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MINISTRY OF WATER AND ENERGY

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Environmental and Social Impact Assessment

(Sewer Line Networking, Waste Water Treatment Plant and Fecal Sludge Management Subprojects for Harar Town)

[Final]

Second Urban Water Supply and Sanitation Project

May 2023
Addis Ababa

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ABR	Anaerobic Baffled Reactor
AIDS	Acquired Immunodeficiency Syndrome
BOD	Biological Oxygen Demand
BP	Bank Procedures
CBOs	Community Based Organizations
CITES	Convention on International Trade in the Endangered Species of Fauna and Flora
CAS	Conventional Activated Sludge
COD	Chemical Oxygen Demand
CR-WSP	Climate Change Resilience Water Safety Plan
CSE	Conservation Strategy of Ethiopia
DMU	Debre Markos University
EAAS	Extended Aeration Activated Sludge
EA	Environmental Assessment
EEPO	Establishment of Environmental Protection Organs
EHS	Environmental Health and Safety
EPA	Environmental Protection Authority
EPC	Environmental Pollution Control
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EHS	Environmental Health and Safety
FDRE	Federal Democratic Republic of Ethiopia
FSM	Fecal Sludge Management
FSTP	Fecal Sludge Treatment Plant
GBV	Gender Based Violence
GE	Green Economy
GHG	Greenhouses Gases
GoE	Government of Ethiopia
GPS	Global Positioning System
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GTP	Growth Transformation Plan
HASP	Health and Safety Plan
HEPA	Harar Environmental Protection Authority
HNAP	Health National Adaptation Plan to climate change
HWSSA	Harar Water Supply and Sanitation Authority
IFC	International Finance Corporation
MBBR	Moving Bed Bio Reactor
MBR	Membrane Bio Reactors
MCA	Multi Criteria Analysis
MoWE	Ministry of Water and Energy
NGO	Non-government Organization
OP	Operational Policy
OD	Oxidation Ditch
PAP	Project Affected People
PCT	Public and Communal Toilet
PDBs	Planted Drying Beds
PPE	Personal Protective Equipment

PT	Public Toilets
RAP	Resettlement Action Plan
RBC	Rotating Biological Contractors
RPF	Resettlement Policy Framework
SA	Sexual Abuse
SBR	Sequencing Batch Reactors
SEA	Sexual exploitation Abuse
SEP	Stakeholder Engagement Plan
SH	Sexual Harassment
STD	Sexually Transmitted Disease
STIs	Sexually Transmitted Infections
TF	Trickling Filter
ToR	Terms of Reference
TMP	Traffic Management Plan
TP	Treatment Plants
UASB	Up flow Anaerobic Sludge Blanket
UV	Ultra-Violet
UWSSP-II	2nd Urban Water Supply and Sanitation Program
WB	World Bank
WB's (EHS)	World Bank Environment, Health and Safety
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WIF	WaSH Implementation Framework
WSPs	Waste Stabilization Ponds
WWTP	Wastewater Treatment Plant

DEFINITION OF TERMS

Aerobic digestion: A process which uses bacteria and oxygen to break down organic and biological waste.

Anaerobic digestion: A process which uses bacteria to break down organic and biological waste in the absence of oxygen.

An Impact: is the effect of any action that affects one or more elements of the natural, social or economic environment, either adversely or beneficially.

Basic sanitation: Use of an improved sanitation facility that is not shared with any other household.

Decomposition: refers to a controlled method to treat fecal sludge whereby its components are broken down by aerobic and/or anaerobic digestion processes. Decomposition in this context can be successfully practiced when fecal sludge is contained (typically underground) for at least two years in an environment where liquids drain and remaining fecal sludge becomes dry. The end product after the decomposition process is called humus, which can then be used as a soil conditioner. Decomposition is an appropriate Fecal Sludge Management (FSM) solution and contributes to safely managed sanitation.

Containment/storage: Ways of collecting and storing (and in some cases treating in-situ) fecal sludge generated from a latrine.

Drying beds: A method of treating fecal sludge off-site whereby sludge is spread out over a contained space to dry.

Direct pit: A pit that is directly under a latrine pan, whereby excreta fall directly into the pit.

Dry pit latrine: type of latrine that doesn't require water for flushing. Excreta typically fall directly into the pit.

Direct Impacts: Those impacts that are caused by the action and which generally occur at the same time and place as the action.

Displaced Household: All members of a subproject affected household residing under one roof and operating as a single economic unit, who are adversely affected by the project or any of its components; it may consist of a single nuclear family or an extended family.

Displaced Persons: In the context of involuntary resettlement, displaced persons are those who are physically displaced (i.e., have been subject to relocation, loss of residential land, or loss of shelter) or economically displaced (i.e., have been subject to loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land; or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.

Compensation: Payment in cash or in kind of the replacement cost of the acquired assets.

Cut-off-Date: The last date for establishing the eligibility of persons displaced by the project for receiving compensation and resettlement assistance. It is determined according to the procedures of the borrower government: usually the completion date of the census of project-displaced persons. In absence of such procedures, it is the borrower who will establish a cut-off date.

Economic Displacement: Loss of land, assets, access to assets, income sources, or means of livelihood because of: (i) involuntary acquisition of land; or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.

Encroachers: People who occupy the land beyond what they legally own. They are usually not entitled to compensation but are sometimes provided with assistance if they are found vulnerable. Loss of built-up structures, trees, crops, and other assets could be compensated.

Entitlement: Range of measures applied to displaced persons to restore their economic and social base: compensation, income restoration, transfer assistance, income substitution, and relocation.

Environment: The physical factors of the surroundings of the human beings including land, water, atmosphere, climate, sound, odor, taste, the biological factors of animals and plants, and the social factor of aesthetics and including both the natural and built environment.

Environment and Social Impact Assessment: A systematic examination conducted to determine whether or not a project will have any adverse impacts on the environment.

Environmental Impact Study: means the study conducted to determine the possible environmental impacts of a proposed policy, project, or activity, and measures to mitigate any such impacts.

Environmental Monitoring: the continuous determination of the actual and potential effects of any activity or phenomenon whether short-term or long-term.

Fecal sludge: Contents of an on-site sanitation facility (such as a latrine pit) typically comprising of excreta, flush water, and anal cleansing materials.

Fecal sludge management: Methods and processes to manage fecal sludge.

Leach pit: Latrine pit that facilitates the draining of liquids into the surrounding soil.

Latrine: A sanitation system that captures fecal sludge and contains it. Through this containment, a barrier is established to prevent contact between humans and potentially disease-causing microbes in fecal sludge. Numerous types of latrine systems, technologies, and configurations exist.

Human health hazards: Hazards associated with fecal sludge that may be related to its microbial, chemical or physical properties. Microbial hazards refer to the health risks associated with exposure to potentially harmful microbes. Chemical hazards can include exposure to cleaning agents and physical hazards, to dangerous labor or machinery.

Indirect Impacts: Those impacts that induce changes in the natural environment, population, economic growth, and land use, as a result of actions not directly linked to the project in question.

Involuntary Resettlement: Land/asset loss, which negatively impacts livelihood. These losses have to be compensated so that no person is worse off than were before the loss of land and/or assets caused by project.

Participation: A process through which stakeholders' influence and share control over development initiatives and decisions or resources that affect them.

Physical Displacement: Relocation, loss of residential land, or loss of shelter as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.

Pollution: any direct and indirect alteration of the physical, thermal, chemical, biological, or radioactive properties of any part of the environment by discharging, emitting, or depositing wastes so as to affect any beneficial use adversely, to cause a condition that is hazardous or potentially hazardous to public health, safety or welfare, or to animals, plants or aquatic life, or to cause a contravention of any condition, limitation or restriction to a healthy environment.

Project: a set of planned activities to achieve objectives within a given area and time frame.

Project brief: a summary statement designed to achieve specific objectives within a given area and the likely environmental impacts and mitigation measures thereto.

Proponent/Developer: means a person, group of persons, or agency developing a new project or proposing to extend an existing project which is subject to an environmental impact assessment process.

Meaningful Consultation: A process that: (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an

atmosphere free of intimidation or coercion; (iv) is gender-inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, sharing of development benefits and opportunities, and implementation issues.

Mitigation measures: Actions that reduce, avoid or offset the potential adverse environmental consequences of a project, and include engineering works, technological improvements, management measures, and ways and means of ameliorating effects to the environment and losses suffered by individuals and/or communities, including compensation and resettlement.

Rehabilitation: Compensatory measures provided under the World Bank Operational Policy 4.12 on Involuntary Resettlement and other than the payment of replacement cost of acquired assets.

Replacement Cost: Compensation for acquired housing, land, and other assets that are calculated at full replacement costs based on the following elements: (i) fair market value; (ii) transaction costs; (iii) interest accrued, (iv)transitional and restoration costs; and (v) other applicable payment if any. Depreciation of structures and assets should not be taken into account.

Resettlement Impact: The nature and value of livelihood loss caused by the acquisition of land or assets

Safely managed sanitation: Refers to the use of an improved sanitation facility, which is not shared with any other household, and where excreta are either: (1) treated and disposed in-situ (in the place where it is kept); or (2) transported and treated off-site; or (3) transported through a sewer to a treatment facility. Safely managed sanitation aims to ensure that the potential health and environmental risks associated with fecal sludge are minimized throughout the entire sanitation service chain.

Septic pit: A pit that is fully sealed (often using cement), connected to a latrine, and collects and stores fecal sludge. Given that pit is sealed, liquid cannot drain from the pit into the surrounding soil.

Scoping: is the early transparent process that identifies concerns, evaluates them, and organizes them by eliminating insignificant impacts and focusing on significant impacts for further assessment so that attention and therefore resources, can be effectively and efficiently utilized

Screening: Selection of actions or projects requiring Environmental and Social Impact Assessment (ESIA). Common methods for screening include project threshold, sensitive area criteria, positive and negative lists, and preliminary assessment/ IEE.

Significance: an expert evaluation/judgment of the magnitude of impact or the degree to which a proposed activity or project may (potentially) impact on the environment if implemented.

Significant effect: substantial, or potentially substantial, adverse changes in any of the physical factors of the surroundings of human beings including land, water, atmosphere, climate, sound, odor, taste, the biological factors of animals and plants, and social factor of aesthetics and includes both natural and built environment.

Significant Impact: Impact experienced by 200 people or more, involving: (i) physical displacement from housing; or (ii) loss of 10% or more of their productive assets or income-generating activities.

Stakeholders: those affected by the outcome of a project or can affect the outcome of a proposed either negatively or positively.

Subprojects: development of Sewer line networking; Public and Communal Toilets; Fecal Sludge Treatment Plant and Wastewater Treatment Plants.

Treatment: A process that changes the physical, chemical and biological characteristics of fecal sludge so that it is converted into a product that is safer for end-use or disposal.

Vulnerable Groups: Households below the poverty line, women, children, elderly, people without legal title to assets (including land).

Waste: is a by-product of day-to-day activities or anything, which is no longer useful to someone and is disposed of. It is an unwanted or undesired material or substance that is thrown away.

EXECUTIVE SUMMARY

INTRODUCTION

Poor sanitation has long been regarded as a constraint to the regional socio-economic growth in the town of Harar like as many parts of the nation or any community. As per feasibility study, nearly 10.9% of the total population do not have sanitation facility in their premises and practice open defection in open spaces, stream buffer zones and street corners. This is common especially around Jegol area. Nonetheless, Jegol is provided with a rectangular covered canal (sullage line) to collect and dispose grey water from kitchen, bathtubs, sinks, cloth washing and other uses. Over the past decade the use of the sullage canal changed informally from grey water conveyance to mixed wastewater (grey and black water) conveyance system. The conveyed wastewater flows from Jegol into the natural drainage system without any form of treatment. This sullage system is now a problem for Harar town municipality in that there is a continuously flowing sewage inside the canal filling the drainage lines around Jegol and finally making it to the downstream river system. In addition, there is neither an operating fecal sludge treatment plant nor a dedicated sludge disposal site in Harar town.

Hence, to alleviate these problems and achieve the goal set in the Ethiopia's Ten-Year Development Plan and Sustainable Development Goals (SDG), the Government of Ethiopia has successfully secured finance from the World Bank under the Second Urban Water Supply and Sanitation Project (UWSSP-II). The UWSSP-II is primarily intended to improve urban sanitation holistically and equitably in the urban space and provide assistance to improve operational efficiency in 22 Ethiopian cities. Harar is one of the secondary cities benefiting from the portion of the finance secured under UWSSP-II (Component 2). The overall objective of the project is to improve and increase access to improve sanitary conditions through constructing Public and Communal toilet (PCTs), Sewer Line Networking, Wastewater treatment plant (WWTP), and Fecal Sludge Treatment Plant (FSTP) to ensure a sustainable waste management system. Other objectives include improving the hygiene and public health conditions and reducing the deterioration of the quality of the environment and water resources.

The infrastructure development may bring adverse impacts on the environment and social aspects that need efforts to minimize the negative impacts and set mitigation measures to make the project environmentally and socially acceptable. Without proper planning and management, the project may result in severe economic, social and environmental impacts. Hence, this project aims to provide an insight of the possible environmental and social impacts which can occur due to the design, construction and operation of the proposed sub projects during different phases and the possible mitigation measures which can be adopted. In connection with this, the Ministry of Water and Energy (MoWE) signed consultancy service contracts with Motion Consultancy and Training PLC., to undertake the environmental and social impact assessment (ESIA) Study for the development of proposed sub projects for Harar town.

The overall objective of this ESIA is to identify, predict and evaluate the potential beneficial and adverse impacts of the proposed project on the biophysical and socio-economic environment in and around the Harar city in terms of magnitude, spatial extent, duration and significance. The study is also aimed to provide recommendations for enhancing the beneficial impacts and mitigation measures for the adverse impacts as well as environment and social management and monitoring plans that would help implementation of the recommended enhancement and mitigation measures. The ESIA gives particular

emphasis to the potential impacts on the quality of life of people living close to the proposed subprojects, the health and safety of those who will be involved in the construction and operation of the proposed subprojects, and the surrounding natural and human environment. The scope of the ESIA study includes:

- Identification and analysis of the national and the World Bank environmental safeguard policies and regulations that will be triggered by the project activities;
- Describe the views and concerns of the public and stakeholders towards the implementation of the project;
- Establish baseline features of the biophysical, socio-economic and cultural attributes of the project area;
- Identify and evaluate the significant impacts (both beneficial and adverse) associated with project implementation and subsequent operation;
- Propose specific mitigation for inclusion in the project detail design and management plan to reduce or avoid significant adverse environmental and social impacts; and
- Prepare Environmental and Social Management and Monitoring Plans for the recommended measures that will minimize adverse impacts and enhance beneficial impacts during the planning, construction, operation as well as the decommissioning of the proposed sub projects.

The current ESIA study focuses on sanitation schemes laid down for Phase I-III (2021-2041), evaluating the necessary requirements for the technology adoption, site selection and construction and operation modalities. This is due to the nature of development activities that started in phase I (immediate horizon) and extended until Phase III (ultimate horizon).

METHODOLOGY

The ESIA study is aimed to contribute to the environmental and social safeguards of the proposed subprojects in Harar town. This ESIA has been prepared according to an environmental and social management framework (ESMF) for UWSSP-II. The ESMF provides guidance for the environmental and social screening process and preparation of appropriate safeguards instruments for proposed investments.

The ESIA study methodology adopted screening to determine the extent of the project and desktop data search and analysis for the baseline bio-physical and social environmental parameters of the project area. In addition, the consultant worked with the project design group and was briefed and obtained design approaches to be used which informed the requirements of the environmental reporting process and for which excerpts have been obtained on salient design information. The Consultant engaged on multi-faceted stakeholder's consultation process, social and environmental surveys using structured questionnaires duly analyzed and key informant interviews to institutions and lead agencies and potential project affected and surrounding community consultations. Based on these findings and expert judgement, the consultant has compiled the projected social and environmental impacts (positive and negative) likely to emanate from proposed project activities and the Environmental and Social Management (ESMP) and Monitoring Plans which details how adverse impacts and risks will be reduced or eliminated and by whom.

POLICIES, LEGISLATIONS AND INSTITUTIONAL FRAMEWORK

Relevant National Policies and Strategies

The Constitution of the Federal Democratic Republic of Ethiopia (FDRE), adopted in 1995, provides the overriding principles and legal provisions for all legislative frameworks in the country. The concept of

sustainable development and the environmental rights of the people are enshrined in the Constitution's Articles 43 and 44. These Articles, among others, state the right to development, the right to live in a clean and healthy environment, and the right to monetary or alternative means of compensation, including relocation with adequate state assistance for persons displaced or whose livelihoods adversely affected as a result of state programs. Article 35 provides a foundation for the recognition and protection of women's rights and guarantees women an equal right with men. The Environmental Policy of Ethiopia, issued in 1997, has the overall policy goal to improve and enhance the health and quality of life of all Ethiopians, to promote sustainable social and economic development through sound management and use of natural, human-made and cultural resources and their environment as a whole. ESIA policies are included in the cross-sectoral environmental policies and they emphasize the early recognition of environmental issues in project planning, public participation, mitigation and environmental management, and capacity building at all levels of administration.

Other relevant policies issued by the Government of Ethiopia (GOE) include Water Resources, Wildlife, Population, Health, HIV/AIDS and Women Policies. Applicable strategies and programs include Climate Resilient Green Economy Strategy, Urban Wastewater Management Strategy, Health National Adaptation Plan to climate change (HNAP), the Second Urban Water Supply and Sanitation Program (2017 to 2022), Integrated Urban Sanitation and Hygiene Strategy, National Hygiene and Sanitation Strategy, and Water, Sanitation and Hygiene (WASH) Implementation Framework and Climate Change Resilience Water Safety Plan (CR-WSP) Strategic framework.

Environmental Framework Legislations

The GOE has issued several Proclamations and Regulations that are aimed to foster environmental protection and sustainable use of natural as well as man-made resources. Among these legislations are the Proclamation on Establishment of Environmental Protection Organs (EEPO), the Proclamation on Environmental Impact Assessment (EIA) and the Proclamation on Environmental Pollution Control, all came into effect in 2002. The EEPO Proclamation lays down the institutional arrangements necessary to ensure environmentally sustainable management and development at Federal, Sectoral and Regional levels. It re-establishes the Federal Environmental Protection Authority (EPA), and empowers every sector ministry or agency and regional state to establish or designate a Sectoral Environmental Unit and Regional Environmental Agency respectively.

The EIA Proclamation makes an EIA mandatory for specified categories of activities undertaken either by the public or by private sectors and is the legal tool for environmental planning, management and monitoring. The EPC Proclamation is mainly based on the right of each citizen to have a healthy environment, as well as on the obligation to protect the environment of the Country and its primary objective is to provide the basis from which the relevant ambient environmental standards applicable to Ethiopia can be developed, and to make the violation of these standards a punishable act. Other most relevant laws and regulations include Water Resources Management Proclamation (Proclamation No. 192/2000); Solid Waste Management Proclamation (Proclamation No. 513/2007); Expropriation of Land Holdings, Payment of Compensation and Resettlement Proclamation (Proclamation No. 1161/2019); Public Health Proclamation (Proclamation No. 200/2000); Labor Proclamation (Proclamation No. 1156/2019);

Regulation on Prevention of Industrial Pollution (Regulation No. 159/2008); and Regulation on Expropriation and Valuation, Compensation and Resettlement (Regulation No. 472/2020).

The World Bank's Safeguard Policies

Of the World Bank (WB) Safeguard Policies, Operational Policy (OP)/BP 4.01 Environmental Assessment (EA) is the most relevant. The objective of this policy is to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through the appropriate analysis of the projects‟ actions and their likely environmental impacts. The Bank undertakes environmental screening for each proposed project to determine the appropriate extent and type of ESIA. The Bank also classifies a proposed project into one of three categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. A project designated as Category A requires a full environmental assessment followed by Independent Environmental Review; Category B projects require a lesser level of environmental investigations; Category C projects require no environmental analysis. Hence, following the contribution it will have to the environment itself and the society, the proposed subprojects fall under category B.

DESCRIPTION OF BASELINE CONDITIONS

Physical Environment

Harar town and its surrounding can be divided into three landforms based on the slope of the topography, namely, plain area at the lowest elevation and gulley at the bottom, sloppy at the banks of the gulley, and transitional zones, and rugged to gently sloping area at the highland areas. The project area stands on a broad upland plateau with an altitude ranging between 1,700 to 2,200 meters above sea level. Gullies, streams, and steep slopes dominate the topography of the town. The climate of Harar is mostly Woina Dega (subtropical). The average annual maximum and minimum temperatures are 25.5℃ and 13.4℃, respectively. The annual rainfall of Harar town varies from 319mm to 1000mm with a mean annual value of 665.5 mm. The annual average wind speed in Harar town is 1 m/s with the highest value of 2.1 m/s in February and 1.9 m/s in January. The minimum wind speed has been recorded in October (0.4 m/s).

Harar is located at the beginning part of Bisidimo-Erer River Basin and the major part of the town is metamorphic rock and with some limestone rock and localized sediments in the valleys and depression. The general rugged topography and relatively thin sediment cover and poor geometry for storing water confined to the potential subsurface sources to localized sediment and weathered zone (saprolith) of the metamorphic rock. The soil type of site mainly is sandy soil cover with varying thicknesses. Previously the site was used to dump solid waste indiscriminately as evidenced by litter spread all around the area. The expected aquifer for Sofi Woreda is an alluvial deposit along the valley. This is evidenced by the riverside 'chirosh'/seepages, which are being exploited by the local people through hand-dug wells.

Biological Environment

An observation-based biodiversity assessment was made in the sites proposed for the WWTP and FSTP. All sewer lines construction sites are in the urban area of Harar town. The area proposed for the WWTP and FSTP site has not been identified as an area of significantly sensitive natural vegetation cover. No threatened, near threatened or any rare and declining species is identified to occur on the study site. There are no sensitive wild species that would occur in the vicinity of each of the sites. The FSTP and WWTP sites are characterized as crop dominant with scattered Mango and Khat trees land use type.

Socio-economic Environment

Harar is one of the oldest and an ancient historical town located on a hilltop in the eastern part of Ethiopia about 525 kilometers from the national capital Addis Ababa at an elevation of 1330-2200 meters. The total land area of the Harari region is estimated to 34.2 km^2 (34,320 ha) out of which the rural area accounts to about 323.7 km^2 (94.3%) and the remaining 19.5 km^2 (1950 ha) accounts for the urban area. The Harari region consists of six urban and three rural Woredas. The rural Woredas include; Sofi, Dire teyara, and Erer-Woldiya. The administrative areas are further divided into 19 sub-Kebeles (urban) and 17 sub-Kebeles (rural). The region is mainly categorized into two agro-ecological zones; 90% of the land area of the region is estimated to be mid-high land (weyna dega), between 1400-2200 meters above sea level, while the remaining 10% is kola (approximately found below 1500 meter above sea level). The settlement pattern of the region is different from other regions of the country where 62% of the population reside in an urban area. The livelihood of the population is basically dependent on farming, trade/small business, and employment in the formal sectors at government and non-governmental offices.

There are different institutions and infrastructures around the proposed subprojects, specifically sewer line networking developments. These include schools, pharmacies, residential houses, clinics, market areas, roads, hospitals, colleges and other institutions and facilities.

DESCRIPTION OF THE PROPOSED SUBPROJECTS

Harar town is among the twenty-two cities that has been selected to participate in the UWSSP-II Program. The development objective of the project is to contribute to the improvement of the socio- economy for the residents of Harar town by providing effective and efficient sanitation services.

- Construction of 5 communal and 7 public toilets in the selected towns
- 1 Fecal Sludge Treatment Plant (FSTP), Wastewater Treatment Plant and Sewer line Installations,
- In the medium horizon which runs between 2026 and 2031 the expansion works will be done.
- In the long-term horizon, which is planed between 2031-2041 expansion and capacity building will be take place.

The objective of this assignment is to conduct an ESIA as part of construction and operational activities of the FSTP and WWTP. The treatment plants will start its implementation in phase I and will continue in phases II and III. Along with the construction of PCT and FSTP, several vacuum trucks are proposed to be purchased in each phase. The present ESIA study focuses on sanitation schemes laid down for Phase I-III (2021-2041).

Table 1: Project Planning Horizons

Horizon Description	Planning Period
Initial Year-Short Term Plan	2021-2026
Future Year- Medium Term Plan	2026-2031
Ultimate Year- Long Term Plan	2031-2041

To achieve the goals delineated under the immediate urgent works, the following measures have been proposed:

Public and Communal Toilets

- Due to high demand for communal toilets, in the short term about 12 are under construction and 20 more communal toilets are planned to be constructed in selected Kebeles. In general, selection of the proposed communal toilet sites considered density of population, living standard (slum areas, old neighborhoods, Kebele rented houses etc.), and availability of space/land for construction. According to the engineering consultant, two types of communal toilets design have been assessed for use under this sanitation management project. Two types of typical communal toilets to be constructed on plot areas of 59.5m^2 (8.50m*7.00m) and 37.5m^2 (7.50m*5.00m) are selected with basic design characteristics of Sanitary Appliances and Plumbing services. In addition to the construction of new communal toilets, about 46 toilets have been approved for renovation works at different sites.
- Based on the nature and types of sanitary problems identified during the feasibility study, about 12 public toilets were recommended in the short term. The construction of five public toilets is already underway (in some cases, near completion) on jointly identified and selected five sites in the town. In addition to that, there are three functioning public toilets currently in use by town residents. The balance of 10 public toilets out of the total 18 required for the short-term intervention is proposed to be implemented in the short term. For implementation in Harar town, the engineering consultant compared different design options. After analyzing the social, technical, and economic issues, a typical public toilet to be implemented on a 92m^2 (11.00m*8.50m) plot has been prepared with different characterization of Block configuration; Sanitary Appliances; Plumbing services; and other services:

Fecal Sludge Treatment Plant

As per feasibility design, the proposed FSTP will have a capacity of 23,601m^3/year or 65m^3/day, but could be modular with a capacity of 10m^3 per unit, with total area requirement of 20,706 m^2 at "Kile' landfill site, Herwi Kebele, Sofi Woreda including improvement of storage, collection, transport, and disposal of fecal sludge wastes, the establishment of a disposal facility, and treatment for fecal wastes (sludge). The following FSTP design component and quantities is proposed for the new FSTP facility near the landfill site.

- **Biological Treatment Units:** Anaerobic Baffled Reactor (ABR) with combination of facultative pond and maturation pond. The treatment process comprises inlet works (coarse screen). The collected leachate from ABR will be treated in a series of facultative and maturation ponds. Where, the main function of maturation ponds is destruction of pathogens and other bacterial growth. The process also carry out polishing of the wastewater to achieve the standards for Biological Oxygen Demand (BOD) and suspended solids. The collected sludge from the ABR will be treated in the sludge drying beds. The Dried sludge will be stored on open ground. ABR consists of five chambers. Each chamber will have a 5m^3 volume. The ABR settler has a length of 6.7m, width of 3.65m and depth 2.05m. ABR chambers have a length of 0.75m, width of 2m and depth 1.5m and the down-flow chambers were 25cm above the reactor's bottom.
- **Sludge Drying Beds:** designed for the dewatering and stabilization of partially treated fecal sludge after accumulation in the ABR and anaerobic ponds. Further treatment of sludge is expected in the Drying

Beds due to the extensive exposure to Ultra Violet (UV) resulting in considerable pathogen reduction. Continuous dewatering and drying of the sludge are also expected to result in more rapid sludge stabilization. For effective management of the beds, it is recommended to provide modular drying beds partitioned into manageable sizes. Based on the topographic setup of the selected area, the width and length of individual beds can be taken as 6 and 30m respectively. For the liquid waste management facilities to be constructed for the town of Harar a modular drying bed with width of 6m and length of 30m has been adopted with 55 Modular Drying Beds of a total area of 9630m^2.

- **Wastewater *Treatment Plant:*** As presented in detail in the feasibility study, the Sofi catchment is the main sewer catchment in Harar town. The catchment constitutes a total of about 491.3 ha area extending from Arategna in the West to the treatment plant close to the new stadium in the East. The sofi catchment is home to the major commercial and institutional centers, and is thus the major contributor of wastewater in the town. Under the short-term intervention, the Consultant recommends the implementation of the WWT that covers several condominium sites and the Jegol area. It is expected that some parts of the Sofi catchment including Jegol, the town and major commercial areas are ready for sewerage intervention during phase I and will continue its expansion in phase II and III.
- The proposed Harar Wastewater Treatment project comprises a centralized and integrated sewer collection system and a single WWTP. ABR+TF has been chosen as one of the most widely used biological wastewater treatment systems for municipal sewage treatment. The WWTPs will be made up of several components that will work in stages. The main components are the influent inlet structure, screen bars, grit chamber, and primary clarifier/sedimentation tank, activated sludge tank, secondary clarifier, and treated Effluent Storage Tank, sludge return and excess sludge removal systems. It will also include sludge dewatering and thickening, anaerobic digestion, landfill for dried sludge disposal, and the Odor Treatment Unit.

Sewer Line Networking

As per feasibility study, in the current sullage/black-water system, there are more than 20 outlets draining to the drainage ditch encircling the Jegol wall which finally drains to the nearby Erer River.

- The proposed network is a gravity system and no pumping is involved. Plasticized polyvinyl chloride (uPVC) sewer pipe will be used for all pipes with diameter < DN450 and GRP pipes are used for all pipes with diameters >= DN450. For manholes, a precast concrete manhole is proposed. Manholes are provided where there is change in direction, change in gradient, intersection of two sewer pipes, and change in pipe diameter or where the length of the sewer is 70m or more. A maximum manhole depth of 5m, maximum and minimum velocities of 3m/s and 0.6m/s respectively and flow to capacity ratio of 75% will be used for the design of the sewer system. Depths greater than 5m are accepted only in special cases where the ground elevation is higher for small stretches of the sewer route. A maximum cover of 1.0 outside Jegol and 0.6m inside Jegol is adopted. A maximum manhole spacing of 70m is used for the design.

SUBPROJECT ALTERNATIVES

During the feasibility study, alternative sites and alternative technologies were assessed, analyzed, compared and selected which are best situated to the local socio-economic and environmental conditions. In this section, summary of the proposed alternative sites and technologies are summarized from the feasibility report. This ESIA and detailed feasibility and the final design studies were conducted in parallel

and joint meetings and discussions were made with the parties involved in the feasibility study and sub projects design consultants.

Five alternative wastewater treatment technologies were reviewed and compared to select the best wastewater treatment technologies. These are Anaerobic Baffled Reactor (ABR) followed by Anaerobic Filter (AF); Anaerobic Baffled Reactor (ABR) followed by Aerated Lagoon (AL); Anaerobic Baffled Reactor (ABR) followed by Trickling Filter (TF); up flow Anaerobic Sludge Blanket (UASB) Reactor followed by TF; and Extended Aeration Activated Sludge (EAAS). Multi Criteria Analysis (MCA) was applied to assess the wastewater treatment technologies considering the criteria including cost, ease of operation and maintenance, space requirement, effluent wastewater quality, environmental impact and contractors design, construction and operation capabilities. Based on MCA, the ABR followed by TF is deemed to be the most advantageous technology to be adopted.

In terms of site analysis, three locations were proposed and assessed by expert of feasibility study, environmentalists, design groups and local administration (regional, woreda and Harar town administration). The site selection was considered the following criteria: availability of land and legal issues, gradient of the site, proximity to the town and access and others. Accordingly, the AwOmur was selected. However, the site close to the settlement and in a close distance to the Harar stadium which needs a better landscape designing and management. Similarly, the FSTP site had went the same site selection process. One of the drawbacks of the FSTP site is the distance from city center which increase the transport cost.

Three alternative sewer network routes were proposed and compared to select the best alternative from environmental and social perspectives. These alternative sewer line network routes were evaluated based on impact on existing infrastructures, impact on roadside planted trees, impact on existing roads, impact on traffic flow and traffic accidents, impact on built up areas and built infrastructures, and impact from construction dust and noise. In general, the Jegol and condominium sites were recommended for implementation in the short-term (Phase I). It is expected that some parts of the Sofi catchment including Jegol, the inner town and major commercial areas are ready for sewerage intervention during phase I. Furthermore, in the current layout design the consultant suggested to adopt the existing configuration/layout of sewer in Jegol.

The "no action" option was one of the many choices provided and examined in the comprehensive ESIA in order to meet the program objectives. Technical, economic, environmental, social, and climate risk comparisons were made amongst the alternatives, taking into account the public's concerns as expressed during public discussions. In order to reduce the requirement for compensation, the project alignment was assessed to look into alternative WWTP and FSTP sites where needed. Doing nothing will jeopardize or delay the long-term town development plan since a good sanitation system is important for maximizing the effects of other development measures and elevating the town's reputation.

PUBLIC AND STAKEHOLDER CONSULTATION

Consultation meetings were conducted with key stakeholders and project affected persons (PAPs) with the main objective of presenting the proposed project and getting feedback from the stakeholders and PAPs on

the project contents and its possible impacts. Stakeholder's consultations were carried out with different actors who have direct/indirect stake in the implementation of the proposed subprojects. Accordingly, consultations were made with key stakeholders at Harar Town Administration level including Harar Water Supply and Sewerage Authority; Environmental Protection Authority; Agriculture and natural resources bureau; Health Department of Harar town; Education bureau; Women and Children Affairs; Harari Culture and Tourism bureau; Harar municipality; Harari Urban development and construction. Also, grass-roots participation was done during the visit to the subproject sites over what shall be done where a wide cross-section of villagers and Woreda leaders were consulted.

The findings of the consultations conducted with the above-mentioned actors reveal that all the stakeholders have interest in the implementation of the project. The main issues/concerns raised by the stakeholders and recommendations provided include the following:

- Environmental pollution resulting from leakages of sewer lines and wastewater treatment plants, and illegal open disposal of wastes especially to rivers and streams that may create bad odor and potential threats to public health.
- Accident risks emanating from construction activities and operation of project vehicular traffic.
- Offensive odor is a significant problem at the proposed treatment plant and this situation may continue even after implementation of the new FSTP/WWTPs.
- Loss of assets like farmlands and properties due to land taking for FSTP/WWTP sites is a major concern for PAPs as this would result in loss of livelihoods.
- Local unemployed youth should be engaged in project implementation by giving priority for employment opportunities created by the project.
- It is important that measures that would minimize potential air and water pollution problems are properly implemented.
- It is crucial that a proper resettlement action plan and/or livelihood restoration mechanisms are developed and properly implemented for project affected peoples.
- It is important to consider positive supports like irrigation and business opportunities arising from the intervention of the project activities.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The sub projects are proposed mainly to improve the quality of the social and natural environment of Harar town. The existing sanitation situation in the town is very poor. The absence of well-organized sanitation facilities has caused deterioration of the social and natural environment with adverse consequences on human health, which is directly or indirectly associated with water, air and soil pollution resulting from improper fecal waste disposal. Though construction and operation of the proposed subprojects is a well-recognized solution to overcome the existing environmental pollution and associated health impacts, some impacts are expected to occur during the construction, operation and decommissioning phases of the project. In this ESIA both positive and adverse environmental and social impacts are identified. Adverse impacts are characterized by type, magnitude, nature, spatial extent and duration of impact, and assessed for significance.

Impacts during Construction Phases

The main positive impact during the construction phases is job creation for skilled and unskilled workers, particularly for the jobless youth in the project area, and for national and international contractors and consultants. Proposed enhancement measures include giving priority for the local communities, for women, and providing business opportunities, job training and capacity building for potential workers. Potential adverse impacts include:

- Air pollution due to dust emission caused by traffic movements on unpaved access roads, land clearing, excavation and earth moving activities, and transport of spoil materials to disposal sites; and gaseous emissions from vehicles and construction equipment.
- Noise pollution resulting from operation of construction vehicles and equipment.
- Soil compaction and soil erosion caused by project activities including site clearing, excavation in soil, and hauling of spoils to disposal sites, which would involve operation of heavy-duty equipment and dump trucks.
- Loss of land under agricultural and other uses due to land requirement for construction of the proposed treatment plants.
- Pollution of water bodies due to inadequate handling and spillage of pollutants (like fuel, oils, greases, and paints), release of solid and liquid wastes from construction camps and workshops.
- Removal of some vegetation around the construction sites.
- Increased traffic congestion or obstruction of normal traffic flows and traffic accidents on the existing roads connecting both Treatment Plants (TPs) and along certain segments of the sewer lines.
- Increased traffic accident risks to project construction workers, roadside communities, road users, and pedestrians due to increased traffic volume on the roads along the sewer lines and at WWTPs.
- Damages of public utility lines (water supply-, telecommunication-, and electric distribution and storm drain- lines) located along or crossed by the sewer lines due to construction of the proposed sewage lines.
- Impacts on occupational health and safety resulting from construction activities, operation of project vehicles and equipment, storage and use of hazardous chemicals and explosives, dust and exhaust emissions etc.
- Alteration of landscape due to construction of waste treatment plants and exploitation of construction materials from borrow and quarry sites and impacts on aesthetic quality of the sites,
- Conflict on employment opportunities created by the project between local and migrant job seekers.
- Increased rate of HIV/AIDS and other sexually transmitted infections due to arrival of construction workers and relations with local women including commercial sex workers.

The identified impacts are predicted to be moderate to high, short-term, reversible and direct adverse impacts. They can be minimized to acceptable levels by adopting appropriate mitigation measures including the following:

- Implement measures that will reduce dust emission including regular spraying of water on unpaved access roads, exposed earth and any stockpiles on site.
- Use updated technology or modern equipment in excavation works that will minimize dust generation from earthen materials and noise emissions and vibration.
- Regular inspections and maintenance of vehicles and equipment to reduce excessive exhaust emissions, and prevent fuel spills by filling fuel at only designated fuel stations.

- Impose speed limits for project vehicles to 30km/hour on unpaved access roads esp. in the vicinity of sensitive areas (residential and business areas, social services, religious places).
- Carry out noisy construction activities in the vicinity of sensitive areas during normal working hours only.
- Keep noise level near sensitive areas such as residential areas and camps below the World Health Organization (WHO) and Ethiopian maximum allowable noise level standards.
- Select the location of campsites in collaboration with local authorities to avoid environmentally or socially sensitive areas.
- Prevent environmental pollution by hazardous substances through proper storage and handling of those substances.
- For loss of farmlands, prepare an appropriate compensation plan for the affected households and implement it before the start of mobilization or construction works.
- Choose hours of less traffic volume on roads for mobilizing materials and construction machinery.
- Implement appropriate traffic management at and in the vicinity of the sites.
- Create awareness for drivers and equipment operators on health, safety and traffic accident prevention.
- Schedule construction works outside of the time of high traffic flows for sections of sewer lines that cross or run along operational roads.
- Post proper and clearly visible signs, barricades, reflectors at appropriate locations so that road users are aware of the active construction works and take precautions while driving through or at nearby project operational areas.
- Reinstate the damaged sections of roads as soon as the construction works have been completed.
- At the intersections of roads, apply pipe jacking to install sewer lines without damaging roads, and causing disruption to normal traffic flows.
- Plant suitable trees and shrubs on the boundary of the sites.
- Provide priority of job opportunities for the local people.
- Provide awareness education about HIV/AIDS, other STIs and COVID-19 transmission and preventive measures for project workers and local community, and avail protective materials.
- Implement other mitigation measures as specified.

