministry of Water	• Issue policy guidance and provision of legal frameworks • Issue licenses, provisions of certificates of compliance • Enforce laws and regulations • Set operation standards for sector projects • Project monitoring
	Vice President's Office (Division of Environment)	• Coordinate various environment management activities in country • Advise the Government on legislative and other measures for the management of the environment • Advise Government on international environmental agreements • Monitor and assess activities, being carried out by relevant agencies in order to ensure that the environment is not degraded • Coordinate implementation of the National Environmental Policy.

Level	Institution	Role and Responsibility
	National Environnent Management Council (NEMC)	• General supervision and coordinating over all matters related to environmental Management. • Conduct environmental audit and environmental monitoring • Conduct surveys to assist proper management and conservation • Review/recommend for approval of environment impact statements • Enforce/ensure compliance of national environmental quality standards • Initiate/develop procedures/safeguards for prevention of accidents causing environmental degradation and evolve remedial measures if accidents occur • Provide advice/technical support where possible to all stakeholders
	EWURA	• Licensing and tariff review, • Monitoring performance and standards with regards to quality, safety, health and environment • Project monitoring
	OSHA	• Registration and compliance on safety
Regional Level	Regional Secretariat	• Responsible for coordination of all advise on environmental management in their respective regions and liaison ***Regional Environmental Management Expert*** • Responsible for advising the local authorities on matters relating to implementation and enforcement of the Act. • Link between the Region and Director of Environment as well as Director General.
	NGOs/CBOs	• Regional environmental watchdog. • Education and awareness raising on environmental management • Stakeholders' platform for voice.
	District/Ward Functional Departments – Planning, Water, Health, Community Development, Natural Resources, etc.	• Extension Services • Advice Committees, Departments on environmental matters • Promote environmental awareness • Gather and manage information on environment and utilization of resources • Prepare periodic reports on the state of the environment • Monitor the preparation, review, and approval of Environmental Impact Assessment of local investments • Review By-laws on environmental management and on sector specific activities related to the environment.

Level	Institution	Role and Responsibility
	Environmental Committees	• Coordinating and advising on environmental policies and implementation obstacles. • Promoting environmental awareness. • Information generation, assembly and dissemination from any person. • Initiate inquiries and investigation on any environmental disputes or violation of the Act • Resolve conflict among individual persons, companies, agencies, NGOs, Government Departments. • Inspect any source of pollution in the area. • Initiate proceedings of civil nature against any person, company, and agency for failing or refusing action under the Act.
	Councils (District, Ward and Village)	• To oversee performance of the Environmental Committees (within their jurisdictions).

CHAPTER FOUR

4 BASELINE CONDITION

4.1 Overview

The study area can be affected by different activities from the project, the area for construction of wastewater stabilization ponds cover 15 acres, therefore consultant must evaluate and present baseline data on the relevant environmental characteristics of the study area. Include information on any changes anticipated before the project commences.

Baseline information include physical environment, biological environment and socioeconomic and cultural environment. Parameters to be collected for baseline cover:

- Physical environment
- Biological Environment
- Socio-economic and socio-cultural environment
- Gender based violence, including sexual exploitation and abuse and workplace sexual harassment environment.
- For ESIAs to capture the socio-economic, cultural and risk context for women.

4.2 Physical Environment

4.2.1 Topography

The City has an area of 600 km^2 of which 538 km^2 island and the remaining 62 km^2 is water bodies. The topography of the district extends inland to about 20 kilometres from the coast. It is between 0 to 17 meters above sea level.

However, the landscape is featured by small rolling hills punctuated by valleys with rivers and streams, notably the Zigi, Nzimwi and Utofu in the north and Mgombani/Kalindu and Gombero in the south.

According to information obtained during the scoping phase, the proposed location for the project is the flood zone. Thus the design of the WSP will consider to the security, strength and safety of the proposed WSP as well as the well-being of the people and properties around the project area

4.2.2 Climate

The District experiences dry season from January to mid-March. This period is followed by three rainy spells, which are the long rains, normally experienced from March to May, resulting to an average of 1000 mm to 1400 mm of rainfall.

The light rains normally experienced from June to August resulting to average of 100 mm of rainfall. The short rains, normally starts in October and ends in December, resulting to an average of 500 mm to 800 mm of rainfall. Due to her location along the coast the City experiences humid tropical climate with temperatures ranging from 24^oC to 33^oC.

4.2.3 Soils

Tanga City has four major types of soils which are closely related to the physiography and can be identified as follows:

i. Well drained, deep to moderately deep, red and yellowish red clays, sandy clays, loams and clays, mainly on Usagaran rock within the mountainous areas;

ii. Well to medium drained, shallow, moderately deep to deep red and brown sandy loams, loamy sands and clays in the upland areas;

iii. Well to moderately well drained, light colored sands and yellowish brown to yellowish red loams and clays in the coastal areas;

iv. Poorly to imperfectly drained, grey to black clays and sands (partly saline) in the alluvial plains as well as minor valleys and depressions.

4.2.4 Geology and terrain

Tanga region is the 15th largest region by size with an area of 26,667 square kilometers, after Songwe Region at 27,656 square kilometers. An area occupying 3% of the country. In comparison Tanga is larger than the African nation of Burundi at 25,680 square kilometres.

The Tanga region shares land borders with four other regions and three regions across the Pemba Channel namely; Pemba North Region, Pemba South Region and Zanzibar North. Tanga north western area is of high elevation, home to the Usambara Mountains with Tanga region's highest point being Chambolo peak at 2,289 meters above sea level.

The largest and longest river in Tanga region is the Pangani River, fed by the Umkomazi River, Soni River and the Lwengera River. Tanga Region is located between 4 and 6 degrees south of the Equator. Another major rive, the Mligaji River forms the southern border between Pwani Region and Tanga Region. Tanga Region is also home to largest cave system in East Africa, the Amboni Caves located a few kilometers north of Tanga city.

4.3 Built environment

The project area can be accessed via the B14 *Mombasa road* (trunk road that connects Tanzania through Horohoro and Nairobi, Nairobi) at Utofu are to Kiomoni gravel roads left side immediate after turning to left. The project will be executed within the urban settlement of Tanga City which will be established within Amboni Mtaa of Kiomoni Ward.

The project is the part of Water Supply and Sanitation Improvement Projects to implementation within Tanga City Council. The Council has several primary and secondary schools, health care facilities and places of worship. There are also places of worship and primary schools within the Kiomoni ward. Importantly there are telecommunication masts in the area as well as broadcasting towers.

Figure 4-1: Roads with the Tanga City (Source: Tansheq, 2022)

Figure 4-2: One of the several primary schools within Tanga City (Source: Tansheq, 2022)

The building structures within the City appear to have a limited lifespan which could most likely be attributed to the nature of the building material used for construction. Houses in various stages of being built and broken down are dispersed throughout the site.

The site also features temporary shelters used during the cropping season. Figure 4-3 illustrates the building structures and material used for construction that may typically be found within the Tanga City.

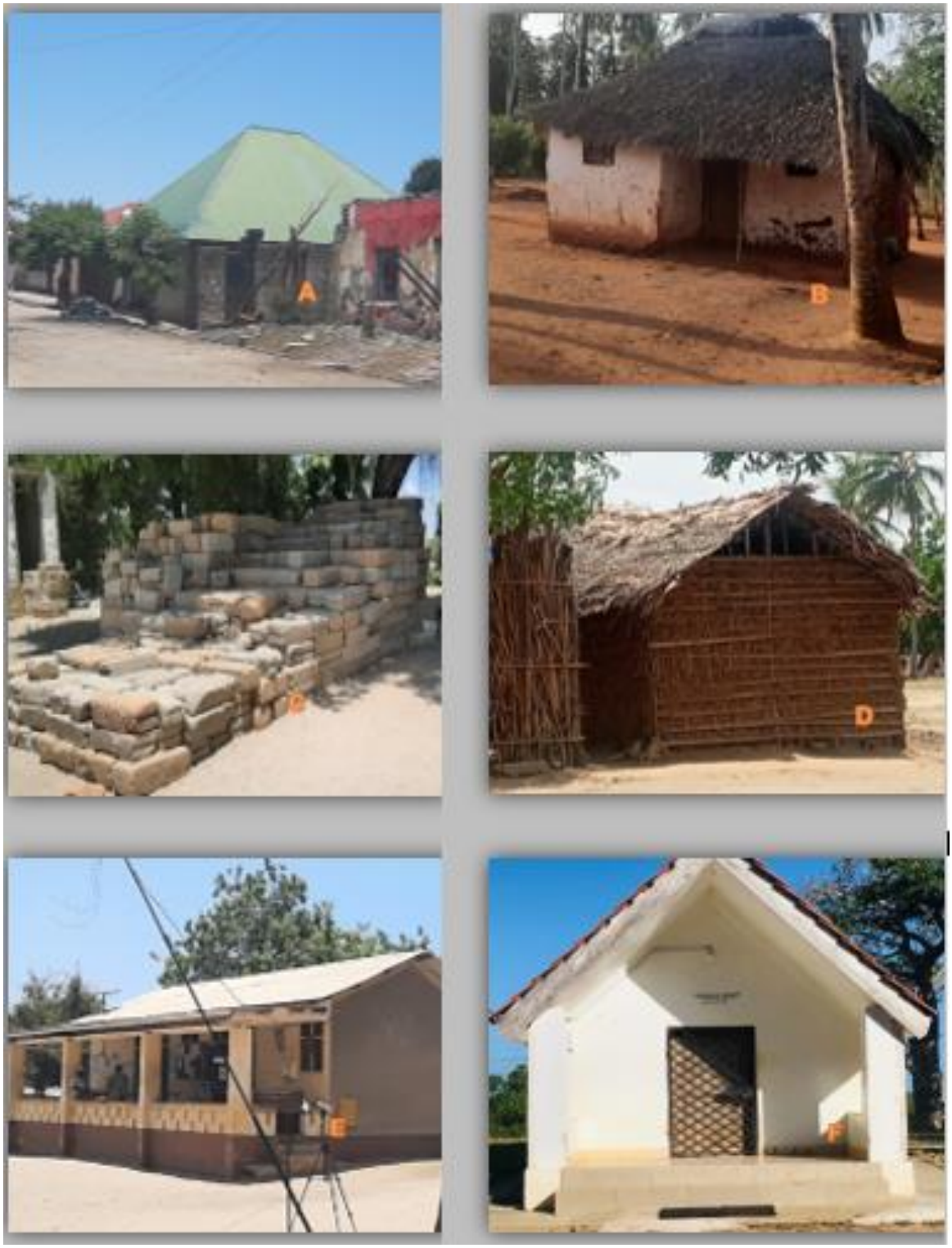


Figure 4-3: The typical building structures and materials used: A – house with iron sheet; B – house roofed with grasses C – Cement/Sand Blocks; D- house with mud/clay wall with grass roof; E and F – houses roofed with iron sheet and tiles and wall plastering (Source: Tansheq, 2022)

Electricity infrastructure in the area which include lines of 132kV, which are looped out at strategic points as 33kV lines towards residential areas. Electricity supply is not always sufficient and there is a large dependence on generators in the area. Electricity supply to rural areas is also limited or in many places absent, the AOI being no exception.

Figure 4-4: High and Low voltage transmission lines within the Tanga City (Source: Tansheq, 2022)

Road infrastructure on the site is tarmac road and some road gravel roads often subject to severe erosion. The roads cross the watercourses on the site with bridges (often in dilapidated state built to accommodate vehicles in the rainy season. The heavy vehicles that are known to access the project area are transporting people and goods as well as trucks used to transport within and outside Tanzania especially Kenya, in Mombasa.

Figure 4-5: Road infrastructure within the City (Source: Tansheq, 2022)

Water and waste infrastructure in the AOI is very limited as can be expected due to the rural setting. The villages in the AOI receive water from up string that supplies within the village by a pipeline coming natural string upstream.

There is no formal sewage works or system in place with toilet facilities being in the form of hand dug pits often covered by small built structures. There is also no formal waste collection system in place but the general area suggests the waste stream is small and materials are often reused. Unusable wastes are most likely burnt. It is noteworthy that at the time of undertaking this study no mine was being established in the vicinity.

Figure 4-6: Water infrastructure on site which is distributed water taps (Source: Tansheq, 2022)

Figure 4-7: one of the Toilets observed within the City (Source: Tansheq, 2022)

4.4 Biological Environment

This shall cover flora, fauna, rare, threatened or endangered species, ecologically important or sensitive habitats, including available forest reserves, significant natural sites; species of commercial importance; and species with potential to become nuisances, vectors, or dangerous (of project site and potential area of influence of the existing project).

The baseline information will include among others, relevant environmental baseline for the river/water bodies which will receive the effluent from the Waste Water Treatment Plant; Baseline for biological environment shall be attained via:

- Collection of data on flora and fauna including rare and endangered species within the study area
- Assessment of species diversity, density, abundance etc., in the study region.

4.4.1 Vegetation and wildlife resources

4.4.1.1 Vegetation

The City vegetation consists of natural forests (1500 Hectors), mangrove (1600 Hectors), bush land, and trees planted by human being. Tanga City coastline is conserved with mangrove forests.

The management committees were formed in 15 villages and a total of 400 Hectors has been planted. Tanga City Natural forests are found in reserve areas such as Mleni, Kolekole and unreserved area of Pongwe and Pande.

The area is characterized by coconut trees. However, there are horticulture activities undertaken in the boundary of the proposed pond site.

The project is located in a built up area and is covered by roads, residential houses, commercial houses and industries within native grasses. The main vegetation cover is natural vegetative canopy of medium density with occasional ridges and hills hidden beyond the canopy.

Most of the vegetation in the project site has not been affected by anthropogenic activities because for a long period access to the area by local people has been restricted. Vegetation covers within the proposed project site are Brachystegia bussei woodland with Miombo woodland, moderate grass cover in the slopes, Piptostachya inamoena

There are also scattered shrubs and trees like Mangos and Coconut trees being the predominant canopy trees. Small mammals rarely encountered are: Hare, Squirrel and Lizards. No rare or endangered species are encountered in the area. During construction, the proposed area will be cleared to excavate the foundation the ponds as this will affect the vegetation of the area on one way or another.

Figure 4-8: Vegetation within the proposed site at Utofu area

4.4.1.2 Wildlife resources

Tanga is home to rich biodiversity of plants and animals. Tanga region is home to two major national parks, Mkomazi National Park, shared with southern Kilimanjaro region. The park is home to the endangered Black rhinoceros and the African wild dog. The second national park in Tanga Region is the Saadani National Park. The only national park in the country that shares an ocean coastline.

In the north western portion of the region is the Usambara mountains with the Amani Nature Reserve, home to the endemic fauna such as Amani Forest Tree Frog and Usambara torrent frog. In the forest, rare bird species like the Usambara eagle-owl, Usambara weaver, Usambara thrush and the Usambara double-collared sunbird are found. In addition, rare reptiles such as Usambara dwarf gecko, and endangered mammals such as the Usambara shrew are also found in the mountains.

Just off the coast of Tanga is home to the Coelacanth. Tanga has one of the largest protected marine parks, Tanga Coelacanth Marine Park. The endangered Dugong is found off the coast in Mkinga District near Kirui Island.

4.4.1.3 Natural Resources

The City Council Management of natural resources and ensure its sustainable utilization for the benefit of present and future generation. The City also plays greater role in generating income of the City Council through collection of natural resources fees. The City conduct awareness creation and sea patrol in order to ensure sustainable use of sea natural resources.

There are two types of forest found in Tanga City. Natural forests which found in Kolekole of 1500 ha and manmade plantation forest at Mkembe and Mleni of 285 ha.

The forest reserve is under the jurisdiction of the Ministry of Natural Resources and Tourism while the plantation is under the custody of the City and village governments. Nurseries raised Cassiaan khayaynyasika (a native hardwood) seedlings for timber and fuel woodlots.

4.5 Water Supply and Sanitation

4.5.1 Water Supply

Tanga UWASA serves about 96% of the urban population with clean and safe water for average of 24 hours a day spread over 27 wards. Tanga City has abundant water sources from the Zigi River. The maximum water treatment plant capacity is 42,000m^3 per day while currently Tanga UWASA supply 31,000m^3 per day. Tanga urban Water Authority provides services in urban areas and in some village areas where water network is available.

Tanga City Council has the responsibility of providing water services in the rural areas which are far from the plumbing water network. Some villages are getting water from wells (deep and shallow) and natural springs

Detailed information of Baseline data will be provided during the Environmental and Social Impact Assessment Study.

4.5.2 Sanitation

The population served by the sewerage system is only 17% of the urban population, out of which only 7.4% of the central area spread to 9 wards have sewerage collection facility (pipe network of 36.81km as of 2021). Balance 19 wards are served with Cesspit Emptier Trucks and onsite sanitation facilities in the form of septic tank.

Only 36.81 km as of December 2021 of the sewerage from Central, Nguvumali, Chumbageni, Ngamiani Kaskazini and Ngamiani Kati Wards are being transferred to the sea by Gravity while Ngamiani Kusini, Usagara and Makorora Wards are being transferred to the sea (Jet Sea Outfall) by Boosting via Makorora Pumping Station (capacity 229 cum / hr with a head of 12m) to Sea Outfall.

Nearly 40,000m^3/month of sewerage is collected and disposed into the sea, without any kind of treatment which is causing pollution to sea ecosystem and creating a health hazard in the surrounding areas.

The discharge point is at 600m inside the sea at Jet Sea Outfall from the bank where 150m of concrete pipe was replaced with WEHOLITE (DN600mm) in the year 2020. As per samples of sewage analysed in December 2021 the average BOD5 at the sea outfall was 360 mg/l and it is estimated to be increase due to point pollutions from garages and other growing Small-Scale Industries

There is a small sewerage network approximately of 4 Km with a Stabilization Pond facility (Saruji SP) at Maweni Ward. This SP has three units (Anaerobic Pond, Facultative Pond and Maturation Pond) which is under-utilized with 174 houses. However, there were plans to accommodate more sewer by extending the more networks from the nearby areas (Pongwe and Kange).

4.6 Air Quality information within the Project Site

4.6.1 Ambient air quality data

The consulting team also conducted the actual monitoring of air quality at the project site using an Aeroqual Outdoor Air Quality Test Kit. This is a complete outdoor air monitoring kit for the measurement of criteria air pollutants and VOCs.

Features Aeroqual's proven Series 500 portable monitor with interchangeable sensor heads, measuring particulate matter ($PM_{2.5}$, PM_{10}), four gas pollutant gas sensors (NO_2, O_3, CO, VOCs), and a combined temperature and relative humidity sensor.

Suitable for use during wide area air quality surveys, personal exposure monitoring, and as part of a short-term fixed monitoring network. The equipment and collected data are shown in Figure 4-9 and Table 4-1 respectively.