Impacts during Operation Phase

Most of the beneficial impacts of the project will be harnessed during the operation phase of the subproject's development. These include improvement of water quality of receiving water bodies, protection of soil resources from hazardous chemicals, improvements of public health, improvements of agricultural productivity and livelihood based on irrigation schemes along streams and river, energy production from methane gas produced from the TPs, production of compost/fertilizers from dewatered sludge removed from the TPs process, and potential for development of riverside parks and botanical gardens with improved quality of the riverine environment. Potential adverse impacts during the operation phase include:

- Some offensive odor at and around the treatment plant sites mainly due to release of hydrogen sulphide resulting from anaerobic digestion.
- Pollution of ground water at treatment sites due to infiltration of wastewater through permeable soils

- Contamination of water bodies mainly streams and rivers due to leakages or overflow from FSTP/WWTPs.
- Contamination of the soils at the temporary storage of sludge that may contain hazardous substances like heavy metals as well as in case of spillages and overflows of FSTP/WWTPs.
- Public health and safety risks related to spills, leakages or discharge of sewage or uncontrolled spreading of sludge. Also, exposure to hydrogen sulphide, which is a colorless and toxic gas, may pose health risks. In addition, operators of the treatment plants could be exposed to pathogenic microorganisms in wastewater and sludge that may cause risks of infection and disease. Other potential health and safety risks are related to accidents and malfunctioning of plants.

The identified adverse impacts of the operation phase are possible, reversible, of moderate to high significance, and long-term. They can be mitigated through:

- Adherence to national rules and regulations and appropriate contract specifications and guidelines;
- Maintaining appropriate buffer zones around the treatment plants and planting trees to prevent spread of nuisance odor and improve aesthetic view of the treatment sites;
- Fencing at least the treatment process areas to guard against vandalism and to protect the public from entering to the treatment sites;
- Proper handling of chemicals and other materials to be used in the treatment process and keeping good personal hygiene;
- Constructing FSTP/WWTP foundation and direct influence areas with concrete lining to avoid leakage of wastewater through permeable soils and weathered and fractured rocks into the groundwater system;
- Applying aeration, proper chemical dosing and oxidation or pH adjustment to reduce offensive odor;
- Covering tanks or installation of exhaust hoods;
- Operating equipment at optimum/design conditions;
- Adopting effective and efficient housekeeping procedures;
- Regular monitoring of the status of sewer line manholes and immediate replacing of stolen manhole covers, if any, or avoiding use of metal covers by replacing with other less reusable materials like plastic materials or other available technology that resist theft; and
- Implement other mitigation measures as specified.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This section provides an Environmental and Social Management Plan (ESMP) that comprises a specific plan of action for the proposed mitigation measures to ensure implementation of the “mitigation measures” to avoid or reduce adverse impacts and enhance positive impacts from the construction and operation of the proposed project components.

ESMP is the key to ensure that the environmental and social quality of the project influence area does not deteriorate due to the implementation of the proposed development project covering all aspects of project implementation in its different phases. It is generally used as the basis for establishing the environmental and socio-economic behavior that the proposed project requires during its various stages including the decommissioning phase.

The ESMP for the proposed project consists of a set of feasible and cost-effective mitigation and institutional measures to be undertaken during the different phases of the project to eliminate or reduce to acceptable levels the adverse environmental and social impacts identified. It is prepared in such a way that it serves, as a document that sets forth those practices that will be implemented to prevent, control, and mitigate significant negative environmental and social impacts arising as a consequence of the implementation of the proposed project. Hence, the ESMP is directed at mitigating, minimizing, or controlling negative impacts arising throughout the different phases of the project.

This ESMP defines the roles and responsibilities of various stakeholders for ensuring smooth and well-integrated implementation and monitoring of the project operations. It contains commitments that are binding on the proponent. It can be translated into project documentation and provide the basis for a legal contract that establishes responsibilities of the proponent. In turn, the proponent can use the ESMP to establish environmental and social performance standards and requirements for those carrying out the works or providing supplies. It can be also used to prepare an environmental and social management system for the operational phase of the project.

ENVIRONMENTAL AND SOCIAL MONITORING PLAN

Environmental monitoring is an important component of environmental management as it provides the basis for rational management decisions regarding impact control. Monitoring will provide the information necessary for feedback into the environmental management process including feedback about the actual environmental and social impacts of a project and will assist in identifying where additional mitigation effort or where alteration to the adopted management approach may be required.

The environmental monitoring plan is developed to provide a basis for evaluating the efficiency of the proposed mitigation measures and for updating the actions and impacts of baseline data. It also gives information for adoption of additional mitigation measures if the proposed measures are found insufficient. Thus, it avails information for management decisions taking in the different phases of the project. Monitoring should be performed during all stages of the project (construction, operation and decommissioning) to ensure that the impacts are no greater than predicted, and to verify the impact predictions. The monitoring program will indicate where changes to procedures or operations are required, to reduce impacts on the environment or local population.

Implementation arrangements and capacity building

Harar Water Supply and Sanitation Authority (HWSSA) has an established position for an Environmental Officer and positions for sociologists which will provide oversight on the implementation of the environment components of the program. It is further planned that oversight on environmental issues will further be supplemented through the recruitment of additional environment expertise by the supervising consultant once the project commences. In the interim, this staffing arrangement is deemed adequate.

The responsibility for implementing the ESMP of the supplement ESIA during construction will be of the contractor, HWSSA and the bureau of Health. During the operation and maintenance of the development works, the responsibility will be mainly under the HWSSA.

The environmental sustainability of the sub-projects is dependent on the capacity of institutions at all levels (i.e., staffing, training, and other necessary support services) to carry out the associated ESMP implementation work. Thus, it is vital that HWSSA allocate sufficient resources for training and capacity building. These efforts will not only benefit the authorities but will also build local capacity to undertake other development initiatives.

Budget estimation

The estimated total budget for the ESMP, which is mainly for the environmental monitoring program and training required to implement the ESMP is about **13,662,000.00** Eth. Birr. It should be noted that most of the recommended mitigation measures for identified impacts are assumed to be incorporated in the design when they require engineering interventions.

In addition, as it is proposed on the feasibility study the treatment plants and sewer lines are to be implemented in Design Build and Operate contract modality. Therefore, they will be taken care of by the specifications and bill of quantities as well as overall contractor and consultant's fees.

CONCLUSION AND RECOMMENDATIONS

Currently Harar town has a significant shortage of safe and suitable sanitation facilities. Sanitation in the town is also deficient as reflected by inadequate facilities for disposal of human excreta, refuse material and wastewater. There is therefore a pressing need to address the sanitation problems in Harar in order to improve the quality of life of the people, generate economic development, create employment and reduce poverty.

It is certain that implementation of the proposed subprojects of Harar will be a major solution to minimize the prevailing poor sanitation related environmental pollution and its consequences in the town and downstream areas. The subprojects will serve as a very important intervention for the protection of the socio-economic and biophysical environment of the Harar town.

The identified adverse environmental, social and health impacts related to the construction and operation of the proposed subprojects as compared to the benefits of the project are of low to moderate significance and can be easily mitigated to acceptable level by properly applying the mitigation measures stated in this report.

Proper implementation of the proposed mitigation and enhancement measures for each stage of the project will avoid or minimize adverse impacts and enhance beneficial impacts. Hence, it is recommended that the enhancement and mitigation measures for the identified potential positive and negative impacts respectively are properly implemented. The benefits of implementing these measures by far outweigh the costs to be incurred. Furthermore, saving life supports environmental resources and ecosystems from further pollution and deterioration would be of paramount importance.

1. INTRODUCTION

Safe sanitation is indispensable for human health through preventing infectious diseases, promoting, and sustaining physical, mental as well as social well-being. It is also an important component in ensuring environmental well-being too. Sanitation is also a building block of development (WHO, 2017). Nowadays, wastewater management and fecal sludge management (FSM) is a global concern including improved sanitary facilities (for example toilets), particularly in low-income countries which predominantly rely on on-site sanitation technologies. That is why, in poor and growing urban areas of those low-income countries like Ethiopia, poor WWM and FSM represents a growing challenge; generating significant negative public health and environmental risks.

Waste management services delivery is a big challenge in Ethiopia's big towns and other secondary towns such as Assosa, Gambella, Harar, and Semera-Logia, especially within the urban areas. For example, Harar town's fecal sludge waste generated is disposed of illegally at the private farms with some payments. Lack of or poor wastewater management system, fecal sludge and shortage of public and communal toilets also cause management problems if the management infrastructure is not adequate. Industrial effluent and diffuse release from agricultural activities are other forms of pollution to the environment. In the growing complexity of problems, precautionary measures such as environmental and social impact assessment (ESIA) of projects to ensure adequate waste management can work out to be more effective. To effectively manage environmental challenges, the Government of Ethiopia (GoE) with the financial support from the World Bank has planned to implement town wide wastewater management and fecal sludge management and the construction of public and communal toilets.

1.1. Background

Ethiopia faces various sanitation problems related to a low level of priority for sanitation, poverty, unavailability of equipped skilled human resources, unclear institutional framework, and responsibilities. As a result, only 4% of rural and 16% of urban households use improved toilet accommodations. About 56% of rural households rely on unimproved toilet facilities and more than 35% of toilet accommodations are shared in urban households, whereas only 2% of rural households share their toilet facilities with other households (CSA and ICF, 2017). One in three Ethiopian households has no toilet facility; defecate to bush/fields (39% in rural areas and 7% in urban areas) (CSA and ICF, 2017). Furthermore, according to the WHO (2017) estimates, diarrhea contributes to more than one in every ten-child death in Ethiopia. The total population growth rate of Ethiopia is also 2.5% a year, with urban centers growing at a rate of 5.1% (Haddis et al., 2013). This situation triggers the construction of PCT and fecal sludge management facilities in selected four towns of Ethiopia. In the town of Harar, as in many other areas of the country or any community, poor sanitation has long been seen as a barrier to socio- economic growth.

Wastewater treatment (WWT) is a broad term that applies to any process, operation or combination of processes and operations that can reduce the objectionable property of water that carries waste and render it less dangerous and repulsive to man (Gilbert, 1991). The wastewater is treated before its ultimate disposal to the natural environment in order to reduce the spread of communicable diseases caused by the pathogenic organisms in the sewage and prevent the pollution of surface and groundwater (Punimia et al., 2005; Mackenzie et al., 1991). Recent reports indicate that worldwide more than half of the population of developing countries does not have access to sanitation and more than 80% of the wastewater generated is

directly discharged into surface and groundwater bodies. The management of liquid waste at household level is very poor. About half of the households handle grey water (household liquid waste) by openly discharging into any accessible public properties, such as streets, drainage lines and nearby open space.

In Harar, the local administration organizes private operators with suction trucks to empty septic tanks and latrines and when a minimum number of users are willing to pay, the private operator is called to service several sites at the same time. As there is no appropriate site for disposal of the fecal sludge waste, the waste is dumped in the fields nearby where the private operator has an agreement with the landowner. As the organization of privately operated vacuum trucks is done by the local administration and pits and septic tanks are being emptied, the main focus will be on developing a disposal facility near Harar to reduce transportation costs and provide hygienic treatment of the wastewater and fecal sludge in a sustainable manner.

The construction and operation of the proposed development will improve Harar's sanitary facility problems including its wastewater flows and therefore reduce the spread of communicable diseases and pollution of ground and surface waters. It also increases hygienic conditions which will bring both social and economic advantages to Harar town and its surrounding environment. Furthermore, the successful implementation of the subprojects will improve the link between the rural-urban communities.

1.1.1. Project Benefits

The project will enhance the proper management of wastewater and fecal sludge in Harar town. In addition, the project will create some jobs during the construction and operation of the facility for local workers and the community.

During the field survey and site study, various sanitation problems were observed, discussed with the local administration, and identified for further analysis. The Harar sanitation facility problems are deep-rooted and accumulated for a long time. These problems are also studied during the feasibility study by MS consultancy in 2021 and 2022. The key sanitation problems are briefly presented below.

Generally, the problems vary from site to site. For example, the Jogel problem is quite different from the condominium site. The latter has a proper sanitation facility but with some sewer problems. In contrast, the Jogel area has complex sanitation challenges such as an improper sewerage system for the management and removal of wastewater and fecal sludge. These are the shortage of private, communal, and public toilets; lack of proper sewerage systems; and problems with emptying due to the structure (narrowed roads networks) of the compound itself. Whereas the condominium site problem is included improper condominium site location without considering the need for enough space for the provision of sanitation facilities, sewer lay problems, missing components (e.g., septic tank, soak pits), mismanagement of solid waste, and clogging of pipes and manholes, limited availability of piped water in the system, forceful damage to the sewer-septic tank system, lack of willingness to pay for desludging services, faulty or clogged connection line between septic and soak pits, lack of maintenance.

Unavailability of wastewater and fecal sludge disposal site: This is a key challenge for Harar town to properly manage wastewater and fecal sludge wastes. The problem is complex and needs an immediate

response from all relevant stakeholders with the consultation of the local community. It used to be dumped on individual farm sites, as the farmer needs soil conditioners and fertilizer and recently the HWSSA is paying the farmer for dumping the same wastes. However, since 2018, this practice cannot be continued as farmers do not want to be a dumpsite for the sludge and other waste collected from the town. Currently, Harar has neither an operational WWTP and FSTP nor a dedicated sludge disposal site.

To address the above-mentioned sanitation problems of Harar town, a feasibility study was conducted with a detailed design for communal and public toilets, WWTP, and FSTP. The project under UWSSP-II is addressing these public challenges, to solve the ongoing wastewater treatment and sludge treatment challenges and related obstacles in the first phase (2021-2025). Therefore, the proposed project implementation sites and treatment technologies have been evaluated against the environmental and social criteria for its eligibility and suitability for the proposed facility construction. The assessment was aimed at the analysis of the potential project impacts on the social and natural environment during construction and operation and to establish the baseline for future monitoring.

1.1.2. The Rationale of the ESIA Study

The ESIA process helps an organization or developer identify critical environmental and social issues associated with a project and ensure that positive impacts are optimized while negative impacts are mitigated or minimized. An effective ESIA process can improve local community understanding of a project, thereby increasing the sustainability of the project. It is most cost-effective to carry out an ESIA prior to site development, to identify and resolve issues at an early stage by appraising options for development, because of a large amount of capital funding involved in developing or altering a site. Environmental and social assessments are also useful for the operational phase to identify areas for improvement and thus avoid site closure as a result of non-compliance. Thus, the purpose of conducting this ESIA study was to facilitate an evaluation of potential social and environmental impacts and its mitigation associated with the proposed works and in harmony with relevant stakeholders.

The Environmental and Social Impact Assessment Proclamation No. 295 of 2002 provides direction for ESIA in the country bringing together stakeholders across different sectors. The proclamation through its EIA outlines the procedures to be followed in undertaking the ESIA study for a development project.

1.2. Objectives of the ESIA study

The main objectives of the ESIA study as stated in the Terms of Reference (ToR) is to assess, identify and propose mitigation measures of potential adverse and localized environmental and social impacts of Harar sanitation projects. It is to ensure that the planned sanitation scheme is environmentally sustainable, socially acceptable and will not cause serious adverse environmental and social impacts. The objective of the report is, therefore, to provide an initial Environmental and Social Impact Assessment to identify important environmental and socio-economic issues arising from the proposed works, especially during the construction and operation phases of the proposed WWTP and FSTP to prepare a corresponding Environmental & Social Management Plan. The specific objectives of the ESIA are to:

- Identify key environmental and social issues related to the proposed project, their impacts, and mitigation if negative.

- Generate baseline information of the biophysical, socio-economic and cultural attributes of the project area.
- Compile an Environmental and Social Management Plan comprising environmental and social management measures as well as mechanisms for their implementation and its compliance monitoring in order to minimize the project's negative impacts and enhance the positive aspects.
- Anticipate, avoid, minimize or offset the adverse significant biophysical, social and relevant effects of the subproject activities.
- Enable information exchange, notification, and consultations between stakeholders.
- Propose effective GRM considering the nature of the project.

1.3. Scope of the ESIA

This ESIA was conducted in Harar town of Harari region on the WWTP and FSTP components. The assessment referred to the rules and standards stipulated by the government of Ethiopia's ESIA (EIA) guidelines, directives, legislation, and World Bank's safeguards policies and legislations as deemed necessary.

In accordance with the ESIA ToR, the consulting team conducted a series of reviewing of relevant policies, legislation, and relevant document including a feasibility study on the proposed project activities and its technologies, collecting, verifying, and constituting environmental and social safeguards and compliances, grievance redress approaches and protocols in line with the ESIA. A conventional and contemporary collection, coding, and analysis of all generated data were employed during the analysis and evaluation of the ESIA. The scope of this report is limited to outlining the overall activities in terms of how, what, when, and who of the ESIA study should be conducted of the assessment in the selected sub-project sites that includes for the three proposed sub projects phases (I-III). During the ESIA assessment, analysis, and presentation the following major aspects of the intended project were carefully examined:

- Outline the national policies, legislation, and administrative framework within which the environmental management of the proposed works will be carried out;
- Describe and evaluate the present baseline data and the relevant environmental characteristics of the area proposed for the development of the work;
- Identify, analyze and assess potential environmental and social impacts that will result from the proposed works, based on the proposed design;
- Stakeholder analysis, responsibility description, and assignment;
- Propose cost-effective mitigation measures for minimizing or eliminating adverse social and environmental impacts of the proposed works, including recommendations on design/technology changes if deemed necessary;
- Propose modalities and arrangements for collection of stakeholders' views ensuring participation of key public and community representatives;
- Prepare an environmental and social management plan for implementing the mitigation measures and recommend institutional administrative and management frameworks.
- Descriptions of the monitoring plan and developing monitoring strategy were specified; and
- Estimation of cost for proposed mitigation measures formulated.

1.4. Team in charge of the ESIA

The ESIA process comprised more than eight senior professionals with a range of backgrounds and a wealth of relevant experience. They all have a second degree or higher (MSC, MA, or PhD), and they have a combined experience of more than 15 years in environmental studies (ESIA, ESMP, Resettlement Action Plan (RAP), and EA) in general and in their particular fields of specialization in particular. Additionally, they are well equipped to plan community and stakeholder consultations and discussions, conduct qualitative and quantitative data collecting, and analyze both qualitative and quantitative data. Appendix 10 presents the qualifications, experiences, and positions of the assigned staff.

2. METHODOLOGY OF THE ESIA STUDY

2.1. Approach

The overall approach used to carry out the ESIA study is based on the Ethiopian ESIA Guideline. Relevant studies, policies and guidelines were reviewed. Primary data was collected through field observation and beneficiary consultation. A field survey of the project sites of WWTP and FSTP was conducted and potential socio-environmental impacts of the expected project activities were identified, assessed and documented pertaining to socio-economic and environmental matters. Consultations were also conducted with key stakeholders and local community representatives. Obtaining experts' opinions and learning from previous experiences were also among other study approaches used.

2.2. Methodology

This ESIA study is based on the review of relevant previous studies, primary data collected through a comprehensive field survey in the project area, and consultations with project-affected communities, Woreda and Kebele administrators, key stakeholders, and relevant experts. Secondary data was gathered from various offices at regional and Woreda levels, as well as feasibility and design study reports. The detailed methodologies followed are explained briefly below. The methodology used in this assessment is corresponding with the EIA proclamation of 295/2002, adopting the approach of identifying, collecting, and analyzing information which included:

- Undertaking the activities initiated during the scoping phase including involvement of key stakeholders and collecting of the baseline information on both natural and built environments including socio-economic conditions surrounding the project area and the municipality at large;
- Analysis of data for identification, prediction, and evaluation of the impacts both beneficial and adverse ones from the proposed project development and operation. This was achieved through the use of checklists, simple matrices, and use of engineering judgment (feasibility study), standards, and guidelines;
- Identifying and proposing mitigation measures aimed at minimizing and where possible eliminating the potential negative impacts and enhancing positive ones using expert judgment;
- Preparing environmental and social management and monitoring plans for follow up during project operation;
- Presenting the information in the ESIA Report (the present report).

The methodology took into account the likely impacts on the physical and biological environment (e. g. on air quality, soil, groundwater quality, and vegetation). Other methodologies used in this assessment include literature reviews, consultative meetings with respective offices including the Regional Office (EPA, Culture

and Tourism, Health, Agriculture, women and children affairs, education, etc.), Woreda officials and village members and their respective leaders, and visual observations through familiarization visits in the project areas. To this effect, the steps adopted to prepare this ESIA study cover the following:

- Deskwork reviews and analyses,
- Fieldworks and
- Stakeholders' consultations

The necessary activities involved in undertaking the study are as follows:

- Consulting key stakeholders to gather their concerns about proposed improvement works and in particular how the surrounding communities will be affected by the project;
- Carry out additional information or data to supplement ESIA;
- Establishing environmental conditions about in the proposed sites for proposed works;
- Assessing the status of ecological and social receptors;
- Describing the project characteristics and affected environment of the improvement works;
- Assessing and evaluate the potential environmental impacts resulting from the proposed sub-projects, especially within the zones of project influence;
- Identifying mitigation measures for serious impacts; and
- Developing an ESMP detailing actions and responsibilities for the mitigation of impacts and for monitoring them.

2.2.1. Review of Relevant Studies, Policies, and Legal Documents

Policies, legislation, and guidelines pertinent to social safeguard and environmental protection were gathered and reviewed for assessing the relevant environmental and social safeguard policies, laws, and regulations related to social and environmental protection matters in general and the expected environmental impacts of the proposed development in particular. In addition, available documents on the previous studies of the proposed projects, baseline of the social and environmental conditions of the project influence area, and other relevant data were collated and reviewed to obtain important data/ information for the project description. The feasibility study and design of the proposed project activities were reviewed to understand the method of delivering the project. The list of the documents reviewed is provided in the list of references.

2.2.2. Screening

Prior to the ESIA exercise, the Town WSSA had conducted environmental and social screening. Accordingly, the sub project is put under category B and require a lesser level of environmental investigations.

2.2.3. Scoping

The consulting team conducted scoping for the subprojects through following key actions

- identifing key environmental and socio-economic issues;
- physical inspection of the site and surrounding areas;
- Identifing possible environmental and socio-economic impacts through public participation and and stakeholder consultation.
- Impact prediction and ratings,

Summary of scoping is presented in appendix 15

2.2.4. Field Surveys and Data Collection

Following an extensive review of existing documents related to the proposed projects, field investigation and collection of detailed data on the social and natural environment were carried out at the project area. The aim of the survey was to collect socio-environmental baseline data for the project influence area and to identify sensitive environmental components that are likely to have a significant effect due to the implementation and operation of the envisaged sanitation projects. Data collection was carried out using a checklist. The checklist was filled at the site and used to identify potential adverse socio-environmental impacts and to categorize and determine the level of ESIA to be conducted.

2.2.5. Stakeholders Consultations

Consultation with key stakeholders including the project-affected people (PAP) were contacted and consulted during the ESIA field survey. The information on the current waste management system concentrates on the limitations, the existing environmental and social features of the project influence area, potential environmental issues/impacts related to the proposed subprojects and their activities, as well as the attitudes of the officials, local communities, and experts towards the planned scheme were assessed. This socio environmental impact analysis has taken these facts and viewpoints into account. The appendices of the document contain the minutes of the consultations held with the Woreda administration and the local people who live near the planned site for the WWTP and FSTP. The meeting's minutes, which are included in Appendix 1, were written in the Amharic language.

The consultation process at the design stage is an initial consultation. More consultation is envisaged during the project's implementation and operation phases since the Government of Ethiopia and World Bank through the local administration encourages community discussions during the implementation of development projects. The stakeholders for the proposed project were categorized as follows:

1. Regional level stakeholders - relevant policy and project implementers
2. Authorities of Harar town (upstream-downstream communities)
3. Authorities of Sofi Woreda administration and Kebeles administration
4. Local communities in the project implementation sites/Kebeles/villages
5. Engineering/design team of the consultant
6. Project affected peoples in proposed WWTP/FSTP/sewer lines sites

2.2.5.1. Identification of Interested Parties

Both, federal legislation and regulations and the WB Sustainability Guideline clearly state that public and stakeholder engagement is mandatory to give the opportunity to the public, stakeholders, and surrounding community to express their opinion in the project and gain knowledge about the project. This may also lead to altering or modifying the project design, location, etc. to consider the community needs and concerns.

To make sure that all concerned parties are involved in a public and community consultation process, meetings were organized by the consultant in collaboration with the project client (HWSSA). The outcomes and findings of the public consultation and community meetings were integrated into the Environmental & Social Management Plan; the Minutes of meeting was added as an appendix to this ESIA report.

As an initial step towards preparing a Stakeholder Engagement Plan (SEP) (Annika Jaansoo, 2019), the Consultant has analyzed the relevant stakeholders to the project, who are considered to be affected or affect the project activities. The SEP shall be implemented during the construction and operation phases of the project, where the Contractor and Operator are responsible for ensuring its proper implementation. Moreover, a Grievance Redress Mechanism (GRM) shall be put in place to allow the below-mentioned stakeholders in communicating their concerns regarding any project activity.

Table 2: List of Concerned Stakeholders

Group of Stakeholders	Stakeholders	Level of involvement
Local Residents	✓ Residents located near the sewer lines, WWTP and FSTP facility to be constructed	Directly affected
Property-owner and landowners	✓ Individuals, legal entities, local administration holding land title documents ✓ Tenants or occupiers without formal rights	Directly affected
Public facility	✓ Educational facilities (none-existence) ✓ Religious entities (mosques/churches) (none existing around the sewer line, WWTP and FSTP site) ✓ Medical facilities (hospitals, clinics, medical centers)-the oldest hospital in Jogel in a close distance from the public toilet ✓ Utilities (electricity, water supply, road, telecommunication facility and others)	Indirectly affected
Business and Service Providers	✓ Shops, markets, supermarkets ✓ Petrol stations, car wash & service, others ✓ Restaurants ✓ Financial services (banks) (are not at a close distance)	Indirectly affected
Administrative Bodies and Authorities	✓ National and Regional Authorities ✓ Ministry of Water and Energy and regional bureaus ✓ Environmental Protection Authority and regional authority/bureau ✓ Harar Water Supply and Sanitation Authority ✓ Regional authorities/bureaus ✓ Local authorities (district and Kebele administration) ✓ Harar municipal authorities	Indirectly affected, but may have influence over the implementation of the project
International donors	✓ World Bank	Indirectly affected, but may have influence over the implementation of the project
Bodies involved in Project implementation	✓ Construction contractor(s) (management, staff) ✓ Sub-contractor(s) ✓ Supervision contractor (the Engineer) ✓ Suppliers	Directly affected, but may have influence over the implementation of the project
Non-governmental Organizations (NGOs) and Community Based Organizations (CBOs)	✓ Specialized environmental and social organizations, NGOs-engaged in WaSH activities ✓ Experts on a national and international level	Indirectly affecting/affected
Community-based Organization engaged in waste management/ emptying/ handling transporting CBOs	✓ Specialized waste management at the local level ✓ Community based organization involved waste collection	Indirectly affected and/or has impacts on project success

2.2.5.2. Consultation Methods

Consultations were undertaken with community members and government officials at Kebele and Woreda levels to obtain the opinions and attitudes towards the proposed WWTP, and FSTP projects for Harar town. Besides, different governmental offices (offices involved in environmental protection and safeguards) in Harar town and its neighboring Kebeles were consulted to collect information and to share their feelings about the implementation of the proposed projects. One government level (municipality level-lead by the Mayor of Harar town) consultation has been conducted with all relevant stakeholders.

The consultation took place in collaboration with and facilitated by both the Woreda local authorities. The consultation participants were selected giving emphasis on their social status and representative views. Community elders also participated in the discussions. The discussions and inquiries made use of an open-ended checklist, as described below.

- Attitudes towards the project.
- Expected benefits from the project.
- Possible adverse impacts of the project and their mitigation measures to manage/ameliorate the negative impacts.
- Participation and cooperation from the people to support the implementation of the proposed projects.

Figure 1: Meeting with HWSSA project staff (Harar)

Figure 2: Community Consultation Meeting in Sofi Woreda, Herwi (left) and Awomur (right) Kebeles

Figure 3: Stakeholder Consultation Meeting in Sofi Woreda

2.2.6. Use of Relevant Data Generated by other Disciplines

Data collected by the project design team (engineering team) were reviewed and the relevant data was used to supplement the environmental data and to understand the proposed technical features of the project so that to render the impact assessment as comprehensive as possible.

2.2.7. Impact Analysis and Development of Mitigation Plan

Following the evaluation of the baseline conditions and analysis of stakeholders' opinions, environmental impacts likely to result from the proposed waste management project were identified and their significance was evaluated. Impact significance was assessed quantitatively/qualitatively based on the magnitude of the impact, relative importance/ value of the affected environmental component, intensity and duration of the impact, and reversibility of the impact.

After the identification of potential impacts and evaluation of their significance, appropriate mitigation measures that can prevent, reduce, or offset the negative impacts to acceptable levels were identified and recommended. Finally, an ESMP that comprises the outline of significant environmental impacts and their corresponding mitigation measures and the responsible bodies for implementation and monitoring was prepared.

3. POLICIES, LEGAL AND INSTITUTIONAL FRAMEWORK

The implementation of the sewer line installation, WWTP and FSTP subprojects have the potential to cause environmental and/or social impacts that shall be addressed in accordance with relevant Ethiopian legislations as well as the requirements of the World Bank Environmental and Social safeguards and standards. The sections below provide more details on the applicable legislative framework for the ESIA.

3.1. Relevant National Policies and Strategies

This section addresses the legislative and institutional framework relating to ESIA, specifically relevant to the WWT and FSTP environmental and social impact assessment associated with the proposed subprojects. For this project, the EIA (here ESIA Assessment Report) has been prepared under specific consideration of the national legal frameworks and safeguard policies.

3.1.1. Constitution of the Federal Democratic Republic of Ethiopia

In consideration of the Constitution of Ethiopia of 1995, article 44 states that every citizen is entitled to a healthy and satisfying environment, and that every person has the duty to protect and safeguard the environment.

To address the environmental concerns to be generated under the clean environment, Article 92 of the Ethiopian constitution further requires that any waste, especially from households and industries and any other dangerous waste, shall be collected, treated, and managed in a manner that does not degrade the environment to prevent, eliminate or reduce their adverse effects on human health, natural resources, flora and fauna and on the nature of the environment.

The Ethiopian Constitution also recognizes ownership of property and every person's right to private property (Article 40). The Constitution also provides that a law should be in place to specify modalities for the acquisition, transfer, and use of land. Thus, proclamation No: Proclamation 1161/2019 and regulation No 472/2020 relating to expropriation and compensation in the public interest, and which defines expropriation in the public interest as, 'an act based on the power of government, public institutions and local administrative entities with legal personality to remove a person from his/her property in the public interest after fair compensation. Further, fair compensation is defined as 'an indemnity equivalent to the value the activities performed thereon given to the person to be expropriated and calculated in consideration of market prices as well as compensation for disturbance due to expropriation'. These provisions will be applicable in the case of Project Affected Persons (PAPs) under this project and will to the extent possible be applied in consideration of the World Bank's requirement for full replacement costs for assets and property lost in the case of Bank-financed operations in line with Operational Safeguard 2 of the Banks Integrated Safeguards System. The constitution also states different treaties ratified by the Government of Ethiopia are parts of the Ethiopian legal system.

3.1.2. Policies

3.1.2.1. Environmental Policy of Ethiopia

The Environmental Policy of Ethiopia (EPE) was approved by the Council of Ministers in April 1997. Its conceptual framework was based on the findings and recommendations of the National Conservation Strategy of Ethiopia. This policy document, along with CSE was developed with the assistance from the

International Union for the Conservation of Nature. EPE includes 9 policy objectives, 19 guiding principles, 10 sectoral policies (one of which is on Water Resources) and 10 cross-sectoral policies (one of which is on community participation and another on ESIAs).

The goal of the Environmental Policy of Ethiopia is to improve and enhance the health and quality of life of all Ethiopians and to promote sustainable social and economic development through the sound management and use of resources and the environment as a whole so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. For the effective implementation of the Environmental Policy of Ethiopia, the policy encourages the creation of an organizational and institutional framework from Federal to community levels. The Environmental Policy of Ethiopia provides a number of guiding principles that require adherence to principles of sustainable development; in particular, the need to ensure that ESIA's:

a. Consider impacts on human and natural environments;
b. Provide for early consideration of environmental impacts in projects and projects design;
c. Recognize public consultation;
d. Include mitigation and contingency plans;
e. Provide for auditing and monitoring; and
f. Is a legally binding requirement.

3.1.2.2. Ethiopian Water Resources Management Policy

The overall goal of the policy is to enhance and promote all national efforts toward the efficient, equitable and optimum utilization of the available Water Resources of Ethiopia for significant socioeconomic development in a sustainable manner. The policy aims to ensure access to water for everyone fairly and in a sustainable manner, protect water resources and sources, and promote cooperation for the management.
The specific objectives of the policy include:

- Promote the development of the water resources of the country for the economic and social welfare of the people, on an equitable and sustainable basis;
- Allocate and apportion the water, based on comprehensive and integrated plans and optimum allocation principles that incorporate the efficiency of use, equity of access, and sustainability of resources;
- Manage and combat drought as well as other drought associated impacts, and disasters through efficient allocation, redistribution, transfer, storage, and efficient use of water resources; and
- Conserve, protect and enhance water resources and the overall aquatic environment.

The project proponent (HWSSE) is required to acquaint itself with the project management requirements and ensure appropriate monitoring based on the wastewater management and water management strategies of the country and the regional government requirements. The project proponent should allocate sufficient resources including facilities and expertise on fecal waste management requirements to prevent further water pollution due to the waste management process including the proposed subprojects in the Harar town.

3.1.2.3. National Health Policy

Ethiopia's health policy was issued in 1993, with the aim of giving special attention to women and children, to neglected regions and segments of the population, and to victims of manmade disasters.
The priority areas of the policy are in the field of Information Education and Communication (IEC) of health to create awareness and behavioral change of the society towards health issues, emphasis on the control of communicable disease, epidemics, and on diseases that are related to malnutrition and poor living condition, promotion of occupational health and safety, the development of environmental health, rehabilitation of health infrastructures, appropriate health service management system, attention to traditional medicines, carrying out applied health research, provision of essential medicines, and expansion of frontline and middle level health professionals.

The Government in its Growth and Transformation Plan has reaffirmed its commitment to accelerate progress on maternal and child health and to reduce child and maternal mortality rates by expanding the provision of essential health and nutrition services to the poor.

To translate the health policy into action the Ministry of Health has developed every five years a Health Sector Development Program (HSDP). Currently it is implementing HSDP IV. HSDP lays an emphasis on service delivery and the quality of service, health facility rehabilitation and expansion, human resource development, pharmaceutical services; Information, Education and Communication (IEC), strengthening health sector management and management information system, monitoring, evaluation and research.

3.1.2.4. National Policy on Women

The National Policy on women was issued in March 1993 emphasizing that all economic and social programs and activities should ensure equal access for both men and women to the country's resources and in the decision-making process so that women can benefit equally from all activities carried out by the Federal and Regional Institutions. Among the main policy objectives is that laws, regulations, systems, policies and development plans that are issued by the government should ensure the equality of men and women and that special emphasis should be given to the participation of rural women.

Consistent with the above policy, Article 25 of the constitution guarantees all people's equality before the law, and prohibits any discrimination on grounds of gender. In addition, Article 35 reiterates principles of equality of access to economic opportunities, including the right of equality in employment and land ownership. The democratization process, the new constitution, the women's policy and the institutional set up have created a conducive atmosphere for the promotion and the advancement of women and the implementation of the plan of action. Accordingly, the proposed subprojects in Harar town shall consider the equal economic opportunities while creating jobs and land acquisition process at various project implementations phases.

3.1.2.5. National Policy on HIV/AIDS

The 1998 Policy on HIV/AIDS of the Federal Democratic Republic of Ethiopia urges communities at large, including government ministries, local governments and the civil society to feel responsibilities for carrying out HIV/AIDS awareness and prevention campaigns "to provide an enabling environment for the prevention and control of HIV/AIDS in the country". So that it is expected that sufficient awareness exists with the

community. In addition, all the workers and contractors working in the proposed sub projects shall be treated fairly in accordance with the policy.

3.1.3. Strategies and Programs

3.1.3.1. Climate Resilient Green Economy Strategy

Ethiopia is experiencing the effects of climate change. Some studies indicate that by 2050 the temperature of the country could increase in the range of 1.7 to 2.1 degree Celsius unless appropriate mitigation measures are taken. This incidence would aggravate food insecurity, spread transmitted diseases in the form of epidemic, and cause degradation of land resources and destruction of infrastructures. Besides the direct effects such as an increase in average temperature or a change in rainfall patterns, climate change also presents the necessity and opportunity to switch to a new, sustainable development model. The Government of the Federal Democratic Republic of Ethiopia therefore issued the Climate-Resilient Green Economy strategy in 2011 to protect the country from the adverse effects of climate change and to build a green economy that will help to realize its ambition of reaching middle income status before 2025. In the long term, if climate change is not tackled, growth itself will be at risk.

Ethiopia is currently in a very strong position of having very low emissions per capita, huge renewable heat and electricity resources and the opportunity to address climate risks in the short term that result from outdated fossil fuel technology and seek clean and renewable alternatives. The Government has recognized this and plays a leading role in driving the climate resilient green economy agenda.

Target of the Plan: The Green Economy (GE) Strategy sets out the plans for developing a low carbon economy in Ethiopia. Detailed analysis showed that GHG emissions in Ethiopia would rise from 150 $MtCO_2e$ per year in 2010 to 400 MtCO2e in 2030 under a conventional development path („business as usual"). The GE Strategy identified and prioritized more than 60 initiatives, which together enabled the country to achieve the envisaged development goals while limiting GHG emissions in 2030 to 2010"s levels. These initiatives would save 250 $MtCO_2e$ per year.

Pillars of the Plan: The green economy plan is based on four pillars:

1. Improving crop and livestock production practices for higher food security and farmer income while reducing emissions;
2. Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks;
3. Expanding electricity generation from renewable sources of energy for domestic and regional markets; and
4. Leapfrogging to modern and energy-efficient technologies in transport, industrial sectors, and buildings.

The agriculture sector (including livestock farming, crop cultivation and forestry activities) in 2010 was the highest contributor to emissions, amounting to about 88% of total greenhouse gases (GHG) emissions. The sector presents the highest abatement potential for GHG emissions reduction; hence was identified as a priority area that needs to be developed resiliently. The other sectors including Transport, Energy, Industry and Buildings each accounted for 3% of GHG emissions in 2010.

In 2010, the transport sector produced 5 MtCO2e representing 3% of total GHG emissions. Emissions from the transport are projected to reach 70 MtCO2e by 2030 under the business-as usual scenario. To reduce emissions from the sector, Ethiopia intends to expand its investments in improved transport systems such as rail transport that depends on clean and renewable energy sources; this measure is expected to contribute to a reduction of 10 MtCO2e emissions by 2030 (14% reduction to BAU). In addition, the country is making efforts to remove subsidies on fossil fuels thereby discouraging excessive consumption of fossil fuel in the transport sector. Ethiopia also plans to implement urban planning that prioritizes accessibility; hence minimizing emissions from motorized transport.

In the energy sector, the Ethiopian government commits to promoting the use of modern energy sources (such as Liquefied Petroleum Gas and electricity) for cooking; and reducing emissions from electricity generation by cutting down on fossil fuel usage and resorting to more renewable sources such as hydroelectric, geothermal, wind and solar sources.

3.1.3.2. Climate Resilience Strategy for Water and Energy

The Climate Resilience strategy sets out the implementation priorities for the Ministry of Water, Irrigation and Energy, building on the Green Economy Strategy. Climate resilience is the ability to cope with, and manage the change brought by weather stresses and shocks. A climate resilient economy is one in which the negative impacts of climatic variability and climate change are minimized and the opportunities realized so that the national growth and development objectives of the country are achieved and sustained. In light of this and given the key role of water and energy in the GTP, the Climate Resilience Strategy for Water and Energy has three objectives:

- Identify the economic and social impacts of current climate variability and future climate change on water and energy in Ethiopia (The Challenge).
- Identify priorities for the water and energy sectors to build climate resilience and reduce the impact of current climate variability and climate change (The Response).
- Map the necessary steps to finance and implement measures in the water and energy sectors to build climate resilience in Ethiopia (Implementation) and deliver an integrated Climate Resilient Green Economy. The main sectors for which the climate resilience strategies concentrated are Power generation (Energy), irrigated agriculture and access to WASH.

When it comes to Access to Water, Sanitation and Hygiene, Ethiopia has the ambition of achieving universal access to water and sanitation as a central part of its poverty reduction ambitions. To this end, a sector wide approach has been developed under One WASH National Program through the Sanitation and Water for All Partnership. Based on the climate planning assumptions, there are three potential impacts on water:

- Reductions in seasonal rainfall reduce surface water flow and long-term reductions in rainfall can reduce groundwater levels.
- However, an increase in the intensity of rainfall can also increase groundwater recharge. Recent studies have shown that rainfall intensity is a much better indicator of groundwater recharge than overall rainfall.
- Temperature rises increase water needs and thermal stress. Increasing temperature also increases evaporation and transpiration, which reduces the amount of water available for productive use. The

impacts of climate on sanitation and hygiene are less well understood at this stage, and have not been assessed.

The strategy emphasizes that Access to WASH is the best way of increasing climate resilience as it shifts people from vulnerable surface water sources to more resilient sources such as groundwater. Delivering universal access to WASH through the One WASH National Program is therefore a critical element of climate resilience.

3.1.3.3. Health National Adaptation Plan to Climate Change

This document deals with the national climate adaptation strategies to mitigate the projected adverse effects of climate change and variability in the Ethiopian health sector. The plan outlines key areas of intervention, alongside the implementation strategy, to support realization of the overall goal of a climate resilient national healthcare sector.

3.1.3.4. Climate Change Resilience Water Safety Plan (CR-WSP) Strategic Framework

This framework provides the strategic blueprint to develop a climate orientated risk assessment and management approach for drinking-water supplies, from catchment to consumer. Considered global best practice, WHO advocates for the WSP approach as the most consistent means to ensure the safe and reliable supply of safe drinking-water. Adapted to the Ethiopian context, this strategic framework outlines a roadmap for the national scale-up of climate resilient WSPs.

3.1.3.5. Urban Wastewater Management Strategy

This strategy was issued by MoWIE in 2017. The purpose of this strategy is to provide a common understanding of the strategic vision to guide wastewater management partners towards an effective and coordinated response through prioritized interventions and targeted programs, whilst encouraging efficient and sustainable use of resources. The objectives of the strategy are geared with the development of strong wastewater management institutions, master plan preparation, implementation methods, protecting the environment from wastewater discharge, social and cultural sustainability, wastewater collection and treatment, wastewater collection transportation and treatment and reuse of treated effluent and sludge. The strategy has the following goals: -

- Develop strong wastewater management institutions at major towns and cities in regions;
- Prepare a national Waste Water Management System (WWMS) plan and management structure aligned with sustainable development goal (SDG 2016-2030) for provision of appropriate wastewater services;
- Protect the public from the potential harmful effects of wastewater through provision of a centralized, decentralized and onsite Urban Waste Water Management (UWWM) system as appropriate under population category of cities and town;
- Coordinate the national UWWM plan in protecting and maintaining safer environment by minimizing adverse environmental effects from wastewater discharge to the natural resources;
- Support cities and town utilities to work with the communities to provide social and cultural sustainability;
- Develop sustainable management structure for wastewater collection, transportation and treatment actions.

Goals are identified in specific, measurable statements of what will be done to achieve the objectives within a particular time frame. In addition, under the strategy, set strategic actions include developing strong wastewater management institutions at all levels, sanitation master plan preparation, implementation of centralized, decentralized and onsite management systems, protecting the environment from wastewater discharge, social and cultural sustainability, wastewater collection transportation and treatment and reuse of treated effluent and sludge.

3.1.3.6. The Second Urban Water Supply and Sanitation Program (UWSSP), 2017 to 2022

UWSSP is a continuation and expansion of the World Bank long term engagement in the urban water supply and sanitation sector and supports the efforts of the government of Ethiopia to improve sanitation services in the urban areas. The basic implementation principles of this program are formulated in accordance with the One WASH National Program including -

- Integrated town-wide approach to sanitation improvement with mix of service options to accommodate diverse needs in different settlement types: This principle aims to ensure a town wide approach, whereby all the residents of the town irrespective of their cultural and socioeconomic background and location are provided an affordable and appropriate mixed technology option. Mixed options approach provides a practical instrument to pick interventions according to specific contexts and capacities. This approach demands a town-wide sanitation improvement to integrate conventional and non-conventional systems used by different service providers to manage waste holistically. A holistic approach demands strategic technical engagement to manage waste using the different options and technologies starting from the point of waste generation up to its final disposal or reuse;
- A stepped approach to give opportunity for towns to create enabling environment prior to pursuing sanitation infrastructure investment: This principle will also create a sense of competition amongst the implementing units to perform timely while at the same time guaranteeing that the investments will bring the intended outcome and impact;
- Developing a suite of services in every town to collect, transport, treat and dispose/reuse liquid wastes: This principle recognizes the need to provide funds for the development of infrastructure for the entire sanitation service chain: collection, transportation, treatment and disposal/reuse. This principle will address the existing gaps in practices in the urban waste water management; Promotion of public awareness and enhanced social engagement to recognize the need to create public awareness and knowledge amongst the society about the health benefits from proper handling of waste. Public awareness will enable them better understand their role and responsibilities in the sanitation chain and make informed decisions about their sanitation technology choice;
- High emphasis on improving efficiency of utilities, as it is not enough to focus on the supply aspect of the infrastructure but also on efficient use of available resources and water supply and waste water management systems at the utility level to achieve the desired results;
- Encourage and facilitate the involvement of the private sector through engaging them in the implementation of the project for provision of services, supply of goods and construction of work.

3.1.3.7. Integrated Urban Sanitation and Hygiene Strategy

The strategy was issued by the Ministry of Health (MoH) in 2008. The goal of the strategy is to mitigate the negative impacts of poor urban sanitation and hygiene on health, environment, society, education and the economy by promoting full sanitation and hygiene systems. The basic premise for the MoH to formulate this strategy were the issues around urban sanitation and hygiene which are complicated due to cross

sectoral interventions and differences between towns. The implementation of the strategy will expect to have a positive impact upon the economy of the country, natural environment, health and wellbeing of all urban dwellers, including the most vulnerable ones. The strategy encourages all sanitation related interventions to be based on town and town development plans, taking advantage of economies of scale, sharing of best practices within the country, and involvement of the private sector and Community Based Enterprises (CBEs). The strategic objectives of the strategy are to:

- To bring sustained behavioral change for better hygienic practices, installation of facilities and delivery and uptake of sanitation services by 2020.
- To ensure open defecation free cities and towns by 2020 from the current average of 6% to zero percent open defecation.
- To ensure that 100% of urban households in any given town or town have access to improved latrines or toilets by 2020.
- To increase the fecal sludge management systems capable of safely removing, treating and recycling fecal matter to 70% coverage by 2025 (interim targets of 30% by 2020).
- To install 1,000 decentralized wastewater treatment systems capable of treating liquid and fecal matter to a standard that can be directly and safely used in the immediate environment or following further conditioning in localized facilities by 2025 (interim target of 200 by 2020).
- To Reduce, Recycle or Reuse 50% of all solid waste generated in medium and large towns and cities by 2025 (interim target of 20% by 2020).
- To dispose of 100% of the remaining solid waste in controlled tipping and sanitary landfill sites that fully comply with 2014 Guidelines by 2030 (interim target of 50% by 2020).
- To ensure safe disposal of 100% health care waste from all health care facilities by 2025 (interim target of 95% by 2020).
- To enforce safe treatment, reuse or disposal of industrial liquid and solid wastes to ensure ecosystem, agricultural and human protection from all industries by 2035 (interim target of 30% of all industries by 2020).
- To leverage and increase effective utilization of resources for accelerated and cost-effective implementation of the IUSHSAP.
- To establish an effective and reliable monitoring system and sanitation database by 2020.

3.1.3.8. National Hygiene and Sanitation Strategy

This National Strategy for Improved Hygiene and Sanitation has been developed to complement the existing health policy (developed by the MoH, 2005) and the national water sector strategy (developed by the Ministry of Water Resources) in placing greater emphasis on „on-site" hygiene and sanitation. The primary focus is on blocking feces from entering the living environment through the safe management of feces, hand washing at critical times and the safe water chain from source to mouth. It places responsibility for improving „on-site" household hygiene and sanitation firmly in the hands of the household with the direct support of the health extension worker and other resources at community level.

The strategy is harmonized with the Health Sector Development Program which places a strong focus on high impact, broad reach, and public health interventions. The strategy has a set of guiding principles for interpretation at the different levels of administration. It is designed to serve a number of purposes. These include to:

- Foster convergence among stakeholders
- Provide a working tool for advocacy Provide a dynamic framework for planning, implementation and monitoring.

Understanding the appropriate technical options people want, can afford and will use is a central pillar of the strategy. The construction of appropriate demonstration facilities at schools, health centers and markets present one opportunity for testing technologies. Promotion will be a central theme and the success of promotional methods and messages (based on understanding and research into behaviors) could be measured in terms of: Increased knowledge and understanding of the linkage between improved sanitation and hygiene and health leading to: Behavioral transformation - improved personal and food hygiene, sanitary excreta management practices with particular emphasis on young children A willingness to pay for some form of sanitation and hygiene improvement with a minimum of capital subsidies (except in special circumstances).
Such changes would be motivated by informed decisions, wider social change, peer pressure and a developing sense of national sanitation and hygiene awareness.

The overall objective of the strategy is progressive individual and collective behavior change which leads to 100% sanitized households within 100% sanitized communities, woredas, regions and zones, and ultimately within a 100% sanitized Ethiopia. Therefore, we believe that the current subprojects will contribute to the national hygiene and sanitation strategies.

3.1.3.9. WASH Implementation Framework

The WaSH Implementation Framework (WIF), prepared to achieve the targets of the Growth & Transformation Plan, represents the collective efforts of the Ethiopian WaSH sector and acts as the guiding document for all WaSH implementation in Ethiopia. The WaSH Implementation Framework (WIF) provides the framework and guidelines for implementing the National WaSH Program based on Growth Transformation Plan (GTP) and WaSH Universal Access Plan (UAP) – undertaken by rural and urban communities throughout Ethiopia and supported and facilitated by governmental agencies, civil society organizations, the private sector and Development Partners. The WIF aims to create an integrated One WaSH Program, led by the government of Ethiopia, to ensure that the targets, set out in the Growth and Transformation Plan (GTP), are achieved. The programming and financial input of all WaSH stakeholders is harmonized, and ultimately channeled through a single Consolidated WaSH account (CWA), in effect ending separate and disparate Development Partners financed projects. The National WaSH Program is based on the Memorandum of Understanding (MoU) signed by the Federal Ministries of Water & Energy, Health, Education and Finance & Economic Development. Four of the significant features of the WaSH program as per this Framework are

- Integration
- Alignment
- Harmonization and Partnership.

On Integration, the WaSH program encompasses water supply, sanitation & hygiene and WaSH in schools and health facilities (Institutional WaSH) in a single program, aimed at integrating safe water use with good sanitation and hygiene practices at the community level. The structural arrangements recommended for

WaSH are designed to build synergy among the sectors through coordinated and collaborative planning, implementation, monitoring, reporting and evaluation of program results. While there are certain mandatory structures, regions are free to design their own structures as long as these are capable of integrated planning, implementation, monitoring and reporting. Mandatory structures are:

- The federal WaSH structures
- The Woreda WaSH Team (WWT)

To harmonize, one of the major aims is to move away from discrete WaSH projects, with the attendant disadvantages in terms of planning, skill and resource allocation, towards a fully programmatic approach. Ideally, this would lead to: One WaSH Plan, One WaSH Budget, One WaSH Report; implying a One WaSH Program. One consolidated WaSH account has been established into which all Development Partners" contributions are deposited and from which WaSH activities and investments are supported. On Alignment, major Development Partners and the government have agreed that the WaSH program will be using the country system and the program will be aligned with:

- Policies, priorities and strategies of the pertinent Ministries as outlined in their respective Sector Development Plans
- Administrative systems, standards and procedures of the Federal and Regional Governments of Ethiopia

For Partnership, it is an evolving feature in terms of scope and level of commitment. The scope has been enlarged to include the four Ministries and the commitment has been increased to engage with Civil Society Organizations (CSOs) and the Private Sector as significant partners. This entails the HWSSE has to commit itself towards achievement of the national WaSH strategies through the implementation of the proposed subprojects in Harar town.

3.1.4. Environmental and Social Legislations/Proclamations

3.1.4.1. Proclamation on Establishment of Environmental Protection Organs

The objective of this Proclamation (No. 295/2002) is to assign responsibilities to separate one organization for environmental development and management activities on hand, and environmental protection, regulations and monitoring on the other, in order to ensure sustainable use of environmental resources, thereby avoiding possible conflicts of interest and duplication of effort. It also intends to establish a system that fosters coordinated but differentiated responsibilities among environmental protection agencies at federal and regional levels.

This Proclamation re-established the EPA as an autonomous public institution of the Federal Government of Ethiopia. It also empowers every competent agency to establish or designate an environmental unit (Sectoral Environmental Unit) that shall be responsible for coordination and follow-up so that the activities of the competent agency are in harmony with this Proclamation and with other environmental protection requirements. Furthermore, the Proclamation states that each regional state should establish an independent regional environmental agency or designate an existing agency that shall be responsible for environmental monitoring, protection, and regulation in their respective regional states.

As per the Proclamation No. 295/2002, each Regional State shall establish an independent regional environmental agency or designate an existing agency based on the Ethiopian Environmental Policy and Conservation strategy and ensuring public participation in the decision-making process, be responsible for:

- Coordinating the formulation, implementation, review, and revision of regional conservation strategies, and
- Environmental monitoring, protection, and regulation.

The Proclamation also states that regional environmental agencies shall ensure the implementation of federal environmental standards or, as may be appropriate, issue and implement their own no less stringent standards. Finally, the Proclamation states that regional environmental agencies shall prepare reports on the respective state of the environment and sustainable development of their respective states and submit them to the EPA.

For Harari, the Environmental Protection Authority is responsible for environmental protection matters in the Region. The Authority is responsible for the review and approval of ESIA of development proposals under the mandate of the Regional Government and for the follow-up of the implementation of ESIA recommendations of such proposals. Therefore, project proponents in the Region should operate in close cooperation with the Authority to ensure that the adverse environmental effects of sanitary facility development proposals are properly identified, and their mitigation or management actions incorporated in the project design or planning and implemented at the right time. Like the federal level, an Environmental Impact Study Report should be prepared by the project proponents and examined, commented and approved by the Authority.

3.1.4.2. Environmental Impact Assessment Proclamation: General EIA Guidelines 299/2002

EIA guideline determining the modalities of protection, conservation, and promotion of the environment in Ethiopia regulates the conduct of Environmental Impact Assessments (EIAs). In its article, it states that every project shall be subjected to EIA before obtaining authorization for its implementation. This applies to programs and policies that may affect the environment and with which ESIA has complied. The Vision further requires that an Environmental and Social Impact Assessment (ESIA) be carried out for development and infrastructures activities likely to negatively impact the environment.

As the project must be undertaken in accordance with requirements and guidelines for the environmental impact assessment process in Ethiopia, the project shall be submitted to EPA for review and approval before implementation. Subsequently, an EPA certificate will be issued to the project. The ESIA process included consultations with relevant agencies and stakeholders, including project beneficiaries, staff of EPA, the Water Supply and Sanitation Authority, Environmental Committees at all local government levels in the project beneficiary towns as well as in Harar town, lead agencies, experts from different institutions, NGOs, and the public in general.

The aim of this Proclamation (Proc. No. 299/2002) is to make an EIA mandatory for specified categories of activities undertaken by either the public or private sectors and is the legal tool for environmental planning, management, and monitoring.

The Proclamation elaborates on considerations with respect to the assessment of positive and negative impacts and states that the impact of a project shall be assessed because of the size, location, nature, cumulative effect with other concurrent impacts or phenomena, trans-regional context, duration, reversibility or irreversibility or other related effects of a project. Categories of projects that will require full EIA, not full EIA or no EIA are provided (Schedule I, II and III). To implement the requirements of this Proclamation, the EPA has issued a Procedural and Technical EIA Guidelines, which provide details of the EIA process and its requirements.

According to the EPA Guideline, proposed projects are assessed and classified as one of the following schedules:

- **Schedule 1:** Projects which may have adverse and significant environmental impacts, and may, therefore, require full EIA;
- **Schedule 2:** Projects whose; type, scale, or other relevant characteristics have the potential to cause some significant environmental impacts but are not likely to warrant a full EIA study.
- **Schedule 3:** Projects that have negligible direct environmental impacts hence do not require environmental impact assessment.

Therefore, the current project activities fall under schedule II that can cause some significant social and environmental impacts but are not likely to warrant a full EIA study.

Like other projects, this project has to be initiated by ESIA to have minimal environmental damage. As a result of this, the subproject will have strong legal standing; a wider global market will be insured; the proponent will have an insight for the pros and cons of the project plus the impacts on the environment by the upcoming subprojects/ project activities. Hence, the project proponent should be committed to abide by the ESIA procedural guideline to achieve the above-mentioned benefits and objectives.

3.1.4.3. Proclamation on Environmental Pollution Control

This Proclamation, Proc. No. 300/2002, is mainly based on the right of each citizen to have a healthy environment, as well as on the obligation to protect the environment of the Country. Its primary objective is to provide the basis from which the relevant ambient environmental standards applicable to Ethiopia can be developed and to the violation of these standards a punishable act. The Proclamation states that the "polluter pays" principle will be applied to all persons. Under this Proclamation, the EPA is given the mandate for the creation of the function of Environmental Inspectors. These inspectors (to be assigned by EPA or regional environmental agencies) are given the authority to ensure the implementation and enforcement of environmental standards and related requirements. It emphasizes the protection of the environment, in general, and the safeguarding of human health and wellbeing, as well as the maintaining of the biota and the aesthetic value of nature. It is promulgated with a view to eliminating or, when not possible to mitigate pollution as an undesirable consequence of social and economic development activities.

The proclamation addresses the management of hazardous waste, municipal waste, and other related industrial and household wastes, and establishment of environmental quality standards for air, water, and soil, and the monitoring of pollution. In this connection, the proclamation provides a basis from which the

relevant environmental standards are applicable to Ethiopia, and violation of these standards is a criminally punishable offense. Thus, the proper installation of fully functioning WWTP, and FSTP is mandatory for the construction and the responsibility of the regulatory bodies such as HWSSA and Harari EPA.

The project might release various pollutants that have an adverse impact on the environment and workers. The project proponent should allocate enough money, facilities and employee environmentalists to implement technologies for better waste treatment and management. This proclamation also helps the project proponent to ensure occupational health and safety of customers and workers.

3.1.4.4. Public Health Proclamation, Proclamation No. 200/2000

The government of Ethiopia issued a public health proclamation in March 2000. It is that the issuance of public health law is an important step for the promotion of the health of the society and for the creation of a healthy environment and for the present and future generations.

The health Policy is linked to a decentralization of the health system and inter-sectorial collaboration. It emphasizes the need for the promotion of occupational health and safety and the development of environmental health. Its provisions for 'accelerating the provision of safe and adequate water for urban and rural populations', 'developing safe disposal of human, household, agricultural and industrial wastes and encourages recycling', and 'developing measures to improve the quality of housing and work premises for health'. The Health Extension Program, a community-based approach to deliver health promotion, disease prevention, and selected curative health services at the community level, is one of the government's primary vehicles to drive the improvement of sanitation at the Kebele level. Of the 16 packages being delivered by extension workers, seven cover hygiene and environmental sanitation.

The project might release various pollutants that have an adverse impact on human health and workers. The project proponent should allocate a sufficient amount of money, facilities and expertise on environmental health to implement technologies for better waste treatment and management. This proclamation also helps the project proponent to ensure occupational health and safety of customers, farmers, and workers.

3.1.4.5. Solid Waste Management- Proclamation (Proclamation No. 513/2007)

The objective of the solid waste management proclamation is to enhance capabilities to prevent the possible adverse impacts while creating economically and socially beneficial assets out of solid waste. The proclamation states that solid waste management action plans designed by, and implemented at, the lowest administrative units of urban administrations can ensure community participation and it is essential to promote community participation in order to prevent the adverse effects and enhance the benefits resulting from solid waste. The Proclamation has also listed the management of different solid wastes such as glass containers and tin cans, plastic bags, used tires, food-related solid wastes, construction debris, and demolition wastes.

This proclamation came into force with the objective of implementing effective solid waste management in the country. The Proclamation recognized the existing solid waste management problems in the country and emphasizes the need to prevent environmental pollution that may result from the disposal of solid waste. The EPA is responsible for initiating and overseeing the implementation of overall policies,

strategies, and guidelines on solid waste management. Regional environmental agencies are also responsible for drawing out their plans as regard to the implementation of the Proclamation and monitoring its efficacy.

The Proclamation promotes community participation to prevent adverse effects and enhance benefits resulting from solid waste. It provides the preparation of solid waste management action plans by urban local governments. Article 5.1 of the proclamation states that urban administrations shall ensure the participation of the lowest administrative levels and their respective local communities in designing and implementing of their respective solid waste management plans. In Article 5.1 each region or urban administration shall set its own schedule and, based on that, prepare its solid waste management plan and report of implementation.

The project proponent is required to acquaint itself to the project management requirements and ensure appropriate monitoring based on the regulation requirements. The project proponent should allocate sufficient resources including facilities and expertise on solid waste management requirements to abide by the regulations.

3.1.4.6. Proclamation on Ethiopian Water Resources Management

This Proclamation (Proc. No. 197/2000) was issued in March 2000 and provides legal requirements for Ethiopian Water Resources Management, Protection and Utilization. The aim of the proclamation is to ensure that water resources of the country are protected and utilized for the highest social and economic benefits, to follow up and supervise that they are duly conserved, ensure that harmful effects of water use are prevented, and that the management of water resources is carried out properly. As stated in the Proclamation, the Supervising Body (the Ministry pertaining to water resources at central level, or any organ delegated by the Ministry) shall be responsible for the planning, management, utilization and protection of water resources. According to Sub-Article 1 of the Article 11, no person shall perform the following activities without a permit from the supervising body without prejudice to the exceptions specified under Article 12:

- Construct water works.
- Supply water, whether for his own use or for others.
- Transfer water which he/she abstracted from a water resource or received from another supplier
- Release or discharge waste into water resources unless otherwise provided in the water resource management regulation.

As per this proclamation, whenever there is a need to prioritize the available water resources, first priority is given for domestic water supply, livestock watering and ecosystem conservation in that order of importance. Water resources rationing for development actions like irrigation, industry, power generation and construction was put at the tail of the list.

3.1.4.7. Proclamation on the Development, Conservation and Utilization of Wildlife

This Proclamation (Proc. No. 541/2007) was issued in August 2007 and it has the following 3 major objectives. These are:

- To conserve, manage, develop and properly utilize the wildlife resources of Ethiopia.

- To create conditions necessary for discharging government obligations assumed under treaties regarding the conservation, development, and utilization of wildlife.
- To promote wildlife-based tourism and to encourage private investment.

Wildlife conservation areas to be designated and administered by the Federal Government and by regions as well as that will be administered by Private Investors and by Local Communities are clearly indicated under this proclamation. Hunting Permit and Collection of Wildlife or Wildlife Products for Scientific Purposes is also receiving enough attention. Wildlife related economic activities such as wildlife resources-based tourism and trading in wildlife and their products is also the attention of this proclamation.

The segregation of powers and duties of the Ministry (Ministry of Agriculture and Rural Development), Regions, and wildlife anti-poaching officers are made clear here. There is also a provision for penalty considerations and the power to issue regulations and directives.

3.1.4.8. Proclamation on Forest Development, Conservation and Utilization

Proclamation No.1065/2018 was issued in 2018 to secure the Conservation, Development and Utilization of Forests. The previous proclamation, Proclamation No.542/2007 is repealed by this proclamation.
The objectives of the forest development, conservation and utilization proclamation are:

- To promote the role of forest sector in arresting the adverse effects of climate change;
- To promote sustainable forest development, conservation and utilization which play a crucial role to halt environmental, social and economic problems caused by the high level of forest degradation;
- To benefit from the decisive role of forest in preventing soil erosion, desertification and loss of biodiversity;
- To balance the demand and supply of forest products, sustain agricultural productivity and thereby ensure food security;
- In addition to developing forest by state and private owners, to introduce community and association forest development;
- To classify forest into productive, protected, and exclusively protected forests on their environmental, social and economic significance;
- To enhance the environmental, social and economic benefits that may arise from multilateral and bilateral agreements; and
- To strengthen forest sector resources, research, education, investment, trade and information systems.

The proclamation classified forest ownership into four. These are Private Forest, community forest, association forest and state forest. The state forest is classified into productive forest, protected forest and preserved forest.

The proclamation among others prohibits cutting endangered indigenous naturally grown trees from state forest or those naturally grown in community forest. But the owner of the tree may utilize endangered tree species planted in his possession upon confirmation from the responsible authority. So, in this regard, the relevant stakeholder shall be involved in the site selection for FSTP and WWTP in Harar town that do not cause permanent damages to the forest/natural resources in the surrounding environmental settings.

3.1.4.9. Proclamation on Research and Conservation of Cultural Heritage

Proclamation No. 209/2000 provides a legal framework for Research and Conservation of Cultural Heritage. The Proclamation establishes the Authority for Research and Conservation of Cultural Heritage (ARCCH) as a government institution with a juridical personality. In addition, it has provisions for management, exploration, discovery and study of Cultural Heritage and miscellaneous provisions.

The Proclamation defines the objectives, powers and duties of the Authority (ARCCH). It also has provisions on Management of Cultural Heritage. Among these are provisions on Ownership and Duties of Owners, Classification, Registration, Conservation and Restoration, Removal, the Use, and Expropriation of Cultural Heritage, Preservation of Cultural Heritage Situated on Land given in Usufruct, and Establishment of Museum.

Furthermore, the Proclamation provides Articles on Exploration, Discovery and Study of Cultural Heritage. Article 41 is on Fortuitous Discovery of Cultural Heritage and Sub-Article (1) states that, any person who discovers any Cultural Heritage in the course of an excavation connected to mining explorations, building works, road construction or other similar activities or in the course of any other fortuitous event, shall forthwith report same to the Authority and shall protect and keep same intact, until the Authority (ARCCH) takes delivery thereof. Connected to this, Sub-Article (2) states that, the Authority shall, upon receipt of a report submitted pursuant to Sub-Article (1) hereof, take all appropriate measures to examine, take delivery of and register the Cultural Heritage so discovered.

Under Miscellaneous Provisions, the Proclamation states that, any person who holds permit to conduct construction works in a reserved area [an area declared to be containing an assemblage of immovable Cultural Heritage or an archaeological site] and who discovers Cultural Heritage in the course of construction activities shall stop construction and shall forthwith report same in writing to the Authority.

3.1.4.10. Proclamation on Classification of Cultural Heritages into National and Regional Cultural Heritages

Projects and other infrastructures development are required to observe the protection and conservation of the Cultural Heritages as defined by law (Proclamation No. 839/2014) by focusing on the following specific thematic areas.

- Sets criteria for Classification of Cultural Heritages;
- Provides for the Procedures and Management of National and Regional Cultural Heritages; and
- Provides for the Establishment of the Cultural Heritages Classification Council.

3.1.4.11. Wildlife Protection Proclamation of Ethiopia

The Wildlife Policy was developed in 2006 by the Ministry of Agriculture and Rural Development. The prime objective of the policy is to create a conducive environment for the preservation, development and sustainable utilization of Ethiopia's wildlife resources for social and economic development and for the integrity of the biosphere/biodiversity. It covers a wide range of policies and strategies relating, amongst others, to wildlife conservation and protected areas with four categories from the highest protection ranking 'National Park', followed by 'Game Reserve' and 'Sanctuary' to 'Controlled Hunting Area'.

The wildlife proclamation was enacted in August 2007 as “Development, Conservation and Utilization of Wildlife Proclamation No.541/2007” to approve the development conservation and utilization of wildlife in

Ethiopia. Hence, this legal enactment is an input and it is appropriate to enhance the contribution of the wildlife sector towards poverty reduction strategy by maximizing the economic and social benefit to be derived from the wildlife resource (FDRE, 2007). Thus, protection and conservation aspects of wildlife species, established mechanisms for conservation and protection of wildlife, etc. shall be assessed to ensure/enhance wildlife management shall be formulated as part of ESMP. The designated WWTP and FSTP sites are not under the category of any of the above wildlife conservation areas and do not have any impact on the wildlife.

3.1.4.12. Ethiopian building code: Proclamation no. 624/2009

This proclamation determines the minimum national standard for the construction or modification of buildings or alteration of their use in order to ensure public health and safety; and will apply in urban centers that have 10,000 or more dwellers. It regulates the design, material used and other minimum standards to guide and control public safety. Control and regulate the materials intended for use and stored on site or incorporated in the works, to be removed from the sites or the works, ban the use of improper materials.

The regulation also gives attention to the surrounding economic and public movement: any building shall be designed and constructed in such a way that it shall not impair the safety of people moving around, other constructions and properties, excavation related to a building is likely to impair the safety or stability of any property or service. The owner of the site shall take adequate precautionary measures to ensure that the safety and stability of such property or service is maintained.

This Code applies to building construction, maintenance, renovation, demolishing and other associated activities to all Classes of Buildings stated in Ethiopian Building Proclamation. This Code covers the Health and Safety precautions for the most common construction activities. If a building construction involves special method/s of construction, the builder needs to come up with the associated Health and Safety precautionary measures for such method/s. The occupational health and safety requirements specified in this document are only the minimum requirements.

3.1.4.13. Ethiopia's Regulations on Public Consultation

The Constitution recognizes the participation of local communities to give their pre-informed consent regarding development endeavors to be implemented in their milieu and share benefits from it as stated in its article 43 (sub-article two, three & 4). Article 43 proclaims the Right to Development, where peoples' right to:

- Improved living standards and to sustainable development; participation in national development in particular, to be consulted with respect to policies and projects affecting their community; and
- Enhancement of their capacities for development to meet their basic needs, are boldly recognized.
- The regulation was well applied in engaging the concerned public and government stakeholders during ESIA document development and shall be approved by the respective regional and/or federal authority.

3.1.4.14. Land Laws-Expropriation and Payment of Compensation (Proclamation 1161/2019 and Regulation No. 472/2020

This proclamation is the most central legislation concerning land expropriation in Ethiopia. The proclamation is a federal legal document; hence it can have regional and town administration varieties in the different regions. The proclamation gives all the basic guidelines for the expropriation process, compensation, and for what purposes expropriation can be done. "A Woreda or an urban administration shall, upon payment in advance of compensation in accordance with this Proclamation, have the power to expropriate rural or urban landholdings for a public purpose where it believes that it should be used for a better development project to be carried out by public entities, private investors, cooperative societies or other organs, or where such expropriation has been decided by the appropriate higher regional or federal government organ for the same the purpose. Hence, process of expropriation and Grievances, as a result, shall be studied.

Concerning the compensation, the government has developed a regulation (Regulation 472/2020) which defines in detail how compensation for the expropriated property should be calculated. If the Proclamation 1161/2019 answers the question "What shall be compensated?" The Regulation 472/2020 answers.

According to the law, people who are displaced due to expropriation in rural lands (lands used for production) have the right to be compensated for the loss of income from the land if they do not receive replacement land. The compensation is defined as 10 times the yearly income from the land, based on the average income from the last 5 years (article 8(1)). The value of the land is not compensated. This is because all land is government owned by the government (public), thus there is no private ownership of the land and no landowner who is eligible for compensation. Ideally the landholder should be compensated with replacement land for the land lost in the expropriation process. During field study and community consultation, it was identified that the local communities had been displaced (at least informed to leave their farm). According to the law, this needs appropriate property/livelihood compensations before the start of FSTP and WWTP sites clearance.

3.1.4.15. Labour Law/Proclamation 1156/2019

The Labor Proclamation (which was revised in 2019) provides the basic principles, which govern labor conditions taking into account the political, economic, and social policies of the federal government, and in conformity with the international conventions and treaties to which Ethiopia is a signatory. The proclamation under its Part Seven, Chapter One, and Article 92 deal with occupational safety, health and working environment, prevention measures, and obligations of the employers. Accordingly, the Proclamation obliges the employer to take the necessary measures for adequate safeguarding of the workers in terms of their health and safety. Moreover, the Occupation Health and Safety Directive (MOLSA, 2008) provides the limits for occupational exposure to working conditions.

According to the proclamation, the employer shall also pay the entire amount of the wages earned by or payable to the workers. Payment of such wages should be done at the end of a month or based on the agreement between the parties. The intended ESIA will try to assess the availability and level of labor required for the proper execution of the project and associated measures that need to be taken into account in safeguarding the socio-cultural component of the area.

3.2. World Bank Environmental and Social Safeguard Policies

3.2.1. The World Bank Operational Policy 4.01

In addition to the requirements of the Federal Government of Ethiopia, donor organizations such as the World Bank have requirements for environmental assessment (EA). The WB E&S safeguards policies are applicable as part of the UWSSP II implementation. The World Bank Operational Policy 4.01 requires EA of projects proposed for Bank financing to ensure that they are environmentally sound and sustainable, and thus to improve decision-making.

Environmental assessment is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, setting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.

EA considers the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The Bank does not finance project activities that would contravene such country obligations, as identified during the EA. EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.

Based on the outcome of the Bank's environmental screening, projects can be categorized as A, B, C or Fl. The selection of the category is based upon the expected environmental impacts.

- Category A: A full EA is required. I.e., A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented.
- Category B: Although a full EA is not required, environmental analysis is required. A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas-including wetlands, forests, grasslands, and other natural habitats are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases, mitigation measures can be designed more readily than for Category A projects.
- Category C: No EA or environmental analysis is required. A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.
- A proposed project is classified as Category Fl if it involves an investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

The World Bank Safeguard Policies are Operational Policies (OP) and Bank Procedures (BP) approved by the Board for addressing environmental and social issues within the Bank's supported development projects. The WWTP, and FSTP have been rated Environmental Risk Assessment Category B and trigger three environmental and social safeguard policies, which are: Environmental Assessment (OP/BP 4.01); Involuntary Resettlement (OP/BP 4.12); and Physical Cultural Resources (OP/BP 4.11). The same policies will apply to the Sub-Project activities under the proposed WWTP, and FSTP constructions.

This policy requires environmental and social impact assessment (ESIA) of projects/to ensure that they are environmentally sound and sustainable. The ESIA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the sub-projects under the core urban sanitation infrastructure component. The environmental and social impacts are anticipated to come from the implementation of subprojects activities by the contractor. The ESIA process will lead in the preparation of an ESMP for proposed project activities in Harar town. The ESMP set out mitigation, monitoring, and institutional measures to be taken during operations of these activities, to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

3.2.2. 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 is triggered by the Sub-projects because Sewer lines infrastructures are located in the vicinity of UNESCO World heritage property i.e., the "Harar Jugol, the Fortified Historic Town". According to approved sub project designs, the proposed projects are such that they do not affect cultural resources. The activities involved in the installation of these components of the sub-project may cause some impacts on the cultural sites unless due precautions and mitigations measures are taken. Hence, the possible impacts of the project activities have been examined and mitigation measures to be taken to avoid the impacts are recommended in the ESMP. Where, procedures have been included in construction and operation phases of the subprojects; Designs and buffer zones will be created to avoid damage to the town's cultural resources.

3.2.3. Involuntary Resettlement (OP/BP 4.12)

WB Involuntary Resettlement Policy OP 4.12 requires that all projects with land acquisition implications are guided by a Resettlement Policy Framework (RPF), which outlines processes and procedures to be followed for the preparation of site-specific RAPs during project implementation. However, in Ethiopia, there are no explicit requirements for an RPF or RAP. As regards compensation Ethiopia requires only the rightful land or property owner (statutory or customary rights of occupancy) should be compensated, while the WB OP

4.12 requires that any person (whether is the rightful owner or not) who lose or is denied or restricted access to economic resources including tenants, encroachers, squatters should either be compensated for use of the land or assisted to move. The UWSS-II project will apply both WB requirements and the Ethiopian government's guidelines regarding compensation and resettlement of PAP, and where there are gaps between these two, the most stringent policy will prevail.

Significant efforts are to be made in the design and screening stages of sub-projects to avoid impacts on people, land, and property, including as far as possible people's access to natural and other economic resources, possible. The WWTP, and FSTP subprojects in Harar are expected to cause some involuntary resettlement as the infrastructure of WWTP and FSTP affect some crop fields owned by individuals that required compensation for lost livelihoods.

3.2.4. General Environmental Health and Safety (EHS) Guidelines

The General Environmental Health and Safety (EHS) Guidelines developed by the International Finance Corporation (IFC), cover a wide range of technical references that can be applied to general and industry-specific actions that resonate with Good international Industry Practices. These Guidelines can be applicable to the UWSSP II, along with the mentioned legislation outlined in this chapter. Specifically, the following EHS guidelines can be considered:

- General EHS Guideline (1): Environmental
- General EHS Guideline (2): Occupational Health and Safety
- General EHS Guideline (3): Community Health and Safety
- General EHS Guidelines (4): Construction and Decommissioning
- Donor Safeguard Requirements and Applicable Standards
- General Environmental Health and Safety Guidelines

3.3. Comparison between Ethiopian and World Bank Policies

Project Categorization in World Bank and Ethiopian legislation are more or less similar. In both policies environmental screening is the requirement to identify whether the project is subject to environmental impact assessment or not. Screening processes in both cases address the need for further EA and its level and scope. However, the categorizations that result from the screening processes are slightly different in their definition, but still are roughly equivalent.

In general, it is understood that "Schedule 1" and "Category A" are roughly equivalent as they both include projects with potential significant adverse impacts that demand a full-fledged ESIA. Though there is a slight difference that in some cases schedule 1 projects as per Ethiopian policy could fall under category B of the World Bank.

Schedule 2 and Category B projects are more or less similar in their definitions; both categories refer to projects with less impacts than those of Category A or Schedule 1 projects. Under OP 4.01, category B projects require environmental work at the appropriate level, be it an ESMP, an ESIA or the implementation of mitigation measures in the context of an environmental and social screening process.

However, the Ethiopian guidelines do not make provisions for the screening of sub-projects of a smaller scale than those listed in Schedules 1 and 2, and which may have negative localized impacts which will require mitigation. Therefore, Categorization of wastewater treatment plants has been screened based on the WB policy and it has been classified under category B.