Figure 4-9: Ambient Air Quality Monitoring equipment used at the project (Tansheq: March, 2022)

Table 4-1: ambient Air Quality data measured from different station in the vicinity of the project site

LOCATION	POSITION 37 L UTM-WGS 84		CO ppm	NO_2 ppm	O3 ppm	VOC ppm	SO_2 ppm	CH4 ppm	$PM_{2.5}$ ppm	PM_{10} ppm
	X	Y								
Project Site	506888	9439495	0.01	0.000	0.00	0.20	0.00	8	0.002	0.005
House 01	506746	9439701	0.00	0.007	0	0.00	0	7	0.013	0.010
House 02	506644	9439633	0.00	0.008	0	0.06	0	9	6.0	11.6
House 03	506548	9439648	0.00	0.011	0	0.00	0	11	0.001	0.002
Along the road	507071	9439662	0.20	0.011	0	0.21	0	16	0.016	0.025
Tanzania Standard [TZS 845:2007]			**20**	**0.1**	**0.0**	**10**	**0.05**	**N.M**	**0.05-0.08**	**0.05-0.116**

All data monitored were below standards with low detectable level so are of no significant. However, the data measured will be used for monitoring project intrusion during project implementation so as to trace how the project has affected the air quality

Figure 4-10: Monitoring station in the vicinity of the project site (Source: Tansheq site work, March 2022)

4.6.2 Noise and Vibration

The noise and vibration survey was conducted in terms of the provisions of International Finance Corporate Guidelines of 2007 (The measurement and rating of environmental noise with respect to annoyance and to speech communication) as well as Environmental Management (Noise and Vibration Standards) Regulations of 2015.

The following instruments were used in the noise and vibration survey as they are displayed in Figure 4-11:

- Sound Level meter – Lutron SL 4023SD;
- Free field microphone – Electric Condenser Microphone; and
- Sound Calibrator (94/114dB) – SC – 942.
- Vibration meter – VB8206SD

On taking measurements, the meter was set to the "A" weighed measurement scale, which enables the meter to respond in the same manner as the human ear. The "A" scale is applicable for workplace compliance testing, environmental measurement, and workplace design and law enforcement.

For, noise measurement the meter was held approximately 1.5 m above the ground surface and at least 0.5 m away from hard reflecting surfaces such as walls. A set of four readings were taken per point for averaging. The equipment used and data collected are shown in Figure 4-11 and Table **4-2**

Figure 4-11: Noise and vibration level meters used to collected data on the project site

Table 4-2: Noise and Vibration data

Location	Position WGS 84; 37UTM		Noise Level [dBA]	Vibration [mm/s]
	X	Y		
Project Site	506888	9439495	36	1.9
House 01	506746	9439701	45	1.1

Location	Position WGS 84; 37UTM		Noise Level [dBA]	Vibration [mm/s]
	X	Y		
House 02	506644	9439633	43	1.2
House 03	506548	9439648	37	1.5
Along the road	507071	9439662	57	2.1
Tanzania Noise and Vibration Control Regulations, 2015			**60-70**	**5**

4.7 Socio economic Data of Tanga City

4.7.1 Administration Units

Administratively the district is the regional headquarters for Tanga region, made up of 4 divisions, which are subdivided into 27 administrative wards. Out of these 14 are urban; subdivided into 146 “Mitaa”.

The remaining 10 wards are peri-urban and rural areas, made up of 23 villages, which are further sub-divided into 129 hamlets locally referred to as “vitongoji”

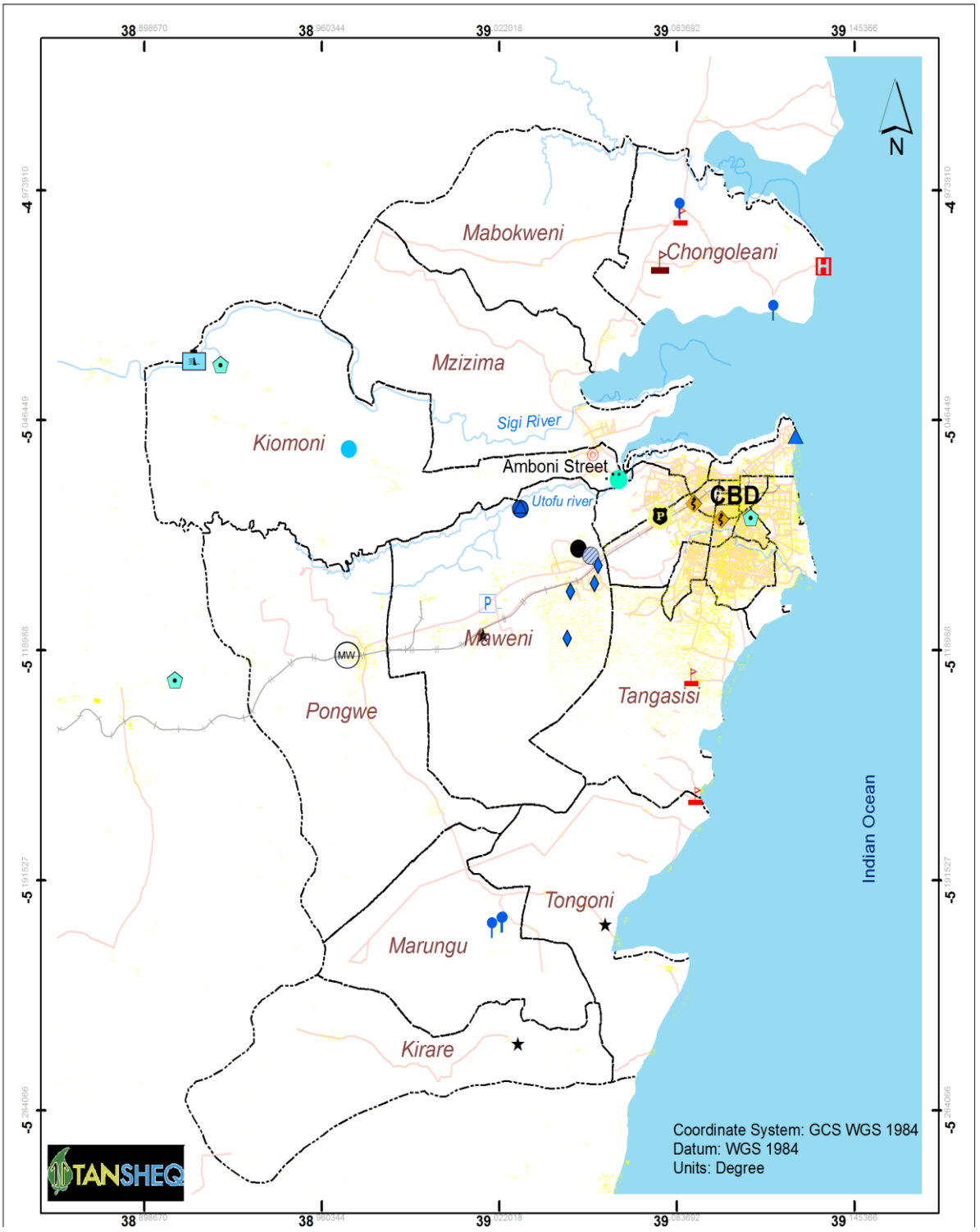


Figure 4-12: Tanga Administrative Units

Table 4-3: Distribution of Administrative Units in Tanga City

Divisions	Urban Wards	Rural Wards	Peri- Urban Wards	Total
Chumbageni	2	3	1	**6**
Ngamiani Kusini	7	-	-	**7**
Ngamiani Kaskazini	6	-	-	**6**

Divisions	Urban Wards	Rural Wards	Peri- Urban Wards	Total
Pongwe	2	5	1	**8**
Total	**17**	**8**	**2**	**27**

Source: 2012 Population and Housing Census General Report

4.7.2 Population

4.7.2.1 Population Density

According to the Population and Housing Census of 2012, The population of the Tanga City is provided as per Wards which were present as indicated in Table 4-4

Table 4-4: Population and Housing Census of 2012

S/N	Wards	Population (2012)	Land Area (Sq.km.)	Population Density (Persons per Sq.km)
1.	Central	5,739	3.884 km²	1,478/km²
2.	Chongoleani	4,737	37.03 km²	127.9/km²
3.	Chumbageni	14,225	2.506 km²	5,676/km²
4.	Duga	18,704	2.407 km²	7,771/km²
5.	Kiomoni	6,587	83.56 km²	78.83/km²
6.	Kirare	4,756	55.67 km²	85.43/km²
7.	Mabawa	35,125	5.176 km²	6,787/km²
8.	Mabokweni	5,433	47.65 km²	114.0/km²
9.	Majengo	7,482	0.9014 km²	8,300/km²
10.	Makorora	16,664	1.132 km²	14,720/km²
11.	Marungu	3,025	42.18 km²	71.71/km²
12.	Maweni	14,091	72.70 km²	193.8/km²
13.	Msambweni	9,610	0.7603 km²	12,640/km²
14.	Mwanzange	7,521	7.670 km²	980.6/km²
15.	Mzingani	29,041	8.177 km²	3,551/km²
16.	Mzizima	11,570	56.27 km²	205.6/km²
17.	Ngamiani Kaskazini	3,910	0.3762 km²	10,393/km²
18.	Ngamiani Kati	4,755	0.3350 km²	14,194/km²
19.	Ngamiani Kusini	7,638	0.4384 km²	17,422/km²
20.	Nguvumali	15,133	5.793 km²	2,612/km²
21.	Pongwe	13,513	77.75 km²	173.8/km²
22.	Tangasisi	19,149	38.91 km	492.1/km
23.	Tongoni	4,594	44.15 km²	104.1/km²
24.	Usagara	10,330	1.026 km²	10,073/km²
25.	Tanga City	273,332	536 km²	77persons/sq.km

4.7.2.2 Population Distribution and Sex Ratio

According to the Population and Housing Census of 2012, Tanga City has a Sex Ratio of males for every 100 females.

The survey team ensured that both genders were involved in interviews and discussions; the idea was to gather information in a more balanced way and have opinions from both males and females. Of all people that were interviewed in the study Ward 36.1% were males and 63.9% were females.

Table 4-5: Gender distribution and Sex ration in Tanga City

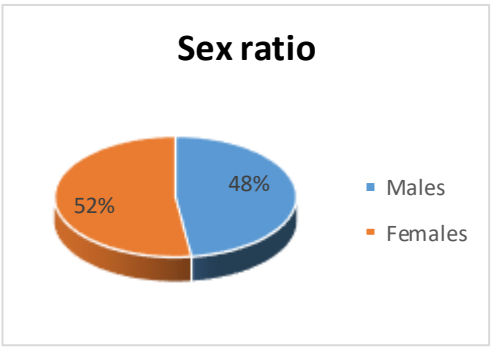
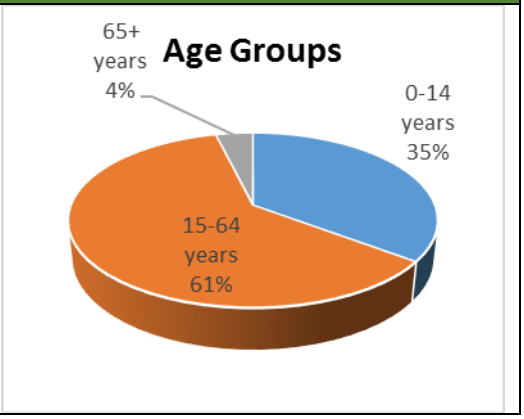
Gender		
Males	130,920	
Females	142,412	

Table 4-6: Age distribution within Tanga City (Census 2012)

Age Groups		
0-14 years	96,302	
15-64 years	166,561	
65+ years	10,469	

4.7.2.3 Households And Household Size

Tanga City had the average 4.4 number of households. With a population of 273,332 according to the 2012 census.

4.7.3 Economic Activities

Major economic activities in Tanga City which the Labor Force is undertaken include;

4.7.3.1 Manufacturing Industries

Tanga City has almost a whole spectrum of types of industries. They range from small scale to large-scale industries. Most of them are in the small and medium size range. In the past Tanga used to be rated second in terms of industrial development after Dar es Salaam.

In the recent past there has been a decline in the industrial sector in Tanga, which has been paralleled by a general decline in the importance of almost all sectors of the economy in the City.

Most industries in Tanga are located in specially designated industrial areas. Typical industrial areas include Gofu, Kange, Korogwe Road, Duga and SIDO Industrial Estate. An inventory of industries in

Tanga City for the year 2006 showed that there are 22 operational industries including large-scale industries like Tanga Cement Factory, Athi River Lime Factory and AFRITEX.

4.7.3.2 Fisheries and Related Aquatic and Marine Resources

The most important source of fisheries resources in the City is the sea. Freshwater fishing is done in River Zigi, but this is on a small scale and is done mostly by residents who live along the river and is mainly for their home consumption. Major fisheries resources from the sea are fish, sardines and “mwani " (seaweed). The Tanga City coastal plain has a length of more than 210km.

Actors in the fisheries sector include private fishing and processing companies; small-scale fishermen and retailers. Small scale fishermen produce fish which are consumed locally as well as sold to private companies for eventual export. Sea Products, a company based in Tanga City processes an average of 180 tons per year of octopus, prawns, squid and other types of fish for export to Europe.

In general, major sea products in the City vary in the types of fish, prawns, “majongoo”, lobsters, oyster, sardines and octopus. Fisheries statistics for 2002 – 2006 in the table present weight of fish and sardines recorded by the Natural Resources Department.

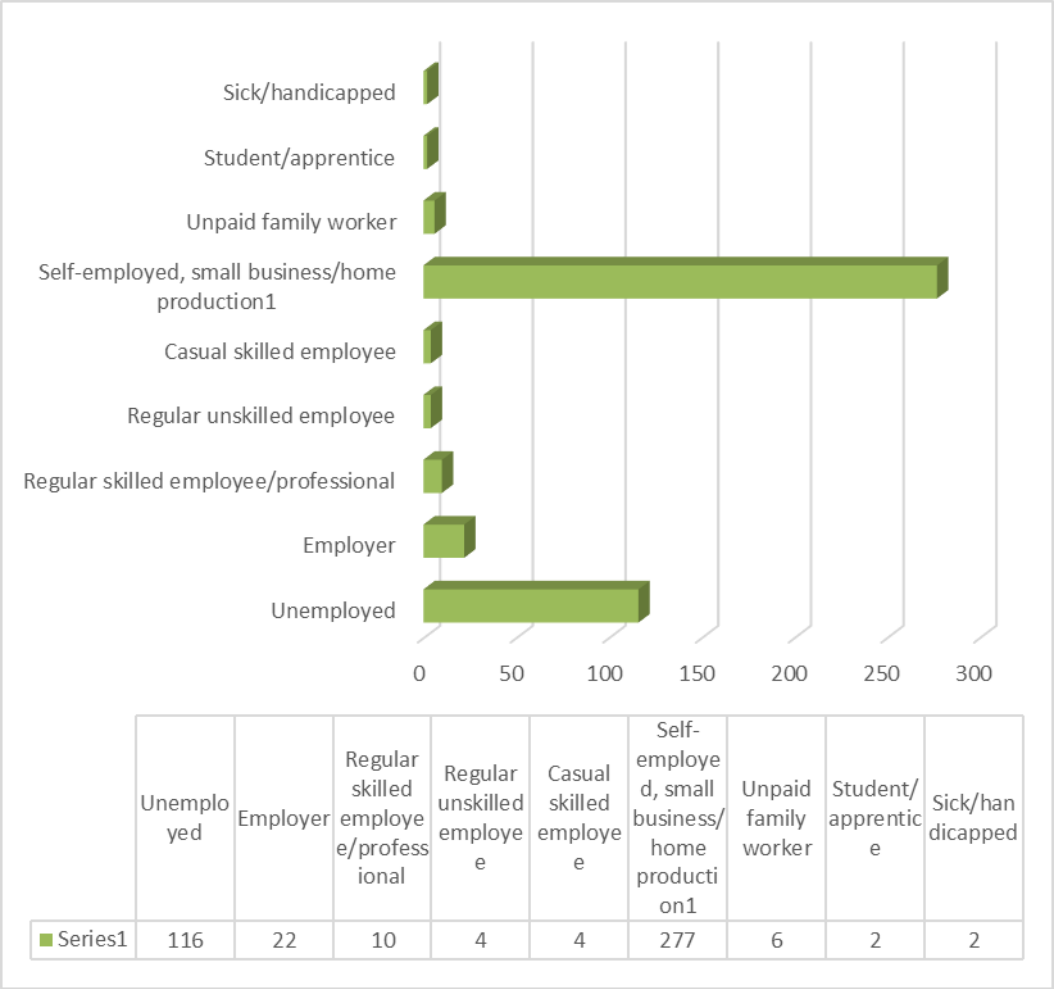
4.7.3.3 Tourism and Recreation

Tanga City is endowed with a number of tourist attractions, whose potential is yet to be fully exploited. These attractions include the Amboni Sulphur Springs in Amboni, Tongoni Ruins in Tongoni Village, Amboni Caves and Tanga Limestone Forests at Kiomoni village, the forests are very rich in birds, mammals, reptiles, amphibians and plants.

There are also small islands in the Indian Ocean, beautiful beaches at Mwarongo and coral gardens (reefs) along the shores of the Indian Ocean. Other features of interest as tourist attractions are historical buildings of Arab, German and British architecture, that are located in the city centre. These include the Greek Orthodox Church building and the old Regional Police Headquarters which used to be the official residence and office of the German governor. Others are the Tanga Library, the old Regional Commissioner’s office and the Cliff Block at Bombo Regional Hospital.

In addition to the above, there are recreational areas provided for the local population. The city’s central parks and gardens offer a potential tourism attraction. Another activity of importance in the tourism sector is the hotel industry. The number of tourist hotels in Tanga City has increased significantly to match with the demand as well.