3.4. Gaps between the National and the World Bank OP 4.12

There are some gaps between Ethiopian laws and regulations and the requirements for resettlement as laid out in OP 4.12. In some cases, the Ethiopian laws and regulations are not compatible with the Bank's OP 4.12 provisions. Table 3 below compares Ethiopian Law on land acquisition and World Bank's operational policy and recommended measures to address the gaps:

Table 3: Comparison of Ethiopian Legislation and World Bank's Operational Policy

Theme	World Bank's Safeguard Policies Applicable	Ethiopian Legislation	Comparison	Measures to Address the Gaps
Eligibility for Compensation	World Bank OP4.12 gives eligibility to: Those who have formal legal rights to the land; Those who do not have formal legal rights to land, but have a claim to such land; and Those who do not have recognizable legal right or claim to the land	Proclamation No1161/2019, Article 8(1) allows' landholders' to be eligible for compensation, No.1161/2019 Article 8, landholders or their agents whose landholdings are to be expropriated shall submit landholding certificates or other proofs that show their landholding rights over the lands that is decided to be expropriated to the urban or rural land administration office on the time schedule of the office. These give entitlement only to those who have formal legal rights over their land holdings (properties).	According to World Bank OP4.12, eligibility for compensation is granted to "affected parties". Ethiopian Legislation only grants compensation to those with lawful possession of the land, and as per Proclamation No 456, those with traditional possession i.e., Communal lands. It therefore does not recognize those without a legal right or claim as eligible for compensation	Eligibility criteria for compensation and assistance shall be in line with the WB eligibility to benefits.
Public consultation and disclosure procedures	Consult project-affected persons, host communities and local NGOs, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate	There is specific Guideline entitled with" Guideline on Public Consultations in Environmental and Social Impact Assessments Process" which has entered into force in December 2018 by the FDRE EPA.	The guideline has clearly articulated the role of the PAPs, project proponent, the Commission, consulting firms, Regional Environmental Agencies and interested parties. It also shows how stakeholder analyzed and prioritized. The guideline has incorporated consultation with "hard to reach" group and individuals, issues to be considered to enhance women`s contribution in the consultation process. Furthermore, public consultation plan should describe the means of notifying and informing and informing the public about the proposal and	Provide project-affected persons and local NGOs/CSOs, local leaders, vulnerable groups, media and women as appropriate the opportunities to participate in the planning, implementation, and monitoring of the resettlement program.

Theme	World Bank's Safeguard Policies Applicable	Ethiopian Legislation	Comparison	Measures to Address the Gaps
	and accessible grievance mechanisms.		ESIA process, beginning at an early stage and continue with updates on the progress of the ESIA study and feedback on community concerns and accepts consultation is ongoing and at different stage of ESIA process which also include other safeguard documents. Documents. Above all the guideline has provisions for vulnerable groups.	
Measures for livelihood restoration and assistance to vulnerable groups	Livelihoods and living standards are to be restored in real terms to pre-displacement levels or better. OP 4.12 further requires attention to be given to the needs of vulnerable groups such as those who are below the poverty line, landless, elderly, women and children, indigenous groups, ethnic minorities and other disadvantaged persons.	There are no specific laws or regulations specifying support for livelihood restoration and transition and moving allowances. Ethiopian law makes no specific accommodations for potentially vulnerable groups such as women, children, the elderly, ethnic minorities, indigenous people, the landless, and those living under the poverty line.	Ethiopian policy and legislation would need to be aligned with the Banks policy to effectively guarantee the rights of all affected persons by involuntary resettlement. Vulnerable groups are at highest risk or prone to experience negative effects due to resettlement and should receive special consideration during the preparation of a resettlement policy framework.	Additional support may be needed for vulnerable groups. Vulnerable groups in the project area will be identified and the support need specified in RAP or LRP.

3.5. Multilateral Environmental Agreements

There are quite a number of multilateral agreements in the environment sector to which Ethiopia has become a party. These agreements form part of the body of laws of the country as per Article 9 of the Ethiopian Constitution and are hence important to be considered when checking for the compliance of economic activities with laws in force in Ethiopia. Some of the main Multilateral Environmental Agreements (such as UNFCCC, UNCCD, and UNCBD) are briefly stated below.

3.5.1. United Nations Convention on Biological Diversity (UNCBD)

Ethiopia has ratified this Convention by Proclamation No. 98/94, on May 31, 1994. The Convention has three goals: (i) the conservation of biodiversity; (ii) the sustainable use of the components of biodiversity; and (iii) the fair and equitable sharing of the benefits arising from the use of genetic resources.

3.5.2. United Nations Convention to Combat Desertification (UNCCD)

This Convention has been ratified by Ethiopia in 1997 through Proclamation No. 80/1997. The objective of the Convention is to combat desertification and mitigate the effects of droughts in countries experiencing serious drought and/or desertification, particularly in Africa.

3.5.3. United Nations Framework Convention on Climate Change (UNFCCC)

Ethiopia has ratified the Convention through Proclamation No. 97/1994 on May 2/1994. This Convention takes into account the fact that climate change has trans-boundary impacts. Its basic objective is to provide for agreed limits regarding the release of greenhouse gases into the atmosphere and to prevent the occurrence or minimizes the impact of climate change.

3.5.4. Stockholm Convention on Persistent Organic Pollutants

Ethiopia has ratified this Convention by Ethiopia by Proclamation No. 279/2002, on July 2, 2002. The Convention aims to ban the use of persistent organic pollutants (POPS). Originally, the POPs Convention contained 12 chemicals that were slated for total elimination or decreased use in industrial and agricultural processes. The list is expanding as parties to the convention ascertain the POPs character of other chemicals through the evolution of knowledge and experience. This agreement will support the implementation of the POPs free waste treatment and management strategies during the proposed subproject operation in Harar, which helps to protect the human health and their environment.

3.5.5. Convention on the Protection of World Cultural and Natural Heritage

Each state which is party to this convention recognizes that the duty of ensuring the identification, protection, conservation, preservation and transmission to future generations of the culture and natural heritage situated on its territory, belongs primarily to the state. Ethiopia has ratified this convention in 1997.

3.5.6. The Vienna Convention on the Protection of the Ozone Layer

The basic objective of the Convention is to combat the negative impact on the environment and human beings resulting from ozone depleting substances by reducing the amounts released and eventually banning their commercial use through internationally agreed measures. The Montreal Protocol entered into force in 1989 to facilitate the implementation of the convention.

Ethiopia ratified and become a party to the Vienna Convention and the Montreal Protocol in January 1996. The National Meteorological Services Agency has been mandated for the coordination and supervision of implementation of this convention.

3.5.7. Convention on International Trade in the Endangered Species of Fauna and Flora (CITES)

Ethiopia ratified the convention in 1989. It provides an international umbrella for management and control of trade in endangered fauna and flora. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. It is initiated because of the crosses-borders nature of the trade in wild animals and plants, which necessitates international cooperation to safeguard certain species from overexploitation. CITES provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level. The implication of this convention for the current subprojects is to ensure that any activities of the subproject shall not intervene with the convention and be respected by the construction enterprises.

3.5.8. Basel and Bamako Conventions

Both of these Conventions have been acceded to by Ethiopia. The agreements regulate the trans-boundary movement of hazardous waste for the purpose of reclamation, or final disposal. In the preparation of this proposed project, these international agreements that Ethiopia signed will be considered when it deems necessary at various phases of the subproject intervention in Harar town.

3.6. Administrative and Institutional Framework

The FDRE Environmental Protection Authority (EPA) is an autonomous public institution of the Federal Government of Ethiopia entrusted with the protection and conservation of natural resources in Ethiopia. The general role of the EPA is to provide for the protection and conservation of the broad environment, through formulation of policies, strategies, laws and standards, which foster social and economic development in a manner that enhances the welfare of humans and the safety of the environment.

In accordance with the principles of government decentralization and the Proclamation no. 295/2002, each national regional state shall establish an independent Regional Environmental Agency or designate an existing agency that shall, based on the Ethiopian Environmental Policy and Conservation Strategy and ensuring public participation in the decision-making process, be responsible for: Coordinating the formulation, implementation, review and revision of regional conservation strategies; and Environmental monitoring, protection and regulation.

The Harar town EPA is responsible for environmental protection matters in the town. The Regional Authority is responsible for the review and approval of ESIA of development proposals under the mandate of the Regional Government and follow up of the implementation of ESIA recommendations of such proposals. Therefore, project proponents in the Region should operate in close cooperation with the Bureau to ensure that the adverse environmental effects of development proposals are properly identified and their mitigation or management actions incorporated in the project design or planning and implemented at the right time. Similar to the federal level, an Environmental Impact Study Report should be prepared by the project proponents and examined, commented and approved by the Harari Environmental Protection Authority (HEPA).

4. DESCRIPTION OF BASELINE CONDITIONS

This section describes the physical, socio-economic, and biological baseline of the proposed site, based on the findings of the data collection, field investigations, and review of the relevant documents (including feasibility study and detailed design).

4.1. Physical environment

4.1.1. Climate

According to the Ethiopia agro-ecological classification, the climate of Harar is mostly Woina Dega (sub-tropical). The minimum average temperatures vary from 12℃ in December (the coldest month) to 27.1℃ in March. December is the coldest month whereas March is the hottest month, with mid-day temperatures exceeding 28℃. The average annual maximum and minimum temperatures are 25.5℃ and 13.4℃, respectively. Daily high temperature is below 24.4℃. In the warm season, from February to March, temperatures rise above 27.2℃.

Rainfall is the most important climatic factor. The annual rainfall of Harar town varies from 319mm to 1000mm with a mean annual value of 665.5 mm. The rainy period extends from April to September with a slight decline in June. The maximum rainfall occurs in April and the minimum in January. The rainy season extends from July to October.

Generally, the climate of Harar town and its surroundings have moderate climatic conditions and experience two distinct wet and dry seasons. As per the study report on the region's potential resources the rainfall in the region has a weak bi-modal pattern with the first peak occurring in April-May and the second and main peak occurring in July – August.

4.1.2. Topography

The project area stands on a broad upland plateau with an altitude ranging between 1,700 to 2,200 meters above sea level. Gullies, streams, and steep slopes dominate the topography of the town.

Harar town and its surrounding can be divided into three landforms based on the slope of the topography, namely, plain area at the lowest elevation and gulley at the bottom, sloppy at the banks of the gulley, and transitional zones, and rugged to gently sloping area at the highland areas. The ground slopes vary from gentle to flat and present no problems for sub-project investments.

Furthermore, the FSTP Site is bounded by a series of hills on the western and northwestern and relatively flatter hills on the eastern side. The WWTP site is located in a relatively undulating topography. Generally, the topographic feature of the project site makes the surrounding mountains drain towards the edge of the sites. Particularly, the WWTP site is strategically situated to receive waste by gravity. The main drainage lines start at north-western mountain ridge in the southeast direction.

4.1.3. Wind Speed and direction

Wind speed describes how fast the air is moving past a certain point and Wind direction describes the direction on a compass from which the wind emanates. The annual average wind speed in Harar town is 1

m/s with the highest value of 2.1 m/s in February and 1.9 m/s in January. The minimum wind speed has been recorded in October (0.4 m/s).

According to the Region's Potential Resources Study Report, 2006, wind direction, southeast, northeast, and northwest wind, account for about 20.5 %, 19.7%, and 19.1% of all observations, respectively. Easterly winds are the most prevailing winds in the town. Therefore, highly pollutant urban activities in terms of smoke, dust particles, and stench smells are recommended to be located opposite to the prevailing wind direction. However, non-pollutant activities that can be easily protected by simple mechanisms such as buffer zones can be located in all parts of the town if they would be compatible with other urban functions.

4.1.4. Geology and Soils

Various construction activities i. e. excavations and earth grading will be undertaken during the construction phase of the proposed project activities. Depending on location, this may encourage soil erosion, soil compaction, chemical soil pollution, and soil degradation. These impacts will be localized as the activities will occur on a footprint or on the development boundaries and also where access roads will be constructed. The selected site does not exhibit fatal flaws in so far as unstable areas, steep slopes, shallow bedrock, or pans and vleis are concerned as per the findings of the geotechnical assessment.

The soil type of site mainly is sandy soil cover with varying thicknesses. Previously the site was used to dump solid waste indiscriminately as evidenced by litter spread all around the area. The road to Jijiga passes through the valley on the upper side of the FSTP site. But there is enough distance between the road and the actual FSTP site.

Soil depth: This refers to the thickness of soil available for use as cover material during operations and at closure. Ideally, the treatment plants should not be placed within a depression or an excavation lower than the surrounding ground since water can collect in it. The optimal sitting of the facility is therefore at ground level and sourcing the cover material from a nearby location. Therefore, Sand soils of alluvium type are available at the sites.

4.1.5. Water Resource

Surface water: In the region, there are several small streams and three rivers. The three rivers (Hamaresa, Bisidimo, and Erer) together with streams flow to the Wabe Shebelle River in the Somali region. The above-stated water resources and various springs were used to provide the region with a considerable amount of water for domestic use and even for irrigation purposes. Due to various environmental problems and climatic changes some streams and springs were dried, while the volume of the existing small streams and rivers, as well as the discharge rate of springs, and have been decreasing from time to time. Leave alone for other purposes water resources for basic use (domestic consumption) have been a critical issue both in urban and rural areas of the region since adduced. (Especially Harar town is suffering a lot for the last 2 decades due to the drying of Haromaya Lake, between high temperature and erosion that were serving as a source of drinking water.

Ground Water: Harar is located at the beginning part of Bisidimo-Erer River Basin and the major part of the town is metamorphic rock and with some limestone rock and localized sediments in the valleys and depression. The general rugged topography and relatively thin sediment cover and poor geometry for

storing water confined to the potential subsurface sources to localized sediment and weathered zone (saprolith) of the metamorphic rock. In the proposed treatment plant areas, there are no boreholes or hand-dug wells.

The expected aquifer for Sofi Woreda is an alluvial deposit along the valley. This is evidenced by the riverside '*chirosh*'/seepages, which are being exploited by the local people through hand-dug wells.

The groundwater level is usually well in excess of 20 meters deep and consequently should present no problem. It should, therefore, be noted that the proposed sub-projects which are the construction of WWTP and FSTP do not come close to any major water sources. The proposed project activities (WWTP and FSTP) are not directly connected and in proximity to any water bodies.

4.1.6. Noise and Vibrations

Considering the planned Sewer line installation, WWTP and FSTP construction and further development of the surrounding residential area some noise and/or vibrations may be generated by the construction works itself. But, the scale of noise and vibrations is limited and insignificant to the direct neighborhood of the construction site and of temporary character.

4.1.7. Air Quality

In general air quality is influenced by anthropogenic activities distinguishing two main sources, namely mobile and stationary sources associated with the project activities. Excavation and vehicle activities are major sources of ambient air pollution arising from the project activities during construction. In addition, the exhaust from the vehicles during the construction is a short-term source of ambient air pollution with insignificant levels. However, during operation, there will be no potential sources of ambient air pollution except evaporation of liquid wastes with some toxic materials.

Emissions to the ambient air from vehicles may include pollutants particulate matter (PM), Carbon dioxide (CO_2), Nitrous oxide (NOx) as well as Sulphur oxide (SOx). Prolonged exposure to these activities poses the risk of acute respiratory infections. However, these toxic substances will not be released in a significant amount since the construction phase takes only a few months.

Similarly, the main pollutants from exhaust emissions from motor vehicles include Hydrocarbon and Benzopyrene, Phosphorus, Carbon monoxide, Sulphur oxides, and Nitrous oxide. Exhaust emissions are highest in urban centers and along the major highways and vary according to periods of peak traffic flow. However, WWTP and FSTP sites are not subjected to such congestion during construction and operation phases.

4.1.8. Land Use

Agriculture is the main source of income for the community. Trees like mango and chat (khat), [*Mangifera indica, Catha edulis*] which are the major source of household income, acacia, lemon, and angora are also grown in a limited number of households. Sorghum, maize, and groundnut are the major crops grown in the area. As per the site survey and observations made on the proposed WWTP and FSTP site, chat/khat is growing in some of the plots and it constitutes a major source of income for some households. Accordingly,

compensation shall be paid for the loss of property and livelihood of the affected community. The survey result revealed that basic social facilities like potable water; school, health, telephone, access road, etc. are not available within the proposed WWTP and FSTP site.

The site allocated for the WWTP and FSTP is owned in full by the community and sewer lines by the regional government of Harari and is used by the community for various economic activities and house construction. The treatment sites are considered sloppy and located on an outskirt (about 12 km-FSTP) and, but WWTP is not significantly far from a residential area. There are no informal land use patterns occurring on both treatment sites, therefore the site is suitable for construction activities with no direct impacts on land use. However, the typical land use of the selected sites are characterized as follows:

- The selected sewer lines sites are road sides with some infrastructures including pipelines, settlement, roads of different types and grades and other utilities.
- The WWTP site is dominated by farms with scattered Mango trees. The downstream of the WWTP is also farming fields which are used for irrigation.
- The FSTP site is also a farming field covered by the various crops including Chat/Khat, mango etc.

4.2. Biological Environment

The proposed subprojects in Harar town have been placed in urban and semi-urban environments with the following specific characteristics. All the sewer lines are proposed to be implemented in urban areas dominated with settlements and public services. Whereas, the proposed WWTP and FSTP sites are dominated by crop farms.

4.2.1. Local Flora and Fauna

An observation-based biodiversity assessment was made in the sites proposed for the WWTP and FSTP. The area proposed for the WWTP and FSTP site has not been identified as an area of significant sensitivity. No threatened, near threatened or any rare and declining species as identified to occur on the study site. There are no sensitive bird species that would occur in the vicinity of each of the sites. Most of the immediate habitat surrounding the proposed development is vacated. No drainage lines transverse the site and do not pose any significant risk in terms of potential impacts during construction and operational phases to surface water resources and wetland ecosystems. Therefore, the conservation issue is insignificant, and the project can have minimal or no impact on local fauna and flora.

The sub-project areas and their vicinity are poorly endowed with wildlife resources. Most of the proposed sub-projects are situated in areas which have no wildlife resources of conservation interest. At the urbanized municipal center there are virtually no game species whereas there are reports that migratory hyenas are occasionally seen in the peripheral areas. The ecological setting of the larger part of the municipality does not allow wildlife game species to flourish. The habitat for wildlife has been significantly modified because of human activities of agriculture, deforestation, and nearby urbanization. Therefore, there is a poor presence of wildlife in the area. As such, there are no known rare or endangered species in the municipality and its vicinity (e. g. by IUCN categories).

4.2.2. Conservation Areas

The sub-project investment areas have no forest reserves, no National Parks, or any form of the conservation area as defined in the National Wildlife Policy. Similarly, there is no culturally, historically, and archaeologically sensitive areas close to the WWTP and FSTP sites.

Considering the natural biological environment, the flora and fauna information at the concerned site can be summarized as follows:

- The proposed site is not located in any conserved area.
- No threatened, rare, or endangered species of fauna or flora were registered or known to exist around the site.
- No sensitive or fragile habitats were noted in relation to the extent and magnitude of the envisaged works.
- No species of fauna or flora that could be exploited for commercial purposes have been noted in proximity to the proposed works.
- The current degree and extent of the proposed works do not interfere with any protected area.

4.3. The Human Environment (Socio-Economic Settings)

4.3.1. Socio-Economic Environment

Population and Settlements areas: Administratively, Harar is one of the oldest and an ancient historical town located on a hilltop in the eastern part of Ethiopia about 525 kilometers from the national capital Addis Ababa at an elevation of 1330-2200 meters. The total land area of the Harari region is estimated at 34.2 km^2 (34,320 ha) out of which the rural area accounts for about 323.7 km^2 (94.3%) and the remaining 19.5 km2 (1950 ha) accounts for the urban area. The Harari Regional State consists of six urban and three rural Woredas. The rural Woredas were Sofi, Direteyara, and Erer-Woldiya . These administrative Kebeles are further divided into 19 sub-Kebeles (urban) and 17 sub-Kebeles (rural). The region is mainly categorized into two agro-ecological zones; 90% of the land area of the region is estimated to be mid-high land (weyna dega), between 1400-2200 meters above sea level, while the remaining 10% is kola (approximately found below 1500 meter above sea level). The settlement pattern of the region is different from other regions of the country where 62% of the population reside in an urban area. The livelihood of the population is basically dependent on farming, trade/small business, and employment in the formal sectors at government and non-governmental offices.

4.3.2. Economic Conditions

Employment in the formal sector has been increasing recently in addition to agriculture, the main economic activity in the region. The income-generating activities of a bigger part of the municipal population are mainly through petty businesses and farming activities, hence, most of the municipal population has low income. The State's population is engaged predominantly in farming, civil service, and commerce. Sorghum, maize, chat/khat, coffee, orange, and mango are among the major agricultural products.

Most of the town's population is driving their livelihoods by undertaking small and medium trades. The major undertakings in Harar town include small-scale trading and micro enterprises, hotels, retail trading, cereal marketing, flour mills, and livestock products marketing, etc. As such, business activities are the main source of income for Harar. About 31% are government workers and the remaining earning livelihoods as

daily laborers, from pensions and other activities. Regarding industrial activities, there are small-scale manufacturing and processors such as hallow blocks and bricks, grinding mills, woodworks, metal works, and bakeries. Other business establishments and service providers in Harar, which are expected to be potential sources of wastes, include 28 hotels, 58 bars, and restaurants, 9 fuel stations, over 5,000 shops, 49 small scale processors (woodwork, metalwork, and flour mills), 20 garages, 9 banks, 2 abattoirs, 44 small industries, 2 stadiums, etc.

4.3.3. Health

Health reports from the Regional Health Bureau indicate that water-excreta-related diseases are major health problems in the Region. Reports indicate that water and hygiene-related diseases rank among the 10 top leading causes of morbidity and mortality. This situation calls for a more coordinated and concerted effort to improve the situation.

According to the 2016 Harari regional health bureau report, the region has a total population of 240,000, of which 123,072 are females. There are two public hospitals (including the oldest hospital in Jogel) and eight public health centers with 591 health professionals in the region.

4.3.4. Education

There are many educational facilities, government, religious, and privately owned. Such facilities include nursery schools, several primary and secondary schools, colleges (private and government), and universities in Harmaya in a close distance to Harar town.

4.3.5. Utilities and Services

WATER SUPPLY: According to the recent data, water supply coverage of the urban and the rural area of the region is 25 and 56 per cent, respectively. The source of drinking water 73.3% is safe water and 26.6% is unsafe water. All kinds of traditional and few developed sources of water supply water are being used for domestic water supply sources. Currently, the town is getting its water supply from the deep boreholes located near Dire-Dewa town and the problem of water shortage seems partially resolved.

Since the town has a water supply distribution system and sewerage system need not be on the same side of the roads to avoid cross contamination of the town water supply system. That is, there is a network of water supply connections and sanitation services composed of a localized sewer system and septic tank system which empties their septic tanks using a Municipal sludge emptier. Other houses are not connected to the main sewer and do not have flush toilets with septic tanks; these houses use pit latrines.

4.3.6. Existing Waste Management Practice

4.3.6.1. Solid Management

The major sources of solid waste in Harar town could be categorized into domestic, commercial, institutional, municipal, and construction and demolition. The predominant quantities of solid waste generated in the town are from domestic and commercial followed by others.

In Harar, solid waste collection systems are not properly planned to effectively utilize available resources. Less than half of the generated solid waste is collected and almost all the collected solid waste is dumped

haphazardly in a crude manner. The current solid waste collection practice in Harar town includes communal containers, curbside truck collection and in some areas of the town door- to-door collection is used.

In Harar, the other major solid waste contribution comes from the streets and open markets of the town where different inorganic and organic material like vegetables, fruits, chat, etc. are generated daily in huge quantities. The Municipality commences a regular cleaning and collection of solid wastes from streets and open markets as one of its major activities of solid waste management. Solid waste collection containers in the town are not transported and emptied daily bases except the market area. Unfortunately, this service is performed very inefficiently and in an unhygienic manner.

4.3.6.2. Wastewater Management

One of the major concerns for Harar town is poor liquid waste management practices that in turn cause a public health problem in addition to threatening the natural environment. Grey water and black water are the two main types of wastewaters, which are being generated in Harar from households, commercial entities, health facilities, hotels, public and non-public institutions, industries, and community gathering places. Both on-site and off-site management of wastewater requires improvement.

To alleviate this sanitation problem, efforts to plan and implement wastewater management, including rehabilitation and construction of communal latrines and effective fecal sludge management have been put in place by different organizations. Despite all efforts made to alleviate the sanitation problem, wastewater management is still posing threats. The study indicated that only 42.3% of households have private toilets while 54.0% yet use a communal or shared toilet with other households. Yet another 1.3% of the households do not have sanitation facilities at all.

The existing public toilets, which are traditional pit latrine types, are not enough to provide services for the town given its size, commercial importance, and high level of interaction. Harar has five public toilets, each having 4 cubicles making a total of 20 cubicles which are not enough to meet people's public toilet needs. At least 48 % of community members were not satisfied with their current sanitation facilities in Harar. Even though the public toilets have showers, they are not functional due to a shortage of water. According to the Ethiopian Demographic and Health Survey (EDHS) 2017, only 20.1% of the urban population had access to improved sanitation facilities. However, this study has found that at least 16 % of the households have access to flush toilets, 48 % use improved pit latrine, 1% are VIP and only 35 % of households use unimproved pit latrine in Harar town.

Liquid waste management of the town is carried out by the general services of the municipality. In the town a total of 2 government and 2 private vacuum trucks are currently giving the pit emptying (desludging) services. These trucks make three trips on an average per day and collect 23,601.2m^3 of FS from households, and public and private establishments, annually.

4.3.6.3. Fecal Sludge Management

For far too long, haphazard disposal of desludged sewage from dry toilets and septic tanks from individual households into open fields and agricultural areas has been a source of environmental pollution in Harar city and the surrounding rural villages. The disposed sludge, through overland runoff during the rainy

season, eventually gets into the river system (then to irrigation farm lands), and is a source of health problems.

It is known that the provision of toilets and septic tanks is not by itself the end of the proper management of generated wastes in the town. Fecal sludge is formed through the process of decomposition of fecal matter in the pits of latrines and septic tanks. Currently, the city of Harar doesn't have a properly designed and constructed fecal sludge treatment system.

Treatment of the solid matter in the fecal sludge generally involves reduction in water content and stabilization of the sludge. The purpose of solids stabilization is to reduce the odors and bacteria levels in the sludge, leaving the stabilized sludge relatively inert. Thus, a sludge treatment system that properly dewaters the sludge during dry months, provide proper storage and treatment during the rainy season, provides further treatment of the percolated leachate and the dried sludge for use in agriculture is recommended in this design. However, the amounts of nutrients (e.g., nitrogen and phosphorus) need to be regulated as to national and WB standards before either discharged to the natural system or used for local irrigation systems. For treatment purposes the technical design has to include appropriate (modern, affordable and easy to use technologies including sources of energy for running of the different parts of the technologies).

4.3.6.4. Downstream Areas from the Proposed Treatment Plant

There are no settlements within 100m around the designated TP site. There is no new proposed settlement site in the area. There are no large-scale structures constructed in the area. Within the treatment plant site, one cannot see any wild animals that interfere with the treatment plant. Therefore, the proposed WWTP and FSTP sites are well situated for the construction of the treatment plants. However, it is highly recommended that the construction should abide by the approved design and landscaping works to avoid any nuisance due to the project operation including the construction phase.

4.3.6.5. Farming Areas

The surrounding area of the wastewater and fecal sludge treatment plants are covered with crops such as Mango and Chat/Khat. The local community is growing Mango, Khat, Sorghum, and groundnut in the surrounding areas including the site selected for the construction and operation of FSTP and WWTP. In the surrounding area-down from the WWTP, farmers use industrial wastewater for local irrigation to grow crops and vegetables both for consumption and local market.

4.3.6.6. Settlement Area

There are people who settled around the treatment plants, which are within a ~400-meter radius (but not too close) to the proposed treatment plant sites. However, none of these settlements (houses) will be affected by the construction of the treatment plant at AwOmur site-WWTP. In the FSTP site there is one household who is settled close to the FSTP site, but not within the treatment plant area that needs an immediate attention by the woreda administration (Sofi woreda) and the regional government.

5. DESCRIPTION OF THE PROPOSED PROJECT

5.1. Overview of UWSSP-II project

Ethiopia's rapid urbanization is putting stress on the already inadequate water supply and sanitation system in urban areas. The capacity of urban centers to adequately dispose of wastewater is low, exposing natural resources to pollution and posing a risk to human health. In line with this, the Government of Ethiopia has successfully secured finance from the World Bank under the Second Ethiopia Urban Water Supply and Sanitation Project (UWSSP-II). The UWSSP-II is primarily intended to improve urban sanitation holistically and equitably in the urban space and provide assistance to improve operational efficiency in 22 Ethiopian cities.

The objective of the Project is "to increase access to improved sanitation facilities and improve efficiency in water supply service delivery in Addis Ababa and other 21 secondary cities[1]". This objective will be addressed through the following three major components: (i) sanitation and water supply services improvement in Addis Ababa; (ii) sanitation and water supply services improvements in selected secondary cities; and (iii) Project management and institutional strengthening. Harar town is one of the secondary cities benefiting from the portion of the finance secured under Component 2 of UWSSP-II. The development objective of the sub project is to contribute to the improvement of the socio- economy for the residents of Harar town by providing effective and efficient sanitation services.

5.2. Project Location

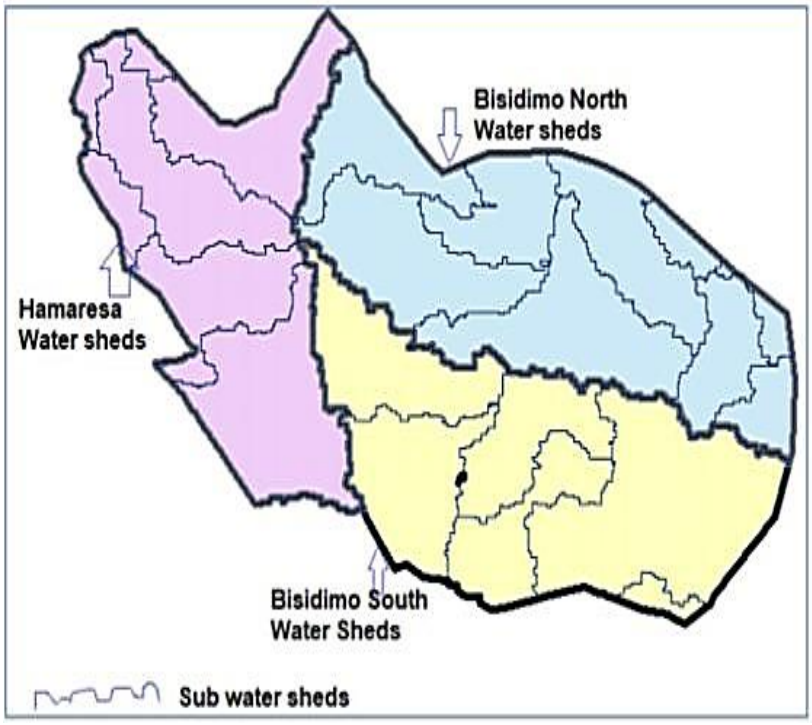

Figure 4: Harar Town Watersheds with Its Drainage Systems
Source: Feasibility Study & Detail Report

Harar town, with the geographical coordinate of 90.19'N and 42.07'E, Harari National Regional State is located at 525 km, east of Addis Ababa. Harar town is one of the oldest and historical towns in Ethiopia and has been serving as an important commercial, political, and cultural center. Harar town occupied a total area of 2,185.43 hectares, and has a rugged topography dominated by gullies, streams, and steep slopes. Concerning its administrative structure, Harar town is divided into 6 urban Woredas and 19 Kebeles. A Harar town watershed with its drainage system is as shown in the figure 4.

[1] Dire Dawa, Mekelle, Adama, Bahiredare, Hawassa, Jimma, Gonder, Sodo, Adigrate, Harere, Jigjiga, Gambella, Assosa, Semera Bishoftu, Dessie, Shashemene, Nekemte, Asela, Arbaminch, and Debrebereha.

5.3. Subproject Description

The overall objective of the sub projects is to improve and increase access to improve sanitary conditions through constructing public and communal toilets, construction of wastewater treatment plants, sewer lines networking, and fecal sludge treatment plants to ensure a sustainable waste management system. Other objectives include improving the hygiene and public health conditions and reducing the deterioration of the quality of the environment and water resources.

This chapter provides a description of the proposed public, communal toilets, wastewater treatment plant, and fecal sludge treatment plant. The proposed works for Harar town are described in the Design Consultant's (MS) Study Report and Draft Design Report (January 2022).

5.3.1. Communal Toilet

Due to high demand for communal toilets, in the short term about 12 are under construction and 20 more communal toilets are planned to be constructed in selected Kebeles. In general, selection of the proposed communal toilet sites considered density of population, living standard (slum areas, old neighborhoods, Kebele rented houses etc.), and availability of space/land for construction as shown in Figure below.

Figure 5: Spatial Distribution of Proposed CT (Purple: Under Construction, Cyan: Proposed for 2025)
Source: Feasibility Study & Detail Report

Proposed communal toilet design: According to the engineering consultant, two types of communal toilets design have been assessed for use under this sanitation management project. Two types of typical communal toilets to be constructed on plot areas of 59.5m^2 (8.50m*7.00m) and 37.5m^2 (7.50m*5.00m) are selected as shown in Figures below.

The selected communal toilets have the following basic characteristics:

Sanitary Appliances: Type I communal toilet will be furnished with 6 Turkish type WC, 3 hand washbasins, 1 Shower unit, and 1 assisted WC for physically challenged users. The other communal toilet (type 2), to be constructed on a smaller plot of land, will have 3 Turkish type WC and 1 hand wash basin, and an additional room with 1 assisted WC for physically challenged users, 1 Shower unit and 1 hand wash basin. Wastewater from toilet and shower rooms as well as from hand washing basins will be collected in the septic tank located off-site from the rooms.

***Plumbing services*:** Besides the provision of the required sanitary fixtures, the plumbing system has been designed to possibly avoid nuisance from foul air. Floor gullies (factory-made and easily available on the market) are proposed for the shower tray. Waste pipes are laid with a vent at the upstream end for the avoidance of foul air release to the block from the septic tank and drainage lines. Sanitary site work comprises a septic tank and percolation ditch, to be constructed within the 59.5m^2 plot area. Both types include an elevated watering system for the constructed toilets with the RHS tower proposed. In addition to the construction of new communal toilets, about 46 toilets have been approved for renovation works at different sites.

5.3.2. Public Toilet (PT)

Based on the nature and types of sanitary problems identified during the feasibility study, about 12 public toilets were recommended in the short term. The construction of 5 public toilets is already underway (in some cases, near completion) on jointly identified and selected five sites in the town. In addition to that, there are 3 functioning public toilets currently in use by town residents. The balance of 10 public toilets out of the total 18 required for the short-term intervention is proposed to be implemented in the short term.

Figure 6: Spatial Distribution of PT (Purple: Under Construction and Cyan: Proposed for 2025)
Source: Feasibility Study & Detail Report

Proposed typical public toilets: For implementation in Harar town, different alternative design options were compared by the engineering consultant. After analyzing the social, technical, and economic issues, a typical public toilet to be implemented on a 92m^2 (11.00m*8.50m) plot has been prepared as shown in the figure below.

Block configuration: The toilet is configured as an L- shape block (8mx8m), one wing for male and the other wing for female users. The layout, with a built-up area of 46m^2, assures more privacy in gender aspects. The block has also an access ramp for physically challenged users.

***Sanitary Appliances*:** The toilet block is furnished with the following sanitary appliances: 3 Turkish type WC, 2 Shower units, 2 Urinals, 1 Hand Wash Trough with two faucets/taps (durable for public use) for men; 2 Turkish type WC, 2 Shower units, 1 Hand Wash Trough with two faucets/taps (durable for public use) for women and for disabled users: assisted WC and hand wash basin in a room with access ramp for both men and female. The wastewater from toilet and shower rooms as well as from hand washing basins will be collected in a septic tank located off-site from the rooms.

***Plumbing services*:** Besides the provision of the required sanitary fixtures, the plumbing system has been designed to avoid nuisance from foul air.

Other services: A separate block with simple aluminum cladding to serve as a shop/ store is also proposed; the location of this service block is to be harmonized with the specific site map of each public toilet. This extension will promote a parallel business to be undertaken. The construction of toilet facilities which includes activities such as excavation of septic pits, stone masonry work for the pit, superstructure, water tanks, etc., is a standard civil engineering construction involving mainly concrete works. A reasonable time period for the construction of toilets was suggested to be about 1 year.

5.3.3. Fecal Sludge Treatment

As per FSTP Feasibility Designs and the final detailed design study, the proposed FSTP will have a capacity of 23,601m^3/year or 65m^3/day, but could be modular with a capacity of 10 m^3 per unit, with total area requirement of 20,706 m^2 including improvement of storage, collection, transport, and disposal of fecal sludge wastes, the establishment of a disposal facility, and treatment for fecal wastes (sludge) as shown in the layout of the proposed treatment plant is shown in the figure below.

Fecal sludge management is a set of scientific practices that ensures safe collection, transportation, treatment, and disposal of onsite collected excreta without polluting the environment. The FSTP site was evaluated against the following criteria: distance from the residence/rural villages, distance from the center, from the water bodies, conservation areas, intact natural forest and wildlife protected areas. This site was selected by the design consultant based on the following criterion: availability of 5 ha land, settlement conditions, distance from service area, risk of flooding, risk of ground and surface water pollution, Nuisance to neighboring activities, and risks to the ecosystem service and conservation of natural resources. During the field observation the ESIA team has witnessed the suitability of the selected site at Kile (Herwi Kebele), Sofi Woreda. The recommendation is to construct the FSTP following the gradient and wind direction and create a buffer zone around the FSTP site. There are multiple fecal sludge treatment technologies available, and each technology has a different field of application. Treatment technology was

chosen based upon the desired product and easy for management and operation. Selected technologies have been discussed in the respective section below.

The following sludge treatment options are ranked by considering key technology aspects including technology viability and affordability. Moreover, the ESIA team further evaluated the feasibility of the technologies in terms of socio-environmental viability and contribution to the clean city development and social development. Finally, the end use of the fecal sludge considered for use to produce byproducts such as composting, energy recovery, and treated wastewater for irrigation.

The main components of fecal sludge treatment plant are access pathways and roads, operators' cloth changing rooms and toilets, waste deposit and sorting area, waste dumping trenches, composting unit, compost storage facility, hazardous waste pit, area for storing the recyclable waste, leachate collection and aeration areas, electricity networks, and sewerage systems. The leachate from the landfill shall be pre-treated and directed to the fecal sludge treatment plant below the solid waste landfill. The table gives a summary of the total area required to implement the different components of the fecal sludge treatment plant.