According to social economic survey conducted by EIA team within the City, It revealed that majority (63%) of the respondents said they do small business, Self-employed/home production as main economic activity, about 26 % unmployed, 5% employer , 6% of the respondents said they Regular skilled employee/professional, Regular unskilled employee, Casual skilled employee, Student/apprentice as shown in Figure 4-13



	Unemployed	Employer	Regular skilled employee/professional	Regular unskilled employee	Casual skilled employee	Self-employed, small business/home production1	Unpaid family worker	Student/apprentice	Sick/handicapped
Series1	116	22	10	4	4	277	6	2	2

Figure 4-13: Respondents' Economic Activities (Source: Tansheq Site work, March 2022)

4.7.4 Household Incomes

Majority (58.9%) of the respondents earn less than Tshs. 50,000/- per month. (24.6%) of the respondents earns an average of Tshs. 50,000 to 150,000/- per month, (12.4%) of the respondents earns an average of Tshs. 150,000 to 300,000/- per month, (3.6%) of the respondents earns an average of Tshs. 300,000 to 700,000/- per month and just 0.5% of the respondents earn above or equal Tshs 1,000,000/- monthly. These results are represented in Figure 4-14

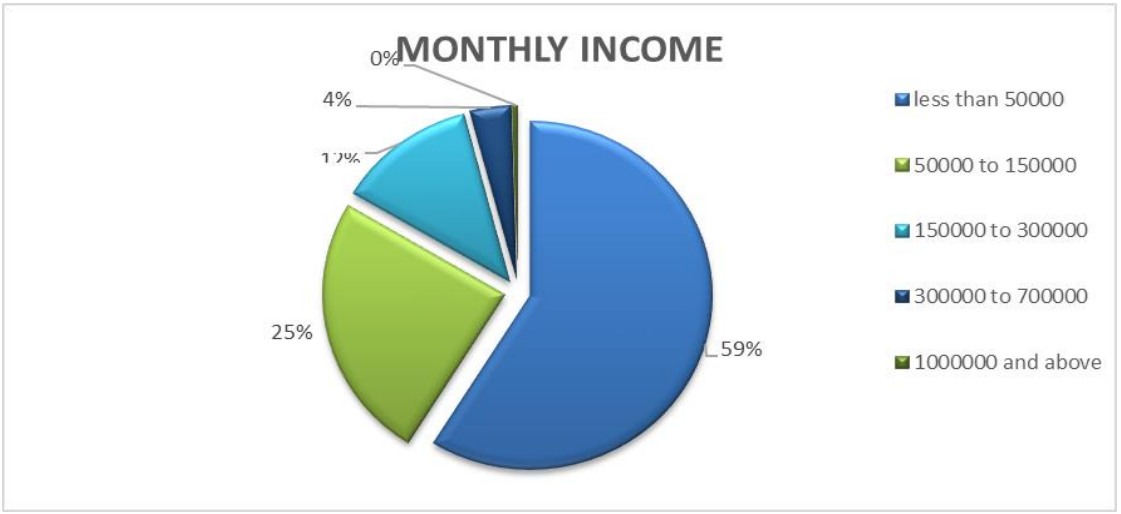


Figure 4-14: Peoples average monthly incomes

4.8 Education and Health Services

4.8.1 Education

Currently there are 43 secondary schools in the council of which 26 are public schools and 17 are for private schools and there 98 primary schools in which 79 public schools and 19 English medium schools.

4.8.1.1 Education Status in the Study area

The results showed that the majority (65%) of the respondents in the study area acquired primary education, just 22.1% of the respondents acquired secondary school level, 6.3% attended college/ university and the remaining 6.5% never attended school. These results are represented in figure

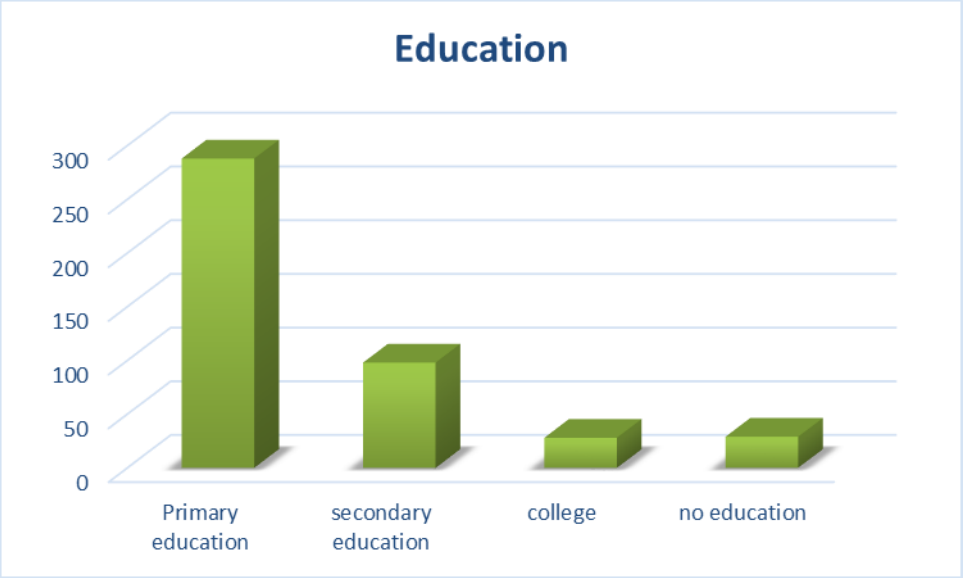


Figure 4-15: Education Status in the Study area

4.8.2 Health Services and Facilities

Health department is among the most crucial area of concern in the provision of social services

Table 4-7: Health facilities

CATEGORY OF SERVICE	OWNER		TOTAL
	Government	Private	
Dispensaries	21	17	44
Health centers	4	6	8
Regional Hospital	1	0	1
clinic	0	4	2
Private laboratory	0	5	2
Pharmacy	0	145	145

4.8.2.1 Health facilities

It is informally estimated that less than 1 % of health facilities have hand washing facilities with soap for patients.

Figure 4-16: Health center in Mpojoni Street with no access to water.

4.8.2.2 Health problems

The District Primary Health Care Report of 2008 for Tanga City indicates some improvement in disease incidence as compared to the 2006 report. However, Malaria still remains the most common public health problem in Tanga and Tanzania as a whole

Table 4-8: Top ten common diseases in OPD (2008)

No	TYPE OF DISEASE	< 5 years	>5years	Total
1	Malaria	79,354	99,491	**178,845**
2	Acute Respiratory Infection	43,787	35,176	**78,963**
3	Diarrhea diseases	12,213	10,502	**22,715**
4	Intestinal worms	7,011	7,066	**14,077**
5	Pneumonia	17,207	10,152	**27,359**
6	Eye infections	4,145	5,028	**9,173**
7	Ear infections	3,176	4,461	**7,637**
8	Non-skin fungal infections	12,256	10,056	**22,312**
9	Asthma	1,382	3,380	**4,762**
10	Cardiovascular disease	24	4,299	4,323

Source:Health Department Tanga City - May 2008

4.8.3 Women and children

Women bare the main responsibility for maintaining hygiene in the home and educating children about good hygiene practices. Women and girls have to collect water for the household for all needs including hygiene purposes.

As you can see in the figure below most women are the ones who fetch water apart from those who get water in their homes where no one specializes in fetching water.

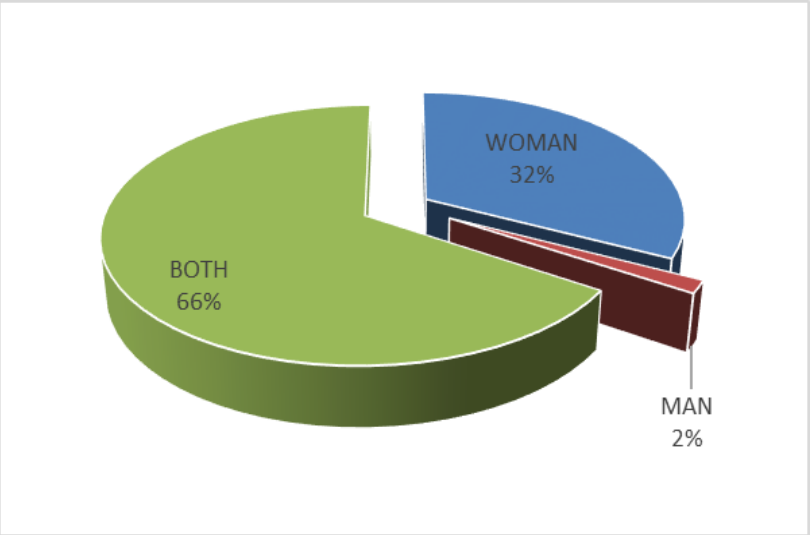


Figure 4-17: Responsibility of water collection for the household (Source: Tansheq site work, March 2022)

4.9 WASTE MANAGEMENT AND CONTROL

To ensure a clean and healthy environment, waste should be managed properly. Proper waste management enhances improved sanitary conditions that are associated with a reduction of disease incidences. The existing waste management practices in the neighbourhood of the proposed project site and within the Tanga City in general include:

4.9.1 Solid Waste Management

In addition, solid wastes should be sorted out (depending on their nature e.g. biodegradable from non-biodegradable, reusable from recyclable, metallic from plastic, clinical from non-clinical and toxic from non-toxic) prior to disposal. NEMC, in line with the Environmental Management (Solid Waste Management) Regulations, 2009 requires all solid waste (unless the generator opts to recycle) to be dumped at approved landfill sites.

The neighbourhood of the proposed site relies on private garbage collectors to dispose of non-hazardous solid waste. Currently, the community uses open pit to disposal waste and open burning is being practiced in the area.

Tanga city generates solid waste approximately 185.3 tons/day; a collection capacity is estimated at 166.8 tonnes/day, which is about 90%, and a recycling capacity around 14.09 tons/day. Tanga city has 28 collection points which are distributed through 11 urban wards which are operated by both the city council and the community based organizations (Tanga City council Env. and Waste Mngmt Report).

Solid waste is generated in different categories from various sources as follows:

- Household waste
- Commercial waste
- Building materials waste
- Worn out motor vehicles
- Industrial waste

Two systems of collections are exhibited in Tanga city. These are the primary door to door systems and the secondary communal collection point systems. The door to door collection is practiced by community groups, especially in the rural wards, while the city vehicle monitors the urban planned wards.

The composition of the waste is largely composed of organic contents which accounts for 66.9% and the rest being the inorganic contents. This presents the possibility of both composting and recycling activities in a measure to reduce the waste that need disposal.

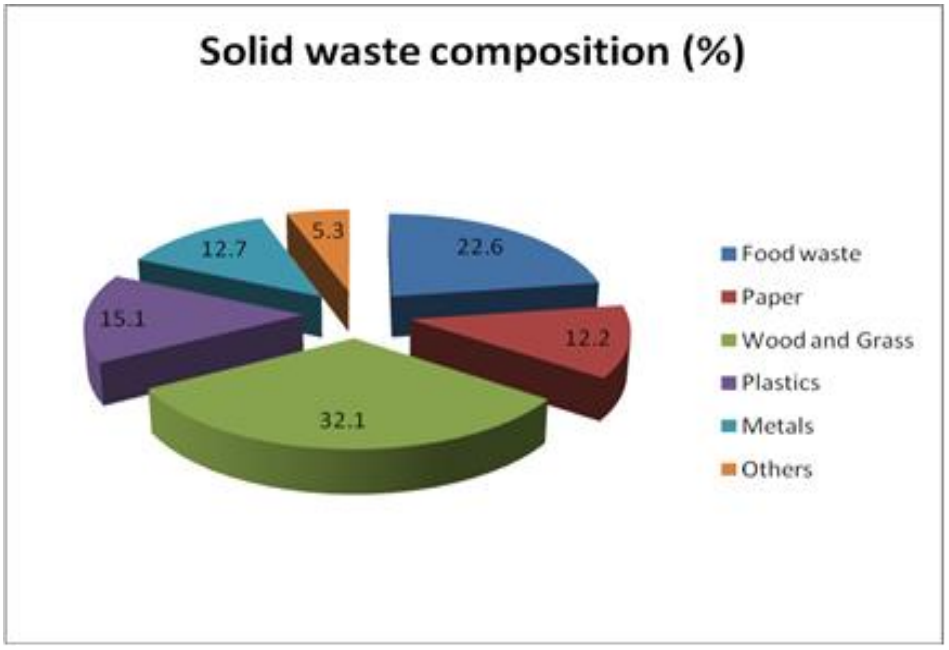


Figure 4-18: Tanga city Solid waste composition (Source: Tansheq site work, March 2022)

4.9.2 Sewerage Services and Waste Management in Tanga City

Tanga UWASA which is the sewerage service provider in the area requires all sewage discharges to be connected to the existing sewerage network. Wastewater and trade effluent are a potential source of heavy metals and other inorganic and organic wastes. The presence of these wastes in an aquatic ecosystem adversely affects it's biological, physical and chemical characteristics and thus the capacity to support aquatic life.

For this reason, such wastes should be treated as required prior to release into the sewage system. In cases where it is not feasible to connect the discharges to the existing sewerage system, the same should be released into a septic tank and an emptying program established.

Currently, Tanga UWASA discharges directly the effluent into the existing sewer line to the Ocean through the screening chamber at Raskazone. The proposed Waste Stabilization Ponds will collect all Sewage from Central Business Development (CBD) and other areas will be added for treatment and it will be discharged directed to ocean through Utofu river. However, Tanga UWASA will be conducting regular monitoring of the quality of effluent.

Hygienic and environmentally safe sanitation are essential to human health and wellbeing. Tanga City's waste management system comprises of four sub-systems. They are a sewer system for disposing wastewater and effluents, an on-site collection and disposal of wastewater and effluents from toilets and kitchens, a solid waste collection and disposal system, and a storm water drainage system. The Central Sewerage system was constructed in the 1930's. The system was rehabilitated in 1992, including the installation of a screening chamber and repairing some manholes.

Only 36.81 km as of December 2021 of the sewerage from Central, Nguvumali, Chumbageni, Ngamiani Kaskazini and Ngamiani Kati Wards are being transferred to the sea by Gravity while Ngamiani Kusini, Usagara and Makorora Wards are being transferred to the sea (Jet Sea Outfall) by Boosting via Makorora Pumping Station (capacity 229 cum / hr with a head of 12 m) to Sea Outfall.

Nearly 40,000m3/month of sewerage is collected and disposed into the sea, without any kind of treatment which is causing pollution to sea ecosystem and creating a health hazard in the surrounding areas. The discharge point is at 600m inside the sea at Jet Sea Outfall from the bank where 150m of concrete pipe was replaced with WEHOLITE (DN600mm) in the year 2020.

As per samples of sewage analyzed in December 2021 the average BOD5 at the sea outfall was 360 mg/l and it is estimated to be increase due to point pollutions from garages and other growing Small-Scale Industries

4.9.3 Sanıtatıon System practices within the City

The majority of rural and urban households in Tanga City used pit latrines as their on-site sanitation system and other offsite as there connected to the sewerline as indicated in Table 4-9

Concrete walled septic tanks and soak-away pits form the main system of collecting wastewater and other effluents for people not connected to the sewage system. The septic tanks can be emptied using a lorry service provided by Tanga City Council for a fee.

The effluents in the septic tank are sucked into a tank mounted on a lorry and transported for disposal usually into the sewer system. Effluents from the soak-away pits leak into the ground and pollute the ground water table, creating serious health and environmental hazards.

Table 4-9: Houses in the Project Area and type of Toilet used

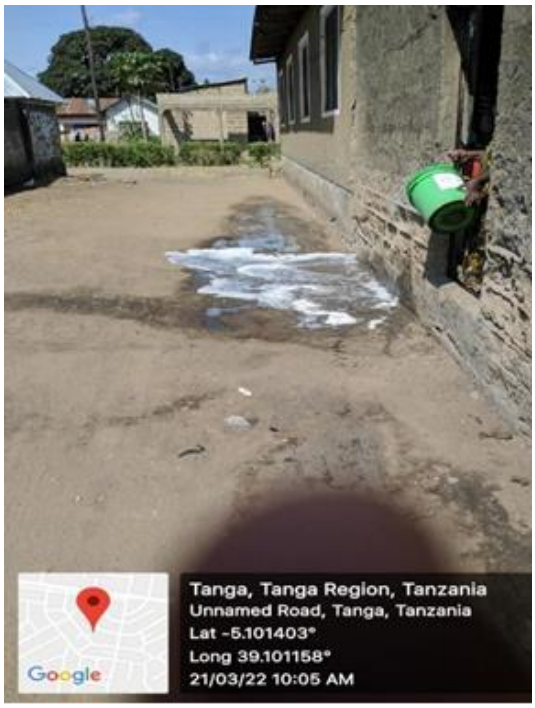
Ward	TYPE TOILET															
	Flush to piped sewer system		Flush to septic tank		Flush/pour flush to pit		Flush/pour flush to elsewhere		Compost toilet		Pit latrine without slab/open pit		No Toilet		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
DUGA	1	0.2	38	8.6	12	2.7	0	0.0	0	0.0	3	0.7	2	0.5	56	12.6
CHONGOLEANI	0	0.0	2	0.5	6	1.4	1	0.2	0	0.0	12	2.7	0	0.0	21	4.7
CENTRAL	9	2.0	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	12	2.7
MABOKWENI	1	0.2	16	3.6	4	0.9	0	0.0	0	0.0	14	3.2	3	0.7	38	8.6
KIOMONI	2	0.5	5	1.1	0	0.0	0	0.0	0	0.0	2	0.5	0	0.0	9	2.0
MARUNGU	0	0.0	11	2.5	0	0.0	1	0.2	0	0.0	7	1.6	1	0.2	20	4.5
MAGAONI	0	0.0	5	1.1	0	0.0	0	0.0	0	0.0	6	1.4	0	0.0	11	2.5
CHUMBAGENI	0	0.0	16	3.6	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	17	3.8
MAKORORA	0	0.0	4	0.9	10	2.3	0	0.0	0	0.0	7	1.6	0	0.0	21	4.7
MSAMBWENI	1	0.2	2	0.5	2	0.5	0	0.0	0	0.0	12	2.7	0	0.0	17	3.8
MABAWA	0	0.0	20	4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	20	4.5
NGAMIANI KASKAZINI	0	0.0	17	3.8	3	0.7	0	0.0	0	0.0	0	0.0	0	0.0	20	4.5
MASIWANI	0	0.0	10	2.3	8	1.8	0	0.0	0	0.0	0	0.0	0	0.0	18	4.1
MWANZANGE	0	0.0	10	2.3	10	2.3	0	0.0	0	0.0	1	0.2	0	0.0	21	4.7
MZIZIMA	0	0.0	7	1.6	3	0.7	0	0.0	0	0.0	8	1.8	0	0.0	18	4.1
NGUVUMALI	0	0.0	8	1.8	5	1.1	0	0.0	3	0.7	1	0.2	0	0.0	17	3.8
NGAMIANI KATI	20	4.5	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	22	5.0
PONGWE	0	0.0	8	1.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	1.8
MNYANJANI	0	0.0	5	1.1	7	1.6	0	0.0	0	0.0	0	0.0	1	0.2	13	2.9
TANGA SISI	0	0.0	8	1.8	1	0.2	0	0.0	0	0.0	6	1.4	0	0.0	15	3.4
MAWENI	0	0.0	7	1.6	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	8	1.8
NGAMIANI KUSINI	5	1.1	4	0.9	1	0.2	0	0.0	4	0.9	2	0.5	0	0.0	16	3.6
USAGARA	0	0.0	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
KIRARE	0	0.0	2	0.5	0	0.0	0	0.0	1	0.2	6	1.4	0	0.0	9	2.0
MAJENGO	1	0.2	4	0.9	7	1.6	0	0.0	0	0.0	0	0.0	0	0.0	12	2.7
NA	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	2	0.5
Total	**40**	**9.0**	**216**	**48.8**	**81**	**18.3**	**2**	**0.5**	**8**	**1.8**	**88**	**19.9**	**8**	**1.8**	**443**	**100.0**

Source TANSHEQ survey team (March, 2022)

4.9.4 Sanitation Coverage

The population served by the sewerage system is only 17% of the urban population, out of which only 7.4% of the central area spread over 08 wards have sewerage collection facility (pipe network of 33.55km as of 2018) which was implemented in 1950s. Balance 19 wards are served with Cesspit Emptier Trucks and onsite sanitation facilities in the form of septic tank.

However Household survey in Tanga conducted by EIA Team from TANSHEQ,48.8% of households in Tanga use Flush to septic tank,19.9% use pit latrine 18.7% use Flush/pour flush to pit, 9% with sewerage connection and 1.8% use Composting toilet while 1.8% without any sanitation options.



A woman pour used water on the street surface

Sea outfall that discharge untreated wastewater to the ocean at Raskazone

Figure 4-19: Sanitation practice and facility in Tanga City

4.9.5 Transportation

4.9.5.1 Road Transport

Tanga City is well served by reliable transportation network which comprises road network (of earth, gravel and bitumen standard); a railway (cargo train), marine and air transport which link it to other parts of Tanzania and neighbouring countries.

The Central Business District (CBD) and the old planned neighbourhoods are well served by over 97.5 km of tarmac road. Under a World Bank financed Urban Sector Rehabilitation Project (USRP) 16.4 km of tarmac road and lateral drains were rehabilitated. About 144 km of worn out gravel roads and 708 km

of earth or ungraded roads serve rural areas of the city. The city, also has major arterial roads; these include Korogwe, Mombasa and Pangani roads,

The main deficiency of the current road system is lack of storm water drains and the inadequate capacity to carry out routine maintenance. During rain seasons many parts of Tanga city are affected by floods partly due to the deficiencies in the storm water drainage system. Such problems used to be very serious in low-lying areas such as Mabawa, Duga and Magaoni. The problem has partially been alleviated by the construction of a main drain in Duga.

Tanga City Council plans to rehabilitate 30 km of existing tarmac roads and build another 5 km of storm water drains through Duga, Mwangombe and Magaoni to the Indian Ocean. Secondary drains are planned to be built in such areas as Nguvumali, Chumbageni, Duga, Mabawa, Msambweni, Makorora and Usagara.

The flat terrain of Tanga encourages walking and cycling. Latest estimates put the number of licensed bicycles in Tanga city at over 14,000 while the total number of bicycles in the city is estimated at 22,000. Unfortunately, the existing and planned roads do not provide for traffic separation of road users namely cycle tracks or pedestrian ways, leading to safety risks for cyclists, pedestrians and other motorists.

4.9.5.2 Air Transport

For about a decade, Air transport was virtually non-existent in Tanga city, but with economic revival in the early 2000, private air charter services provided by Coastal Aviation Services ply between Tanga – Pemba – Zanzibar, and Dar es Salaam daily. Also the service is available for Kilimanjaro/Arusha through KIA airport

4.9.5.3 Tanga Port

Tanga port is the second largest after Dar es Salaam port. It used to be the main gateway for Tanzania's exports before the 1990s. The current handling capacity of the port is 500,000 tonnes per year

4.9.6 Telecommunications

Tanga has telephone services of cellular and radio link (plus land lines). The main telephone service provider is the Tanzania Telecommunication Company (TTCL) network services are also available, provided and operated by TTCL mobile, Tigo, Vodacom, Airtel, Halotel and Zantel. which operates a Subscriber Trunk Dial (STD) telephone system. Mobile Cell phone

CHAPTER FIVE

5 STAKEHOLDERS CONSULTATIONS AND PARTICIPATION

5.1 Introduction

Consultation with stakeholders is a key aspect of the ESIA process as it ensures that all the concerned parties are given adequate opportunity to comment on and input into the proposed project. This enables the affected and interested stakeholders to actually be a part of the solutions to mitigate project impacts and/or implement management measures.

5.2 Objectives of Stakeholder Engagement

Objectives of the stakeholder engagement were to:

- To introduce and provide a brief overview of the project scope and activities
- To request stakeholders' support and input:
  - Baseline data and information on potential receptors (Valued Environmental and Social Components – VECs
  - The identification of project impacts and mitigations measures.
  - Their roles and responsibility in the implementation of impacts management.
  - Procedure for management of grievances.
- To listen to questions and concerns from the stakeholders and ensure these are addressed in the ESIA

5.3 Identification of Stakeholders

The identified people, groups, or institutions which are likely to be affected by the proposed project of construction Gold Processing Plant (either directly or indirectly, positively or negatively) and those which can influence the outcome of the survey as well as those who may have interest in the project.

The identification method was based on the project environmental impacts and risks identified through project screening process by the ESIA technical team. For each impact category people and groups who are interested or are likely to interact with and/or be affected by the project were determined

Peponi started with stakeholders' consultation as soon as the proposed started. During consultation, Tansheq undertook the first visit to the Area of Interest (AOI). The purpose of the visit was to inspect the AOI as well as engage with all the relevant stakeholders.

5.3.1 Institutional Stakeholders

Institutional stakeholders identified on the basis of their involvement in decisions that might affect the proposed development or the stakeholder. The Institutional stakeholders include:

- Vice Presidents Office, Division of Environment and National Environment Management Council (NEMC);
- Ministry of Labour and Employment (Occupational Safety and Health Authority, OSHA)
- Ministry of Minerals

- Tanzania Mining Commission
- Ministry of Home Affair [Fire and Rescue Force and Police Force (Traffic Unit)];
- Singida Water Supply and Sanitation Authority (DAWASA)
- Regional Government Regional Commissioner (RC) and District Commissioner (DC); and
- Local Government (Municipality/Ward/Street/Village
- Surrounding community

5.3.2 Other Stakeholders

Individual stakeholders refer to those occupying, owning, living or working within the AOI and surroundings that may be impacted upon resulting from project implementation. They include: surrounding Communities/Residents/affected people and gas users

The stakeholders involved were identified and involved include the central and local government stakeholders directly responsible with the project activities are detailed in Table 5-1**:**

Table 5-1: Central and Local Government Stakeholders

Central and Local Government Stakeholders	
Central Government at National Level	
Ministry	**Department or Executive Agency**
Ministry of Water	Pangani Water Basin Board, Tanga-UWASA
Vice Presidents Office-Division of Environment	National Environment Management Council
Ministry of Labour and Employment	Occupational Safety and Health Authority, OSHA
Central Government Regional Level	
Office	**Executives**
Tanga Regional Commissioners Office	Regional Secretariats under RAS
Tanga District Commissioner Office	District Secretariat under DAS Assistant Administrative Secretaries for various functions within the District
Local Government - Municipal, Ward, and Village Levels	
Office	**Executives**
Tanga City Council	• City Council • City Director • Member(s) of Parliament
Kiomoni Ward	Ward Development Committee (WDC). Consisting of: • Ward Executive Committee (Secretary of the Committee) • Chairpersons of all Mtaa Councils within the ward, • Member(s) of the City Council who ordinarily reside in the Ward • Invitees including persons from NGOs and other civic groups involved in the promotion of development in the Ward
Amboni Mtaa	• Mtaa Executive Committee • Mtaa Councils under Chairperson

5.4 Information Dissemination and Disclosure

Participatory and consultative approach was employed for information dissemination and data collection. The team carried out consistent messaging on the key aspects of the project. Guiding notes on types of information to be shared with each category of stakeholders were used as a reference material to support engagement during various meetings.

5.5 Consultation and Participation

Stakeholder consultations involved notifications, community awareness meetings and technical meetings. The consultation approaches used different participatory methods:

(i) Small group interviews
(ii) Focus group discussions
(iii) Key informant interviews and
(iv) Community assembly.

5.5.1 Community Engagements

Engagement activities entailed scouting visit and meetings with Mtaa leaders and the whole community. The team conducted initial transect walks and observations accompanied by community leaders, Tanga UWASA staffs (Developer). Meetings were undertaken by ESIA team with support from Kiomoni Leaders and Tanga UWASA.

During this phase also door to door engagement whereby the residents who are residing nearby the proposed the project site were consulted as they offered their views and concerns.

5.5.1.1 Meeting Organization

Meetings with ward leaders and representatives of community groups were conducted at the Ward office. In response to health and safety requirements against COVID-19, the meetings were small gatherings attended only by necessary people and completed within the shortest time possible – lasting a maximum of 2 hours.

Representatives of community groups were met in small gatherings of 25 people at a time, and all meeting attendees had to keep a desirable social/physical distance, wash their hands with soap and running water and / or sanitizer and wear masks.

The meeting attended by all community members was organised by local leaders and conducted during afternoon hours. The time was arranged not to interfere with people's daily commitments. The village meeting was held at office.

5.5.1.2 Participation

Information regarding dates, locations, venue, time /duration and participants/audience at the various meetings were well spread through the various means including notifications, awareness meetings and technical meetings. This was reflected in the good turn up of targeted categories of people at the various consultative events. The presence of a diversity of meeting participants is reflected in the attendance records

The main issues of concern during consultation were the awareness of the project, the relationship between the project proprietors and different levels of the government structure and down to the community level. Another issue was on corporate social responsibility of the operation, most of the stakeholders were concerned with Peponi participation/ contribution in social activities.

On the other hand, direct and indirect benefits of the project to the local communities were briefly discussed especially regarding to health, employment, safety and location. These views were obtained in meetings, individual consultations. A summary of views that were given and issued raised by these stakeholders reached for the purpose of this exercise is given in the

Figure 5-1: Consultative meeting with the community (Source: Tansheq site work, March 2022)

Figure 5-1: Consultative meeting with the community (Source: Tansheq site work, March 2022)

5.5.1.3 Summary of Issues

The EIA study has identified main concerns and issues raised by the different stakeholders. A list of the stakeholders consulted is provided in appendix I. Based on the raised concerns, an analysis was carried out and issues ranked accordingly.

The ranking was based on the frequency an issue was raised. The stakeholders concern and categorized in this section details all issues which have been raised by the Stakeholders. The first column identifies the stakeholders with the views/concerns in the following column.

Table 5-2: Summary of stakeholders concerns

STAKEHOLDER	RAISED ISSUES, CONCERNS AND OR COMMENTS

STAKEHOLDER	RAISED ISSUES, CONCERNS AND OR COMMENTS
Tanga Region Timotheo Sosiya **Regional Environmental Management Expert (REME)**	• The project site is not disturbed ecologically, thus the developer need to be informed and should observe and conserve the surrounding environment such as beekeeping • Proper solid waste management system must be in place during the project lifecycle by constructing the collection chambers and distributing waste bins. • The water catchment in the vicinity of the project area should project such a way that no pollution • Socio economic activities which are taking place within the community should not be affected by the project activities • Security issues should be well established to avoid sabotage and destruction of infrastructures. • During rehabilitation of access road, avoid unnecessary clearance of vegetation which can lead to vegetation cover deterioration.
Pangani Basin Water Board Zania D Msangi	• Baseline data on water quality should be taken before any activities • It is the good thing Tanga UWASA is increase the production Capacity as the demand is too high compared to the existing. However, they should also increase sources to abstract water. • Tanga UWASA should drilling borehole to cutter the demand as the water table is very high • Awareness on the environmental conversation as well as water sources protection especially Zigi river should be provided to the community as well as associations such as JUWAMAKIHU, JUWAMAZIJU, JUWAMAKICHI • Samples must be taken to accredited laboratory for checkup and this need to be done regularly.
Tanzania Rural and Urban Roads Agency (TARURA) Tanga Region Eng. Boniface Mwombere **Regional Manager**	Eng. Boniface was concerned that as per his experience in rehabilitation and improvement of water supply and sanitation facility, the roads always are being affected. Thus, it will be the best choice for Tanga UWASA to construct the new system rather than replacement. This is because the cost to backfill the disturbed roads is very high compared to have a new system
Tanga City Council	The City Environmental and Sanitation Officer had the following opinions: • The project is very important as it is needed but measures to protect

STAKEHOLDER	RAISED ISSUES, CONCERNS AND OR COMMENTS
Kizito L. Nkwabi **City Environmental and Sanitation Officer (CESO)**	the environment must be taken • Protective the local forest which surround the project area • The project is at slow down terrain; thus the proponent must protect the catchment from pollution • Construction of wall to surround the project area is recommended so as people should not observe inside activities taking place but also animals should not enter the site • Plant trees surrounding the project area as this will help to reduce erosion and protecting some plumes from escaping • Make sure the acquisition of all relevant permit from Water Basin Board • Make sure all revenue which is supported to be received by the Government is received accordingly. • The employment opportunities should consider local people first for unskilled labors if needed. • Improvement on community' social services
Fire and Rescue Force Unit Tanga Region Insp. Katlala, Issah (**District Fire Officer**)	• We are grateful for this engagement as we do always not get involve for issues like this regardless of being the important for Fire and Rescue Force unit in case of fire explosion within the City. • Engage our office during purchases of Fire hydrants so as to provide the specification which met our equipment in place • We are requesting the authority to shift exiting hydrants as we will be available for any directions required. • Tanga UWASA should submit the map/drawing as well as layout prior to construction activities • Contractor must visit and engage us during the design and review of networks and witness the existing fire hydrants.
Occupational Health and Safety Authority (OSHA) Billy Muushi **(Hygiene Inspector)**	• Register your workplace through wims.www.osha.go.tz • Ensure all workers health are examined by doctors from OSHA • It's the duties of the employer to provide safe and clean drinking water to your workers • Survey should be conducted to the area to be rehabilitated and where improvement activities of facilities will be executed • Each component of the project implementation should observe to comply with occupational health and Safety Act, 2003 • Ensure first aid kit is available all the time at workplace with adequate

STAKEHOLDER	RAISED ISSUES, CONCERNS AND OR COMMENTS
	contents • Conduct risk assessment to identify hazards presents in your workplace and submit report especially for pipelines/confined/underground works. • Ensure provision of appropriate personal protective equipment • Appoint and facilitate statutory training for IFAT (Industrial First Aid Training) and SHE-REPs (Safety and Heath Representatives) conducted by OSHA • Prepare and display occupational safety and health policy at conspicuous area • Ensure there is active safety committee at the workplace and all safety meeting records must be kept • Establish OSHA file to keep all OSHA documents and must be available at the site all the time • You are supposed to report at OSHA any incident, accident or any occupational diseases that will raised at your workplace • Allocate and mark all safety signs and emergency and emergency assembly point at the workplace
Government Chemist Laboratory Authority (GCLA) Jovitus Mukela **Head GCLA Tanga**	• The team was informed that GCLA has been working with Tanga UWASA in other operation such as water treatment plant at MOWE. We have been acquiring certificates for chemicals accordingly. However, he added that all activities involving chemicals should be handled according to Industrial and Chemicals Consumers Regulations of 2013. • For new project site, all chemicals to be used should be registered to GCLA through online www.gcla.go.tz • The inspection need to be done by GCLA prior to commissioning of the project • Ensure provision of appropriate personal protective equipment
Kiomoni Ward Shabani A. Ally **Ward Executive Officer (WEO)**	The ward is positive about the project since there is assurance of portable water service since there are some streets that are not connected to the current water system. Employment is also viewed as a benefit to the ward during construction Additionally, the community expect Tanga UWASA to supply quality pipes and durable ones to avoid frequent leakages. Currently, low quality pipes are sometimes supplied by the individual who needs to be connected to the water system

STAKEHOLDER	RAISED ISSUES, CONCERNS AND OR COMMENTS
Iddy Kapinga **(Member)**	He know about the project, he suggest the compensation should be done to those who affected by the project.
Restuta Masawe **Resident at Utofu**	The compensation should be made and the victim should be relocated because the Lima area has a history of flooding so a sewage system should not be endangered.
Mutalemwa Hyera **Resident at Utofu**	He is well aware that it is in the area of water authorities but they did not know that sewage wing If they decide to build we just tolerate the weather meaning it is so easy to move elsewhere also from the beginning he did not know what the place was
Fatma Adam **Resident at Utofu**	They suggest that if possible they should not build this place because it will be affected and if Tanga city decides to build we will endure the same
Ummy kuruthumu **Resident at Utofu**	The information he had that the site would be used for the purpose of the sewage dam. The construction of the dam should be relocated to this area after compensation is paid and they are ready to relocate after compensation, this because is not friendly to our health and environment

5.6 Perceived Positive Issues by Stakeholders

5.6.1 Employment opportunities

Due to the nature of the Project is expected to employ 250 employees whereas 20 will be expatriates and the rest Tanzanians. Tanga UWASA will also engage their internal staff in monitoring the implementation activities for construction, operation as well as maintenance.

To avoid the possibility of unfair allocation of jobs to non-local staff, the Tanga UWASA should commit to engage contractor who will meet semi-skilled or unskilled requirements. In that regards, they recommended the contractor to engage Local Government Authority in recruitment process.

5.6.2 Economic benefits

The operations will result in the establishment and boosting of existing commercial activities within Tanga City, locally such as food vending, soft drinks, kiosks, and bars.

The project experts shall improve occupancy rate at local hotels hence resulting in increased purchase of agricultural products such as vegetables, fruits and grain locally, which will boost local trade.

5.6.3 Knowledge transfer and competitiveness

The proposed project among the direct positive impacts that it will bring to the surrounding communities there will also be other impacts because of influx of people in the area.

The exchange of culture and skills will automatically benefit the dwellers as they will get an opportunity to learn soft life skills.

5.6.4 Local Expectations from the Project Proponent

Stakeholders expect Tanga UWASA to implement its Corporate Social Responsibility (CSR) policy and collaborate with local government to optimize social benefits from the project and support on-going natural resources conservation efforts in the area.

Table 5-3: Issues Raised by Stakeholders

S/N	Issue	Frequency	Rank	Response
1	Employment opportunities, economic benefits and increased revenues locally (District Authorities and community) and nationally (positive impact)	15	1	People to engaged are discussed in section 2.2.4
2	Air Pollution from waste stabilization ponds activities and waste disposal	11	2	This is directed according in ESMP
3	Public health issues related to emission of nuisances gases from the Waste Stabilization Pond			This is illustrated in section 6.4.11
4	Ground and surface water pollution from spills of sewage and sludge	11	2	This is illustrated in ESMP
5	Road accidents leading to spill of chemicals and fuels	10	3	This is illustrated in section 6.4.14
6	Noise, vibration and Dust generation during construction activities	7	4	Discussed in Environmental Management plan and 6.4.4 and 6.4.5
7	Risks related to flooding issues of the area as the site is within the lowland.	6	5	Waste management is described in section 2.4.3 and 6.4.10

5.7 Perceived Negative Issues

5.7.1 Nuisance gases and foul smell from the waste treatment plant

The community is concerned with the nuisance smell which will be generated by the WSP as it will be expected during the operations. Thus, at least the construction should consider this by raising the wall higher than the existing houses.

5.7.2 Final Disposal Site of Chemicals and Wastes

Stakeholders raised concerns on the lack of procedures for handling of chemicals and wastes produced from processing operations.

Chemical waste and other hazardous waste shall be collected in special container by the proponent ready for final disposal in a specified manner as detailed in the ESMP.