Table 4: Total Area Requirement for FSTP

Treatment unit	Area	Number of units	Total area
Drying Bed Cell	6X30m^2	55	9900m^2
Maturation pond	13.78x29.45m^2	3	1218m^2
ABR	Area for settler(m) L=6.7, w=3.67, d=2.05 Area for baffle L=0.75, w=2.0, d=1.5 Width of down flow shaft 0.25m	No of baffles = 5	143m^2
Septage lagoon	20*98m^2	1	1960m^2
Sanitary Landfill	21x45 m^2	1	945 m^2
Guard House	10.88 m^2	1	10.88 m^2
Office	29x36 m^2	1	1044
Access Road and drainage	5250 m^2 (25% of the TP foot print)		5250 m^2
Total			**20706 m2**

Source: Feasibility Study & Detail of WWM System for Harar town

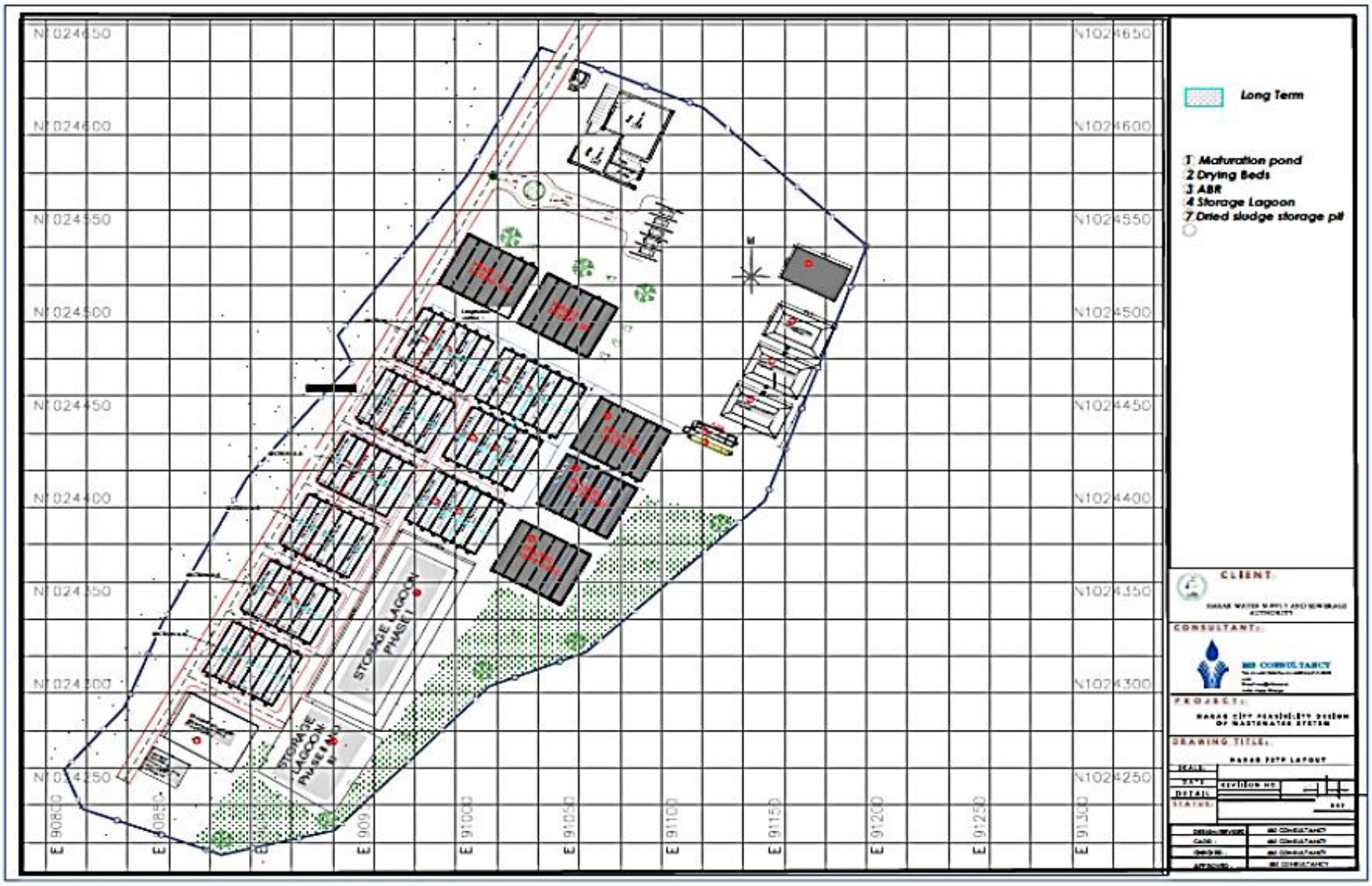

Figure 7: Layout of the Proposed Fecal Sludge Treatment Plant
Source: Feasibility Study & Detail of WWM System for Harar town

According to the "Feasibility Study & Detail Design of Wastewater Management System for Harar Town", the following FSTP design component and quantities is proposed for the new FSTP facility near the land fill site.

5.3.3.1. Design of Drying Beds

Sludge drying beds are used to dewater digested sludge that has passed through a treatment system or raw. Drying beds consist of a gravel and sand filter, equipped with a drainage system. Raw or pre-settled fecal solids from pit latrines and septic tanks is loaded on the bed in a 300mm layer and the water is evacuated mainly by percolation through the filter and to the minor part is allowed to dry by evaporation.

Among the available treatment technologies, during the feasibility study, sludge treatment by using unplanted drying beds has been selected and approved for further detailed design for this particular project.

A fecal sludge treatment plant using drying beds consists of several unplanted drying beds in one location. Sludge is deposited on each of these unplanted drying beds where it remains until the desired moisture content is achieved. It is subsequently mechanically or manually removed for disposal or further treatment and reuse. Treatment for fecal sludge can be broadly classified into four stages:

- Screening – removal of solid waste, trash and grit from the incoming fecal sludge
- Solid-liquid separation – dewatering the fecal sludge into solid and liquid streams
- Solid treatment – to meet pathogen and VAR standards
- Effluent (liquid) treatment – treatment of effluent to meet discharge standards

The conventional way of using drying beds is just directly discharging the fecal sludge to the beds without any settling tank. Conventional drying beds are simple and easy to operate but their land take is much higher than that of other solids–liquid separation.

For this particular project, two gravel layers with combined a depth of 20cm have been selected. A gravel layer with grain size of not less than 25mm will be packed at the bottom to a depth of 12.5cm. The second layer of gravel will be packed to a depth of 7.5cm and the grain size of the gravel should not be less than 15mm. Finally, filter sand with uniformity coefficient of less than 4.0 and effective grain size between 0.2 and 0.75mm will be packed.

The depth of sludge to be filled at a time varies between 20 to 30cm based on the weather condition of the area and the desired level of the concentration of residual microorganisms. With the relatively lower annual precipitation of Harar and a shorter period of rainy season, the depth of sludge to be filled at a time has been adopted to be 20cm. This depth ensures drying of the sludge within three weeks.

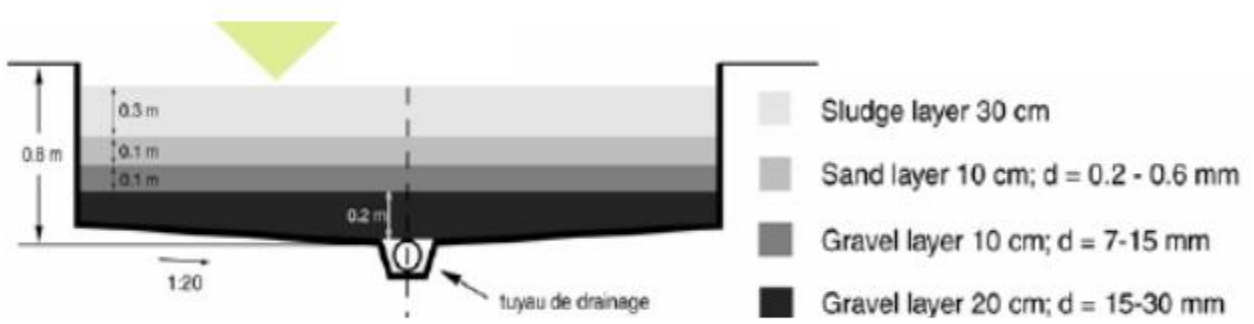

Figure 8: Typical Section of Unplanted Drying Bed
Source: Feasibility Study & Detail Report

For effective management of the beds, it is recommended to provide modular drying beds partitioned into manageable sizes. Based on the topographic setup of the selected area, the width and length of individual beds can be taken as 6 and 30m respectively. For the liquid waste management facilities to be constructed for the town of Harar a modular drying bed with width of 6m and length of 30m has been adopted.

As per feasibility study, total area and number of drying beds required for the estimated sludge volume have been determined. The boundary of the Treatment facilities (drying bed and its component) is given by coordinate of (190638 E, 1024250N), (190594E, 1024106N), (190541E, 1024173N), (190691E, 1024184N) and average elevation of 1688m.

Considering population projection for 2025 = 171,445

- Total sludge = 23,601 m^3/year
- Dry Period Sludge Volume = 0.75*23,601 m^3/year = 17,700.75m^3/year
- Number of Cycle of Use = 9
- Sludge Volume treated per cycle = 17,700.75m^3/year/9=1,966.75m^3/cycle
- Sludge Filling Depth = 0.25m
- Total Area Required = 1,966.75/0.25m^3/cycle = 9830m^2
- Number of Modular Drying Beds (6.0m x 30.0m size) = 9830m^2/180m^2 = 54.6 (55)

Source of energy for FSTP and WWTP: As environmental benefit and socio-economic benefits, the ESIA team highly appreciated the use of solar driven energy to run and operate the treatment plants. This analysis has been made based on the availability, duration and intensity of solar energy in the project sites. The solar energy can be used for lightning, for running the treatment plant, and drying the sludges. The overall system layout of unplanted drying beds is as indicated below.

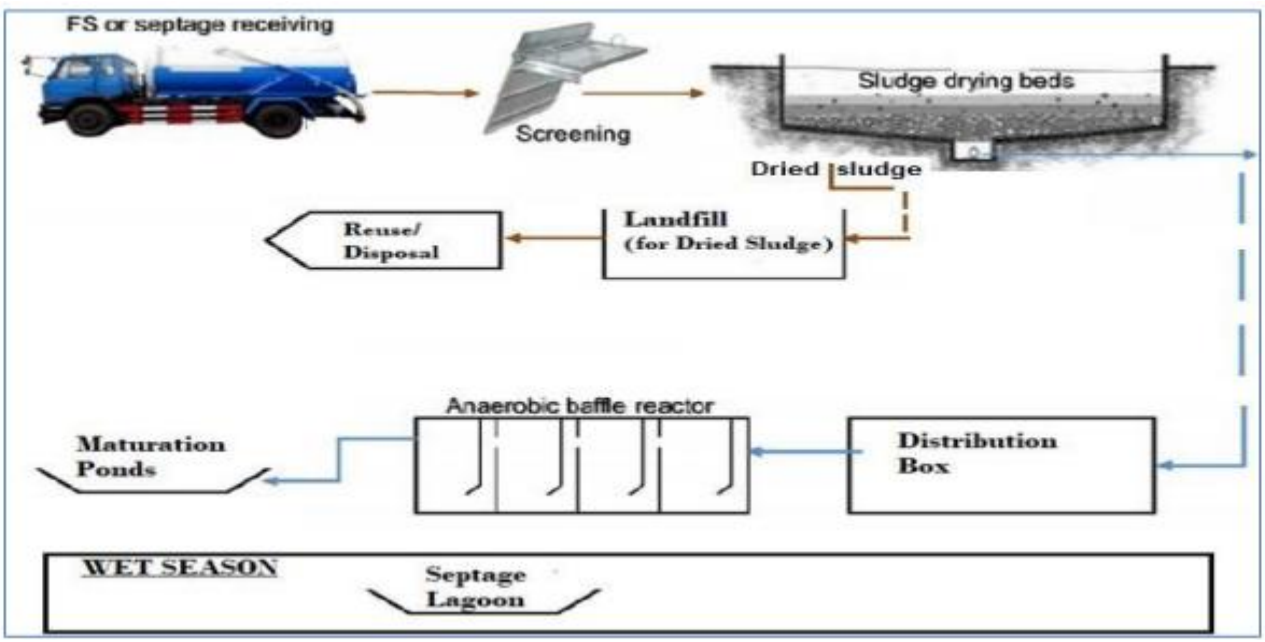

Figure 9: Flow Chart of Drying Beds
Source: Feasibility Study & Detail Report

In the figure above, the fecal sludge is first passed through a screen and grit chamber to physically separate solid waste, inorganic solids like plastic, cloth, sand and silt. The sludge is then dried in the drying beds. The dried sludge is further treated for pathogen reduction by following any of a) co-composting b) storage for periods in excess of 12 months or c) solar drying or any other process prescribed for pathogen reduction. The percolate from the drying beds is collected and further treated to reduce organic content and pathogens to achieve liquid discharge standard.

In this project, the leachate from the drying beds is treated further through anaerobic baffled reactor (ABR) and a maturation pond, whereas the dried sludge is further treated by storing the sludge in a landfill for 12 months. The details are discussed below.

5.3.3.2. Design of Anaerobic Baffled Reactor ABR

Anaerobic baffled reactors (ABR) are improved septic tanks that have been upgraded with a series of baffles along the treatment chamber. The up-flow chambers provide enhanced removal and digestion of organic matter. As septic tanks, ABRs are based on a physical treatment (settling) and a biological treatment (anaerobic digestion). An ABR consists of a tank and alternating hanging and standing baffles that compartmentalize the reactors and force liquid to flow up and down from one compartment to the next, enabling an enhanced contact between the fresh wastewater entering the reactor and the residual sludge, containing the microorganisms responsible for anaerobic digestion of the organic pollutants.

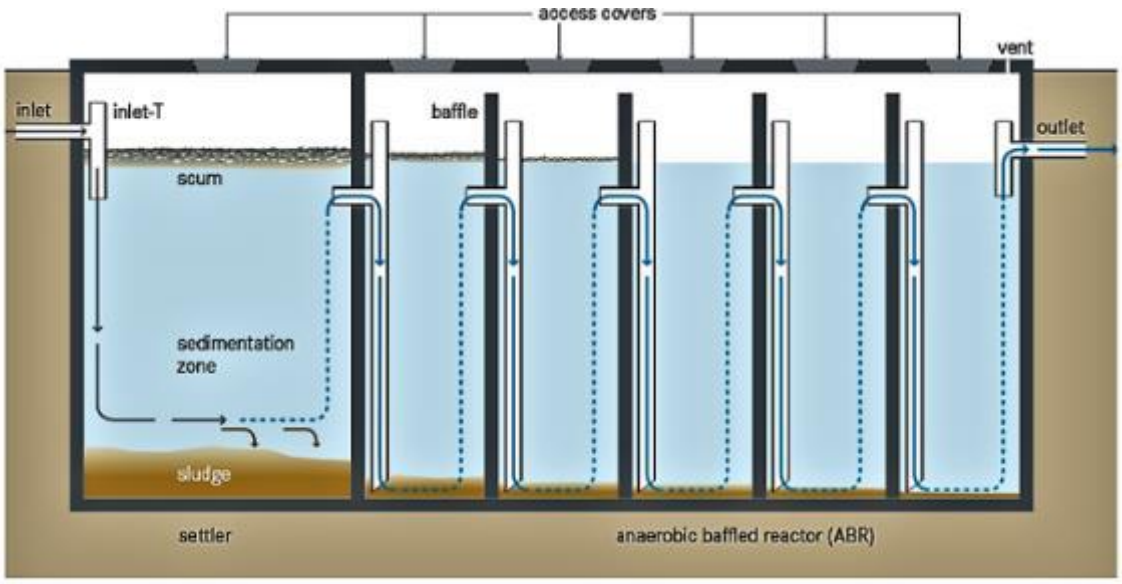

Figure 10: Schematic of the Anaerobic Baffled Reactor.
Source: Feasibility Study & Detail of WWM System for Harar town

The designed ABR consists of five chambers. Each chamber will have a 5m3 volume. The ABR settler has a length of 6.7m, width of 3.65m and depth 2.05m. ABR chambers have a length of 0.75m, width of 2 m and depth 1.5m and the down-flow chambers were 25 cm above the reactor's bottom.

ABRs are suitable for a wide range of wastewater, including high-strength industrial wastewater, but its efficiency increases with higher organic load. Therefore, ABRs are particularly suited for influents with a high percentage of non-settleable suspended solids and a narrow COD/BOD ratio (SASSE 1998). BOD may be reduced in ABRs by up to 90%, which is far superior to its removal in a conventional Septic Tank. The proposed ABR will bring a significant reduction in BOD, COD and TS.

Table 4: ABR Removal Efficiency for Harar Leachate Treatment

No	Parameter	Unit	Raw sludge	Removal efficiency	Treated effluent	Treated Effluent Standards	Recommendation
1	BOD	mg/l	500	63%	185	30	To achieve the treated effluent standard, it needs further treatment to remove/reduce the amount of BOD, COD and Pathogen.
2	COD	mg/l	1200	62%	456	125	
3	TS	mg/ l	540	90%	54	50	

Source: Feasibility Study & Detail of WWM System for Harar town

The above table 5 shows that the ABR partially reduced the amount of BOD and COD (63% and 62% respectively), but it is very good in the reduction of TS (90%). Thus, the effluent from the ABR requires additional treatment due to the existence of pathogens to satisfy the prescribed effluent limit and to reduce the BOD and COD further. To achieve this, Maturation Ponds are employed to bring the effluent parameter values close to the standard limits.

5.3.3.3. Design of Maturation Pond

According to the feasibility study, the treated effluent from the ABR is allowed to flow to a maturation pond for further treatment. Maturation or polishing ponds are essentially designed for pathogen removal and retaining suspended stabilized solids.

Maturation ponds constitute an economic alternative to the disinfection of the effluent by more conventional methods. The maturation ponds should reach high coliform removal efficiencies (E > 99.9 or 99.99%), so that the effluent can comply with most uses of the water in the receiving water body, or for direct uses, such as irrigation. In order to maximize the coliform removal efficiency, maturation ponds are designed with one of the following two configurations: (a) three or four ponds in series or (b) a single pond with baffles.

In this design, the consultant has adopted three maturation ponds in serious. Regarding the other organisms of public health importance, which are not well represented by coliforms as indicators, the ponds usually reach complete (100%) removal of protozoan cysts and helminth eggs. The major removal mechanism is sedimentation. For phase I, three 10.58m x 26.45m x 1m Maturation Ponds will be sufficient. One additional 10.58m x 26.45m x 1m maturation pond will be provided for phases II and III.

Where, the analysis results show that maturation ponds helped reduce the amount of pathogen in the effluent from the maturation ponds. In the same way, additional BOD removal (up to 80%) is expected in the maturation pond. Assuming an average of 70% removal efficiency for BOD and COD in the maturation ponds for the influent from the ABR, the final BOD, COD, and TS after the maturation ponds is about 56, 137 and 16 respectively. The corresponding release standards are 30, 125 and 50. Thus the final values are much closer to the release standard for rivers and lakes.

5.3.3.4. Design of Septage Lagoon

Extra storage facilities are usually needed during the wet season as the efficiency of drying beds is low during this season. Thus, the fecal sludge during wet season (June to August) is stored temporarily in a storage facility (storage lagoon). The stored sludge is then dried under the heat of the sun during the dry months from September to May. The dried sludge is scrubbed and transported to the dried sludge landfill for further pathogen removal, as discussed above.

On top of storing the sludge, it also treats the sludge by stabilizing organic solids. The stabilized solids settle to the bottom of the lagoon and accumulate there for removal. The liquid part of the sludge is allowed to evaporate over an extended period of the dry season. The stabilized solids may be stored indefinitely in a lagoon, or it may be removed periodically after draining and drying. The size of septage lagoons depends on the quantity of fecal sludge produced, when it can be removed, and its moisture content. Drier solids can be stacked higher with fewer tendencies to slump. In line with environmental safety requirements, a watertight storage lagoon with all the protection measures is proposed. The walls of the lagoon are constructed from stone pitched with ferro cement plastering and the floor will be treated with impermeable liner membrane. The liner membrane consists of the following

- 300mm thick compacted protective and drainage sand layer
- 0.75mm flexible membrane liner (polyethylene sheet)

- 100mm thick clay sealant

Septage lagoons should be relatively shallow, 1 to 1.5 m, if they are to be cleaned by scraping. For this particular project, sludge storage depth of 1.5 m has been considered with access ramp provision for dry sludge cleaning and to provide mountable slope for labor operated push cart. For phase I, one 40m x 100m lagoon will be sufficient. One additional 20m x 100m lagoon will be needed for phases II and III.

5.3.3.5. Design of Sanitary Land Fill

It is mandatory that the dried sludge on the drying bed called the dry cake has to be manually cleared and separately treated for further removal of the pathogens. As discussed in the sludge management system, drying and storage is not the final disposal. As the drying bed shall be used for a number of cycles per year, the dried sludge must be removed and disposed to final disposal facility. Thus, dry sludge after being removed from the drying bed needs to be disposed of in an environmentally safe way. The most common possibilities include land application options (including both direct application to the land and as a component of compost or topsoil products), disposal in landfills, and incineration. In this project, since it is proposed to use the dried sludge as agricultural fertilizer, the dried sludge is further treated in a sanitary landfill for further pathogen removal.

Sanitary landfill is a pit designed to dispose of the dried sludge and compact it as per the standard layers. As discussed in previous sections, 30% of the raw fecal sludge is assumed to evaporate into the atmosphere and 50% of the raw fecal sludge is assumed to flow into the ABR in the form of a leachate. The remaining 20% of the total fecal sludge is taken to be the volume of dried sludge to be removed from the drying beds. This 20% dried sludge is used for the design of the landfill. The proposed landfill will have a clay seal from the top. This ensures that the dried sludge will not be exposed to rainfall. Confining the dried sludge inside the landfill for nearly a year allows the pathogens to die and to remove the remaining dried sludge moisture.

For phase I, one 21m x 45m landfill will be sufficient. One additional 20m x 14m landfill pit will be provided for phases II and III. After 12 months, the dried or treated sludge offers a wide range of applications, including for agricultural land application. The dried biosolids act as a fertilizer for crop production.

5.3.4. Proposed Wastewater Treatment Plant

As per site investigations, there are parts of the town which generate ample quantities of wastewater that should be properly collected and disposed of. This includes mainly the Haramaya University (Hiwot Fana Referral Hospital), condominium Sites, Jegol and inner town commercial and institutional centers. The wastewater from these areas is proposed to be treated and disposed of safely through provision of a wastewater treatment plant.

The sub projects under UWSSP-II are expected to play an important role in alleviating the ongoing wastewater treatment dilemma and related obstacles in Harar town. The program schemes of the projects are implemented in a three-time horizon: Phase I (2021-2025), Phase II (up to 2030), and Phase III (up to 2040) will be carried out successively keeping wastewater generations over the different phases of implementation due to population increases. A revised waste water flow for design of sewer system for the sofi catchment project's phase I (2021-2025) is given in Appendix adopted from the feasibility study.

Based on a multi-criteria analysis discussed during the feasibility study, A2O-CAS type treatment plant was selected to be implemented at a site some 1000m southeast of the Muslim cemetery. Where, the following treatment processes were evaluated in the feasibility study document: Oxidation ditch; Trickling Filter; Upgrading the existing waste stabilization Lagoons; UASB with Trickling Filter; Moving Bed Bioreactor (MBBR); and Conventional Activated Sludge.

The proposed Harar Wastewater Treatment project comprises a centralized and integrated sewer collection system and a single WWTP. The treatment plant has the following proposed components and a phase-I designed capacity of 1400 m3/d and will be constructed at Awomur Kebele. For phase I, the proposed treatment plant will serve Jegol, some condo sites and the inner-town of Sofi catchment as shown in Figure Layout of proposed WWTP. And, the proposed A2O-CAS type waste water treatment plant will have the following components and quantities as presented in table below. The construction of all sanitary facilities started in phase I and will continue to the third phase (III).

Table 5: WWTP Components

Component	Shape	Number and Dimensions
Screen and Grit chamber	Rectangular	Width 4.3m, length 20m and Depth1m
Partial Flume	Rectangular	Width Var, Depth Var
Distribution Box	Rectangular	6.9m length, Depth Var, Width 5.7
Primary Sédimentation Tank	Two identical circular tank	Radius, 4.55m each with Depth 5m
Aeration Tank	Rectangular	Length 26.55m, Width 25.39m, Depth 6.8m
Final Clarification Tank	Two Identical Circular tank	Radius 5m each, with Depth 4.8m
Chlorine Contact Tank	Two Identical Rectangular Tank	Depth 1.3m, width 8.9m and length 17.7m
Sludge Thickening and Stabilisation Tanks	Two Circular tank and one rectangular tank	One circular tank radius 2.9 and Depth 3.3m, the second Circular tank Radius 3.9 and Depth 3.3. And Rectangular tank width 4.3m, length 13.2m and Depth 4m.
Sludge Drying Bed	Two Drying Beds, 3 units each	Length 31m, width 7m, Depth 2.1m
Energy Room	Rectangular Room	4.8m by 12.6m, Depth 3.3m
Chemical Room	Rectangular Room	Length 11.3m, width 4.2m, Depth 3.7m

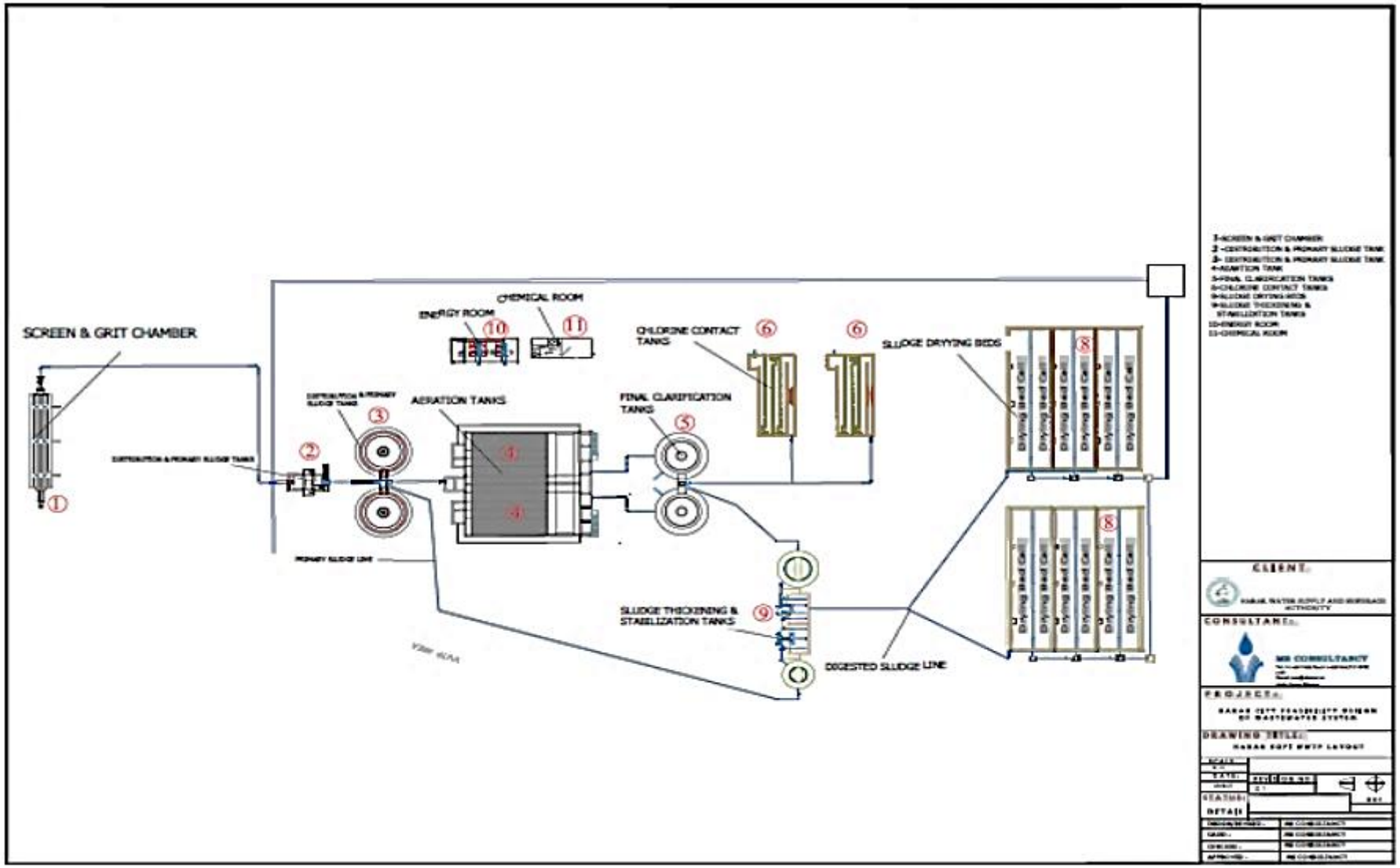

Figure 11: Layout of Proposed Waste Water Treatment Plant at the Sofi site
Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

5.3.4.1. Preliminary Treatment

The incoming wastewater pipeline enters the inlet chamber in the screening building. The screening units consist of 20 mm coarse screens and 6 mm fine screens, which remove screenings and larger objects from the wastewater. If the incoming wastewater flow exceeds the design capacity of the WWTP, it overflows to the effluent chamber through the by-pass line. Collected screened material is processed in the screen press to reduce its volume and residual material is discharged to the containers for final disposal off site.

Screened influent is then distributed to rectangular grit and grease removal tanks to settle the grit particles and scrape grease from the surface of the wastewater. Settled grit is discharged by submersible pumps to grit classifiers in order to reduce the volume of material collected. Grease is diverted to the grease channel by surface scrapers and further processed in the drum sieve before final disposal off site. Required air flow to maintain lateral movement within the tanks is supplied by rotary lobe blowers located in the grit blower building. The grit and grease removal tanks are fully covered to contain odors.

5.3.4.2. Primary Treatment

Following screenings, grit and grease removal, wastewater gravitates to circular primary clarifiers, where it is retained for a certain time to settle particulate matter at the bottom of the tanks. A center driven scraper drives the accumulated sludge to the bottom hopper where sludge is withdrawn for further treatment. Clarified effluent discharges over a peripheral vnotch weir and is collected at a chamber from where it is distributed to the secondary treatment step stage. The clarifiers are fully covered to contain odors.

5.3.4.3. Secondary Treatment

Primary clarifier wastewater is transferred to the secondary treatment units for further removal of nutrients, in particular carbon, nitrogen, and phosphorus compounds. As part of the biological removal process, anaerobic tanks are used as a conditioning step in the phosphorus removal cycle. The phosphorus removal process consists of rectangular concrete tanks equipped with submersible mixers to prevent settlement. Returned sludge from the secondary clarifiers is mixed with the incoming flow in the distribution chamber located at the head of the tanks. These anaerobic tanks are fully covered to contain odors.

From the phosphorus removal tanks, wastewater gravitates to the aeration tanks where anoxic and aerobic reactions occur. The units consist of “racetrack” shaped concrete tanks equipped with fine bubble diffusers, submersible mixers and recirculation pumps. The first zone of the aeration tanks is anoxic to allow denitrification to occur. Mixers are installed in the anoxic zones to keep the mixed liquor in suspension and increase its contact with oxygen in the subsequent section by providing horizontal movement within the tank. Following the anoxic zone, wastewater enters the aerobic zone of the tanks where carbon removal and nitrification occurs. Air is supplied from the centrifuge blowers with variable speed motors installed in the blower building and distributed through fine bubble diffusers installed at the bottom of the tanks. Nitrate rich sludge from the aerobic zones is circulated by the internal recirculation pumps back to the anoxic zone to increase the efficiency of denitrification. The process is monitored and controlled by a series of instruments.

Flows from the aeration tanks gravitate to the final clarifiers where the suspended solids settle. The clarification system consists of a peripheral drive rotating bridge scraper with center bearing and slip ring

collector. The sludge is removed from the clarifier to the sludge sump by an adjustable bell-mouth which maintains the liquid level in the settlement tank at a specific level. Collected sludge is recirculated to the distribution chamber upstream of the phosphorus removal tanks and excess sludge is diverted to the sludge treatment line via return and waste activated sludge pumps. The ratio of the return and waste sludge flow is adjusted periodically depending on the influent flow, sludge characteristics and process requirements. Clarified effluent discharges over a peripheral v-notch weir and is collected at a chamber from where it is distributed to the tertiary treatment step.

5.3.4.4. Tertiary Treatment

Tertiary treatment is achieved via the UV disinfection process to generate a final treated effluent free of pathogens. Secondary clarified effluent enters parallel channels where UV units are installed. All secondary clarified effluent receives tertiary treatment. Part of the disinfected effluent is collected in storage tanks and can be reused either for internal usage within the WWTP or transferred offsite for irrigation or other applications. The remaining portion of the disinfected effluent is diverted to the final effluent chamber for sampling and measurement of the effluent quality before discharging to the receiving water body or irrigation field.

5.3.4.5. Additional features

In order to minimize the environmental impact associated with odors generated from the WWTPs, a number of process treatment units are covered (grit and grease removal tanks, primary clarifiers, biological phosphorus removal tanks, gravity thickeners, sludge tanks), whilst certain equipment is installed within buildings (screening units, mechanical thickening and dewatering units). Odors generated from these sources are collected and directed to the odor treatment system via above-ground GRP pipes. The screening units and sludge buildings are also ventilated with axial fans and equipped with gas detection systems. The odor control unit consists of extraction fans, scrubbers, chemical dosing unit and bio filter.

To further protect the biological processes within the WWTP from toxic effluent, an external bypass of the WWTP will also be provided. This external bypass is operated by the opening and closing of automated penstocks upstream of the screening building. In-line pH and COD monitors will assess the effluent for signs of toxicity and will automatically activate the external bypass if toxic or industrial effluent arrives at the WWTP. In the case of such circumstances the toxic industrial effluent needs to be separated and treated appropriately. This protection of the biological plant processes is necessary as plant shutdowns associated with toxic influent to activated sludge WWTPs result in long recovery times.

Proposed Effluent Discharge Requirements: The feasibility study/ESMF demands that nutrient removal (i.e., nitrogen and phosphorus) and BOD and TSS is a requirement. The treated effluent is expected to be used for irrigation and when irrigation is not required, such as during the rainy season, it is to be discharged into the river. The feasibility study also recommended that possible applications of the treated effluent for industrial purposes would require further study. To meet irrigation needs, the treated effluent treatment levels have been set in conjunction with various factors such as protection of human health, protection of the environment (river and crops to be irrigated), etc. within the constraints of the technologies selected.
Wetlands have been designed to remove pathogens and particularly helminths eggs to meet recommended treatment levels for irrigation usage. These wetlands will also remove nutrients through plant uptake, which will assist in preventing algal blooms in the ponds and other water bodies downstream of the plant.

The required level of treatment should be based on:

- Whether wastewater is being discharged to surface water or to use for irrigation
- National and local standards as reflected in permit requirements
- Assimilative capacity of the receiving water for the load of contaminant being discharged after treatment such as pathogens, BOD, COD, Nitrogen, phosphorus, heavy metals, and other inorganic substances
- Downstream use of the receiving water body (e.g., as a source of drinking water, recreation, irrigation, or other)

The proposed series of treatment processes is very interesting and designed in a suitable manner to adapt to the specific situation. As noted from the feasibility study, providing a better wastewater system will reduce, if not prevent diseases associated with poor sanitation; improved treatment will permit reutilization of treated effluent for irrigation and improve the quality of river water; byproducts of the treatment processes can be harnessed to produce an alternative energy source and fertilizer.

Therefore, the WWTP should be designed and operated to achieve discharges that fall within the maximum values set out in the appendixes. These values comply with National requirements or the WBG EHS Guidelines, whichever is the more stringent. See Appendices for Proposed Effluent Discharge Requirements.

5.3.5. Proposed sewer lines networking

5.3.5.1. Overview of Existing Drainage System

Hamaressa and Erer rivers are the two major surface water sources in Harar Town. These rivers form two drainage systems i.e., the Hamaressa and the Erer drainage systems. In the figure shown below, the orange lines indicate the major flow directions in the two drainage catchments.

a) Hamaressa Catchment

The Hamaressa catchment within the boundary of the town drains along two main directions indicated by the orange-colored arrows and forms two sub-drainage watersheds. The area between Arategna and MFM technical school (sub watershed 1) drains in the SW direction, whereas the area between the MFM technical school and the town border on the way to Addis (sub watershed 2) drains in the NW direction. The surface flows from these sub-watersheds join outside the town boundary and far from the town, on the Hamaressa River, as shown with the yellow-colored spot on the left in figure below.

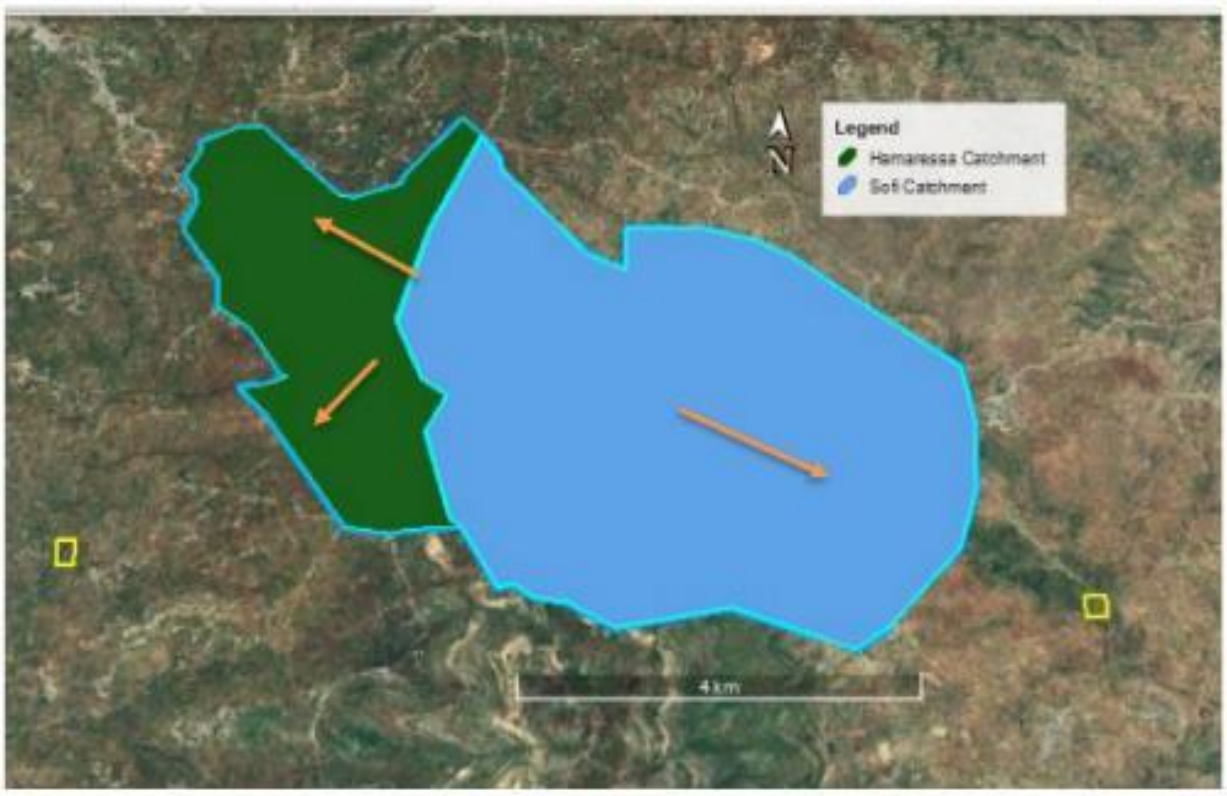

Figure 12: Hamaressa and Erer River Drainage Systems
Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

The average slope of Hamaressa catchment in the SW and NW directions is about 7.2% and 4.3% respectively. Regarding the land use type, in both flow directions, there are both residential and commercial buildings along existing roads, and chat plantations on peripheral areas. The total area of sub-watershed 1 is about 534 ha while the corresponding area for sub-watershed 2 is 524 ha.

b) Sofi Catchment

The Sofi catchment within the boundary of the town drains in the SW direction. There are two sub-watersheds in the catchment which follow two parallel flow directions. These are the north-Bisidimo and the south-Bisidimo sub-catchments. The flows from these two sub-watersheds come to a common confluence point (yellow-colored spot on the right in figure above outside the boundary of the town forming the Erer River. The average slope of the North-Bisidamo and south-Bisidamo sub-watersheds is about 4.7% and 5.17% respectively. Regarding the land use type, there are both residential and commercial buildings built along existing roads, and chat plantations on the peripheral areas. The total area under the North-Bisidamo sub watershed is about 1300 ha and the corresponding size for the south-Bisidamo sub watershed is 1321 ha.