Domestic waste shall be collected by and disposed of as Tanga City Council solid waste management system as it will be communicated and the contractor will be contracted to do the same accordingly

5.7.3 Damage or disturbance to local natural habitats and biodiversity

The stakeholders were concerned about the potential loss of and disturbance to the natural environment from human presence and activities at the proposed site.

5.7.4 Road accidents leading to spill of chemicals, fuels or oil

The scenario of large spills of oil during transportation of fuel; spills in or around the surrounding environment during fuel transfer operations; accidental leakage of stored chemicals at the plant, are a concern for residents and resource users. It was felt that these scenarios should be the main components of the oil spill response strategy.

5.7.5 Lack/limited access to employment opportunities to locals

Stakeholders pointed out that there should be clear employment procedures, which should involve LGAs, for locals for unskilled and semiskilled labour.

5.7.6 Risks related to flooding of the project area

The proposed site is at low land which are always being flooded during the heavy rains. Thus Tanga UWASA and Contractor who is review and designing the WSP should consider to fill the area with soil to exceed the flooding level. However, the consideration should also consider the people who are living nearby the site.

5.7.7 Public health and community wellbeing.

The surrounding community are concerned about their wellbeing during operation of Waste Stabilization ponds due to bad smell, and congested air which dangerous gases to be emitted from the ponds such as H_2S. However, this will be considered and observed by Tanga UWASA.

5.8 Acceptance of Proposed Project

The stakeholders met by the EIA consultants, commenced since February 2022, generally supported the undertaking Improvement of Water Supply and Sanitation Projects within Tanga City.

The broad degree of acceptance by different stakeholders are presented in Table 5-4, yet within these different stakeholder groups there were variations in acceptance both locally (in ward and Mtaa levels) and nationally.

Table 5-4. Summary of Project Acceptance by Different Stakeholders

Stakeholder Group	High	Indifferent	Low
Central Government ministries, departments & agencies	√		

LGAs: District (Tanga)	√		
Local stakeholders (Kiomoni ward)	√		
Ministry of Water	√		
Other stakeholders (Surrounding Community at Utofu)	√		

5.9 Conclusion

Stakeholder engagement is an ongoing process throughout the project implementation. Project footprint and activities shall enable identification of project stakeholders.

The purpose of stakeholder identification is to identify and prioritize project stakeholders for consultation. Stakeholder identification is an on-going process, and thus key stakeholders will be identified during different stages of the project.

CHAPTER SIX

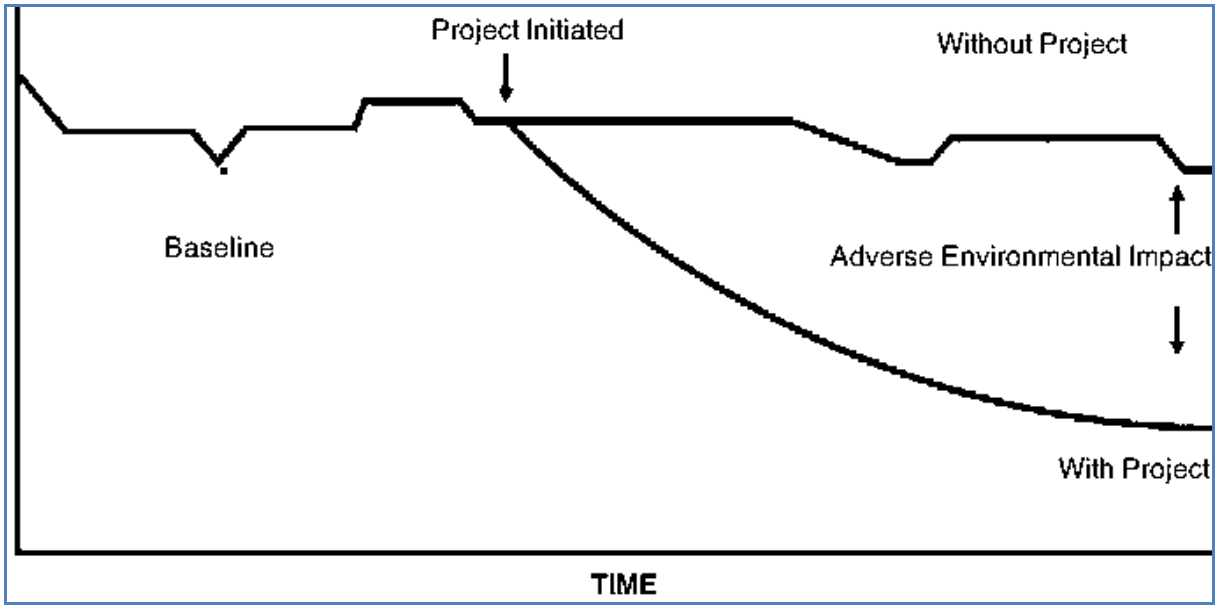
6 ENVIRONMENTAL IMPACTS IDENTIFICATION AND ANALYSIS OF ALTERNATIVES

6.1 Overview

The environmental and social impacts associated for the proposed Waste Stabilization Pond (WSP) are likely to result in both negative and positive impacts. This requires that the negative impacts be managed and the positive impacts be enhanced to minimize the potential impacts on the environment.

The evaluation of impacts was based on the methodology described in the subsequent section below. An assessment of environmental impacts aims to identifying and evaluating significant effects that are very likely to occur as compared with the baseline.

The assessment focuses on the issues identified with most significant effects and not on concerns that the assessment indicates to be insignificant. An impact can be either positive or negative.



Environmental impacts assessed in this Chapter are those changes to the environment, whether adverse or beneficial, wholly or partially resulting from activities of constructing WSP. Likely sources (WSP construction and operation activities) for both negative and positive impacts are presented.

Development of a wastewater treatment plant is likely to bring rise to several environmental impacts ranging from vegetation loss to disturbance of environment.

6.2 The Nature and Evaluation of Impacts

The studies undertaken during this ESIA considered direct, indirect, cumulative, and residual environmental impacts associated with the construction and operations of WSP. These were assessed in terms of the following criteria:

- Description of what causes the effect, what will be affected, and how it will be affected.
- The extent, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international.
- A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
- The duration, wherein it is indicated whether: The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1. The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2. Medium-term (5–15 years) – assigned a score of 3, Long term (> 15 years) - assigned a score of 4 and Permanent - assigned a score of 5.

The magnitude, quantified on a scale from 0-10, where a score is assigned:
0 is small and will have no effect on the environment
2 is minor and will not result in an impact on processes
4 is low and will cause a slight impact on processes
6 is moderate and will result in processes continuing but in a modified way
8 is high (processes are altered to the extent that they temporarily cease)
10 is very high and results in complete destruction of patterns and permanent cessation of processes

The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:

- Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
- Assigned a score of 2 is improbable (some possibility, but low likelihood)
- Assigned a score of 3 is probable (distinct possibility)
- Assigned a score of 4 is highly probable (most likely)
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)

The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high The status, which is described as either positive, negative or neutral
The degree to which the impact can be reversed
The degree to which the impact may cause irreplaceable loss of resources
The degree to which the impact can be mitigated

The **significance** is determined by combining the criteria in the following formula:

$$S=(E+D+M)P$$

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)

- **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area)

As the developer has the responsibility to avoid or minimize impacts and plan for their management (in terms of the ESIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures.

Table 6-1: Criteria for Assessment of Significance of Potential Impacts of the Project

Significance Category		Description
Major negative Impact	Major Positive Impact	High magnitude with a local extent and medium-term duration
		High magnitude with a regional extent and short-term period or a site-specific extent and long-term duration
		High magnitude with either a local extent and short-term period duration or a site-specific extent and medium-term duration
		Medium magnitude with any combination of extent and duration except site-specific and construction period or national/international and long-term
Moderate negative impact	Moderate positive impact	Low magnitude with regional extent and long-term duration
		High magnitude with a site-specific extent and short-term period duration
		Medium magnitude with a site-specific extent and short-term period duration
		Low magnitude with any combination of extent and duration except site-specific and short-term period or regional and long-term
		Very low magnitude with a regional extent and long-term duration
Minor negative impact	Minor Positive Impact	Low magnitude with any combination of extent and duration except site-specific and short-term period or regional and long-term
		Very low magnitude with a regional extent and long-term duration
No impact		Zero magnitude with any combination of extent and duration

6.2.1 Assumptions and Limitations

The following assumptions and limitations are applicable to the studies undertaken within this ESIA Phase:

- All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
- It is assumed that the development area identified by the developer represents a technically suitable site for the implementation of the WSP.
- It is assumed correct that the proposed connections to sewerage system is correct in terms of viability and need.
- Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.

This report and its investigations are project-specific to the construction of the proposed Waste Stabilization Ponds (WSP) and consequently the environmental team did not evaluate any other water utility companies operating in Tanga. The team has identified potential impacts which will be resulted from the proposed project execution.

Table 6-2: Summarized the Impacts resulted from the proposed Project

PHASE	POTENTIAL IMPACT	DESCRIPTION
Mobilization	Loss of vegetation cover	Vegetation clearing (e.g. trees and shrubs) will be required for site preparation activities for work areas and lay down areas.
	Employment opportunities	The site clearance will be conducted by local people
Construction	Noise, vibration and air pollution	Due to an increase in activities and number of operational vehicles, the impacts of noise and vibration will cause disturbance to humans and animals as well as birds. Vibration may even cause physical damage to properties near the construction site Also due to presence of vehicle and excavation of WSP foundation, fugitive dust and toxic gases will be generated as well.
	Scenic quality deterioration	Scenic quality deterioration will occur due to stock piling of construction materials and discoloration of plant leaves and houses in the vicinity of the project sites
	Increase road traffic jams	The project will use accesses roads to lay the pipelines to the WSP in which during excavation of trenches and laying down pipeline as well as crossing roads will lead to traffic to the respective area
	Deterioration of road quality	During the excavation of trenches to cross roads, tarmac roads will be disturbance while will need to be reconstructed after laying down the pipes. Due to that replacement the quality of road/materials won't be the same as the existing which will lead to fractures and faults along the roads passed by the pipes.
	Loss of Natural Habitats	Land clearance (15 acres) for construction of wastewater treatment plant at will involve uprooting trees and crops which are in the project sites. These vegetation are natural habitats for different fauna
	Soil erosion and relocation	The earth works and site clearance will disturb and

PHASE	POTENTIAL IMPACT	DESCRIPTION
	of sediments	expose the soil to erosion factors such as wind and rain. Soil erosion and sediment transfer may result from the construction of facilities especially at the construction site of WSPs at Utofu river valley.
	Increased spread of HIV/AIDS and STDs	The HIV/AIDS epidemic is the most serious health threat. In light of the socioeconomic situation in the project area's economic and geographical characteristics. There are a lot of issues that could either influence or contribute to the high infection rate, thwart attempts to curb the epidemic
	Increased of Wastes Generated	It is self-evident that construction activities are associated with the generation of waste. These wastes can be either solid or liquid in nature. waste to be generated include spoil, rubbles, tree logs, metals, glasses, papers, and other solid waste while sewage, oils, and other liquid waste are examples of liquid waste.
	Increased water and soil pollution	Small-scale and short-term water pollution may occur during the construction phase, regardless of the construction method used. The dust from the construction site is expected to have a significant impact, but accidental spillage of fuels, rubble, scrap metals, and construction materials, which may pollute both water and soil, may also have an impact. While larger particles settle quickly, finer particles increase the turbidity of the water course.
Operation	Increased water pollution	In the event that the proposed WSP fails, water pollution may result. The WSP is located near the Utofu River, allowing for easy transport of treated effluent to the water body. As a result, if the WSP fails to function properly, there is a risk of polluting the existing water body with low-quality effluent.
	Harm to Public Health	WSP engineers and workers daily exposure to sludge and wastewater. Possible harm to people and farmers who are close to WSP.
	Degradation of Ambient Air Quality	During operation of wastewater treatment plants, nuisance gases will be emitted as it will pollute the

PHASE	POTENTIAL IMPACT	DESCRIPTION
		existing ambient air quality of the surrounding project area.
Demobilization	Loss of income and employment	The local population who will be employed in the project will lose their jobs as soon as the project is completed. Job losses will have far-reaching consequences.

6.3 Positive Impacts

There a number of positive benefits associated with the proposed project. The following are some of the positive impacts anticipated during construction and operation phases:

- The proposed construction WSP will allow Tanga UWASA to connected new customers to the sewerage network; this will in turn reduce ground water pollution through disposal of sewers through septic tanks and pit latrines.
- There will be improve aesthetic in the project area due to the rehabilitation and upgrade of sewer pipes and manholes allowing sewers to flow without blockages.
- The proposed Waste Stabilization Ponds (WSP) will increase coverage of sewerage network. This will eliminate discharge of untreated sewer in undesignated areas.
- It will allow upcoming developments to discharge sewer into the expanded sewer network
- Provision of employment during both construction and operation phases of the project.
- Improved health of the people through reduced cases of waterborne diseases associated with poor sanitation

6.3.1 Creation of Jobs and Business Opportunities

Implementation of the project will involve the use of both skilled and unskilled labour from the construction phase to the operational phase. The project will involve the engagement of surveyors, engineers, technicians, machine operators and other staff with various skills sets.

The creation of employment and business opportunities will have social economic benefits on households directly or indirectly involved on the project. The project will ensure that local communities in the project areas are given priority during recruitment of staff.

6.3.2 Improve Provision of Sanitation Services

The proposed project will improve access to sanitation services in the project areas across Lusaka. The will result in the reduction of waterborne diseases, sewer leaks and reduce on the use of onsite septic tanks. The project will also set best practices on how other similar projects can be constructed and operated.

6.3.3 Reduced Public Health Risks and Associated Treatment Costs

The provision of sanitation services and construction of WSP at Utofu will result in the reduction of public health risks. This will result in the reduction of costs associated with the treatment and prevention of diseases as all sewage generated within the central wards will be directed to the constructed WSP.

6.3.4 Improved ground water and surface water quality

The project will involve the provision of sanitation services and construction WSP facilities in Tanga. Connecting of households that are currently using onsite facilitates, replacing old piping with much stronger durable uPVC lines and improved sewer treatment at the proposed Waste Stabilization Pond (WSP) will result in the reduction of leaks, discharge of untreated sewer and infiltration of sewer effluent from septic tanks into ground water. This will result in improved ground and surface water quality.

6.4 Negative Impacts

The negative impacts that are likely to arise from the construction and operation of the Waste Stabilization Ponds (WSP) are;

- Impacts on ground and surface water
- Ecological impacts
- Impacts on soils
- Disturbance on air quality
- Increased levels of noise and vibration
- Visual intrusion
- Temporary and permanent displacement
- Impacts on utility infrastructure.
- Generation of waste
- Occupational health and safety risks
- Impact on water resources
- Impact on landscape
- Impact of hydrocarbons on soil.
- Public health and safety
- Increased incidence of HIV/AIDs and other communicable diseases

6.4.1 Impacts on Ground and Surface Water

The proposed of WSP including auxiliary facilities will result in expansion of the sewerage network. Sewer blockages and leakages in the sewerage network will result into discharge of untreated sewers into the environment.

Similarly, when the WSP is down or not working at optimum efficiency there is a potential of untreated sewers being discharged into the environment. These are likely to have impacts on ground and surface water in the area of operation surrounding areas.

6.4.2 Ecological Impacts

The proposed establishment of the WSP will involve the clearing of vegetation, excavation, trenching and laying of pipes. This will result in the loss of flora and fauna, however this shall be limited to the construction phase and restricted to the network route and construction sites. The impacts are however low and localized.

6.4.3 Impacts on Soils

Owing to the nature of the project, machinery will be required during excavation and trenching. This will result in loosening of the soil at the project site and may result in soil erosion.

6.4.4 Disturbance on Air Quality

The proposed construction sites are within or adjacent to commercial and residential areas. Construction activities are likely to generate dust that may affected surrounding communities and businesses properties.

Since construction activities will be undertaken in a short time frame the impact is temporary and localized. Site clearing activities will be limited to project sites and will not potentially adversely affect air quality. Other sources of emissions are also likely to emanate from vehicles due to increased vehicular traffic flows. However, this is negligible and transient.

6.4.5 Increased Levels of Noise and Vibration

Noise and vibration are likely to be generated during construction by concrete mixers and transportation vehicles. Generally, construction noise exceeding a noise level of 70 decibels (dB) has significant impacts on surrounding sensitive receptors within 50m of the construction site. Blasting activities in areas of high rock formation are likely to generate high noise and vibration levels.

6.4.6 Visual intrusion

Visual intrusion is likely to occur during earthworks for the proposed project activities through presence of excavations scars, poorly managed construction waste, untidy storage of construction materials, visible portable pit latrines. The visual impacts will however be confined within the project areas.

6.4.7 Temporary and Permanent Displacement

There is a potential for temporary and permanent disruption of physical properties during the implementation of WSP. Tanga UWASA will need to compensate four resident houses for project implementation as the people are nearby the proposed construction WSP. This impact will be temporary.

6.4.8 Impact of Public Traffic

Construction activities laying within the Project Right of Way (ROW) will have minimum impact on pedestrians and public traffic owing to their location.

However, there is a potential road safety risks from construction vehicles and trucks delivering materials especially in the heavily populated areas. Children and pedestrian's coming close to the project sites may also cross the roads careless and this may lead to accidents and fatalities during project implementation. In areas where there will road cutting, there will be cumulative impact requiring traffic control measures from blocked roads, increased traffic congestion, disruptions of public transport and deliverables. There is also a potential risk of traffic disruptions and congestions during road cutting.

Despite using underground channel measure will be put under the Contractor Environmental and Social Management Plan (CESMP) in terms of warning signage with regard to impending works and reducing speed.

Similarly, on all the roads where the will be road cutting activities, road signage and detours will be implemented to guide both pedestrians and motorist. All excavated sites near the roads will be cordoned from the public as a prevention toward fatalities and accidents.

6.4.9 Impacts on Public Utility Infrastructure.

Project construction will have potential to interfere with existing underground utilities (water pipelines, and communication and power cables), and may result in temporary suspensions of service. Collaboration will therefore be required with partners such as Zantel, Airtel, Vodacom, Halotel, Tigo and TTCL.

6.4.10 Generation of Waste

During the construction period, construction, municipal solid waste and refuse will be generated. Unsound management practices of waste have potential to pollute surface water resources. The decomposing vegetative waste materials might produce foul smell and affect the quality of the surrounding air.

Open air burning of waste may emit air polluting substances and cause a nuisance to nearby communities. Waste that is disposed of in an improper manner may be unsightly thereby affecting the visual characteristics of the area.

6.4.11 Occupational Health and Safety Risks

During the civil works, public as well as construction staff safety risk may arise from various activities such as deep excavations, operations and movement of heavy equipment and vehicles, storage of hazardous materials and disturbance of traffic. Due to the long duration and complexity of the construction phase, if such activities are not properly controlled the associated risks may be higher.

Likewise, poor supervision and lack of safety measures may increase the likelihood such impacts. Tanga UWASA will ensure that best management practices are employed to ensure that welfare and communities are safeguarded during project implementation. Tanga UWASA will ensure that workers are provide with personal protective equipment at all times. Proper signage will be placed to warn children, elderly and traffic of areas that are potential safety risk.

6.4.12 Impact on Water Resources

The proposed WSP will have an impact on the availability of existing and potential water sources in terms of quality and quantity as well as use of water from rivers through increased volumes of treated wastewater that ultimately is discharged into the receiving streams and rivers such as Utofu River.

6.4.13 Impact on landscape and Aesthetics

Activities such as clearing using heavy machinery have potential to change the natural landscape and may therefore degrade areas of scenic beauty. Areas will need to be cleared for the installation of pumping houses as well as trenching where the interceptors will subsequently be laid. These activities have the potential to destabilize the existing natural ecosystems within the respective project areas.

The area where the sewer interceptors are located is generally flat and the clearing and leveling activities that will be carried out for the establishment of the proposed structures will therefore have an

impact on the local topography. The trenches where the pipes will be laid will cause significant impact on the topography. The removed soil will have to be replaced and compacted.

Installation of structures and compacting using heavy machinery has the potential to change the natural landscape and may therefore have an impact on local aesthetics. This impact is, however, expected to be minimal.

6.4.14 Impact of Hydrocarbon on Soils

Soil contamination may result from the leaking of hydrocarbons such as oil and diesel during drilling operations from machines. The hydrocarbons are likely to contaminate both surface, subsurface soils and surface water.

6.4.15 Public Health and Safety

Inadvertent access to the construction site by the members of the public, particularly the trenches before backfilling with soil, may result in personal injury.

During construction there will be increased levels of dust, air and noise pollution. These are considered as negative impacts as they significantly lower the quality of the environment. The residents and workforce will be subjected to these environmental hazards. For food provided by mobile vendors this can compromise health of workers especially if foods stuff is prepared in unhygienic conditions.

6.4.16 Increased incidence of HIV/AIDs and other communible diseases

There is a potential induced impact during construction phase of high sexually transmitted diseases and HIV/AIDS due to new entrants in communities for employment. The socioeconomic environment created by the project, may encourage migrant labour directly or indirectly in search of new employment opportunities.

There is a potential induced impact of increased income in the communities, from construction worker salaries that may lead to domestic abuse in the home.

6.5 Summary of Potential Impacts associated with the Construction phase

The list of potential Impacts during construction, nature of impacts, extent and the magnitude on the proposed are listed and summarized in the table below.

Table 6-3: Summary of impacts during the construction phase

S/N	Impact/Aspect Description	Nature	Magnitude	Extension	Duration	Significance of Impact	Probability of Occurrence	Risk
1	Temporary job creation and creation of business opportunities	Direct	Medium	IIA	Medium-term	Minor Positive Impact	Definite	Low Risk
2	Potential conflict on employment opportunities between local communities and outsourced workers by contractor	Direct	Low	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
3	Potential resentment by local communities if construction activities become a public nuisance	Indirect	Low	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
4	Capacity Building for local communities who will be engaged in various on job training	Indirect	Low	IIA	Short-term	Minor Positive Impact	Definite	Low Risk
5	Increased local revenues from kiosk selling foodstuffs to contractors	Indirect	Low	IIA	Short-term	Minor Positive Impact	Definite	Low Risk
6	Potential disruption of public services including sewer lines, water supply, underground power and communication cables	Direct	High	IIA	Medium-term	Moderate Negative Impact	Definite	Significant Risk
7	Part of the sewer expansion works may interfere with land use change in neighboring communities	Direct	High	IIA	Short-term	Moderate Negative Impact	Definite	Significant Risk
8	Ecological impacts on Flora, avifauna and Fauna, from the clearing of vegetation and excavation works	Direct	Low	IIA	Medium-term	Minor Negative Impact	Definite	Low Risk
9	Potential emissions of dust from trucks and vehicles accessing the construction	Indirect	High	IIA	Short-term	Moderate Negative Impact	Highly Probable	Significant Risk

S/N	Impact/Aspect Description	Nature	Magnitude	Extension	Duration	Significance of Impact	Probability of Occurrence	Risk
	areas and camp sites as well as material piling (sand and aggregate)							
10	Potential restriction to residential access for residential and commercial properties due to excavations	Indirect	High	IIA	Short-term	Moderate Negative Impact	Probable	Significant Risk
11	Potential road safety risks from construction vehicles and trucks delivering materials to construction sites	Indirect	Medium	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
12	Potential public safety risks to neighboring communities accessing the construction sites (open channels and excavated sections) affected members could be children, the elderly, sick and motorist	Indirect	High	IIA	Medium-term	Moderate Negative Impact	Definite	Significant Risk
13	Occupational health and safety risks to construction workers(slips and falls, cuts heavy objects, snake bites, in all points of work	Indirect	High	DIA	Long-term	Major Negative Impact	Definite	High Risk
14	Potential risk of contamination of food and water from solid waste leading to health challenges of workers and nearby communities	Direct	High	IIA	Short-term	Moderate Negative Impact	Probable	Significant Risk
15	Risk of vector diseases to workers and nearby communities (bilharzia, malaria, Negative Local High	Indirect	High	IIA	Medium-term	Moderate Negative Impact	Probable	Significant Risk
16	Potential cases of HIV/AIDs arising from interactions among construction workers and local communities	Direct	High	IIA	Long-term	Major Negative Impact	Highly Probable	High Risk

S/N	Impact/Aspect Description	Nature	Magnitude	Extension	Duration	Significance of Impact	Probability of Occurrence	Risk
17	Potential for Increased noise levels during excavation, trenching and blasting activities	Direct	Medium	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
18	Potential of soil erosion due to loosening of soils due to trenching and excavations	Direct	High	IIA	Medium-term	Moderate Negative Impact	Probable	Significant Risk
19	Potential air pollution caused by emissions from construction equipment (carbon, hydrocarbons, particulate matter from earth movers, excavators, vehicles, and trucks	Indirect	Medium	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
20	Visual intrusion (aesthetics) during the installation of pipeline and rehabilitation of the WSP.	Direct	Low	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
21	Impact of odours due to sewer spillages during diversion of existing sewer lines	Direct	Low	DIA	Short-term	Minor Negative Impact	Low	Negligible Risk
22	Impact on rock excavation that may lead to trenching and hence affecting public safety	Indirect	Medium	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
23	Potential contamination of soils and water sources due to spillage of hydrocarbon fuels and lubricants	Direct	Medium	IIA	Medium-term	Minor Negative Impact	Highly Probable	Low Risk

6.6 Summary of Potential Impacts associated with the Operational phase

The list of potential Impacts during operation, nature of impacts, extent and the magnitude on the Waste Stabilization Ponds (WSP) are listed and summarized in the

Table 6-4.

Table 6-4: Summary of Impacts during operational phase

S/N	Impact/Aspect Description	Nature	Magnitude	Extension	Duration	Significance of Impact	Probability of Occurrence	Risk
1	Employment and business opportunities during the operation of sewer lines	Direct	High	NIA	Long-term	Major Positive Impact	Definite	High Risk
2	Increased local revenue for LWSC on sewer charges	Direct	Medium	NIA	Long-term	Moderate Positive Impact	Definite	Significant Risk
3	Capacity building and skills transfer to LWSC employees	Direct	Medium	DIA	Short-term	Minor Positive Impact	Definite	Low Risk
4	Permanent affected entities will be impacted by economic or physical displacement of losing crops, business income or structures	Direct	Medium	IIA	Medium-term	Minor Negative Impact	Probable	Negligible Risk
5	Potential for Increased noise levels from generators during power outages	Indirect	Medium	DIA	Short-term	Minor Negative Impact	Low	Negligible Risk
6	Potential raw sewage overflows flow due to sewer blockages	Indirect	Medium	IIA	Short-term	Minor Negative Impact	Probable	Negligible Risk
7	Potential discharge of sewers from pumping stations due to power outages	Indirect	High	IIA	Medium-term	Moderate Negative Impact	Probable	Significant Risk
8	Potential contamination of surface and ground water from sewer spillages	Indirect	High	IIA	Short-term	Moderate Negative Impact	Probable	Significant Risk
9	Potential odours from pumping stations due to none functional pumping stations	Indirect	High	IIA	Short-term	Moderate Negative Impact	Probable	Significant Risk
10	Potential risks to health of communities neighboring and along the sewerage system caused by contamination	Indirect	High	IIA	Short-term	Moderate Negative Impact	Probable	Significant Risk
11	Potential risk of occupational and health risk employees working on operation and maintenance	Direct	High	IIA	Short-term	Moderate Negative Impact	Probable	Significant Risk
12	Potential risk to the public from open sewer inspection manholes (risk of	Indirect	High	IIA	Medium-term	Moderate Negative Impact	Probable	Significant Risk

S/N	Impact/Aspect Description	Nature	Magnitude	Extension	Duration	Significance of Impact	Probability of Occurrence	Risk
	falling into uncovered manholes)							
13	Potential risk to health of foods grown using raw or partially treated sewage as has been observed in various parts of the city	Indirect	High	DIA	Short-term	Moderate	Probable	Significant Risk
14	Potential increase of value of land and properties with project areas due adjacent to sewer connection	Direct	High	IIA	Short-term	Moderate Negative Impact	Probable	Significant Risk
15	Potential for the sewer system susceptible to inflow of surface runoff that would effectively overwhelm the carrying capacity of sewer lines	Indirect	High	IIA	Medium-term	Moderate Negative Impact	Probable	Significant Risk
16	The site and other points with potential sewer overflows will encourage vegetation growth which may be breeding grounds for mosquitoes	Indirect	High	IIA	Medium-term	Moderate	Probable	Significant Risk

CHAPTER SEVEN

7 MITIGATION MEASURES

7.1 Overview

This chapter describes mitigation measures or interventions that shall be implemented so as to minimize the potential impacts identified in the preceding chapter. Many of the mitigation measures put forward are nothing more than good engineering practice that shall be adhered to during the design and execution. The proposed mitigation measures are tabulated in Table 7-2

The summary of mitigation measures of those impacts which are considered of moderate to high significance, by matching the predicted impact, possible mitigation measure, the target levels, responsible entity and approximate cost. It also presents a detailed plan to monitor the implementation and success of the mitigation measures.

For each impact identified assessed in this study, mitigation measures will be proposed to reduce and/or avoid negative impacts and enhance positive impacts. Typical mitigation measures are detailed in Table 7-1.

Table 7-1: Impact Mitigation Measures

Approach	Example
Avoid	Change of site details, to avoid important ecological or archaeological features
Reduce	Filters, precipitators, noise proof, dust, enclosures, visual screening, wildlife corridors, and changed time of activities
Minimize	Minimize emissions and waste generation
Replace	Regenerate similar habitat of equivalent ecological value in different location
Restore	Site restoration after construction

These mitigation measures will be incorporated into an Environmental and Social Management Plan (ESMP) to facilitate implementation during the mobilization, construction, operational and decommissioning phases.

Table 7-2: Summary of mitigation measures for the identified potential impacts

Potential Impact	Mitigation measures
Mobilization	
Loss of vegetation cover	Use barren or fallow land for storing materials and vehicle manoeuvring area. Compensation will be provided to tree owners. Replanting of trees at designated areas identified in consultation with Roads Authority.
Employment opportunities	Enhance employment of Local people during this phase of the project

Potential Impact	Mitigation measures
Construction	
Temporary job creation	Tanga UWASA will enhance employment opportunities by giving preference to affected local's communities for both skilled and unskilled jobs The project will endeavour to employ at least 30% of women in order to promote and increase equal employment opportunities among women The project will ensure that contractors comply with Tanzanian and International Labour laws
Capacity Building	Training of Tanga UWASA staff and contractors in WSP and sewerage network construction.
Increased Business Opportunities	Preference for business opportunities will be given to locals to help stimulate emerging enterprises in the construction and service provision sectors
Ecological impacts	Restrict vegetation clearance to within the project footprint Identification of any endangered species preserving or relocating them. Rehabilitation and revegetation of construction area to near pre – construction condition Ensure protection of local ecosystem by proper handling of cement during civil works and other solid and liquid wastes
Impact on public conveniences	Ensure construction activities do not disturb access to residential and commercial properties access by scheduling of works and expediting rehabilitation works. Contractor to liaise with affected parties in advance of planned project activities. Contractor shall maintain minimum pedestrian access for residential and business. The access should incorporate all necessary measures to ensure public safety Monitor construction activities to ensure that private and commercial property do not suffer losses or damages Contractor to give prior notification before commencement of work
Temporary and permanent displacement	Network route and site selection will be aligned in a way that minimises or eliminates involuntary resettlements All relocated and displaced people will be compensated in line with provisions of the RAP The contractor shall be liable for repair of structures such as entrances under standard contractual obligations
Increased levels of noise due	All machinery and site vehicles will adhere to a stringent

Potential Impact	Mitigation measures
to machinery	maintenance regime to ensure noise levels are kept to a minimum level in accordance with the manufactures specification Use of PPE such as ear muffs/plugs will be mandatory in areas of high noise levels. As set out in the EHS Guidelines Contractor shall install temporary sound barriers where necessary. The project will continuously engage with the affected residents and business to ensure issues related to high noise level are addressed in the shortest possible time
Impact on public traffic and pedestrian safety	Contractor shall be required to prepare a Traffic Management Plan(TMP) for approval of the project covering: Traffic signage for roads detours and rerouting of sidewalks for pedestrians shall be installed. Assign traffic control personnel and flags. Provide alternative access to pedestrians. Install relevant safety elements such as metal guardrails, road signs, pavement markings, barricades, beams and lights. Selecting quarry and borrow sites that are served by roads of adequate capacity for heavy trucks and where minor roads cannot be avoided provide provisions for repair in conjunction with RDA. Review and monitor road safety records to ensure all project related accidents are being properly investigated
Impact of air and dust pollution	Regular Maintenance of vehicles and construction equipment to reduce on vehicular emissions. This will be done in accordance specification All construction areas will be regularly watered to suppress dust. It will be necessary to notify nearby neigh hood of any potential dust emissions during excavations.
Impact on Waste generation	Provide guidelines for proper disposal of solid waste and construction material Designated sites will be chosen for solid waste disposal before ultimate disposal to landfills Identify in consultation with ZEMA potential safe disposal sites. Works constructor to keep records of waste streams Estimate the amount of waste generated
Impact of soil contamination from sewage spillage and hydrocarbons	Create temporary sewer bypass routes during construction and maintenance works.

Potential Impact	Mitigation measures
	Plan emergency response measures in case of accidental oil spills Ensure all used oils are stored in drums and disposed of with registered dealers with NEMC All Chemicals, hydrocarbon and other potentially polluting materials shall be stored on an impermeable surface Spill kits shall be made available to workers shall be trained to respond to emergencies spills and taught how to clean up and manage leaks
Impact of soil erosion due to trenching and excavations	Earth moving equipment shall be restricted to areas earmarked for installation A construction sites will be rehabilitated to pre – construction conditions
Impacts of visual intrusion and aesthetics	Install signage's within project area to assist community who may be impacted by the project in terms of visibility Ensure adequate lighting Construction activities will be undertaken in within the agreed time schedule to minimise visual instruction Restricting project activities within corridor of impacts Rehabilitation of site to pre – construction state.
Increased incidences of sexually transmitted diseases (STDs) and HIV	LWSC shall conduct education and sensitization on the dangers of HIV/AIDS together with the promotion of self-protection targeting contractors, community in HIV/AIDs Provision of condoms and other awareness materials Provide workers with information on existence of anonymous VCT centres (Testing, pretest, post counselling) through referrals. Prepare a code of conduct for all employees. Maximise employment of local labour force to reduce on labour influx.
Public health and safety	LWSC shall sensitize community about the project through focus group meetings, posters, flyers and community engagements. Sensitize schools, churches dangers of construction sites Traffic management Signage and fencing of project sites Provide 24 hours' security of all project sites and enhance surrounding communities All open excavations should be fenced off and signage installed to ensure they do not pose safety risk to the public

Potential Impact	Mitigation measures
Operation Phase	
Creation of jobs and business opportunities	Tanga UWASA will enhance employment opportunities by giving preference to affected local's communities to for both skilled and unskilled jobs The project will endeavour to employ at least 30% of women in order to promote and increase equal employment opportunities The project implementation will comply with Tanzanian and International Labour laws and observe
Reduced public health risks and associated waste treatment costs	Ensuring the efficient operation of WWTP and treating effluent levels to within permissible limits effluent levels and World Bank EHS Guidelines. Implementation of a stringent maintenance regime to prevent network leaks in accordance with manufactures specifications
Occupational Health and Safety	Ensure all workers are provided with PPE Ensure that safe work systems are established for operation and maintenance Ensure all workers are sensitised on safety and health matters Ensure all workers undergo mandatory medical at time of engagement. Ensure machinery and equipment that emit air pollutants are sited away from communities No burning should be undertaken without prior permission
Odours due to sewage spillages	Ensure that all sites affected by sewage spills are adequately sanitised Ensure all sewer blockages are attended within 24 hours as in Tanga UWASA service level guarantee
Impacts on surface water quality	Tanga UWASA shall ensure that leakages from the sewerage network are minimised by periodic monitoring and maintenance of the network and treatment plants. All chemicals, hydrocarbons and other potentially polluting materials should be stored on an impermeable surface Ensure workers are trained on how to respond to clean up small spills and leaks Ensure availability of spill kits to workers Tanga UWASA shall undertake periodical analysis and sampling of treated effluent from the WSP to ensure its within permissible limits and World Bank Environmental, Health and Safety (EHS) Guidelines.

Potential Impact	Mitigation measures
Impacts on ground water quality	Monitor sewers for possible leaks Monitor nearby sampling boreholes and shallow wells Regular maintenance inspection of sewers Operation and maintenance should be tested and calibrated on regular basis.
Loss of income and employment	Small group business and SACCOS shall be established to assist people access loans to enable them run small businesses.

CHAPTER EIGHT

8 PROJECT ALTERNATIVES

8.1 Overview

The Environmental Impact Assessment and audits regulations of 2005 as amended 2018 requires that alternatives be identified during the EIA study. Screening of alternatives was a function of the scoping phase and a list of feasible alternatives that need to be assessed in further detail in the ESIA Phase was derived.

This section is an assessment of impacts of the identified alternatives. The analysis of alternatives covers project site, design and technologies and reasons for preferring the proposed options. An alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need as described in the following subsections

8.2 Analysis of Alternatives

Consideration of project alternatives is crucial in ensuring that the Tanga UWASA and decision-makers have a wider base from which they can choose the most appropriate option. In this project only one alternative (No project alternative) was analysed because the project is site specific.

8.2.1 Project Location

This is the alternative which involve the improvement and extension of sewer and the treatment of sewage be done at the proposed stabilization ponds at Utofu. The area is already acquired by the Tanga – UWASA and the community have been compensated and resettle from the area. The area is characterised by coconut trees.