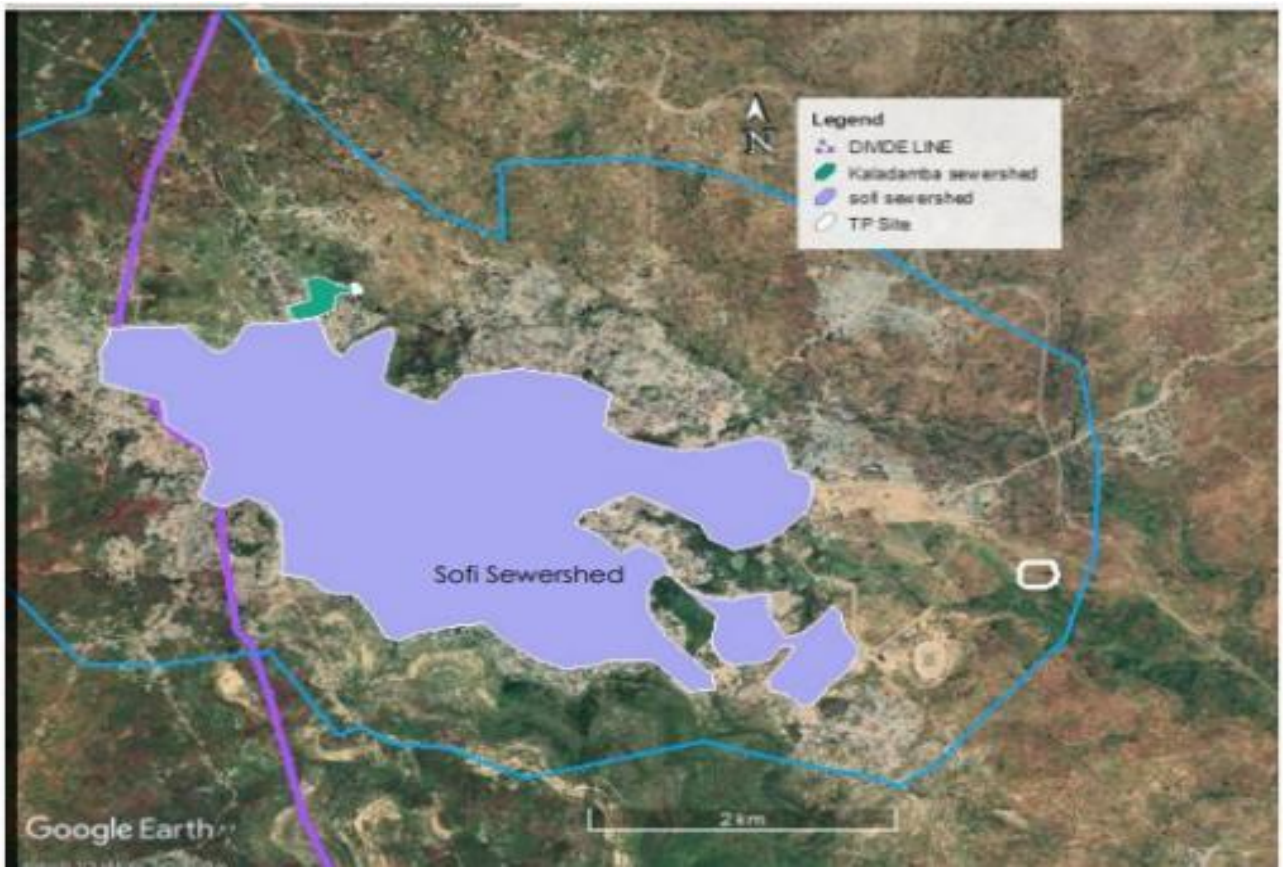

Figure 13: Sofi and Kaladamba Sewer Catchments
Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

The Sofi catchment is divided into Kaladamba and Sofi sewer Catchments. The total area of the Sofi sub-catchment is about 700 ha whereas the Kaladamba catchment constitutes of only the two Condo sites (Kaladamba 1 and Kaladamba 2). The sofi sewer catchment covers the highly developed and populated central part of the sofi watershed catchment. Both Catchments are provided with their own respective treatment plants and no sewage pumping is involved.

5.3.5.2. Phasing of the Sewer Network

As presented in detail in the feasibility study, the sofi catchment is the main sewer catchment in Hara town. The catchment consists a total of about 491.3 ha area extending from Arategna in the West to the treatment plant close to the new stadium in the East. The sofi catchment is home to the major commercial and institutional centers, and is thus the major contributor of wastewater in the town.

Sewerage intervention for Sofi catchment was proposed in three phases, as development expands horizontally and vertically. A revised layout of the sewerage interventions for the three phases for the Sofi catchment is shown in the figure below.

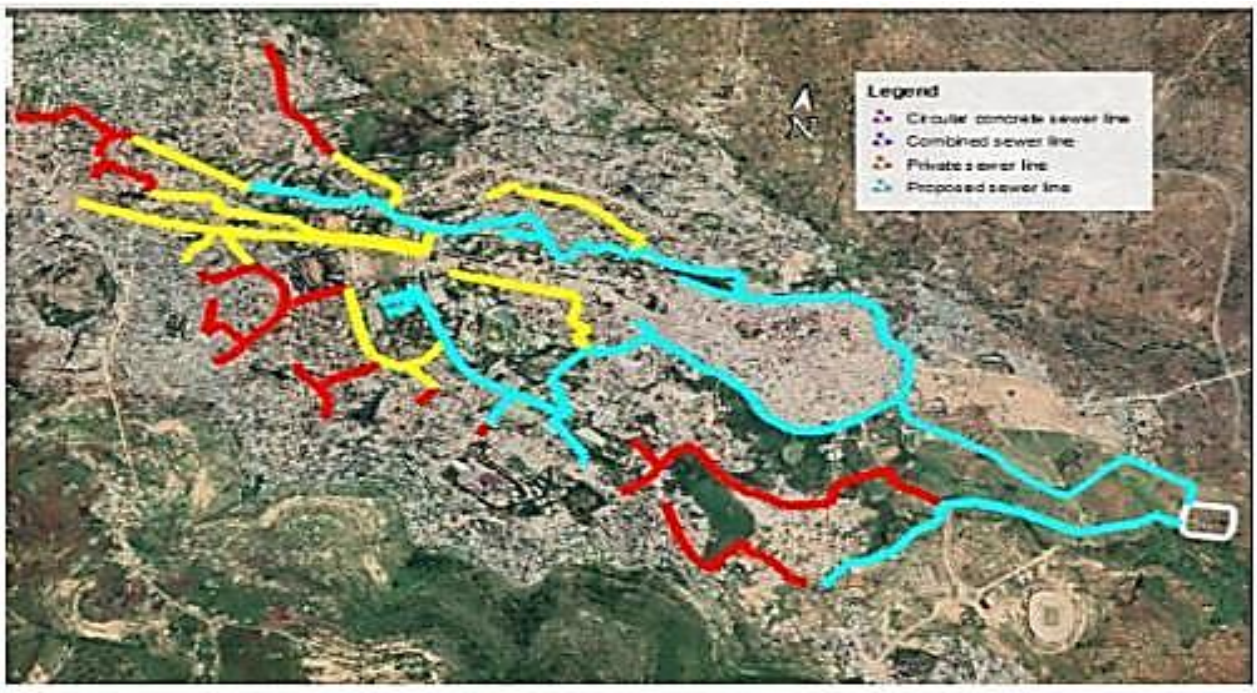

Figure 14: Layout of Sewer for Sofi Catchment (All phases)
Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

In the figure above, lines in cyan color are the trunk, primary and secondary sewers of phase I implementation, yellow lines are the phase II expansion and the red colored lines are the phase III expansion lines.

Under the short-term intervention, the Consultant recommends the implementation of the Sofi catchment that covers several condominium sites and the Jegol area. It is expected that some parts of the Sofi catchment including Jegol, the town and major commercial areas are ready for sewerage intervention during phase I.

In the revised layout, much effort is made to include the major waste contributing areas in the short-term intervention and to use existing infrastructure especially in Jegol. As per feasibility study, in the current sullage/black-water system, there are more than 20 outlets draining to the drainage ditch encircling the Jegol wall which finally drains to the nearby Erer River.

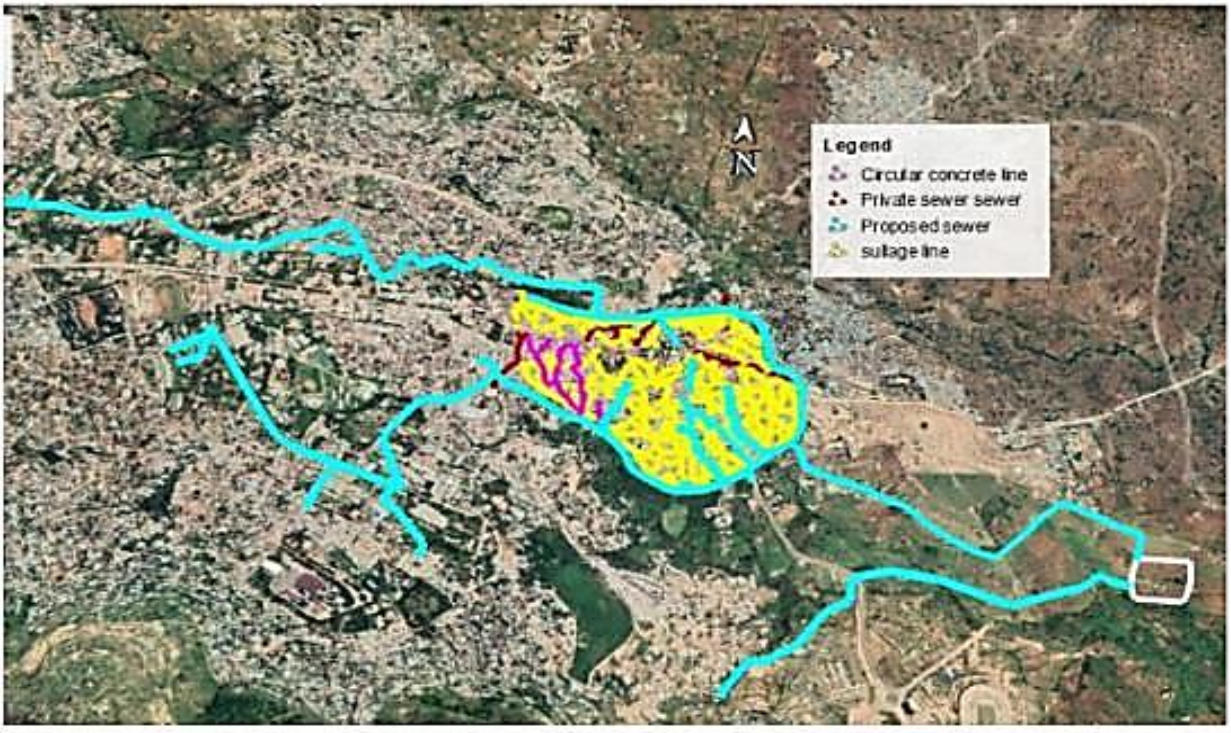

Figure 15: Updated Sewer Network for Short-Term Implementation
Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

During construction, the existing sullage layout was done carefully by considering each and every household and the configuration of the housing unit with respect to the road, and so far, no major problem is seen in the system. Thus, in this design we have adopted the existing configuration/layout of the sewer in Jegol.

The main challenge of the sewer network in general and the Jegol area in particular is the existing inadequate water provision and the possibility of sewer blockage due to lack of self-cleansing conditions. However, until water supply delivery to the town is increased to the required standard, different approaches are proposed to make the sewer system efficient. These include,

- Use of rainwater harvesting at household level
- Use of shallow groundwater wells
- Wise use of greywater (from kitchen and cloth washing) for toilet use
- Pressurized flushing of sewer system with special vehicles from time to time

The entire sewer pipe network is designed for phase III flow. Invert levels of manholes are fixed based on the assumption that in the long run much of the area proposed to be covered in phases I, II and III will connect to the sewer system. Pipe sizes are fixed based on phase III peak hourly flow. Once the entire network is configured and sized, then only that portion of the designed system needed only for phase I will be implemented during phase I. This approach has the advantage that the trunk sewer pipes (for all phases) leading to the treatment plant are laid during the first phase, and that secondary and tertiary sewer pipe expansions during the second and the third phases can easily connect to the existing trunk sewer without problem.

5.3.5.3. Sewer system design specifications

The proposed network is a gravity system and no pumping is involved. Plasticized polyvinyl chloride (uPVC) sewer pipes are used for all pipes with diameter < DN450 and GRP pipes are used for all pipes with diameters >= DN450.

For manholes, a precast concrete manhole is proposed. Manholes are provided where there is change in direction, change in gradient, intersection of two sewer pipes, and change in pipe diameter or where the length of the sewer is 70m or more. A maximum manhole depth of 5m, maximum and minimum velocities of 3m/s and 0.6m/s respectively and flow to capacity ratio of 75% are used for the design of the sewer system. Depths greater than 5m are accepted only in special cases where the ground elevation is higher for small stretches of the sewer route. A maximum cover of 1.0 outside Jegol and 0.6m inside Jegol is adopted. A maximum manhole spacing of 70m is used for the design. A daily peaking factor of 1.1 is used for peak flow quantification. Hourly peaking factors are estimated based on the sewered population. 10% groundwater infiltration is assumed. Minimum diameter of 200mm sewer and minimum slope of 0.5% is adopted.

UPVC pipes of various diameters are used for the intended use, Manholes shall be made of circular type precast concrete. Cover to manholes can be varied from place to place. In areas where there is high traffic load, the manholes shall be provided with steel manhole cover; whereas in areas with low or no traffic load, the manhole cover can be made of two semicircular shaped concrete slabs, joined together to form a circular cover.

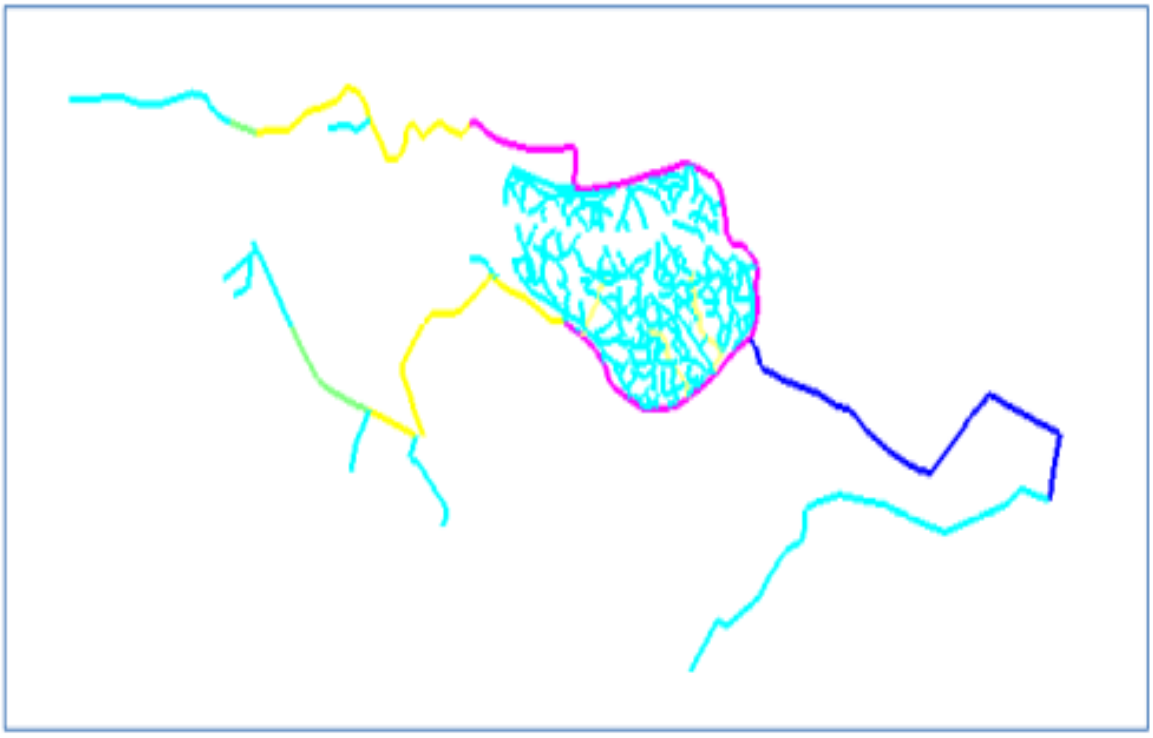

Figure 16: Layout and Pipe Sizes of Sewer Lines for the Sofi Catchment (Phase-I)
Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

In the figure, the blue lines are diameter of 450mm diameter sewer pipes, the purple lines are diameter of 350mm sewer pipes, the yellow lines are diameter of 300 mm sewer pipe, the green lines are diameter of 250mm pipes and the cyan color lines are diameter of 200mm sewer pipes.

Table 6: Designed Sewer Size for Sofi Catchment (phase I)

Sewer Diameter (mm)	Sewer Length (km)
	Phase I
200	21.48
250	0.59
300	2.74
350	2.96
450	1.53

Manhole Depth (m)	Number of Manholes
	Phase I
0-1m	708
1-2m	478
2-3m	53
3-4m	22
4-5m	14
5-6m	1

Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

Maximum Manhole depth is restricted to 5m. Exceptions are seen in a few places where the depth is a bit higher but still less than 5.5m. The average manhole depth for phase I Sofi catchment sewer network is 1.6m, whereas the average depth of Manhole for Jegol is only about 0.96m. This is due to the fact that the minimum cover required for sewers laid under Jegol roads is only about 0.6m, which is the standard value used for such sewers laid under roads which are not accessed by vehicles.

5.4. Cost Estimation

The cost estimates for construction of different components of the FSTP and WWTP is presented in tables below

Table 7: FSTP Construction Cost Estimation

Description of units	Cost estimation in birr
General item	1,737,000
Site Work [Grading Cut, Access Road, and drainage]	33,288,307
Guardhouse	123,130
Office	701,868
Sludge Drying Bed	67,771,279
Septage Lagoon	5,007,853
Maturation Pond	3,097,142
ABR	458,698
Sanitary Landfill	2,764,313
Total	114,949,594

Source: Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

Estimated cost made by the engineering consultant for construction of WWTP is as presented in the table 9 blow.

Table 8: Construction Cost Estimation for WWTP and Sewer Line Networking at Different sites

Intervention/activity	**Total cost (Birr)**
General Items Civil Works: Mobilization & Demobilization, Camping and Office Facilities, etc.	10,000,000
Civil Works	85,179,987
Electromechanical Works	78,258,001
Sewer Network	
General Items Civil Works: Mobilization & Demobilization, Camping and Office Facilities, etc.	10,000,000
Civil Works (site I, II, III, &4)	202,306,016
Total	385,744,004

Source: Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

5.5. Implementation arrangements

The construction has been proposed to be undertaken in three phases. The first phase (short term) is between 2021 and 2026; the second phase (medium-term) is between 2026 and 2031, and the final phase (long term) is between 2031 and 2041. The current project is planned to be implemented in the short-term period: from 2021 to 2026. Considering the nature of the project, this ESIA report addresses the environmental and social impacts issues for the three phases. All phases are based on the similar principles, design, location and management systems.

To pursue the smooth implementation of projects activities proposed in the Plan, this sub-section presents an organizational arrangement shown below composed of concerned organizations:

HWSSE is the central unit responsible for the implementation of the overall subproject activities together with municipal and regional stakeholders. In this regard, HWSSE is a project management unit, which will oversee front-line activities and day-to-day management in the course of the implementation. The enterprise is responsible for preconstruction (designing), construction, operation and decommissioning phases. The project management unit is to be headed by the enterprise and supported by the regional water and energy Bureau. The management unit is further composed of the divisional officers concerned from relevant sectorial offices. Experts or consultants on a technical assistance basis (assistance concept) may assist the unit. On top of this MoWE is an overarching institution to facilitate the implementation and sustainability of the proposed project. The other entities include health, education, agriculture, culture and tourism, urban development and construction, women and children affairs, labor affairs, etc.

6. SUBPROJECTS ALTERNATIVE ANALYSIS

During the feasibility study, alternative sites and alternative technologies were assessed, analyzed, compared and selected. In this section, summary of the proposed alternative sites and technologies are summarized in consultation with the feasibility and design study consultants. This ESIA and detailed feasibility and design studies were conducted in parallel and joint meetings and discussions were made with the parties involved in the feasibility study and sub projects design consultants.

6.1. Alternative Sites (Existing Situation in Harar Town)

The selection of sites for developing a WWTP and FSTP for Harar is one of the most important and challenging decisions to be made by the HWSSA in developing and implementing its wastewater and fecal sludge management plan. A poorly chosen site is likely to require unnecessarily high expenditure on waste transport, site development, site operations, or environmental protection. It may also cause long-term political problems from public opposition. The existing master plan of the town has not designated a site for wastewater and fecal sludge disposal site so far. Consequently, the Consultant team (engineering) in consultation with the Client, particularly the HWSSA, and the regional cabinet, conducted an exhaustive field visit to the potential site of the region and the town including traditional waste disposal sites for the purpose of selecting the most appropriate sites for WWTP and FSTP development.

Accordingly, the Sofi Woreda (Herwi Kebele) was selected for FSTP. Similarly, Awomur Kebele from the same Woreda was selected for WWTP.

These sites have different geomorphological setup and geology varying from alluvium, colluviums and pediment deposition on the plain and sedimentary and metamorphic rock on the rugged part. The site was assessed at this preliminary phase with the objective in addressing issues, which will be related to the WWTP and FSTP development. The assessment stressed on the following points.

- From the point of view of selecting the most degraded area under no/little economic activity
- From the perspective of optimizing site selection with the rehabilitation of degraded area with the development of WWTP and FSTP site
- From the point of view of enhancing the opportunity for minimizing land ownership and compensation issues
- To adopt previous dumpsites and incorporate the Client's interest in the assessment. Repeated field visits and the study was conducted to select the environmentally, geographically, technically, and economically most viable sites for the WWTP and FSTP.
- However, it is important to note that, the ESIA team has been informed that the land in Harar is very rare and difficult to allocate large amounts of land for the proposed treatment plants. During site visits, the ESIA team confirmed that the selected sites is best situated within the selection criteria mentioned above.

In contrast, sites for sewer line networking were selected within the town boundary and in some cases use the existing systems.

6.2. Alternative FSTP

The necessity to provide safe disposal of fecal sludge wastes in a way that minimizes negative effects on the environment and human health, as well as cost-effectiveness as defined by the distance to disposal sites,

was highlighted through different scenarios and site selection for the fecal sludge disposal component. Alternative scenarios and site selection for fecal sludge collection and treatment highlighted the necessity for secure management. Alternative means for compensating those who were impacted included: Land for land, Cash for lost assets, and a mix of the two. Expropriation or cash in exchange for lost assets shall be used in accordance with local laws and the national compensation proclamation.

6.2.1. FSTP Location

Selection of the FSTP location has been done by applying the criteria listed above. Various options have been considered. The fact that the selected location is located on land that did not require resettlement but acquisition of the farmland, and the fact that it is located downwind from the town for most of the year, and still is easily accessible, indicates that few other options would offer a better choice. By the time that the ESIA study started the site had been selected already, and there were no reasons to propose or select another site given the contagious land situation in the surrounding areas of Harar town. Other criteria were, the selected FSTP site is less conflicting with the local community but needs all compensation incorporated in RAP implementation.

The analysis of site selection was done based on the certain local contexts in internationally accepted ways. During the decision making on the FSTP site, the ESIA consultant considered the following selection criteria: access to road, proximity to water points and other utilities in the surrounding areas, sensitivity to ecosystem function and conservation, residential areas, public and private institutions such as schools, health posts, markets, and shops. In addition, the land suitability and availability have been considered in addition to the technical inputs from the design consultant.

6.2.2. Technology Alternatives for FSTP

As outlined in the feasibility study, the methodology and approach used to select the most appropriate process technology for the new proposed FSTP focused on the principal methods used to process and dispose sludge are thickening (concentration), conditioning, dewatering, and drying applied as primary operation to remove moisture from sludge.

1. Planted drying beds (PDBs) (planted dewatering beds)
Vertical-flow constructed wetlands and sludge drying beds are beds of porous media (e.g., sand and gravel) that are planted with emergent macrophytes. PDBs are loaded with layers of sludge that are subsequently dewatered and stabilized through multiple physical and biological mechanisms.

2. Unplanted sludge drying beds are shallow filters filled with sand and gravel with an under-drain at the bottom to collect leachate. Sludge is discharged onto the surface for dewatering. The drying process in a drying bed is based on drainage of liquid through the sand and gravel to the bottom of the bed, and evaporation of water from the surface of the sludge to the air.

In general, among the available treatment technologies, during the feasibility study, sludge treatment by using unplanted drying beds has been selected and approved for further detailed design for this particular project. Thus, the current FSTP technologies such as construction of drying bed, anaerobic baffled reactor, maturation pond, and septage lagoon are among the best technology and cost effective when compared to

for example to mechanical treatment option/technology. Instead of using a thermal dryer, which can dry materials more quickly but is more expensive since it uses more energy, the proposed treatment technique for the fecal sludge treatment component uses sun drying technology.

During the draft feasibility study, the proposed fecal sludge treatment plant was provided with a settling tank. The purpose of including a settling tank was to decrease the footprint of proposed drying beds by separating the liquid from the solid part. The proposed settling tank requires provision of a sludge pump at the bottom of the tank to pump the settled sludge to the drying bed. However, operational difficulties are expected in the use of a sludge pump at the bottom of the settling tank and, after communicating with the client on this issue and after having reached agreement about it, the proposed settling tank is omitted in the final design. Nonetheless, advantages of mechanical treatment options include compactness and speed of the process. The imitations of mechanical treatment options include high investment costs, operation and maintenance and electricity requirements.

Under the proposed development alternative, the project would create a more efficient system for FSTP, alleviate sanitation problems in Harar town and provide a better sanitary system. Therefore, the selected technologies, system and process are the best options among the available and which is sustainable for Harar case.

6.3. Alternative WWTP

6.3.1. WWTP Location

The treatment and disinfection of sewage would contribute to the improvement of the environmental and social conditions in the Harar town. Currently, untreated wastewaters from the town are disposed of directly to the environment without any proper treatment, and eventually to the nearby rivers drainage system posing serious risks to the environment and public health. Treatment of wastewater would reduce such a negative impact and improve the physical and social environment in the region. The project is widely accepted by all stakeholders and expected to indirectly improve the livelihood of the inhabitants of the Awomur Kebele in general and those in direct use of the drains water in particular either for irrigation or other purposes. The project also meets all the Bank's environmental and social requirements.

Location of the project site to remove the sludge from the wastewater and disinfect the remaining water using appropriate technologies is best situated and the sewer line directly connected to the system through gravity. The project will add a capacity of 1,400m^3/day to the system. The project will be implemented entirely within the premises of the Harar and will not entail involuntary resettlement or displacement of people and businesses.

6.3.2. Technology Alternative for WWTP

Based on a multi-criteria analysis discussed with the World Bank Safeguard team, MS Consultancy, Motion Consultancy, the Harar client (HWSSA), and the MoWE Water Supply and Sanitation Directorate Team. Conventional Activated Sludge (CAS- A2O) type treatment plant was selected to be implemented at the envisaged site. That will serve Jegol, some condo sites and the inner-town of Sofi catchment for phase I Implementation.

Subsequent multicriteria evaluation of the listed technologies showed CAS to be the preferred option of technology for use in Harar town. The choice of the treatment technology was influenced by the stringent effluent limit requirements set in the ESMF guidelines and the limited land reserved by the Harar client for the implementation of the treatment plant.

6.3.2.1. Description of Potential Treatment Technologies

Choice of technology is often considered a simple process, but is usually quite complex, requiring careful assessment of factors, consultation with the beneficiaries and the operating authority, and an understanding of the integration of factors affecting the sustainability of a system. The selection of an appropriate technology from a range of possibilities is the key step towards implementation of a more feasible and sustainable sanitation intervention.

A brief review of wastewater treatment plant technologies that are currently in use and have the potential to be used for the Harar projects are outlined below. The review is focused on primary and secondary treatment processes options as it is assumed that preliminary and tertiary treatment would be common across all technology options. Hence, considering the current and local conditions in the area, the following primary-secondary treatment processes are considered.

6.3.2.2. Activated Sludge Processes

Conventional activated sludge process consists of an aeration tank, a secondary clarifier and a sludge recycle line. Floating matter and settleable solids in the raw sewage are generally removed by pretreatment and primary treatment before aeration. The process utilizes a mixed microbial population in the aeration tank to aerobically convert the organic matter into cellular material which can be subsequently separated from its suspending liquor in the secondary clarifier.

A portion of the settled sludge in the clarifier is recycled to the aeration tank while the remainder is wasted. Among the various modified process, Extended Aeration Activated Sludge (EAAS), Oxidation Ditch (OD), Sequencing Batch Reactors (SBR), & Membrane BioReactors (MBR) have been successfully used for the treatment of wastewater from small communities.

a) Extended Aeration Activated Sludge (EAAS): EAAS is usually operated in the endogenous phase and provides sufficient aeration time for oxidizing the biodegradable portion of the sludge synthesized from the organics removed in the process. Aeration is mainly provided by a diffused aeration system. Extended aeration is characterized by a long detention time and a high MLSS concentration. The extended aeration process has been used extensively to treat wastewater at 9.5 m3/d to 3,500 m3/d.

b) Oxidation Ditch (OD): OD is a variant of an EAAS where a ditch forms the aeration basin in which the raw sewage is mixed with the microbial population and converted to new cellular material. Aeration and mixing may be provided by a Kessener Brush, cage rotor or another similar device. The rotor entrains oxygen in wastewater and provides sufficient horizontal velocity to keep all solids in suspension. The mixed liquor is continually drawn off to a clarifier where the sludge is settled and returned to the aeration basin.

c) Membrane Bioreactor (MBR): This is one variant of an Activated Sludge system where solid and liquid separation is carried out with a membrane instead of the conventional secondary clarifier. The advantages

of MBR technology involve better effluent quality, less footprint, and less waste sludge generation. However, membrane biofouling is a major hindrance in the use of MBR that leads to clogging of membranes.

d) Sequencing Batch Reactor (SBR): It is a variant of an activated sludge system where all the unit process and operations of a conventional activated sludge (primary sedimentation, biological oxidation, and secondary clarifier) are incorporated in a single tank. Using a single tank, these processes and operations simply become sequences in time, and not separate units as in the conventional continuous-flow system. This technology is known to be space-efficient as it is designed to conduct all the unit processes and operations in the same tank. However, since all the process is highly dependent on the EM units to convey signal coming from the sensor installed its operation is very expensive. Besides, a high level of expertise is required to operate the treatment plants. The process involved in this type of WWTP is summarized down here:

- Fill - entrance of the influent in the reactor
- React - aeration/mixture of the liquid/biomass contained in the reactor.
- Settle - sedimentation and separation of the suspended solids from the treated sewage.
- Draw - removal of the supernatant, which is the treated effluent from the reactor.
- Idle - cycle adjustment and removal of the excess sludge

I. Anaerobic Baffled Reactor (ABR): It is a high-rate anaerobic digester that is internally compartmentalized by a series of hanging and standing baffles. Wastewater enters the reactor and flows under a natural head under and over the hanging and standing baffles. No oxygen or mechanical mixing is applied in the system; treatment is achieved through anaerobic digestion by naturally selected anaerobic bacteria (referred to as sludge). The ABR is similar in concept to a septic tank in that passive treatment of wastewater is obtained by the (relatively) unassisted development of anaerobic microorganism consortia in a simple digester design. The system is well suited for small communities. ABRs provide partial treatment and the effluent from the units would require further treatment to meet the secondary treatment requirement. A possible treatment combination includes:

1. ABR + Anaerobic Filter
2. ABR + Facultative Ponds
3. ABR + Aerated Lagoons
4. ABT + Constructed Wetland
5. ABR + Trickling Filter
6. ABR + Activated Sludge

II. Anaerobic Filters: It is a fixed-bed biological reactor with one or more filtration chambers in series. As wastewater flows through the filter, particles are trapped and organic matter is degraded by the active biomass that is attached to the surface of the filter material. Filter material, such as gravel, rocks, cinder or specially formed plastic shapes, provide additional surface area for the biomass to settle. By forcing the fresh wastewater to flow through this material, intensive contact with active biomass is established; the larger the surface for microbial growth, the quicker the digestion. Good filter material provides 90 to 300m² surface area per m³ of occupied reactor volume. Rough surfaces provide a larger area, at least in the

starting phase. Like their counterpart aerobic fixed bed reactors, Anaerobic Filters can provide secondary level treatment if preceded by primary treatment units.

III. Lagoons

a) Waste Stabilization Ponds (WSPs) are large, shallow basins in which raw wastewater is treated entirely by natural processes involving both algae and bacteria. They are used for wastewater treatment in temperate and tropical climates, and represent one of the most cost-effective, reliable and easily-operated methods for treating domestic and industrial wastewater. Waste stabilization ponds are very effective in the removal of fecal coliform bacteria. Sunlight energy is the only requirement for its operation. Further, it requires minimum supervision for daily operation, by simply cleaning the outlets and inlet works. The temperature and duration of sunlight in tropical countries offer an excellent opportunity for high efficiency and satisfactory performance for this type of water-cleaning system. They are well-suited for low-income tropical countries where conventional wastewater treatment cannot be achieved due to the lack of a reliable energy source. Further, the advantage of these systems, in terms of removal of pathogens, is one of the most important reasons for its use. WSP systems comprise a single string of anaerobic, facultative and maturation ponds in series, or several such series in parallel. In essence, anaerobic and facultative ponds are designed for removal of Biochemical Oxygen Demand (BOD), and maturation ponds for pathogen removal, although some BOD removal also occurs in maturation ponds and some pathogen removal in anaerobic and facultative ponds.

b. Aerated Lagoons These are deep waste stabilization ponds in which wastewater is aerated by mechanical aerators to stabilize the organic matter present in the wastewater, rather than relying only on photosynthetic oxygen produced by algae. Thus, aerated lagoons represent a system of wastewater treatment that is intermediate between waste stabilization ponds and activated sludge systems.

IV. Constructed wetlands

It is a shallow basin filled with filter material and planted with vegetation. Wastewater is introduced into the basin and flows over the surface or through the substrate, and is discharged out of the basin through a structure which controls the depth of the wastewater in the wetland. A constructed wetland comprises the following five major components: Basin, Filter, and Vegetation, Liner, and Inlet/Outlet arrangement system. Constructed wetlands provide secondary treatment.

VI. Trickling Filter

A trickling Filter consists of a bed of inert media, such as plastic or other synthetic material, broken stone, gravel, 5 to 10 cm in size, on which a biological slime is grown. Trickling filters are always preceded by primary sedimentation so that the filter media will not be clogged by settleable solids. Wastewater is distributed over the top of the bed by a rotary distributor and trickles down through the media. Organic material and oxygen are absorbed and utilized by the microorganisms attached to the filter media. Trickling filters are always followed by secondary clarifiers. They are usually classified as low or high rate according to the applied organic or hydraulic loadings.

VII. Rotating Biological Contactors (RBC)

These are aerobic units using fixed-bed reactors, in which the biomass grows attached to a support medium. In RBC, the support medium consists of stacks of rotating discs mounted on horizontal shafts.

VIII. Up flow Anaerobic Sludge Blanket (UASB)

UASB is an anaerobic process that involves a reactor in which untreated wastewater enters at the bottom and flows upward through a biological sludge blanket. At the top of the UASB is a phase separator which collects solids rising with the liquid. The solids accumulate and finally fall back down to accumulate as a sludge blanket. The key feature of the UASB process is that it can handle high BOD loadings compared to other anaerobic processes due to the formation of dense granular sludge. Suspension of the sludge is achieved by maintaining up flow velocities between 0.6 to 0.9 m/h. UASB reactors have smaller footprint and land requirements compared to activated sludge systems. However, in order to provide a higher level of treated effluent, these systems usually require a secondary treatment stage for polishing of effluent. In some instances, the UASB is followed by a trickling filter or polishing ponds to achieve the required water quality for irrigation purposes.

Options for Tertiary Treatment: There are three options considered for the disinfection of wastewater pathogenic microorganisms. These include:

a. Maturation ponds disinfection
b. Ultraviolet Radiation disinfection
c. Chlorine disinfection

Each method has its own advantages and disadvantages as described below.

A) Maturation Ponds

The use of maturation ponds to disinfect the effluent from wastewater is a common practice especially in developing countries. A large pond with shallow depth will expose pathogens in the wastewater to sunlight radiation. Under extended exposure the pathogens die off and the wastewater becomes effectively disinfected. However, the use of maturation ponds is not feasible for the Harar project for it needs a large area in the order of 4 to 5 hectares for the short-term implementation only. Thus, this option is left out from further consideration and analysis.

B) UV disinfection

In the UV disinfection system, electromagnetic energy from a mercury arc lamp is transferred to the organism's genetic material. When the UV radiation penetrates the cell wall of the organism, it destroys the cell's ability to reproduce. The effectiveness of UV disinfection system depends on:

- Characteristics of the wastewater (flow rate, concentration of colloidal and particulate material, concentration of bacteria, etc.)
- The intensity of UV radiation
- The amount of time the microorganisms are exposed
- There is already experience in Ethiopia in the use of UV disinfection especially in wastewater treatment plants implemented in universities. Discussion with the operator of the wastewater treatment plant at Debre Markos University (DMU) shows that the UV disinfection system implemented 6 years back at DMU is operating without any problem and without the need for frequent replacement of parts.

C) Chlorination Disinfection

Chlorination disinfection is a commonly used process of killing or inactivating most microorganisms in the treated wastewater, including all pathogenic organisms. Chlorine and its various forms are powerful chemicals that kill/inactivate most pathogenic organisms that are harmful to human and animal life. Chlorination of wastewater is effected by employing hypochlorite preparation facilities and construction of a chlorine contact tank. Preset dose of hypochlorite solution is injected into the effluent from the secondary clarifier that passes through the chlorine contact tank. The contact tank has a detention time of about 30 minutes, and it is assumed that all pathogens die off during this period.

Having analyzed all the advantages and disadvantages of the above two options of wastewater disinfection from the perspective of investment cost, operational challenge, disinfection capability and anticipated environmental impact, finally disinfection using Chlorination is chosen for Harar application for all treatment plant sites.

6.3.3. Multi Criteria Analysis

Even if the above list of treatment technologies are potential candidates for use in Harar Wastewater management system, not all of them shall pass through a rigorous multi criteria evaluation system. Most of them shall be prescreened based on expressed client requirements and real conditions on the ground. Therefore, a systematic way of prescreening is performed to identify those treatment technologies that would be most feasible from the perspective of the requirements set above.

From the group of Activated sludge processes, EAAS, which is the least complex and relatively simple among the group requiring only one big aeration tank is taken for further MCA analysis. The rest of the group members require additional electromechanical parts and have components which add to the degree of complexity than expected from EAAS.

From the nature-based treatment systems, both CW and WSP systems do not fulfill the area requirement. The estimated area for CW for Harar application is about 9 ha for the short term only, and this much land is not available at the selected treatment plant site. In the same way, WSPs are not useful for Harar for their large area requirement (more than three times the 5.6 ha area provided by the client) and are not considered for further MCA analysis.

Therefore, from the list of treatment technologies identified in above, those selected for further MCA analysis include:

- Anaerobic Baffled Reactor (ABR) followed by Anaerobic Filter (AF)
- Anaerobic Baffled Reactor (ABR) followed by Aerated Lagoon (AL)
- Anaerobic Baffled Reactor (ABR) followed by Trickling Filter (TF)
- Up flow Anaerobic Sludge Blanket (UASB) Reactor followed by Trickling Filter (TF)
- Extended Aeration Activated Sludge (EAAS)

As described in the previous section, five wastewater treatment plant technologies are selected for further consideration and MCA (Multi Criteria Analysis). Multi Criteria Analysis is a process of integrated assessment of projects, alternatives or options for ranking or selecting and priority setting among the finite

set of project alternatives or options. It is a structured approach to determine overall preference among alternatives. It enables an integrated assessment of subjective and objective information in a single framework.

In order to compare the different WWTP technical options, the following 5 criteria have been considered. The Client, HWSSA, requirements as well as the industry practice have been used in drawing up these criteria. MCA was applied to assess the wastewater treatment technologies considering the criteria and weighting factors described in Table 10 below.

Table 9: Weighting Factor Applied to Select a Technology

S. No	Criteria	Weight (%)
1	Investment Cost	35
2	Ease of O & M, Simplicity and Sustainability	40
3	Land requirement	10
4	Effluent quality	5
5	Environmental Impact	10

Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

The table below summarizes the evaluation results of the MCA. The performance of each technical option is evaluated against the five chosen criteria; the weighted score for each criterion is aggregated to get the final score for each option. Expert opinion and experience in other similar projects in Ethiopia and elsewhere are used in evaluating and assigning scores to each criterion.