However, there are horticulture activities undertaken in the boundary of the proposed pond site. The WSP will be located along the Utofu river and treated effluent will be discharged into the Utofu river and finally into the Indian Ocean via the Utofu Bridge located near the site.

Thus, the proposed project site is considering the best location due to the fact that it is close to the Ocean which will be used as the final disposal of waste water from the WSP.

8.2.2 Technology/ Design alternative

8.2.2.1 Waste Stabilization Ponds

The proposed project adopted the Waste Stabilization Ponds for water treatment which occupy small area and very efficient which include the following process.

- ✓ The effluent after the screening process will be passed into pond system. This will consist of anaerobic ponds, facultative ponds and maturation ponds.
- ✓ Due to the stringent environmental management standards that are becoming tighter day after day, additional polishing ponds are proposed as final waste treatment technique. These are proposed due to their cost effectiveness as compared to the other options.

This option is highly cost effective in term of construction, operation and maintenance costs. If well designed, at the prevailing environmental conditions in the project area, this can be a very effective system in pathogen removal.

Its use is limited by the huge land requirements which tend to be more compared with other options. The water treatment process technology is illustrated in the Figure 8-1

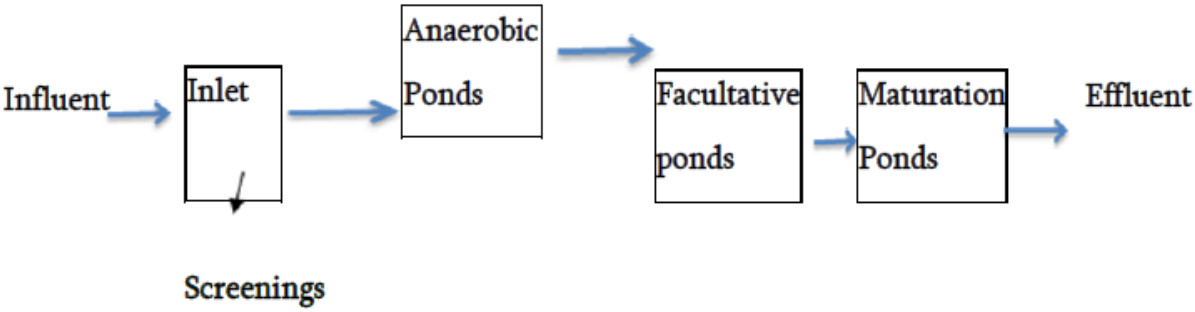


Figure 8-1: Schematic diagram for Waste stabilization ponds arrangement

Hence, consideration to change the technology was not found logical. The technology will include anaerobic, facultative and Maturation ponds with sludge dry beds.

8.2.3 Energy alternative

The use of other forms of alternative energy apart from depending on power from the National grid and the diesel generators were considered. The supply of electricity from the national grid is not reliable as it comes from hydroelectric power generators which depend on the amount of water in the impoundments.

For the case of diesel generator, these are mainly used during power breakdown, however they emit a lot of carbon dioxide when required to produce a lot of kilowatts for a long time. The use of solar power was considered but when summing up the capital and operational costs it was found to be not a good alternative.

8.2.4 Effluent and Sludge Disposal

Effluent Disposal Depending on the effluent quality attainable and the location of the point of discharge, in addition to the direct disposal to the lake/river, the following modes of effluent disposal will be investigated

- Irrigation
- Ground Water Recharge
- Fish Farming
- Industrial Re-use

Among the existing options for the final waste disposal after treatment, the most economical, environmentally and financially sound option is the disposal of the final effluent from the treatment works to Indian Ocean. This is the most cost effective method of disposing off the waste as opposed to irrigation or fish farming.

8.2.5 Sludge Disposal

Upon drying, a recommendation on the final sludge remnant will be made depending on the quality of the sludge. Two very feasible methods are;

- Incineration
- Composting

The treated and dried sludge may be disposed of by using it as humus on nearby gardens. Composting of the sludge will be an appropriate way of adding nutrients value to the sludge prior to use in the agricultural activity. Green solid waste, i.e. organic waste from plants like food left-over and throw-away, can be very good materials for blending the fertilizer.

Sludge incineration might be a more technically effective for small quantities of, but uneconomical for waste water treatment plants.

8.2.6 Construction Materials and Technology

There is a wide range of construction and furnishing materials which can be sourced locally and internationally. In this construction, certified raw materials/equipment and modern technology will be used.

Also, electrical appliances that save energy will be given first priority. The concrete walls will be made using locally sourced stones, cement, sand (washed and clean), metal bars and fittings that meet the Tanzania Bureau of Standards requirements.

8.2.7 No project alternative

The no project option comprises maintaining the current state of affairs without making any further improvements. Adopting this option would mean avoiding the majority of the negative effects associated with improved water supply while ignoring all of the positive benefits, the improved health and sanitation as a result of reduced occurrence of water-borne diseases, and benefits to communities resulting from employment and other economic activities linked construction of Waste Stabilization Pond (WSP).

CHAPTER NINE

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Introduction

The Environmental and Social Impact Assessment for the proposed project operation in has identified a number of impacts that are likely to arise during the site preparation and operation stage of the proposed project. The EIA has examined bio-physical, socio-economic and cultural effects of the proposed activity from mobilization, construction and operations/maintenance.

On evaluation of environmental impact, it is observed that the real benefits of proposed project can result only if the risks of the identified adverse impacts are minimized. This can be accomplished through implementation of adequate preventive and mitigation measures outlined in this report.

Where adverse impacts have been identified, the Environmental and Social Impact Assessment has examined the intensity, extent, duration and probability to which these impacts would be mitigated through the adoption of industry standard practice and guidelines and following local legislative requirements.

The Environmental and Social Management Plan (ESMP) presented in this report describes both generic good practice measures and site specific measures, the implementation of which is aimed at mitigating potential impacts associated with the proposed project activities.

The EMP provides the means of assessing the accuracy of the predicted project impacts and the monitoring of the effectiveness of the proposed mitigation measures contained in the EIA study report.

The ESMP should therefore indicate how the environmental concerns highlighted in the EIA would be managed. Tanga UWASA will monitor the implementation of key contractor parties and assess compliance with the provisions of the ESMP through its contractual mechanisms and management.

9.2 Objectives of the ESMP

The objectives of the ESMP are to:

- Adhere to and address necessary legal frameworks and other requirements;
- Promote environmental management and communicate the aims and goals of the project ESMP to all stakeholders;
- Incorporate environmental management into project design and operating procedures;
- Ensure all workers, contractors, sub-contractors and others involved in the project meet all legal and institutional requirements with regard to environmental management;
- Address issues and concerns raised in the project stakeholders' consultation process;
- Serve as an action plan for environmental management;
- Provide a framework for implementing commitments of the project (i.e. mitigation measures identified in the EIA);
- Prepare and maintain records of project environmental performance (i.e. monitoring, audits and compliance tracking); and
- Prepare an environmental monitoring plan whose aim is to ensure that the negative environmental impacts identified of this EIA are effectively mitigated by way of design, construction, operational and decommissioning stages of the project

The EMPs for port rehabilitation project consists of the following:

- Management Policies;
- Management Plans; and
- Decommissioning Plan

9.3 Management Policies

Tanga UWASA shall develop and document management policies that guide operations of the Project. The policies are vital in that:

- They enable management to develop and maintain sound relations with stakeholders;
- They enable management to put in place measures and structures that care for the safety, health and welfare of all Proposed Project users;
- They ensure that management plan for, and put in place, monitoring programmes that ensure Project activities confirm to stipulated environmental standards; and
- They ensure that management assumes its corporate responsibility for its activities regarding conservation of the environment as well as for the wellbeing of the neighbouring community.

The following policies are going to be in place:

- Environmental Management Policy;
- Occupational Health and Safety Policy; and
- Community Relations Policy.

9.4 Environmental Management Policy

The environmental policy developed should be one that enables the Project management and staffs to carry out their activities with the highest regard to the natural environment and sustainable utilization of environmental resources therein. The policy should therefore cover the following, among other issues:

- Ensure that all project activities operate within legal requirements of all relevant national legislation covered in Chapter Four;
- That there are continuous environmental improvement and performance through monitoring of Project activities;
- Ensure that utilization of natural resources is optimal with measures in place to ensure resource availability for future generation;
- Awareness creation to the surrounding community regarding sustainable utilization of natural resources, protection of sensitive ecosystems and bio-diversity maintenance for communal livelihood; and
- Balancing between natural resource use, environmental conservation and economic development

9.5 Occupational Health and Safety Policy

The Occupational Safety and Health Policy developed for management of Waste Stabilization Ponds and Sewerage system should enable establishment of appropriate measures that ensure that the health, safety and welfare of all and operators and users are cared for as well as the health requirements of the local community in which the project is located. The policy should highlight on the following, among others:

- Medical examination of workers;
- Waste water treatment procedures;
- Proper liquid and solid waste management and disposal;
- Emergency preparedness;
- Fire safety;
- Necessity and availability of personal protective equipment
- Safety measures for equipment;
- Appropriate safety and rescue equipment are availed to Project users;
- Risk minimization of accidental damage to the community and environment; and
- Training in safety.

Preventive and protective measures should be introduced according to the following order of priority:

- Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc.;
- Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc.;
- Minimizing the hazard through design of safe work-systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

9.6 Community Relations Policy

The Local Community Policy are developed by management to ensure that the management of the project develops and maintains sound relations with all stakeholders on mutual respect and active partnership. The policy should highlight on ways the management should:

- Work with the local community and relevant government departments and agencies to achieve sustainability of the project;
- Come up with ways of enhancing information flow from management to the community and stakeholders, and vice versa;
- Community capacity building; and
- Active engagement of the local community in all project activities that impact on the local community.

9.7 Organizational Structure and Responsibilities

The overall organizational structure for environmental management on the project identifies and defines the responsibilities and authority of the various organizations and individuals involved in the project. The project structure and associated personnel shall be sufficient to ensure the required standard of environmental performance.

For the purposes of this document there shall be no distinction between Ministry of Water, Tanga UWASA and contracted companies and they shall be referred to collectively as Tanga UWASA

With regard to environmental management during the Mobilization, construction, operation and demobilization of the project, the principal responsibilities of each party within this structure will be detailed in the ESIA

For certain aspects of the programme, assistance will be needed from the Local Government Authorities and the NEMC (mainly in the form of guidance and advice and in project monitoring).

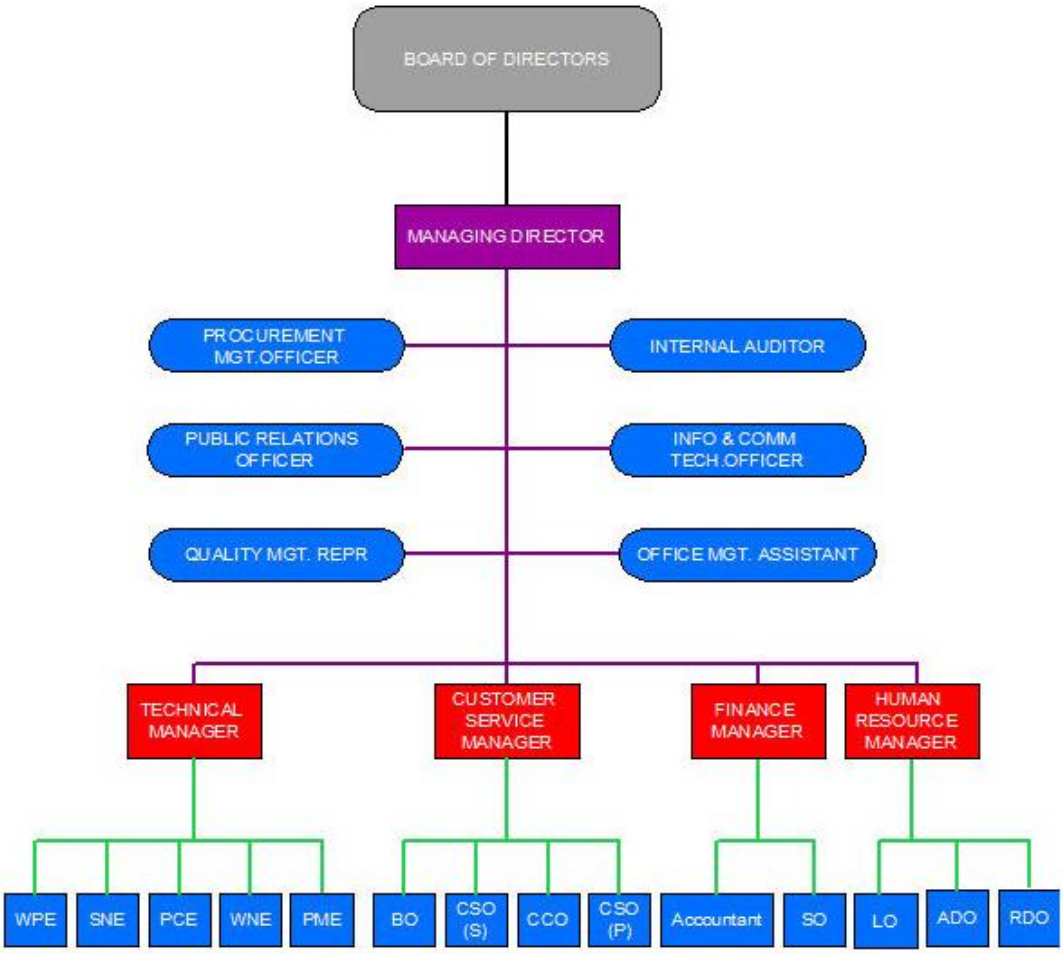


Figure 9-1: Organogram for Tanga UWASA

9.8 Coordination and Review of the EMP

The EMP forms the basis for environmental management on site. Based on the results of the performance assessment and review process, the EMP may be modified as the project progresses.

Modifications will only be permitted by the Tanga UWASA Technical Manager Changes to the EMP will only be allowed:

a) If alternative measures with equal or improved outcomes have been identified subsequent to the compilation of the report.
b) Prior to non-compliance, therefore requiring pro-active evaluation.

The Technical Manager shall ensure that any modifications are communicated, explained to and discussed with all affected parties (i.e. the authorities, subcontractors, Managers and any directly affected party who requests this information). All changes to the EMP shall be submitted to NEMC for approval.

9.9 Reporting

In addition to all reporting requirements identified in the EMP, records shall be kept by the Environmental Management office of all monitoring results, monitoring reports, incident records, audit reports and management reviews. Minutes of all environmental project meetings shall be submitted by the Contractors.

9.10 Stakeholders

The presence and involvement of several other stakeholders developed as the project begins and

during implementation of the ESMP. Mindful that most of the proposed project activities will take place at or around the project site, it will be the responsibility of Peponi Group to coordinate involvement of relevant government authorities and service providers to maintain the project schedules. The roles and responsibilities of some of these key stakeholders are included in the ESMP