Table 10: Multi-Criteria Comparison of Treatment Options

No.	Criterion	Criteria Weight	ABR+AF		ABR + Aerated Lagoon		ABR+TF		UASB + TF		EAAS	
		Wt.	*Score*	*Weighted Score*	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	*Weighted Score*
1	Investment Cost	35	9	3.15	9	3.15	8	2.8	7	2.45	4	1.4
2	Ease of O & M, Simplicity and Sustainability	40	5	2	7	2.8	9	3.6	7	2.8	5	2
3	Land requirement	10	8	0.8	5	0.5	8	0.8	9	0.9	10	1
4	Effluent Quality	5	7	0.35	9	0.45	9	0.45	9	0.45	10	0.5
5	Environmental Impact	10	7	0.7	7	0.7	8	0.8	8	0.8	10	1
Final Score		100	7		7.6		8.45		7.4		5.9	

Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

Based on the MCA result, the overall scores and ranks of the treatment options is summarized in table 12 below. Accordingly, ABR + TF is found to be the most feasible option among the alternatives. This is followed by ABR + Aerated lagoon. The least favored option is the conventional EAAS.

Table 11: Rank of Treatment plants

No.	Options	Score	Rank
1	ABR + AF	7.00	4
2	ABR + AL	7.60	2
3	ABR + TF	8.45	1
4	USBR + TF	7.40	3
5	EAAS	5.90	5

Source: Feasibility Study & Detail Design of Wastewater Management System for Harar Town

EAAS did poorly among the alternatives mainly because of expected high investment cost and known operational challenge that comes from the use of sludge pumps, blowers etc. In the same way,

ABR +AF also did poorly mainly because of the Anaerobic Filter. On one hand, the Filter is known to clog and pose difficulty in the proper operation of the whole system until the filter material is cleaned, and on the other, the cleaning of the filter material is a very cumbersome task for it involves taking the filter material out, washing it and reinstating back into the filter box.

An aerated lagoon is a good option for Harar; however, it scores poorly with the land requirement and operational aspects. From among all the options considered the aerated lagoon needed the largest area. In addition to that, the fact that it needs mechanical aeration adds one degree of complexity in the operation of the treatment plant as compared to the ones without aeration.

UASB + TF is also a good option for Harar, however the sludge removal mechanism from the reactor (that could involve sludge pumps) and the quality of civil structure needed for the reactor adds to the overall cost of the system. In addition, forming and maintaining a stable sludge blanket in the reactor at all times needs continuous follow up and monitoring by a skilled professional, something which makes the operation of the treatment plant a burden to the client.
ABR +TF scores high with both criteria that have the highest weight (Investment cost and Ease of operation, simplicity and Sustainability). It also seems to fit well into the demands of the client. It does not require huge investment cost, does not require very large area, does not need mechanical aeration, does not involve complex EM parts, and is operationally simple.

As was shown during the feasibility study, the nursing catchment WWTP will be implemented in phase II and will see expansion work in phase III while the Hamaressa catchment WWTP will be implemented during phase III. The result of this multi-criteria analysis developed for the Sofi catchment WWTP also applies to the nursing and Hamaressa catchments too.

6.4. Alternative Sewer line networking

According to the engineering and design consultant, there are a number of factors that can affect the layout of a sewer system for Harar town. In proposing the layout of the sewer systems, the following main factors are used as guidelines.

- **Priority given by client:** The client has already made its preferences as to what type of system would be more appropriate for the town. From this perspective, the client wants a more decentralized system that could be constructed within the boundaries of the town administration and that addresses the pressing problems of Jegol and the condominium sites, is sufficiently phased and can be implemented independently at different phases with minimal investment cost expenditure. As a result, during the layout of the pipe network, priority is given to all these factors.
- **Topography:** As much as possible effort was made to avoid a pipe layout that would require pumping.
- **Investment cost:** Much effort was made and compromise on maximum possible service area was accepted to avoid laying a sewer system along river courses as this would require huge resettlement cost and provision of a road along the banks of the rivers for operation reasons.
- **Existing conditions (Jegol, condos, universities, commercial centers, hotels etc.):** The existing pattern of settlement, location of condos, the relative positions of the different institutions, commercial centers, hotels and so on has dictated the layout to a larger extent.
- **Settlement pattern (slum vs. upscale neighborhoods):** The location of the upscale neighborhoods vs the slum areas has determined the phasing of the works and the location of the proposed sewer system.
- **Drainage pattern:** The fact that there are two river catchments within the town limits, the Sofi sewer catchment is dictated to have two primary lines draining to the treatment plant.
- **Land use plan:** In the layout, priority is given to parts of the town with the highest liquid waste generation including commercial and institutional centers, Jegol and condominium areas.
- **Existing informal sewerage:** Jegol sub-town has an informal and unconventional sewerage system already in use. Effort is made so that the new layout aligns with the existing system so as to be able to serve those who have already connected with the system.
- **Development of the commercial corridor**: In the 2007 LDP, future commercial centers are identified with red color. Effort is made so that the proposed sewer system serves these areas.
- **Density of population**: The higher the density of housing units the higher the wastewater from the residents and thus the need for sewer transport.

Layout of sewer system: There is no universally accepted rule for the laying of sewer systems in reference to the alignment of roads. Usually, the laying is guided by locally developed manuals and guidelines. When it comes to Ethiopia, there are no locally developed standards available to follow.

There are three types of roads in Harar where the sewer lines are to be laid. In the first group of roads, there is space between the property boundary and the road, and the space is being used as a walkway. When the width is sufficient enough to dig a trench and lay a sewer pipe, the sewer line is proposed to pass under this walkway. Example in this group of roads is the asphalt road from Ras Hotel to Hiwot Fana hospital, where the walkway has sufficient width to lay a sewer line.

In the second group of roads, there is a drainage ditch between the road edge and the property boundary, but the space between the ditch and the property boundary is too narrow to allow laying of a sewer line. In such cases, if the road is asphalt, it is proposed to lay the sewer directly under the ditch. A typical example of this situation is the line from Military condo near TTI campus to Tesh Café. The space between the property boundary and the ditch is used by water supply and telecom lines. There are also water supply chamber boxes at multiple places. Even then there are places along this line where the space is much narrow, making it difficult to lay a sewer line. The best option without cutting the asphalt road would be to lay the sewer line under the drainage ditch (without incurring much cost by cutting the asphalt road). While it is a standard practice to cut the asphalt road and place the sewer line under the road, in the case of this project, if such approach is followed, the cost of the implementation would increase exponentially. On the other hand, if the road is cobblestone road, the sewer shall be laid on either the left or right portion of the road (close to the ditch) depending on which side of the road the area is to be served by the sewer line. Because of topography of the town, on those roads laid parallel to the contour, it is possible to serve only the houses located on the side of the road with higher elevation as compared to the elevation of road. Serving the houses with elevations lower than the elevation of the road demands laying the sewer much deeper. Especially for those houses, where the bathroom or the septic tank is located at the backyard of the house, at a lower elevation than even the elevation of the main house itself, making a connection to the sewer is nearly impossible from the maximum depth requirement perspective. Thus, only houses on one side of the road can be effectively served by the sewer line without making the project uneconomical. An example would be a sewer line inside Jegol laid along any road that runs parallel to a contour line.

The third group is the Jegol ring road. This road encircles Jegol wall and is paved with cobblestone. There is an open masonry ditch between the road and the wall. In some places along the wall (nearly 40%), there is space between the wall and the ditch and the sewer line can be laid under this space. But in nearly 60% of the total length of the wall, there is barely no space between the wall and the ditch. Moreover, the ditch is just the edge of the road. In this part of the road, the sewer shall be laid either under the ditch or under the road. However, laying the sewer under the ditch has the disadvantage of the possibility of affecting the Jegol wall during construction. Probably UNESCO might not also allow this construction to happen. Thus, it is proposed to lay the sewer, traversing from Berbere Ber to Buda Ber, on the right side of the road, close to the ditch, and not at the axis of the road. This results in a minimal reinstatement work for the road as compared to laying at the center of the road. Moreover, in the event there is a need for maintenance, laying the sewer line on the farthest edge of the road would involve less traffic obstruction and is preferable.

Thus, the choice and selection of the placement of the sewer line is made case by case according to the local condition of the road and availability of walkway space, Sewers shall be laid below all other infrastructure including water supply lines, telecom lines, power lines (if any). Where this is not the case and the sewer is above. In general, the Jegol and condominium sites were recommended for implementation in the short-term (Phase I). It is expected that some parts of the Sofi catchment including Jegol, the inner town and major commercial areas are ready for sewerage intervention during phase I. Furthermore, in the current layout design the consultant suggested to adopt the existing configuration/layout of sewer in Jegol. Thus, it is not expected to cause any damages to the historical buildings and other infrastructures.

During the implementation of the sewers system for phase I, the total sewer network designed for the short-term implementation is divided into 4 sites to select the best alternative from environmental and social perspectives.

Site I

Site I mainly consist of the collector line around Jegol, the trunk line from Jegol to the Sofi treatment plant and some secondary lines within Jegol. This is the minimum sewer network to be implemented to address the Jegol problem. The site I sewer system receives the highest priority among the 4 components to be implemented in the short-term horizon.

Site II

Site II is the sewer system to be implemented to address the condominium challenge in the Sofi catchment. It covers a total of about 9 condominium sites out of a total of 17 sites in Harar Town. In addition to the condominium sites, the sewer system in this site also serves institutions like Haramaya University, Hiwot Fana Hospital, major commercial centers, hotels etc. This component receives the second priority to be implemented in the short-term horizon. For reasons of connectivity issues, implementation of component 1 is a prerequisite to implement component 2.

Site III

Site III is the proposed sewer network inside Jegol. Since this is proposed to replace the sullage lines, if funds are not available clients can keep the sullage system running (though its shortcomings) for a while until after funds become available from other sources. Thud it receives a third level priority among the four components.

Site IV

There is a new upscale neighborhood village being constructed by the diaspora community from the Harari region. These houses are already constructed but are not yet completed. For some political reasons the construction is halted for some two years now, and it is not clear to the consultant when this would be cleared and the construction finalized. However, the client has requested this part to be included under the short-term implementation and the design is included. This component is ranked at fourth level priority of intervention because first it needs a number of rivers crossing structures (minimum of 4), an access road along the sewer route to the treatment plant, a road bridge and a pumping station near to the proposed treatment plant. The inlet to the treatment plant is located at an elevation of 1942.2masl. The pumping station is located at an elevation of 1925.2m. There is a static head difference of 17m between the pumping station and the inlet to the treatment plant. The horizontal distance from the pumping station to the inlet of the treatment plant is about 150m and the corresponding head loss is about 3m. Therefore, there is a need to pump the wastewater to a total head of 20m between the pumping station and the treatment plant.

6.5. No sub-Project' Option

The "no action" option was one of the many choices provided and examined in the comprehensive ESIA in order to meet the program objectives. Technical, economic, environmental, social, and climate risk comparisons were made amongst the alternatives, taking into account the public's concerns as expressed during public discussions. In order to reduce the requirement for compensation, the project alignment was assessed to look into alternative WWTP and FSTP sites where needed. Doing nothing will jeopardize or delay the long-term town development plan since a good sanitation system is important for maximizing the effects of other development measures and elevating the town's reputation.

Under the Do-Nothing Alternative, WWTP, and FSTP will not be built and operated, and the insanitary conditions associated with the dispersal of raw untreated wastewater and fecal sludge on lands surrounding the town will continue. The do-nothing alternative would mean that land and water and ultimately the surrounding environment will continue to be polluted and loaded with untreated fecal matter and potential disease vectors. The system released the untreated micro-nutrients (mainly nitrogen and phosphorus) into the natural environment. Furthermore, discharge of these two nutrients through the wastewater into the watercourse causes the increase in concentration of nitrogen and phosphorus compounds, which subsequently leads to the problem of eutrophication.

These WWTP and FSTP sub-projects in Harar town are expected to: improve sanitation and public health in the urban setting. The municipal population is growing fast amid the absence of adequate and quality sanitation, wastewater and fecal sludge management services and facilities. Thus, choosing the 'no project' option is, from the economic perspective as well as health and social considerations, the following benefits will be realized: i) improved sanitation; ii) enhance modern WWM and FSM; iii) employment; and (iv) low incidence of pollution, diseases, and accidents. For this subproject, the alternative of "no-project" will increase the risks of poor public health and environmental degradation. Hence, the 'no sub-project' option is not a viable alternative.

Similarly, the construction and installation of sewer lines networking is also critical for the health, social, and environmental setting of Harar town. The 'no-project' alternative will increase the risk of public health mostly for the poor.

As anticipated, the zero-alternative option (do nothing scenario) was eliminated since it would have meant that the urban population would continue to have insufficient access to clean WWM, FSM, and consequently, poor sanitary conditions. It entails releasing all organic wastes—including those containing nitrogen and phosphorus directly into the environment without any biological processing.

7. CONSULTATION PROCESS

ESIA was prepared for phase I and an environmental impact statement certificate will be given for the project to start. The public consultation process in Harar town was conducted in accordance with the Ethiopian Environmental Impact Assessment Regulation of 299/2002. Importantly, the stakeholders were given information about the improvement works and allowed to give their concerns or opinions about the planned works. Public consultations were made to:

- Provide clear and accurate information about the Project to communities living in the subproject area, especially along with the proposed sub-projects in order to obtain feedback/valuable suggestions directly from impacted communities on their preferred mitigation measures
- Promote understanding through the active engagement of individuals, groups, stakeholders, and organizations who have a stake in the sub-project and its outcomes. Public consultation plays a critical role in raising awareness of the impacts of the new developments
- Share information with stakeholders on proposed improvement works, implementation schedule, and expected impact on the physical, biological, and socio-economic environment of the sub-project
- Understand stakeholder concerns regarding various aspects of the subprojects and the likely impacts in different phases of construction and operation
- Share experience from the implementation of previous HWSSA works particularly how impacts were mitigated and
- How best to enhance people's participation and involvement?

During the preparation of the ESIAs, extensive consultations were conducted. In general, communities were given detailed information about the project through presentations by the consultant team (Appendix-1 Community consultation minutes). The presentations highlighted the project background, objectives, expected upcoming activities, and potential socio-economic and environmental impacts of the proposed subproject interventions. After the presentations, the community was given an opportunity to give their views, comments, and queries. Questions were answered, clarifications offered, and their recommendations received. Some of the key questions raised during the public consultations, includes clarification on the mode of compensation, For the Sofi Woreda where the treatment plants are located, consultations were held at the district office and project intervention sites (Awomur and Herwi Kebeles on 31 April 2022) and attended by staff in charge of infrastructure in all sectors where the project will be implemented. Meetings were chaired by district leaders (vice head of the district) and HWSSA representatives.

For Harar Town Sewer line networking, WWTP and FSTP construction, several stakeholder engagement activities were conducted, including WASH Steering Committee meetings, public hearings, and bilateral meetings with institutional stakeholders. In addition to the WASH Steering Committee, public hearings were also conducted. On March 27 2022 two public hearings were held, one with the community of Awomur and Herwi villages, where the WWTP and FSTP is planned to be constructed, and one with the district cabinet which consists of environment and land, natural resource management, Agriculture, Health, Education, Women and children affair, and others relevant key stakeholders who involved in the process. On 23 and 24 March 2022 two institutional stakeholder meetings were organized in the sectors of Hara town, where the WWTP and FSTP systems were developed.

Local residents were consulted, and a meeting was conducted by a team of consultants on 27 March 2022. The consultation exercise identified PAPs whose assets/properties will be affected by the project and some of which are nearest to the proposed WWTP and FSTP site. ESIA presents issues raised by the community during the consultations, but key issues included, among others, issues of jobs, plans for compensation and mode of compensation, and whether communities would benefit from the project.

The people in the project impact areas of influence have also been approached with questionnaires for several surveys. The project ESIA process also involved the development of a separate Stakeholder Engagement Plan (SEP) report which provides guidance for the engagement and disclosure activities for the future project stages, starting from the project preparation to the actual operation of the wastewater project. For the fecal sludge components, discussions and interviews were conducted with the local authorities, and stakeholders, as well as with temporary workers in the existing open dumping sites.

7.1. Consultation with Woreda administration

All members of consultation meetings were very interested to participate in the discussions and they shared their views and opinions on the points of discussion. The discussion took place in the office of the Sofi Woreda administration. All participants in the meeting have discussed and forwarded their opinions on the issues of the implementation of the proposed WWTP, and FSTP projects. They discussed in detail the expectations of the people from the proposed project, the possible adverse impacts and their mitigation measures, and the role of the Woreda administration in the implementation and operation of the project. The attitudes of the Woreda administration and the people of the Woreda towards the realization of the proposed WWTP, and FSTP projects were discussed.

All participants of the meeting have mentioned that the Harar town resident has serious sanitary challenges. The Sofi Woreda administration tried to convince and raise awareness about nature and type of the project. In general, they agreed to provide lands (it is already secured) for the WWTP (at Awomur) and FSTP at Kile (Herwi Kebele), Sofi Woreda. However, the meeting participants raised the issue of safe disposal of the fecal sludge and proper treatment to ensure the health of the local community and the environment. The project client needs to properly compensate for the loss of livelihood. There is an agreement between the project client and the local administration and thus with the local community. The agreement is clear in that the client agreed to compensate the PAP for the loss of the livelihoods such as crops and trees. The Woreda authorities express their feelings that the communities living around the WWTP and FSTP must be properly compensated and the client has to respond to ensure proper management of the site in a way not to pollute the environment.

Furthermore, the officials confirmed that they are not standing against the arrangements made to WWTP, and FSTP to Harar town. They felt that the development of these projects is very vital to improving the hygiene and sanitation problems of their people.

7.2. Consultation with the local communities at the project intervention site

The participants of the meeting were Kebele officials, community elders, and PAP. Before the start of the official discussion, the study team briefed the participants about the proposed WWTP and FSTP and town wide sanitation problems. Then after, the team requested them to express their feelings, anticipated

positive and negative impacts, and the possible mitigation measures to avoid the expected adverse impacts in various phases of the project implementation.

Participants of the consultation were assigned a chairperson of the Kebele to lead the discussion and the Kebele secretary to take the minutes of the discussion. Major issues raised by the participants of the meeting were:

- The problem of compensation-it should be competitive and timely;
- Occurrence of bad smells (experienced from the previous landfill sites);
- Prevalence of diseases (due to pests and other insects);
- Frequent visits by Hyenas-affects their livelihoods (destroying crops, cattle, etc.) and risks to small children.

The participants of the consultation meeting repeatedly mentioned that the issue of property loss needs to be properly handled and provide sufficient compensation for the PAP. The problem of nuisance odor needs to be properly addressed during the project design and construction phase. The project needs to properly manage the site and make it suitable for local people.

The consulted community members explained that they do not have problems giving the lands to the proposed project implementation if the government makes appropriate arrangements and pays them appropriate compensations for the lost properties ahead of the start of construction. Other possible impacts discussed during the consultation were the problem of drainage and erosion from the proposed project implementation. They emphasized that these problems should get proper attention from the concerned bodies before it causes damage to croplands next to the project site. The proposed remedial measures suggested include:

- Provide livelihood alternatives and sufficient compensation for the property loss;
- Properly fencing the compound to protect entering wild animals (such as Hyenas) and other scavengers;
- Conduct regular monitoring for effluent quality and needs to fulfill the national and international standards before it released to nearby water body and/or used for irrigation purpose;
- The constructed facilities need to be managed with properly trained workers;
- Health and safety of the workers need to be properly addressed;
- Implement the WWTP and FSTP as indicated in the design and technologies so that reduce/avoid bad smells from the treatment plan; and
- Create an employment opportunity for the local people.

Finally, they concluded that they would support the project and participate in its implementation with full heart if they are sure that they will get the expected benefit from the project, such as irrigation water at Awomur site.

7.3. Consultation with governmental stakeholders at Harar town

The Environmental and Social Impact Assessment Team has consulted different government stakeholders at the office of HWSSA, in Harar. The objective of the consultation is to discuss the issues of the project and to identify the possible solutions and mitigations measures for the problems that would be caused due to

the project intervention in Harar town and Sofi Woreda. All the consulted organizations were very cooperative to share their concern and information about the project. These organizations include:

- Harar Water Supply and Sewerage Authority
- Harari region Environmental Protection Authority
- Harari region Agriculture and natural resources bureau
- Health Department of Harar town
- Harar education bureau
- Harari Women and Children Affairs
- Harari Culture and Tourism bureau
- Harar municipality
- Harari Urban development and construction

The outcomes of the discussions are briefly presented below:

- The project is critical and needs to be urgently started its construction and designed in such a way to ensure the health and wealth of the public. The implementation of this project is critical to bring about sustainable development and ensuring equitable share considering the interests of all stakeholders;
- The WWM and FSM are long-standing problems of the town of Harar, that need to engage all stakeholders in the design, implementation, and operation;
- Some of the stakeholders complain that they were not consulted at the initial stage as they are key stakeholders.

One of the mechanisms to disclose the project is conducting public consultation with the project affected people and relevant stakeholders. The public consultation is part of the ESIA study and it should be conducted at various levels of the project study. Public's consultations at these levels of the study are vital to disclose the type and nature of the project to directly affected people and to incorporate the public concerns, feelings, and advice in the design of the project. Projects designed through such public participation will be well recognized by the public and induce a feeling of ownership. Timely disclosure of the project to the public is also important to empower communities and involve them in the project implementation process. This eventually will make the project sustainable and socially acceptable.

As part of the ESIA study, the socio-environmental impact assessment team conducted public consultations and discussions with different stakeholders. During the discussions, we learned that there was a different level of knowledge and understanding about the proposed project among the local people. As a result, they were curious to know the details of the project and its benefits to them. Moreover, we feel that further discussions and consultations between HWSSA and local communities at the WWTP and FSTP sites would be important to disclose the project and incorporate their needs in the project implementation.

7.4. Consultation with Project Affected Peoples (PAPs)

Consultations were undertaken with the people affected by both treatment plants with the following listed objectives. The meetings were aimed at presenting and explaining the proposed project and getting feedback from project affected population, contents and its possible impacts. The main purposes of the meetings were to:

- Introduce the proposed treatment project;

- Gain an understanding of issues of concerns that the PAPs may have;
- Share experiences and to disseminate information to the PAPs about the project to avoid misunderstandings;
- Establish areas of cooperation and development;
- Identify problems, concerns and needs; and obtain feedback;
- Learn local knowledge and gain understanding, particularly on environmental and social baseline;
- Promote ownership and enhance social acceptability;
- Build trust amongst the PAPs;
- Evaluate alternatives and seek solutions; and
- Resolve and avoid conflict.

7.5. Consultation Findings

Main issues raised and how they are addressed in the program design and in the ESIA in general. The outcome of the consultation meeting in particular the concerns is provided in table 13 below.

Table 12: Issues and Concerns as Rose during Stakeholder Meeting for Proposed Work

Stakeholder	Subproject impacts/concern raised	Mitigation suggested
Institutional stakeholders	Project delay, appropriate compensation issues Lack of coordination, the complexity of land acquisition,	Improve project communication and capacity of the client and its stakeholder's coordination system
Woreda stakeholders	Impacts on the existing land use, livelihood, and response to the challenges Appropriateness of property compensation,	Promote appropriate rehabilitation for degraded lands due to the project and provide appropriate compensation timely as the law demands
Community	Impacts on their livelihood, nuisance odor, aesthetic value deterioration, a frequent visit by hyenas which damages the crops	The project ensue the proper compensation of PAP livelihoods lost due to the project
PAP	Impacts on their livelihood and issue of appropriate compensation. Need appropriate attention from the client	Timely and appropriate compensation by preparing RAP according to the national and regional law

7.6. Public Disclosure

Start of the project study has been disclosed to PAPs and relevant stakeholders through a series of consultations made at Town, Woreda and Kebele levels. Through these consultations, project information (including purpose, project type, project location) and the ESIA requirements was disseminated to the stakeholders and PAPs. This helped to gain feedback and concerns that need to be addressed during the project planning, construction and implementation processes. This draft ESIA report has been prepared taking into account all the feedback from stakeholder and PAPs consultations. In accordance with the World Bank policy on access to information, disclosure of relevant project information needs to be posted on the World Bank external website to receive the opinion and suggestions of civil societies, academics, and other professionals as well.

7.7. Stakeholders Engagement Plan (SEP)

For establishing successful and positive relations between the Project and its stakeholders including the communities to be affected from the Project, the Stakeholders Engagement Plan needs to be prepared.

The project proponent has to conduct public and stakeholder consultation starting from the project inception to the completion of the project. So far, a number of public consultations have been conducted during the project identification, scoping and ESIA assessment phases and more consultations should be continued during the construction phase of the project to settle any issues related to construction activities and interaction of construction workforce with local community. Hiring a community liaison officer from local community/project woreda or Kebele would facilitate consultation and grievance redressing processes during the construction phase. Public consultation sessions should involve Woreda and Kebele officials, community elders, women representatives, and representatives of youth and NGOs if available. All the consultation should be minted and properly filed.

Consultation conducted during the scoping and ESIA phases revealed that the consulted stakeholders and PAPs at both treatment sites are positive towards the proposed project. However, further consultation will be needed particularly at FSTP/WWTP site with PAPs and those who are claiming that the previous compensation was not adequate to sustain their life and with those who claim there was no compensation paid at all for their lost land and properties.

Consultation is expected to continue in the subsequent phases of the project. The essential objectives of the Stakeholders Engagement Plan can be defined as:

- Identifying relevant stakeholders to be engaged in consultations.
- Creating an open dialogue with the communities being affected from the Project and all the related stakeholders.
- Informing the disadvantaged groups, understanding the opinions of these groups and ensuring that they actively participate in opinion exchange activities.
- Increasing the social benefits of the Project and preventing or mitigating the negative social impacts.
- Informing all the stakeholders about the project in a timely and clearly understandable manner.
- Monitoring the concerns and information requirements of the communities being affected by the Project.
- Providing an open communication between the Project owner and the project-affected people and other stakeholders).
- Providing timely and correct information about the project and its progress to all the stakeholders including project-affected persons, related institutions, local and government authorities,
- Ensuring that all the related stakeholders and the project-affected persons attend the meetings organized.
- Giving priority to the project-affected persons while hiring workforce from the local community.
- In case of any planned interruption or unplanned damage at the infrastructure of the nearby residential locations during construction, notifying the public and the relevant institutions for reaching a solution within the shortest time possible.

SEP will encourage keeping record of all the complaints, concerns and feedback received regarding the Project and ensure resolution of any reaction, disagreement or disputes related to the Project impacts via an open communication method. It will help to establish an internal formal grievance mechanism for complaint resolution. It will contribute to caring for life and property safety during construction works & ensure the continuity of the good relations with the local community. Therefore, during the construction phase the contractor is required to prepare his SEP that will be implemented during the construction phase. The plan to be prepared should take into account the above objectives and should be updated regularly based on the actual condition of the project activities and interaction with stakeholders.

Whenever stakeholder's consultation is required, stakeholders can be approached through existing administrational structures such as through Woreda Administration, Kebele administration and project sub-town administration.

Future consultation can be initiated by the community or by project proponents or by other stakeholders depending on the issue to be discussed.

8. IMPACT IDENTIFICATION, ANALYSIS AND POSSIBLE MITIGATION MEASURES

8.1. General Considerations

This part of the report addresses potential impacts associated with the proposed MoWE subproject and measures for avoidance, reduction or restoration of the negative impacts and enhancing (improvements) of positive effects of the subprojects. For the assessment of the socio-environmental impacts of the proposed subprojects, the following issues were considered:

- Impacts should be assessed for all phases of the project cycle including construction, operation, and decommissioning;
- All elements of the project infrastructure and activities associated with the project, including actions by third parties on which the project depends, should be assessed, whether they are funded as part of the project or by other parties;
- The assessment should address the potential impacts of the project on the physical and natural environment, social, economic and cultural environment including impacts on the health and safety of the local communities and project workers;
- The assessment should address positive impacts as well as adverse effects, and measures to enhance the beneficiary impacts and mitigation measures for the adverse impacts should be proposed.

Any impact analysis should be viewed in light of available data and information on the baseline environment, an appropriate description of the project, and subsequent positive and negative changes that are anticipated as the result of project implementation.

8.2. Scoped Out Topics

With reference to the analysis of the legal and institutional framework and collected information in the baseline, there are certain topics considered not relevant or with less importance to the project and therefore proposed to be scoped out.

Topics of less importance and therefore proposed to be scoped out

- Surface and groundwater resources as there are no such resources in the vicinity of the subproject sites specifically for Sewer trunk lines.
- Biodiversity conversion and sustainable management of living natural resources. Not relevant, given that there are no threatened, rare or endangered species of fauna or flora registered or known to exist around the site.
- Climate change assessment (climate check).

8.3. Impact Identification

When identifying the potential impacts of the subprojects on the existing environment, it is necessary that it should be measured against the existing baseline conditions. For convenience, the project is divided into four parts: sewer line, the wastewater treatment plant and the fecal sludge treatment plan. Thus, in this section, the possible impacts that are expected under each stage of the project activities were identified and analyzed for the four subprojects in relation to the various stages of their implementations.

For the purpose of this assessment, the impacts identified were those which are considered to be 'significant impacts. This is not to say that minor impacts were disregarded, but that their impact, whilst detectable, is not considered significant. The overall level of predicted impacts, this being both positive and negative ones, are evaluated. Realistic assumptions have been made and qualified. The impacts may be positive as well as negative and, may be short or long-term, temporary, and reversible or permanent. The impact assessment for the proposed project works has considered the level of the potential impacts, this being based on both the value of the environment and the nature and magnitude of the potential impact. Identification of boundaries within which the ESIA was undertaken is an important component of the study. The identification process focused and delineated the sewer line networking, WWTP and FSTP within an area where impacts both positive and negative will be felt on the environment, economy and the local community. The types of boundaries considered were institutional, temporal, and spatial in nature.

8.3.1. Institutional Boundaries

The institutional boundaries are composed of institutions and sectors, which are relevant to the project development. These can be determined from the political boundaries, regulations, institutional mandates, and structures. The proposed project is likely to affect directly or indirectly the interests of the surrounding institutions. Therefore, these institutions will be adequately consulted during the ESIA process.

The institutional framework for environmental management and handling ESIA requirements in the town\region exists at the regional, sector, Municipality/ HWSSA/ Woreda Council / local government and Village (Kebeles). The relevant institutions for handling ESIA requirements for the construction sector include the following: National and regional environmental protection authority, Harari Region Urban development and construction, Health bureau, education, culture and tourism, women and children affairs, and Woredas/ Municipal Environment Management Committees, village Committees, and HWSSA.

8.3.2. Temporal Boundaries

Temporal boundaries refer to project life span and the reversibility of impacts. For example, the impact of construction works on natural vegetation may be short-lived if measures to restore vegetation and the land are taken after material extraction. However, the resettlement of the community to give way for proposed works if applicable may have a long-lasting impact, stretching far into the future in terms of loss of income, land, and disruption in cultural life and livelihood of the people. However, the proposed sanitation subprojects will not have permanent impacts to the local community in terms of resettlement but there will be little loss of properties at WWTP and FSTP sites.

Table 13: Estimated Temporal Boundaries of The Project.

Project phase	Duration
Construction	Up to 2 years
Operation	20 years
Decommissioning	After facility operational lifetime

8.3.3. Spatial Boundaries

Spatial boundaries refer to the area affected by the project. The area of direct impact for the proposed Sewer line networking, WWTP and FSTP will be within the legal boundaries of the project where most of the activities will take place. The immediate impact area of the proposed projects is adjacent to the farm

site and the village residence where some of the impacts, such as the damage to people's properties or interference to business; traffic accidents; spread of communicable diseases such as COVID-19/ public health; and dust pollution will be felt directly. The influential impact area is defined as the one comprising area where decisions are made. For this project, decisions are made mainly at regional, district/ Municipality, and village administration levels. In addition, regional land administration and environmental protection, Vice President's Office/ HWSSA may all have input regarding land ownership and construction permits and issues.

8.4. Impact Characterization and Significance

When identifying the potential impacts of a new project on the existing environment, it is necessary that it should be measured against the existing baseline conditions. For convenience, the sub projects are divided into three parts: sewer trunk line, the wastewater treatment plant and the fecal sludge treatment plan. Thus, in this section, the impacts that are expected to result at each stage of the subproject activities are elaborated and analyzed in relation to their implementations, operation and decommissioning phases.

Impact significance of each identified impact was decided by expert's judgment based on past experience, field observation and outcome of consultation with stakeholders. Key experts involved in the impact assessment were assigned impact significance for each impact separately and finally each rating of experts combined into one significance rating (low, medium, high) for each impact. The overall significance of the possible impacts has been determined by combining the perceived 'Likelihood of Occurrence' of the source of the impact in combination with the corresponding impact 'Consequence' describing the severity of the impact, 'Significance' describing the level of required mitigation measures, the 'Spatial Influence', describes the proximity of the impact, 'Temporal Influence' describes the duration of the impact, and finally, 'Reversibility' describes the ability to return to original conditions after implementing mitigation measures.

The detailed classification of impacts is provided in table 15 below and Matrix of Potential impacts against classification and significance for each subproject (sewer trunk line, the wastewater treatment plant, the fecal sludge treatment plan).

Table 14: Detailed Classification of Impacts

Impact Criterion	Effect on Environment	Classification of Effect	
		Expression	Impact description
Likelihood of occurrence	What certainty of occurrence is associated with impact?	Unlikely	Probably will not occur
		Likely	May occur
		Certain	Will occur
Consequence	How severe the impact will be?	Marginal	Little impact
		Critical	Moderate impact
		Severe	High impact
Significance	How important is impact in Project design?	Low	Impact of little importance, needs limited mitigation
		Medium	Impact has influence and requires mitigation
		High	Impact of great importance, mitigation is a must
Spatial influence	How the impact shall be extended spatially?	Local	Within the surrounding area of the project
		Regional	Extends beyond the surrounding area
Temporal influence	How shall the impact extend over time?	Short term	The impact shall last short period of time
		Medium term	The impact shall last medium period

Impact Criterion	Effect on Environment	Classification of Effect	
		Expression	**Impact description**
		Long Term	The impact shall be permanent
Reversibility	Can the influence of the impact be removed once the impact end or the influence will remain?	Reversible	The influence of the impact can be reversed
		Irreversible	The influence of the impact cannot be reversed and shall be permanent

Table 15: Prediction and Significance of Potential Impacts of FSTP Subproject Activities

No	Identified Potential Impacts	Type of Impact		Likelihood of occurrence			Consequence			Spatial influence		Temporal influence			Reversibility		Significance without Mitigation/ Enhancement Measures			
		Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
	CONSTRUCTION PHASE																			
1.	Loss of land		X			X		X		X				X		X				X
2.	Soil compaction and erosion		X		X			X		X		X			X				X	
3.	Ambient air pollution		X		X		X			X		X			X			X		
4.	Noise dust and vibration		X			X		X		X									X	
5.	Pollution of surface water		X		X		X			X		X			X				X	
6.	Risk of flooding, erosion, landslide		X		X		X			X		X			X			X		
7.	Impact on archaeological & cultural heritage sites		X		X			X		X	X		X		X				X	
8.	Impact on livelihood		X		X			X		X			X		X				X	
9.	Impact due to ancillary works (Quarry, borrow, spoil sites & camp)		X		X		X			X		X			X			X		
10.	Traffic congestion and accident		X		X		X			X		X			X			X		
11.	Impact on flora and fauna		X			X	X			X						X			X	
12.	Occupational Health and safety of workers		X		X			X		X								X		
13.	Job creation	X				X				X			X						X	
14.	Skill transfer to local workers	X			X					X			X					X		
15.	Indirect job opportunities for coffee and tea venders	X			X					X		X						X		
16.	Health impact (HIV AIDS/ STDs)		X		X			X		X			X					X		
17.	GBV/SA		X		X			X		X			X						X	
	OPERATION PHASE																			
1.	Odor (Foul smell) at the site and surrounding environments		X			X		X		X			X		X				X	
2.	Ambient air pollution		X		X		X			X		X			X			X		

No	Identified Potential Impacts	Type of Impact		Likelihood of occurrence			Consequence			Spatial influence		Temporal influence			Reversibility		Significance without Mitigation/ Enhancement Measures			
		Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
3.	Risk of flooding, erosion, landslide		X		X		X			X		X			X			X		
4.	Impact on public health		X		X			X		X	X		X			X			X	
5.	Occupational safety		X		X			X		X						X				
6.	Job creation	X								X	X			X						X
7.	Compost generation from sludge	X								X				X						X
8.	GBV/SA		X		X			X		X			X						X	
	DECOMMISSIONING PHASE																			
1.	Air and Noise pollution		X			X		X		X			X		X				X	
2.	Impact on water bodies		X	X			X			X			X		X			X		
3.	Loss of Job opportunity		X		X					X										
4.	Soil compaction and erosion		X		X			X		X									X	
5.	Spoil disposal		X							X								X		
6.	Health impact		X		X					X									X	
7.	GBV/SA		X		X			X		X			X						X	

Table 16: Prediction and Significance of Potential Impacts of WWTP Subproject Activities

No	Identified Potential Impacts	Type of Impact		Likelihood of occurrence			Consequence			Spatial influence		Temporal influence			Reversibility		Significance without Mitigation/ Enhancement Measures			
		Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
	CONSTRUCTION PHASE																			
1.	Loss of land		X			X		X		X				X		X				X
2.	Soil compaction and erosion		X		X			X		X		X			X				X	
3.	Ambient air pollution		X		X		X			X		X			X			X		
4.	Noise dust and vibration		X			X		X		X									X	
5.	Pollution of surface water		X		X		X			X		X			X				X	
6.	Impact on flora and fauna		X			X		X		X				X		X				X
7.	Risk of flooding, erosion, landslide		X		X		X			X		X			X			X		
8.	Impact on archaeological & cultural heritage sites		X		X			X		X	X		X		X				X	
9.	Impact on livelihood		X		X			X		X			X		X				X	
10.	Impact due to ancillary works (Quarry, borrow, spoil sites & camp)		X		X		X			X		X			X			X		
11.	Traffic congestion and accident		X		X		X			X		X			X			X		
12.	Occupational Health and safety of workers		X		X			X		X										
13.	Job creation	X				X				X			X					X		
14.	Skill transfer to local workers	X			X					X			X					X		
15.	Indirect job opportunities for coffee and tea venders	X			X					X			X					X		
16.	Health impact (HIV AIDS/ STDs)		X		X			X		X			X						X	
17.	GBV/SA		X		X			X		X			X						X	
	OPERATION PHASE																			
1.	Odor / obnoxious smell at WWTP site and its surrounding		X			X			X	X				X	X					X
2.	Noise and vibration		X		X		X			X			X		X			X		

3.	Ambient air pollution		X		X		X			X		X			X			X		
4.	Pollution to ground and surface waters in the surroundings	X			X			X		X			X		X					X
5.	Air quality in the catchment	X			X			X		X			X		X					X
6.	Land use, scenic and visual quality	X			X			X		X			X		X			X		
7.	Risk of flooding, erosion, landslide		X		X			X		X			X		X				X	
8.	Impact on flora and fauna	X			X			X		X				X		X			X	
9.	Impact on public health	X			X			X		X			X		X				X	
10.	Occupational safety		X		X			X		X			X		X			X		
11.	Job creation	X			X					X	X			X		X				X
12.	Compost generation from sludge	X			X														X	
13.	GBV/SA		X		X			X		X			X						X	
	DECOMMISSIONING PHASE																			
1.	Air and Noise pollution		X			X		X		X			X		X				X	
2.	Impact on water bodies		X	X			X			X			X		X			X		
3.	Loss of Job opportunity		X		X					X										
4.	Soil compaction and erosion		X		X			X		X									X	
5.	Spoil disposal		X							X								X		
6.	Health impact		X		X					X									X	
7.	GBV/SA		X		X			X		X			X						X	

Table 17: Prediction and Significance of Potential Impacts of Sewer Trunk Lines Subproject Activities

No	Identified Potential Impacts	Type of Impact		Likelihood of occurrence			Consequence			Spatial influence		Temporal influence			Reversibility		Significance without Mitigation/ Enhancement Measures			
		Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
	CONSTRUCTION PHASE																			
1.	Soil compaction and erosion		X		X			X		X		X			X				X	
2.	Noise dust and vibration		X		X			X		X			X		X				X	
3.	Ambient air pollution		X		X		X			X		X			X			X		
4.	Obstruction of access for human and animals' movement		X			X		X		X									X	
5.	Pollution of surface water		X		X		X			X		X			X				X	
6.	Impact on archaeological & cultural heritage sites		X		X			X		X	X		X		X				X	
7.	Impact on infrastructures and utility lines (water supply, tele, Electric power)		X		X			X		X			X		X				X	
8.	Risk of flooding, erosion, landslide		X		X		X			X		X			X				X	
9.	Impact due to ancillary works (Quarry, borrow, spoil sites & camp)		X		X		X			X		X			X			X		
10.	Traffic congestion and accident		X		X		X			X		X			X			X		
11.	Impact on flora and fauna		X	X			X			X					X		X			
12.	Occupational Health and safety of workers		X		X			X		X										
13.	Job creation	X				X				X			X					X		
14.	Skill transfer to local workers	X			X					X			X					X		
15.	Indirect job opportunities for coffee and tea venders	X			X					X			X					X		
16.	Health impact (HIV AIDS/ STDs)		X		X			X		X			X						X	
17.	GBV/SA																			
	OPERATION PHASE																			

No	Identified Potential Impacts	Type of Impact		Likelihood of occurrence			Consequence			Spatial influence		Temporal influence			Reversibility		Significance without Mitigation/ Enhancement Measures			
		Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
1.	Odor when manhole covers are not functioning well or when the cover is removed or when there is leakage at pipe joints or when sewer lines are broken		X		X			X		X		X			X			X		
2.	Risk of flooding, erosion, landslide		X		X		X			X		X			X			X		
3.	Ambient air pollution		X	X			X			X		X			X			X		
4.	Water quality along sewer lines and at the catchment	X			X			X		X			X		X			X		
5.	Impact on public health along the sewer lines	X			X			X		X		X			X			X		
6.	Impact on aesthetic value along the sewer lines	X			X		X			X				X	X			X		
7.	Job creation	X		X						X				X		X	X			
	DECOMMISSIONING PHASE																			
1.	Air and Noise pollution		X			X		X		X			X		X				X	
2.	Impact on water bodies		X	X			X			X			X		X			X		
3.	Soil compaction and erosion		X		X			X		X									X	
4.	Spoil disposal		X							X								X		
5.	Health impact		X		X					X									X	
6.	GBV/SA																			

8.5. Positive Impacts and Enhancement Measures

The most significant benefit derived from these subprojects will be the well-developed institutional capability for sanitation and hygiene service delivery and eventually a cleaner natural and living environment, and greatly improved health standards in the Harar town targeted by each subproject. This then has much broader implications in terms of better economic productivity, and it will contribute to boosting development, particularly in the tourism sector for which reliable and affordable sanitation and hygiene facilities are essential.