Table 9-1: Environmental and Social Management Plan

Phase	Potential Impacts	Management/Mitigation Measures	Responsibility	Estimated Costs [TZS]
Mobilization/Construction Phase	Loss/disturbance of biodiversity and threatened species	▪ Minimum vegetation clearance will be ensured by clearing only those areas that are utilized for construction of WSP and layout of networks and the area used to lay down the sewer networks activities. ▪ Employees and subcontractors shall not be permitted to remove vegetation or fauna from site. ▪ Indigenous tree seeds will be collected and geminated to obtain seedlings for rehabilitation ▪ The project proponent shall consult the experts for advice and for potential flora stocks for re generation of disturbed vegetation along the proposed project.	Tanga UWASA, Ministry of Water (to monitor) and EWURA	20,000,000
	Accelerated erosion due to loss of ground cover	▪ Where practicable all excavations will be backfilled, resurfaced and lightly compacted; ▪ Siltation of down-slope streams and ditches will be prevented through the construction of run-off control systems around material stockpiles, waste dump ▪ Progressive rehabilitation and re-vegetation of disturbed land surfaces.	Tanga UWASA, Ministry of Water (to monitor) and EWURA	11,000,000
	Flooding impacts on the project site	▪ The proposed site will be backfilled with soil so as to maintain the safety level of flood ▪ The flood management system to improvised on site to protect the surrounding community.	Tanga UWASA and Contractor as well as Consultant	Part of Bill of Quantity for Contractor
	Atmospheric emissions from engines of vehicles	▪ Douse the surface with water to suppress excessive dust and whenever possible, water bowser should be used. ▪ Haul roads should be routinely maintained in good condition ▪ The project proponent shall plant indigenous trees and grasses over a period on area. This will prevent fine dust entering ambient area. ▪ Due care will be taken during site clearing and stripping of top soils during haul roads and in the project area ▪ The project proponent shall observe the standards for air quality ▪ Minimize track movement, this means vehicles will be used only when it is necessary. ▪ Using cars with good conditions. ▪ Responsible usage of tracks e.g. instead of using 3 tons track to	Tanga UWASA., Contractor	7,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Responsibility	Estimated Costs [TZS]
		carry loads twice is better to use 7 tons track which will only make one trip to reduce amount of carbon emissions.		
	Dust and noise pollution from mobilization vehicles, machines	▪ Douse the surface with water to suppress excessive dust and whenever needed, water bowsers shall be used. ▪ Provide protective gear (i.e. breathing masks) to workers working in dusty environment ▪ Trees will be planted along the road where the sewer networks will be passing so as to shield the communities from generated dust during operation and maintenance activities; ▪ Minimize truck movement, this means vehicles will be used only when it is necessary. ▪ Using cars with good conditions, cars with good conditions have the potential of having less noise pollution. ▪ Responsible usage of tracks e.g. instead of using 3 tons track to carry loads twice is better to use 7 tons track which will only make one trip to minimize noise polluted.	Tanga UWASA, HSE Officer Contractor	8,000,000
	Public health hazards and safety from construction of supportive infrastructure	▪ Tanga UWASA through Contractor shall ensure that all authorized personnel are aware of the relevant safety issues and will obtain training where appropriate ▪ The contractor will document procedures for the control of substances hazardous to health ▪ The contractor shall provide protective gear and ensure that they are used during construction	Tanga UWASA, HSE Officer Contractor	10,000,000
Operation and Maintenance Phase	Air pollution	▪ Provide protective gear (i.e. breathing masks) to workers working in dusty environment ▪ The project proponent shall observe the standards for air quality; ▪ Regular maintenance of all equipment on site will be conducted as a way or reducing emissions of noxious gases; ▪ The location of air quality monitoring stations will be reviewed through consultation with an air monitoring expert to identify the need for new stations to cover the new introduced activities;	Tanga UWASA, HSE Officer Contractor	36,000,000
	Surface and ground water contamination	▪ Regular maintenance of all equipment working along the project area and close monitoring of their movements will be ensured as a way of minimizing any discharges of hydrocarbons in the area. ▪ A water-monitoring programme will be developed and implemented to cover all water sources within the project area and those	Tanga UWASA, HSE Officer Contractor	50,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Responsibility	Estimated Costs [TZS]
		downstream the area especially at Utofu river ▪ Identification of monitoring points for both surface and groundwater monitoring will be established with the assistance of a water expert. ▪ Monitoring stations will be established and regular monitoring conducted around all waste stabilization ponds; ▪ A protection trench shall be constructed around oily facility areas i.e. fuel and lubricant storage area as well as power station area so that any spillage will drain into it.		
	Road accidents from moving vehicles	▪ Only the designated roads will be used during the project especially for emptier trucks ▪ Speed control alarm to all vehicles to be used will installed to monitor the speed; ▪ Traffic sign warning drivers of road humps, pedestrian crossings, animal crossings, sharp bends and other accident-prone areas will be posted along the road stretch and within the project environment ▪ Road safety education programmes will be established for the communities living along the road; such as right of the road, precautions necessary when crossing the road, etc. ▪ All drivers to undergo driving and vision tests prior to recruitment; ▪ All drivers to receive training on the operation of their specific vehicle, and in awareness of pedestrians and cyclists;	Tanga UWASA, HSE Officer Contractor	10,000,000
	Work Place Hazards and Accidents	▪ Proper handling of sludge at the WSP will be observed and workers will be provided with appropriate training on waste and protective gears and require the workers to use them. ▪ At work place, there shall be provided and maintained first-aid kits to be easily accessible during working hours ▪ Will institute regular medical check-ups for the workers ▪ All employees will be subjected to adequate medical insurance cover ▪ Adequate number and appropriate of fire hydrants will be installed in all strategic locations of the project site to put out fire in case of any contingency ▪ Hygienic conditions at work place, e.g., washrooms, change-rooms, dining and cooking areas, etc., will be provided and enforced. ▪ Drawing up and establishing health and safety regulations, and	Tanga UWASA	20,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Responsibility	Estimated Costs [TZS]
		formulating preventive measures for accidents and other human health and safety hazards ▪ Displaying of operation procedures of the WSP within the project area as well as other warning signs		
	Conflicts related to restricted access and trespassing	▪ Awareness raising and education to the communities including posting banners and warning signs at appropriate places at WSP. ▪ Visible mark of the WSP and along public roads and within the community. ▪ The fence will be constructed to surrounded the proposed waste stabilization ponds for the surrounding community safeguarding.	Public Relations Officer	20,000,000
	Pressure on natural/social service resources	▪ Impacts brought about by changes in population shall be mitigated through use of the local labour force and provision of social facilities by Tanga UWASA as well as contractors. ▪ Consultations with the local authorities will be conducted so that priority areas are identified and outreach assistance programme prepared and implemented; ▪ Awareness campaigns will be conducted to surrounding community on the significance of resources conservation; ▪ In consultation with the authorities will be assisted to develop and implement security measures that will assist them in safeguarding their properties and general security; ▪ In consultation with authorities, measures for enhancing contributions of the outreach programmes to reduce pressure on existing resources will be developed and implemented.	Tanga UWASA, HSE Officer Contractor	30,000,000
	Potential health hazards: HIV/AIDS, STDs to the community	▪ In consultation with the Local authorities, an expert to design special programmes to enable people (workers & surrounding community) handle HIV/AIDS will be engaged. These programmes will include promoting and training Peer Educators. ▪ To have a buffer zone of 500m at least from the ponds ▪ Continuous awareness on safety issues regarding waste water treatment plants operation to the community ▪ Ensure intensive and timely monitoring and maintenance of all infrastructures.	Tanga UWASA, HSE Officer Contractor	50,000,000
Dec om miss ion	Abandoned infrastructure	▪ Restoration of disturbed areas will be carried out as soon as project activities have ceased and indigenous vegetation species	Tanga UWASA, HSE Officer	32,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Responsibility	Estimated Costs [TZS]
		will be used for restoration. ▪ Tanga UWASA will remove all structures on decommissioning. ▪ Metal parts will be sold or given free to smelters	Contractor	
	Loss of aesthetics	▪ Rehabilitate and restore all the land that will be cleared of the vegetation for various project activities, through re-vegetation of the ground by planting native species of tree and grass planting. ▪ Tanga UWASA will prepare a rehabilitation plan that includes strategies to address long-term stability and sustainability, and time frames for assessment of rehabilitation activities.	Tanga UWASA, HSE Officer Contractor	40,000,000
	Unemployment	▪ Preparing the workers to be employed anywhere else in the through provision of extensive training ▪ Preparing the workers for forced retirement by providing skills for self-employment, wise investment. ▪ Ensuring that all employees are members of the National Social Security Fund and the employees should ensure that the developer's contributions are made.	Tanga UWASA, Ministry of Water	25,000,000
Total estimated Cost				**369,000,000**

CHAPTER TEN

10 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

10.1 Introduction

The proposed project requires regular monitoring and auditing of key environmental, health and safety indicators to:

- assess the overall performance of the project;
- to comply with local environmental, health and safety legislation; and
- Benchmark its project with other similar scientific core projects for improved management.

Key environmental parameters of concern with the operation of such a project are:

- water consumption,
- energy consumption; and
- solid and liquid waste handling;

Additionally, the following social parameters need to be keenly monitored to ensure benefits to the community and its sustainability:

- Health and safety status of project surrounding community and workers;
- Employment opportunities to local community; and
- Corporate Social responsibility programs.

With these factors in mind, there are a need to put in place elaborate and sound environmental management system and mechanisms of monitoring on a continuous basis the environmental performance of the Project. Undertaking monitoring and auditing of key environmental parameters and putting in place of all approved recommendation of the environmental management plan and conditions of the EIA license achieved, this Monitoring undertaken are both active and reactive.

With increased urban development come the challenges of waste handling and disposal. The monitoring programme developed must take into account possible impacts of solid waste disposal. All wastes emanating from the Project and its disposal must be monitored to ensure no environmental nuisance or degradation arises.

10.2 Inspections and Audits/Verifications

Regular audits/verifications shall be undertaken throughout the execution of the Project. The objectives of these are to:

- Check that practices conform with planned arrangements including implementation of mitigation and management measures and compliance with legal and project commitments;
- Identify where existing planned arrangements (e.g. measures outlined in the ESMP) do not meet the needs or can be improved; and
- Establish information which can be used by management to continuously improve performance.
- Two types of audits/verifications shall be undertaken:
- Periodic audits by Tanga UWASA, but frequency based on needs; and
- Ad-hoc audits by Tanga UWASA; in response to accidental events.

10.2.1 Daily Follow Up

On site follow up shall be conducted on a daily basis. All results shall be documented and submitted to in daily report

10.2.2 Audits/Verifications

Internal audits shall be conducted periodically based on the need identified during performance. (These shall be based on reports from the waste management, patrols on right of way and safety management issues/facilities)

All results of audits shall be documented and retained. Instances of non-conformances shall be reported to the relevant Supervisors/Managers to ensure that appropriate corrective and/or preventive action is taken.

10.2.3 AD-HOC Audits/Verifications

These shall be triggered by an incident and will specifically seek to understand the cause of the incident and identify a solution.

10.2.4 Audit Reporting

All audit findings shall be reviewed and where corrective actions are deemed necessary, specific plans (with designated responsibility and timing) shall be developed aimed at addressing the specific finding, any underlying issues and ultimately achieving continuous improvement in performance.

10.2.5 Monitoring

The day to day monitoring of Health, Safety and Environmental (HSE) issues during operations is to be conducted by the Contractor's respective HSE officer(s). Tanga UWASA has more of a supervisory and audit/control responsibility to ensure that HSE procedures and standards are being kept.

Detailed monitoring during emergency need to be a part of Management Plan in place where applicable. The Planned monitoring activities are described in Table 10-1

Table 10-1: Recommended Environmental Health and Safety Monitoring Plan

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Sampling Area	Target Level/ Standard	Responsibility	Estimated Cost (Tanzanian Shillings)
Mobilization/Construction Phase	Loss/disturbance of biodiversity and threatened species	Biodiversity	Before commissioning and once every six months	Within the project area	As previously or better	Tanga UWASA, Ministry of Water	10,000,000
	Accelerated erosion due to loss of ground cover	Soil erosion tendencies	Before commissioning and once every six months	Within the project area	As minimum as possible	Tanga UWASA, Ministry of Water	2,000,000
	Dust from rough roads, land clearance and excavations	< 10µm (PM10), Total suspended Particulates	Daily	Right of way and trenches for sewer network pipes, rough access roads and WSP	WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, 2005 TZS 845:2005 Air Quality – Specification; IFC Environmental, Health, and Safety (EHS) Guidelines, 2007	Tanga UWASA, OSHA, NEMC	20,000,000
	Atmospheric emissions from engines of vehicles	SO_2, NO_X SOX, CO, CO_2	Continuous	Exhausts equipment and vehicles	WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, 2005 TZS 845:2005 Air Quality – Specification; IFC Environmental, Health, and Safety (EHS) Guidelines, 2007	Tanga UWASA., Contractor	3,000,000
	Noise pollution from mobilization vehicles and construction equipment and	Noise level emitted	Construction phase	Along the access roads, in the vicinity the project area	Environmental Management (Noise and Vibration Pollution Control) Regulations, 2015	Tanga UWASA, Contractor	4,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Sampling Area	Target Level/ Standard	Responsibility	Estimated Cost (Tanzanian Shillings)
	machineries						
	Public health hazards and safety from construction of supportive infrastructure	Public health status and Safety incident records	Once every 3 months	Casual Workers and Personnel	Occupational Health and Safety Act, 2003/ IFC Environmental, Health, and Safety (EHS) Guidelines, 2007	Tanga UWASA., OSHA	1,000,000
Operation phase	Impaired air quality from dust pollution	< 10µm (PM_{10}), Total suspended Particulates, Nitrogen oxides as NO_2, Sulphur dioxide	Once in a week	Along the sewer networks, access road and WSP	WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, 2005 TZS 845:2005 Air Quality – Specification; IFC Environmental, Health, and Safety (EHS) Guidelines, 2007	Tanga UWASA, OSHA, NEMC	2,000,000
	Air pollution from noxious gases	CH4, NOX, SOX, CO, CO_2	Once in a week	Area close to the access roads and WSP and surrounding environment	WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, 2005 TZS 845:2005 Air Quality – Specification: IFC Environmental, Health, and Safety (EHS) Guidelines, 2007	Tanga UWASA	3,500,000
	Work Place Hazards and Accidents	Public health status and Safety incident records	Daily	Surrounding Community and along the sewer networks	Zero incidence	Tanga UWASA, OSHA, Ministry of Water	1,500,000
	Flood impact of the area						

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Sampling Area	Target Level/ Standard	Responsibility	Estimated Cost (Tanzanian Shillings)
	Conflicts related to restricted access and trespassing	Reported conflicts	Before commissioning and once every 2 months	Contractor Offices and LGA Offices	Conflict to be kept as minimum as possible	Contractor, Tanga UWASA LGA,	2,500,000
	Potential health hazards: STDs, HIV/AIDS, waterborne diseases etc.	Number of HIV cases	Once every six months	Confidential file	As low as possible	Contractor, Tanga UWASA. LGA	1,000,000

CHAPTER ELEVEN

11 DECOMMISSIONING

11.1 Overview

Decommissioning is not anticipated in the foreseeable future. However, if this will happen, may entail change of use (functional changes) or demolition triggered by change of land use.

A decommissioning plan that takes environmental issues into consideration shall be prepared by the developer prior to the decommissioning works. Should it be done, decommissioning may entail change of use (functional changes) or demolition triggered by change of land use

CHAPTER TWELVE

12 COSTS AND BENEFIT ANAYLSIS

A cost-benefit analysis is more often conducted as part of a feasibility study that incorporates the environmental, social, and economic costs and benefits of a particular undertaking.

The aim is to inform the proponent and the environmental authorities of the main environmental and socio-economic costs to weigh in decision making.

12.1 OVERALL COST IMPLICATIONS

The costs of constructing Waste Stabilization Pond (WSP) include the actual investment cost, the costs on the environment and the socio-economic costs.

12.1.1 Investment Costs

Preliminary estimates of the project are of the order of Twenty-Six Billion six hundred eighty million (26,680,000,000.00) Tanzanian Shillings. This includes:

- Expenditure on materials and equipment,
- Operational and maintenance costs (for waste treatment plants and associated facilities),
- Personnel costs (employed staff and consultants) and
- Health, Safety and Environment management.

12.1.2 Environmental Costs

The main environmental costs are related to moderate and large impacts identified in chapter six. These impacts are primarily a result of the risk related to a potential release of water during the mobilization of the equipment and the accidental leakages or spills during operation.

The monetary costs of such impacts are difficult to quantify depending on the costs to clean up pollution. However, the estimated budget for the implementation of the environmental and Social Management Plan is Three hundred and sixty-nine Million only (369,000,000/=) Tanzanian Shillings.

12.1.3 Socio-Economic Costs

The social costs of potential impacts during planned operations are negligible. The financial resources needed to mitigate the impacts from planned activities are minimal in comparison to the investment costs. Large socio-economic costs are only expected if an accidental spillage occurs. These costs will be related to

- Impacts on economic activities such as fisheries, tourism and shipping,
- Injury or more severe fatalities to crew and compensation to be paid,
- The economic cost of operational down time depending the severity of the damage to the vessel(s),
- Any damages to the survey and supply vessels caused by immense pressure or fire that have to be repaired or re-built.

12.2 OVERALL POTENTIAL BENEFITS

12.2.1 Environmental Benefits

Tanga UWASA has already invested in water supply and sanitation facilities improvement projects

which are currently taking place in various sites within Tanga City. This information is not only beneficial for Tanga UWASA but has been made available for Ministry of Water and Other financiers to improve environmental management and monitoring of sensitive areas

12.2.2 Socio-Economic Benefits

The immediate socio-economic benefit from project activities is employment and the procurement of local supplies and services. This will contribute positively to the local economy in Tanga and Tanzania as a whole.

The long-term benefits to the community are the easy accessibility of water and sanitation facilities. The availability of water and sewerage system will have a multiplier effect in the growth of industry. Furthermore, the government will also earn income from water supply and sewage tariffs'.

CHAPTER THIRTEEN

13 CONCLUSIONS AND RECOMMENDATION

The following key conclusions and recommendations have been developed during preparation of the present report on assessment of possible environmental impacts caused by Waste Stabilization Ponds (WSP) construction and operation process:

13.1 Conclusions

- According to the project, the normalized treatment of wastewater will be provided in Tanga and some other nearby settlements, if the effective system of wastewater treatment is implemented;

- The discharge of untreated wastewater into the Utofu river will be minimized if the planned activity is implemented, which serves the improvement of the local water quality;

- Construction of WSP project implementation serves the sustainable development of the local infrastructure, which holds a significant importance in terms of the social-economic development of the region;

- The selected area for WSPP is exposed to significant anthropogenic load. Reinforced concrete constructions of the treatment plant have remained at the area, and most part is contaminated with the household and construction waste. The existing anti-sanitary state endangers individual environmental receptors (incl. impact on the animal habitats, surface water pollution risks, high chance of disease spread and the risks of effecting the population health);

- Project implementation results in territory cleanup and significant improvement of the existing sanitary-ecological conditions, reducing the abovementioned risks considerably;

- Jobs will be created through the construction and operation phases of the treatment plant, which is important in terms of the employment of local population;

- According to the calculations made through the environmental impact assessment process, the impacts related to the decrease of ambient air quality will not be significant, during the construction and operation of the treatment plant;

- There is no high risk of the impact on water environment at the construction and operation phases in case the appropriate mitigation measures are taken and the terms of operation are satisfied; WSP operation phase is assessed positively in terms of the impact on water environment;

- There is a small portion of fertile soil layer at the project area. The amount of soil is scarce and has no special value. The effect on ground and soil will not be significant;

- The engineering-geological researches made withing the area have revealed that there are minimal risks of dangerous processes to develop; There is no need to take significant mitigation measures in this regard;

- The cleanup of vegetation cover at the project area will not be necessary during the construction phase. No vegetation included in Red List was found. In terms of appropriate mitigation measures and monitoring, the impact on vegetation cover will be insignificant;

- The selected area has a high anthropogenic load and the existing animals are accustomed to the intensive anthropogenic activities. In case the project is carried out, the effect on animals will not be significant. Some positive impacts are expected as well;

- There are minor risks of negative impacts expected on protected areas, as they are significantly far from project area. Only the minor indirect impacts might occur;

- The plant construction process will be related to visual-landscape changes, which might reduce considering the planned mitigation measures. Overall, the project implementation is associated with positive consequences in this regard.

- No historical or cultural monuments have been spotted at the project area and its surroundings to be effected by the project;

- The construction area is state owned, non-agricultural land. Project realization is not related with either physical or economical resettlement;

- Local, natural resources can be used for the plant construction (sand-gravel storages, water resources for industrial water and drink purposes, etc.), which is also notable in terms of the effect on local environment.

13.2 Recommendations:

1. Both Tanga UWASA and the building contractor are obliged to establish a strict control over the implementation of the activities regarding mitigation measures defined by economic expertise as said in the environmental impact assessment report;

2. Provide the personnel working on construction site and those involved in later operation phase with periodic (once every 6 months) training and examinations regarding environmental protection and professional safety issues;

3. It is necessary to ensure the personnel engaged in construction and operation activities with individual protective equipment;

4. The project documentation should include the re-cultivation and greenery planting activities of the construction camp and site. The local varieties of trees and plants are preferable for greenery planting activities.

5. In case of the arrangement of the fuel storage reservoir at the construction camp, the reservoir should have concrete or clay fencing, with a capacity of no less than 110% of the tank volume. Fencing of the reservoir enables the prevention of spread in cases of accidental spills of oil.

6. During the construction process, the temporary storage for hazardous waste should be built on the constriction camp site, and during the exploitation process, the storage must be built on the area of wastewater treatment plant. Hazardous waste storage must be arranged in the following conditions:

    - The storage must have waterproof bottom.

    - The ceiling will be painted with moisture resistant paint;

    - There will be the shelves and racks for disposal of the waste inside the storage;

    - The storage will be equipped with the following: Indoor and outdoor lighting systems exhaust ventilation system, wash stand and tap water for washing the area, water intake trap, fire stand, warning and prohibiting signs.

7 The disposal and management of the hazardous waste generated from the process of construction and operation should be carried out by the contractors with the appropriate, special license.

8 Dewatered sludge from the treatment plant, to be placed at Kutaisi sanitary landfill on the contractual basis.

9 Systematic monitoring of the technical soundness of the treatment plant system and the effectiveness of wastewater treatment is necessary for control management.

10 Periodic surveys should be conducted with the population and personnel regarding the spread of unpleasant odor in order to assess the effectiveness of the prevention measures; Planting the pine trees on the perimeter of the site in order to prevent the spread of unpleasant odor.

11 Periodic laboratory tests of purified water and River Utofu in accordance with Monitoring Plan.

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APPENDICES

APPENDIX I: STAKEHOLDERS CONSULTED

APPENDIX II: PRELIMINARY DESIGN REPORT