The sub projects will result in many socio-economic and environmental benefits for Harar town and for those in their peri-urban areas. It is expected that the project will result in better access to safe sanitation and hygiene facilities and treatment units leading to an improved standard of living in terms of reduction of diseases, access to basic services as well as the creation of temporary/permanent employment during construction and operation. Not last longing negative environmental or social impacts are expected from this activity as it does not involve permanent changes in the socio-economic and environmental settings except for a few households who lose some of their plots. It will mainly benefit the poor in the town areas by providing access to clean and affordable sanitation and hygiene facilities.

The sewer system expansion, wastewater, and fecal sludge component will contribute to alleviating the impacts of the existing open dumping and uncontrolled fecal waste disposal into the environment, which include nuisance odors, poor aesthetics, and risk of groundwater pollution, among others.

The impact analysis presented above identified positive impacts of the proposed Subproject activities. The positive impacts have been ranked depending on their anticipated impacts during the construction, operation, and decommissioning phases. *The potential positive impacts are more or less the same for all subproject developments.* The identified impacts and their enhancement measures are briefly described in the sections below.

8.5.1. Job Creation

The construction, operation, and decommissioning of the subproject activities will create both short- and long-term employment opportunities. Most of it will be during the construction phase where the possibility of engaging skilled and unskilled labor from the project affected communities can be created. Indirect job opportunities like coffee and tea selling around the construction site, mainly by women, is another benefit of the project, particularly during the construction phase. Skill transfer from experienced and skilled workers to others will also be one of the beneficiary impacts of the project. This beneficiary impact is rated as low to high based on different phases of the project. Low job creation is expected during the decommissioning phases, while high amounts of job creation is predicted to occur during the construction and operation phases.

Enhancement measures: Benefits from job opportunities can be enhanced by providing priority for the project affected people and for women. By providing on job training and capacity building, it is possible to enhance job opportunities for the project affected people.

8.5.2. Health

The implementation of the proposed subprojects will prevent any health related-problems, particularly from outbreaks of waste-related diseases (such as cholera dysenteric disease caused by poor sanitation. Health reports from the Regional Health Bureau indicate that sanitation and hygiene related diseases are a major health problem in the Region. According to the Harari Region Health Bureau, diarrhea, bacterial intestinal infection, and typhoid fever were ranked among the top ten diseases that caused morbidity. Moreover, Health bureau experts who participated in the consultations disclosed that the existing practice of disposing of fecal sludge in undesignated and uncontrolled locations is unacceptable from a health point of view. The proposed Subprojects will positively contribute towards improving the environmental sanitation and community health in Harar.

Enhancement measures: Health advantage from treating the wastewater would be enhanced by creating awareness among the users on clean and polluted water as well as its advantage and disadvantage. Advising residents to organize an environmental health committee and follow up their environmental sanitation status. Provision of health centers by responsible government offices in areas where there are no health facilities. It is clear that wastewater treatment alone cannot make the environment clean. Proper solid waste collection, treatment and disposal would enhance the benefits to be obtained from the wastewater treatment process.

8.5.3. Air Quality in the Catchment

Though the localized odor at treatment sites and their boundaries is expected to be adverse, the overall air quality of the catchment will be improved. This is because liquid waste which is being discharged to a wider environment without treatment will be collected at treatment plants and treated to remove harmful components. The project itself is designed to mitigate environmental pollution. Hence, the impact of the project on air quality will be highly positive.

Enhancement measures: To improve the air quality in the Sofi Catchment in particular and in the town in general, connecting all the areas which are not connected to the central treatment system and promoting construction and implementation of decentralized treatment systems where the topographic condition doesn't allow connecting to the central treatment systems.

8.5.4. Improvement of Water Quality

Wastewater treatment is essential to protect one of our most valuable resources, the water. The quality of water flowing from the WWTP to the nearby rivers can be improved by way of changing positively water quality parameters such as the BOD, COD, turbidity, color, pH, temperature, total dissolved and suspended solids, conductivity, coliforms, nutrients, and trace metals.

Concerning surface water, including the bottom sediment, the major positive impact from the operation of the WWTPs is the improved water quality within the project area and downstream of the Erer River. Therefore, the discharge of treated wastewater from the new WWTPs will play a key positive role in diluting the otherwise contaminated river water.

The operation of the WWTP will have a major positive impact on groundwater quality. The implementation of the proposed treatment plant is expected to give good quality of treated effluent which can benefit ground water recharging. This beneficiary impact is rated as very high provided that the treated effluent is within the acceptable standard of Ethiopian and other international standards of treated effluent quality.

Enhancement measures: In order to enhance the positive impacts on downstream water quality, it would be important to regularly monitor the quality of the effluent to be released to downstream rivers and check whether the effluent quality complies with the Ethiopian effluent discharge standards. In addition, treating localized wastewater from residential areas and other sources which due to topographic or other reasons cannot be treated at the central treatment plants would enhance the benefit. Water quality of the Erer River can be further improved provided that pollution monitoring and controlling capacity of the regulatory body is increased. Furthermore, it is advisable to plan and implement integrated watershed management in the micro-catchment that helps to enhance the quality of water resources and reduce the negative impacts of WWTP and FSTP residues. This can be implemented in collaboration with the Harari water and energy and agriculture and natural resource bureaus.

8.5.5. Production of Compost/Fertilizers

Dewatering sludge removed from the FSTP/ WWTP process can be utilized for fertilization and conditioning of the soils in the immediate irrigated agriculture area and far beyond downstream and upstream. Biodegradable materials removed in the process can be given to the agricultural sector for the production of natural fertilizers to be used in place of other products that may be more harmful to people and the environment. In addition, the Harar town, water and energy office, can mobilize resources to take advantage of FS wastes to generate biogas for households and institutions. The good learning and collaboration point will be Haramaya's University, biogas infrastructure. In this regard the related office will collaborate with the institutions in the Harar town to convert the wastes into biogas.

Enhancement measures: Creating a demonstration field and training farmers on how to use the compost on their farm plots and biogas to fuel their houses would enhance the benefit. Producing marketable compost will enhance the benefit and generate income to the concerned authority (establishing small enterprises that prepare marketable compost).

8.5.6. Supplementary Measures

The following proposed measures would scale up the expected benefits obtained due to the implementation of the subproject activities. These include:

- Capacity **Building:** The other broad area of intervention required to enhance the identified positive impacts is conducting capacity-building programs within HWSSA and municipality. The implementation of training and capacity-building programs would serve the sustainability of the project. Furthermore, it would inform and publicize the benefits that can be achieved as a result of the implementation of the proposed WWTP and FSTP, and sewer networking.
- Strengthening **the legal framework:** Another recommended enhancement measure is to work on and strengthen the legal aspect. Laws relevant to solid and liquid waste management (including the disposal methods) should be reinforced and their application must be monitored to minimize the ongoing gap.

Seeing that waste is an inherent part of the production system, the "Waste is Resource /Wealth" approach must be viewed as an important waste management principle.

- Awareness raising on construction, proper utilization and maintenance of sanitation and hygiene facilities: The Community's awareness on construction and proper utilization of the sanitation and hygiene facilities and services is low. In addition to hardware components, integrating hygiene promotion and awareness creation activities will enhance the positive impacts or results of the proposed subprojects.
- Properly manage and use available public and communal sanitary facilities efficiently and effectively in safe and hygienic condition
- Give priority to job opportunities for the local people in general and for the women and disabled community groups in particular.

Table 18: ESMP for Enhancing Beneficial Impacts

Socio-Environmental Component	Proposed Enhancement measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		Implementation	Supervision		
Job opportunities	Benefits from job opportunity can be enhanced by providing priority for the project affected people and for women. By providing on job training and capacity building, it is possible to enhance job opportunity for the project affected people. Recruit local labor in consultation with project administration office	Construction Contractor	HWSSA/ SC	construction phase	Not require
	Give priority of skilled and unskilled job for project affected people. Provide on job training to build the capacity of workers.	HWSSA	Labor office	Operation phase	750,000
Improve ambient air quality	Proper housekeeping procedures (regular cleaning of the grit and screenings) facility maintenance and monitoring emissions and leakage/overflow.	HWSSA	HEPA	Operation phase	Part of the routine monitoring cost
Improvement on water quality	Regularly monitor the effluent quality to be released into downstream river and check whether the effluent quality is complying with the Ethiopian effluent discharge standard. In addition, treating localized waste water from residential areas and other sources which due to topographic or other reasons cannot be treated at the treatment plant would enhance the benefit. Water quality of the downstream river can be further improved provided that pollution monitoring and controlling capacity of the regulatory body is increased. Maintain stringent operational/effluent discharge standards.	HWSSA	HEPA	Operation phase	HEPA's regular budget
Improvements on public health	Creating awareness among the users on clean and polluted water as well as its advantage and disadvantage. Advising residents to organize environmental health committee and follow up their environmental sanitation status. Responsible governmental office should provide health centers in areas where there are no health facilities. Promote proper solid waste collection, treatment and disposal system to supplement the benefit obtained from treatment.	Harar Health Office	Community Health Promotion Office	Operation phase	Cost for establishing health facilities like health center is part of the Government budgets.
Production of compost/fertilizers from the Sludge	Creating a demonstration field and training farmers on how to use the compost on their farm plots would enhance the benefit. Producing marketable compost will enhance the benefit and generate income to HWSSA.	HWSSA in cooperation with Agriculture Offices	HEPA		Part of the operation budget

8.6. Negative Impacts and Recommended Mitigation Measures

An impact evaluation matrix has been used for the identification and assessment of potential negative impacts of the proposed project in terms of spatial extent, duration, level of significance, probability of occurrence, and reversibility of the issue for the stages of construction, operation, and decommissioning.
The assessment is made against each issue or medium of impact on physical elements that include water bodies (surface and ground), soils, ambient air and flora as well as the human or socio-economic elements that include the socio-economy, health, and safety, noise and vibration, traffic accidents referring to the impacts on the overall wellbeing. These impacts areas that are of concern for the implementation of the subprojects and their proposed mitigation measures are presented below:

8.6.1. Impacts in FSTP Subproject Activities

8.6.1.1. Construction Phase

Loss of land: The proposed project activities would lead to the land-use change (land clearance). The FSTP is planned to be implemented in agricultural lands and hence change it into other land-use types such as removing all vegetation covers (herbaceous and some fruit trees-mango, chat (khat)). The new land-use type will be semi-built. However, this change is permanent, and needs to be compensated with the planting of trees in the vicinity to maintain the cleared tree species.

Total area of farm land (khat cropland) required for construction of the proposed treatment plant is 7.37ha. And above 116 trees to be cut down. Therefore, all the PAPs at proposed FSTP sites need to be compensated ahead of mobilization and commencement of construction works. The significance of impact on land resources is rated to be high impact.

Mitigation measures

- Create awareness and consensus among the landholders and the project.
- Ensure that an appropriate resettlement action plan (RAP) is conducted.
- Prepare an appropriate compensation plan for the affected households and implement it before the start of mobilization and construction works.
- Pay adequate compensation for loss of farmlands as per the new compensation law and regulation.
- Promote project affected households (PAHs) who have farming skills through irrigation systems using the treated effluent water.
- Give priority for the project affected people for job opportunities created by the project.
- Give on job training to build capacity of PAPs so that they would fit for the available job rather than filtering out using education or training level requirements.
- Prepare and implement a livelihood restoration program.
- Provide special support for vulnerable project affected people.
- HWSSA has to redress grievances raised by former land owners amicably.

Soil Compaction, and Erosion: Potential impacts on soils during the project construction phase include soil compaction, soil erosion, and soil contamination by hazardous substances. Among the activities that would affect the soil resources include site clearing, stripping of topsoil, excavation in soil, and loading of spoils and hauling of the same to disposal sites; these activities would involve operation of heavy-duty equipment and dump trucks. These undertakings have the potential to cause soil compaction as well as damages to soil

structure and expose the soil to runoff water erosion. This will increase the risk of soil erosion and silt transport to rivers, streams and other watercourses.

In addition, there will be a risk of soil contamination from leakages of hazardous substances such as fuel and oils from equipment and vehicles. Soil pollution could also occur due to spillages of toxic substances (fuel, lubricants, and oil) resulting from poor handling of the substances especially during maintenance of machinery and vehicles can contaminate the soil.

The impacts on soils are predicted to be moderate, localized and temporary without applying any mitigation measures.

Mitigation measures

- Limit land clearing and excavation works only to what is absolutely necessary and carry out the works in the dry season only to reduce exposure of soil to runoff water erosion.
- Careful removal and proper stockpiling of the topsoil removed from the sites, and re-using it for site restoration when construction works are completed.
- Reduce the time exposed surfaces or excavated soils remain bare following completion of works and implement restoration measures such as re-vegetating exposed areas as quickly as possible.
- Prevent environmental pollution by hazardous substances such as fuel, oil, cement sludge, and detergents through proper storage and handling of the substances. Among the precautions to be taken is that the Contractor shall install drip pans and fuel funnels at dispensing points of fuels and lubricants. Oil exchange should take place only in the pre-prepared workshop area. Washing of vehicles and machinery should only be conducted in the workshop area and never done in rivers and open soils.
- Use only existing roads to the extent possible and do not drive through farm lands or unpaved soil.
- Park all the vehicles and machineries at only designated parking areas.
- If a temporary access road is constructed, scarify and loosen the compacted soil when use for the access road is completed or no more needed.
- Construction sequencing, locating stockpiles away from watercourses, and disposing of grit, screenings, and sludge from existing lagoons in a landfill.

Risk of flooding, erosion, and landslide: During construction phase the damages from flooding, erosion and landslides in the surrounding infrastructure is expected to be less in its occurrence. The impact is less adverse, unlikely, reversible, of moderate significance, and short-term the following measures are implemented. However, a precautionary action shall be taken before the start of the construction and site preparation works to avoid any unforeseen risks of flooding/erosion and landslide. The following activities shall be considered to avoid and protect the surrounding environment and social infrastructure from risks of flooding, erosion and landslides

Mitigation measures:

- Pre-preparation for the waste way/flood ways in the project construction and providing appropriate waterways or not blocking the natural waterways.
- Removing/clearing any materials including soils and other construction materials from the natural waterways.
- Providing awareness to the construction site manager and the employee on flood/erosion and landslide management as appropriate.

Security risk: security risk is very low if proper consultation is conducted with the local people and PAP in the proposed project area. The security situation in Harar city is not critical concern for the FSTP construction. Accordingly, the FSTP security situation will not be a serious problem. However, there might be few insecurity cases that need to take a precautionary action at various project phases including construction. If the risks of the security may be raised, it might affect the construction of the FSTP infrastructure and may cause delay of the project, quality of construction and environmental problems if not properly functioned. The level of security risk in the project site could be low, reversible and short-time and easily managed if it happens.

Mitigation measures:

- Proper consultation with local authorities and community about the existing situation.
- Appropriate training on security issues and potential risk management including reporting to appropriate authority.
- Establish and collaborate with the local security guards, regional security and police.

Impacts on Ambient Air Quality: The emission sources in the construction phase are:

- Site clearance;
- Excavation and earthmoving activities;
- Dust emissions from handling and transportation of excavated materials, construction inputs, and auxiliary materials;
- Vehicular traffic movements on unpaved roads and earth moving activities;
- Gaseous emissions from vehicles and construction equipment; and
- Cutting and welding operations.

The impact on air quality is rated as moderate, localized, short-term and reversible without applying any mitigation measures.

Mitigation measures

- Implement measures that will reduce dust emission including regular spraying of water on unpaved access roads, exposed earth and any stockpiles on site, and where feasible, covering stockpiles on site with plastic materials;
- Use updated technology or modern equipment in excavation works that will minimize dust generation from earthen materials.
- Regular vehicle inspections and maintenance of equipment and vehicles to reduce excessive exhaust emissions;
- Minimize excavation and earth moving to only what is required for the specific nature and type of construction;
- Backfill of borrow pits and exposed excavation sites as soon as possible;
- Limit stockpiling of excavated topsoil to the maximum of 2m height;
- As much as possible use paved roads; and
- Limit speed of vehicles to 30km/hour on unpaved access roads esp. in the vicinity of sensitive areas (residential and business areas, social services, religious places).

Noise and Vibration Impact: Similar to air pollution, noise pollution is one of the adverse impacts of construction activities that involve operation of vehicles and heavy equipment. Especially, high noise levels

above WHO and Ethiopian noise standards can cause health impact on recipients. The Ethiopian noise standard for day time at residential areas is 55 dB and for night time it is 45 dB. The long-term exposure to noise level above this standard at residential areas is expected to cause health impact.

The activities that are expected to generate significant noise and/or vibration include:

- Operation of the traffic that will deliver construction materials to and from the lay down areas and to site;
- Excavation works to construct the proposed wastewater treatment plants;
- Excavation and materials moving activities;
- Drilling of pipe jacking to install underground pipes;
- The activities involved in the production of concrete pipes; and
- Operation of quarries to extract rocks and production of the aggregates required for concrete works.

Considering the nature and extent of construction works and machineries involved, the noise impact of the project is rated as moderate, localized, short-term and reversible impact.

Mitigation Measures

- Carryout noisy construction activities in the vicinity of sensitive areas during normal working hours only;
- Use update technology or modern equipment in excavation works that will minimize noise emissions and vibration.
- Keep noise level near sensitive areas such as residential areas, health facilities, schools, religious sites and camps below the WHO and Ethiopian maximum allowable noise level standards;
- Provide ear protection equipment (earplugs) for workers in vicinity of noise emissions;
- Incorporate low-noise equipment in the design and/or locate such mechanical equipment in properly acoustically lined buildings or enclosures.

Pollution of Water Bodies: Pollution of water bodies could be anticipated during the construction phase due to inadequate handling and spillage of pollutants (like fuel, oils and paints). Release of solid and liquid wastes from construction camps has the potential to affect the surface and ground water quality. In addition, spillages of hazardous substances such as fuel and oils from workshops may affect the water quality of nearby streams. Moreover, there will be increased silt loading of the Erer River downstream of the project sites due to increased soil erosion from areas cleared off vegetation cover and excavated for construction of the FSTPs.

The impact on surface water bodies before mitigation measures is anticipated to be moderate, while the impact on groundwater is rated to be low.

Mitigation Measures

- Perform excavation works and earth moving activities during the dry season only thereby minimizing erosion or transport of excavated materials by runoff water to water bodies;
- Prevent environmental pollution by hazardous substances such as oil, fuel, cement sludge, and detergents through proper storage and handling of these substances. Among the precautions to be taken is that the Contractor shall install drip pans and fuel funnels at dispensing points of fuels and

lubricants. Oil exchange should take place only in the pre-prepared workshop area. Washing of vehicles and machinery should only be conducted in the workshop area and never done in rivers and open soils.

- Properly collect used oil and other chemicals and safely dispose of them through accredited oil reprocessing or disposal agency or in other manner approved by the Supervision Engineer.
- Adopt good site management that considers good pollution prevention measures such as locating storage areas and compounds away from watercourses, appropriate storage of fuel and materials, providing suitable facilities for workers, disposing of waste according to approved waste management plan (avoid open waste disposal practices).

Traffic Accident Risks: During construction, there will be increased traffic volume on the roads along the construction of FSTPs and commensurately this may result in increased traffic accident risks to the workers. In general, the factors that could contribute to traffic accidents include:

- Low awareness of many drivers about traffic safety and traffic regulations and signs as well as lack of discipline;
- Lack of awareness of pedestrians about traffic about traffic safety and traffic regulations and signs;
- Presence of roadside poles, trees, ditches, and barriers that impair the visibility of the road.
- Absence of adequate zebra crossings, lack of parking areas, and bus stop arrangements.

Traffic accident risks during construction are anticipated to be moderate, short-term and direct adverse impacts.

Mitigation measures

- Develop and strictly implement and follow up a well-designed work program and traffic management plan (TMP) that would consider local conditions like the normal traffic and socio-economic conditions;
- Provide necessary information such as speed limits, hazard locations, sensitive sites (e.g., schools, religious areas, health centers, etc.) by putting appropriate signs and hazard markings;
- Assign traffic regulators or traffic police to control traffic flows at critical sections or periods where/when traffic safety is a significant issue.
- Provide awareness training for operators of equipment and construction vehicles in traffic safety measures;
- Establish speed limits and controls for construction vehicles and discipline for the drivers;
- Provide awareness education for the nearby residents in traffic safety measures at public meetings, social gatherings, schools, mosques and churches, etc.

Impacts on Vegetation and Flora: The construction of the proposed subproject is not expected to cause significant adverse impacts on vegetation and flora. There are only two types of perennial trees that would be affected by the subproject development, namely the mango tree and chat/khat. At the proposed FSTP site about 116 trees are expected to be remove.

In general, the impact on flora during the construction phase is considered as minor, localized and temporary.

Mitigation measures

- Pay appropriate cash compensation for project-affected trees and/or crops.

- Provide alternative land in the nearby area if applicable to support the livelihood of the affected persons (provide support to those households who lose their livelihood up to 10 years, according to the federal land appropriation and compensation laws).
- Pay compensation for the investment they made on the land. The compensation paid for the affected persons has been estimated based on the annual income lost due to the project construction and current market value (federal and regional land compensation law).
- Planting of appropriate trees and shrubs either indigenous or exotic species, which are friendly to the environment is proposed to compensate for the unavoidable losses during the construction.
- The selection of appropriate tree species and locations of planting shall only be done in consultation with the concerned Environmental Protection Office.
- Plant appropriate trees at the boundaries of the site to improve the aesthetic value of the areas, to absorb air pollutants from the air, and to serve as a windbreak as well as to increase the biodiversity of the area.

Impact on Cultural, religious and Archaeological Sites: According to site observations, the proposed subproject site is far from Harar Jogel, which is identified as a cultural and archaeological site, is unlikely to be affected. However, the Project Contractor must take appropriate measures not to affect any chance to find or discover cultural or archaeological assets during the project construction and immediately report to the relevant Culture and Tourism Office.

Mitigation measures

If archaeological, cultural and religious resources are discovered during excavation for construction of the proposed subproject, the Contractor shall stop the construction at that specific location and report to the relevant Culture and Tourism Office. After the culture and tourism bureau takes necessary measures, construction work could be resumed.

Occupational Health and Safety Impact: Large scale construction work by its nature is a hazardous job, and hence it requires adopting appropriate occupational health and safety measures. There could be safety risks related to storage and use of hazardous chemicals and explosives. Moreover, there might be accidents of various nature to project workers. Furthermore, dust and exhaust emissions may affect the respiratory tract of project workers and local people exposed to such emissions. The impact on the health and safety of project workers, local people and users of the existing roads or paths affected during construction of FSTPs is anticipated to be a moderate to high, short term to long term and direct adverse impact.

Mitigation measures

- The contractor to take maximum care and minimize accident risks by applying internationally accepted standards and recognized occupational health and safety guidelines;
- The contractor to take appropriate care in storing and using hazardous chemicals and explosives and provide training to workers in handling hazardous chemicals;
- Provide workers with protective clothing and equipment and create awareness on safety issues;
- Provide awareness creation among the local community on the hazardous nature of chemicals, explosives if it is used during the construction works.
- Provide first aid kits at workshops, construction worksites, and inside vehicles;

- Provided workers with appropriate PPE such as hand gloves, eye goggles, safety shoes, reflective vests, helmets, etc., based on their work condition as much as possible and strictly inspect proper use of the same throughout the construction phase;
- Avail equipped ambulance at construction site for any emergency cases;
- Conduct general medical check-ups for recruits and subsequently, conduct periodic medical check for all employees and take appropriate action and keep all records;
- Hung-up fire extinguisher bearing detailed information about its status at appropriate places;
- All personnel, vehicles, and machinery should be covered under an appropriate Insurance System;
- Carefully record and keep all incidence of injuries and accidents including date, time, and place of occurrence, level of injuries, resources damage, people injured/dead, major causes for the accident, etc.;
- Provide awareness creation on safety procedures and HIV/AIDS and avail healthcare services;
- Regularly spray water in dusty roads and work areas; and
- Introduce a traffic management plan with speed and traffic regulation through the neighboring areas by using appropriate traffic signs.

Exposure to HIV/AIDS and Other Sexually Transmitted Infections (STIs): As it is well-known, large scale construction project workers are considered to have a high potential for the spread of HIV/AIDS and other sexually transmitted infections partly because construction workers are mostly young, sexually active group of the population, mobile and are partly because they are forced to live in hotel rooms or in construction camps.

It is obvious that the presence of a large number of workforces at construction sites attracts sex workers to the area and also entices young girls from the locality to go into the business. Hence, this makes the project area highly vulnerable and easily exposed to the spread of STIs and HIV/AIDS transmitting factors.

Mitigation Measures

- Contractors should assign experienced HIV/AIDS sub consultants to handle the issues related to HIV/AIDS awareness and prevention.
- Launch awareness and education campaigns about HIV/AIDS among the construction workers and community to make them informed. This has to be done on the one hand by the contractor's sub consultant and on the other hand by the local health institutes along the project road targeting especially women and sex workers.
- Condoms shall be provided at a subsidized rate or for free to construction workers and health facilities must be supported with a supply of condoms. To prevent young and school age people, schools should include information campaigns and/or special courses.
- Town administrations and health offices, HIV/AIDS Prevention and Control Office, Elders, and NGOs operating in the area need to work jointly to create positive impact and bring major attitudinal and behavioral changes.

Gender and Gender Based Violence/SH Risks: Experiences from different infrastructure projects show that there is lack of knowledge and understanding on Gender issues and GBV/SH and Sexual exploitation Abuse (SEA) by Contractors, consultants and construction workers. Due to this, female construction workers could face difficulties in their work places, such as, GVB and sexual harassment. Hence, there is a potential that

gender abuse might occur during the construction of the proposed wastewater treatment plant and sewer line construction through unequal distribution of work, sexual harassment, discrimination against women, and unequal pay for women, among others. This impact is rated to be low for the reason that contractors are expected to include gender specialists among the workforce to create awareness to prevent GBV/SH and SEA.

Mitigation measures

- Provide awareness on the GBV/SH to the staff/workers.
- Provide and avail a separate sanitation facility for women at construction camp,
- Provide women friendly safety equipment and materials,
- Assign women in works that do not affect their biological condition,
- Ensure that women construction workers do not face GBV and sexual harassment,
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all workers including international workers if involved and subcontract workers,
- Ensure equal pay for women and men for equal job,
- Assign gender specialist at construction site to aware and prevent GBV and sexual harassment

8.6.1.2. Operation Phase

Risk of flooding, erosion, and landslide: During construction phase the damages from flooding, erosion and landslides in the surrounding infrastructure is less in its occurrence. However, a precautionary action shall be taken before the start of the construction and site preparation works to avoid any unseen risks of flooding/erosion and landslide. The impact is less adverse, unlikely, reversible, of moderate significance, and short-term

The following activities shall be considered to avoid and protect the surrounding environment and social infrastructure from risks of flooding, erosion and landslides.

- Pre-preparation for the waste way/flood ways in the project construction and providing appropriate waterways or not blocking the natural waterways.
- Removing/clearing any materials including soils and other construction materials from the natural waterways.
- Providing awareness to the construction site manager and the employee on flood/erosion and landslide management as appropriate.

Security risk: security risk is very low, reversible and short-time and easily managed if proper consultation is conducted with the local people and PAP in the proposed project area. So that it is not critical concern for the FSTP construction. Accordingly, the FSTP security situation will not be a serious problem. However, there might be few insecurity cases that need to be given attention at various project phases including construction. If the risks of the security raised, it might affect the construction of the FSTP infrastructure and may cause delay in implementation of the project, quality of construction and environmental problem.

Odor (Foul smell): The frequent dumping of truckloads for fecal sludge may cause bad smell in and around the FSTP. However, as the FSTP is located outside the town amidst farm land, an obnoxious smell from the treatment plant area is expected to be of minor significance.

Mitigation measures

- Create awareness to the FSTP works and even to the local community in the surrounding area on proper management and precautionary action.
- Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills;
- Covering swampy parts of the settlement and drying beds with a layer of earth or sand.
- Establish buffer zones and plant relevant plant species around the FSTP.

Ambient air pollution: The inherent presence of multiple contaminants (CH4, CO2, and H2S) in biogas requires an effective purification or use as a source of energy. Actually, these gases will be generated from fecal sludge treatment plants and there will be a release of these gases into the atmosphere, and impact on the environment through generation of bad odors. The impact is adverse, possible, reversible, of moderate significance, and long-term. Therefore, it is better to adopt treatment process such as alkaline, oxidation and chemical precipitation treatments in the FSTP in Semera town to reduce nuisance and bad odors. A more elegant strategy is to regulate key operational parameters (such as PH, temperature etc.) and suppress sulphate-reducing bacteria to restrict or eliminate H2S formation.

Biotechnologies based on hydrogen trophic such as (decarbonation) CO2 reduction to CH4 (power-to-gas), algal–bacterial symbiosis, or chemo lithographic H2S oxidation (desulphurization) can be implemented depending on the GWSSE capacity to reduce their impacts.

There are two technologies for H2S removal. The first is post-treatment which is efficient and could induce an addition cost to the treatment. The second alternative is pre-treatment process is a simple and potentially low-cost strategy. It removes significant amount of H2S from the sludge/anaerobic digester by reducing H2S formation during anaerobic digestion. It is a mechanism by which, Sulphur in the substrate is removed by precipitation prior to anaerobic digestion, thus can reduce Sulphur content in the sludge/substrate, followed by liquid–solid separation and the suppression of sulphate-reducing bacteria.

Mitigation Measures:

- Regular monitoring of the ambient air including measuring H2S presence in air,
- Control an aerobic digester parameter (pH, Temperature, oxygen level etc.) for H2S producing bacteria/microorganism (creating unfavorable environment),
- Changing redox potential, which helps in reducing or oxidizing capacity of anaerobic digestion system.
- Planting relevant plant species around the FSTP in the buffer zone

Health impact and risks

a) Health impact on people contact with sludge:

It is understood that sludge should be removed from the treatment system from time to time to give the way for fresh sludge. This partially dried sludge should be collected and dumped at appropriate areas or converted into useful products, otherwise its impact on human health and environment would be adverse.

Partially dewatered or dried sludge is reached in pathogenic organisms such as bacteria, virus, eggs and cysts of nematodes, cystoids, jardia and amoeba. This shows that negligently handled sludge cake could impose adverse health impacts on nearby residents and workers involved in day-to-day operation of the system.

Die-off or survival of excreted pathogens is an important factor influencing transmission of disease. In principle, all pathogens die off upon excretion. Prominent exceptions are pathogens whose intermediate stages multiply in intermediate hosts such as Schistosoma, which multiply in aquatic snails and are later released into the water body. Some bacteria (Salmonellae & Shigellae have the potential to multiply outside the host primarily on food and at warm temperature. The pathogens have varying resistance against die-off, and worm eggs are among the more resistant with Ascaris eggs surviving longest in the extra-intestinal environment. The main factors influencing die-off are temperature, dryness and UV-light. The survival rate of pathogens can also vary depending on the media they are attached. For example, the survival duration of pathogens usually longer in soils than in crops.

Mitigation measures

- Provide awareness training to the facility operators on the handling and management of the system and potential dangers. Equip the operators with the necessary precautionary measures (including reporting system) for any pathogenic incidents during the operation of WWTP and FSTP.
- Carefully handle fecal sludge.
- Use of protection clothes such as gloves and masks and good hygiene (washing hands after work etc.).
- Most important is that workers be aware of the nature of the health risks to which they are exposed and that they know how to protect themselves.
- Training of staff and targeted information may therefore be the most successful measures.
- The department of HWSSA dealing with sludge should introduce rules for use of protection by their staff and care should be taken to enforce those rules.
- Site shall be entirely fenced and access to site restricted to employees having received the adequate training.
- Restricting access to the site for unauthorized users

b) Health impact from use of untreated fecal sludge in agriculture

Fecal sludge is a good organic fertilizer and soil conditioner and therefore frequently used in agriculture. If the sludge is not adequately treated, pathogenic organisms contained in the sludge are dispersed on the fields. Here they can infect the farmers working on the fields as they permanently enter in contact with the contaminated soil and usually do not use protection measures. Bacteria and worm eggs may also attach to the plants and infect consumers if the crops are eaten raw and are not thoroughly washed.

Mitigation Measures

- Create appropriate awareness on preparation and utilization composts from such sources.
- Fecal sludge should always be treated prior to its use in agriculture. Treatment has then to provide sufficient pathogen reduction in the sludge to guarantee the safety of its use. The most resistant organisms in treatment are eggs of parasitic worms, in particular those of Ascaris lumbricoides. These eggs can only be destroyed by exposure to temperatures above 60°C, by desiccation at moisture contents lower than 10%, or by awaiting the natural die off after at least ½ year.
- Use thermophilic composting. If composting is well done (the substrate has the right composition, moisture content and aeration are optimized) the temperature in the heaps usually rises above 55°C for several days and all pathogens are destroyed.

- Storage of sludge over a period long enough to allow natural pathogens to die off (minimum 6 months) is the other possibility to disinfect sludge without using expensive technologies. However, in cities like Harar, area for storage of sludge for a long time is scarce.
- Sun drying of sludge can enhance the pathogen destruction during storage and therefore increase the security of this method. To enhance the effect of sun drying, construct a separate sun drying floor, preferably concrete and coat with black color or lay black plastic so that it could absorb much solar energy that increases the temperature and kills most of the pathogens.
- Avoid Use of untreated sludge for growing food crops: Agricultural use of fecal sludge for non-food crops can be possible without prior disinfecting treatment. In this way, the health risks for consumers can be excluded. However, the farmers handling the fecal sludge are still at risk. Therefore, it is important to not use untreated sludge for growing food crops. Particularly, abstain from irrigating edible vegetables & crops with untreated sludge water or percolated water from the drying Bed. Irrigating edible crops and vegetables with untreated sludge would directly result in the transmission of intestinal nematode and bacterial infections.
- Avoid Use of untreated sludge for growing cattle feed: Cattle grazing on pasture irrigated or contaminated fields with raw sludge could be heavily infected with the larval stage of the tapeworm, Taenia saginata (Cysticercus bovis). Therefore, avoid cattle from feeding contaminated grasses or grasses grown through irrigation with untreated fecal sludge;
- Hygienic Education and Treatment: Good personal hygiene breaks the direct contact routes by which pathogens are transmitted and the full impact of the measures described above will only be achieved if they are accompanied by efforts to improve hygiene. Hygienic education should be targeted on all aspects of hygiene and sanitation. Particularly, promote hand washing with soap after any contact with fecal sludge. If any person is proven to be infected, he should go to health facilities and consult health experts or health doctors.

c) Non-Pathogenic Health Risks

Chemical contamination is another potential health risk associated with fecal sludge. Contamination of soil and water can be easily possible by chemical constituents embodied in the Fecal sludge, particularly heavy metals. Eventually, these chemicals accumulate in soils and water and directly or indirectly affect human health through various routes or through the food chain. Further non-pathogen risks result from impurities of non-biodegradable origin such as Glass splinters or other sharp objects contained in the sludge. Such impurities can affect health by physically piercing or cutting those who could be involved in the manipulation of the waste. Also, health risks due to the attraction and proliferation of rodents and other disease carrying vectors are common features of improperly managed sludge treatment and dumping sites. Due to the smell, several rodents, flies, some birds (vultures), hyena, and dogs will be attracted to the area and increase the routes of contamination and disease transmission.

Mitigation Measures

- Avoid use of percolated liquid from the sludge dry bed for irrigation or any use before adequately treating and disinfecting;
- Create awareness among these people who are potentially exposed to the direct and indirect health impact of the sludge;
- Fence the area to prevent the entrance of dogs and other nocturnal animals; and
- Keep the area neat and attractive so that flies and rodents could not be attracted.

Impact on water and soil

The waste is treated inside properly designed units. Neither the sludge nor the drained water will be allowed to leave the FSTPs without proper treatment. For these reasons the impact of FSTPs is rated as very high positive for downstream areas and would minimize the existing uncontrolled discharge of wastewater into the water bodies. However, if there is leakage or overflow, the contamination risk will be high. The heavy metals in the treated wastewater may have potential human and environmental health impacts. The proposed FSTPs will have the capability to retain a significant amount of such contaminants, but they can just transfer from the liquid phase into the solid phase (sludge) in case of primary and secondary treatment. It is anticipated that most of the high molecular and non-polar petrochemicals can be efficiently retained in the proposed FSTPs. However, as some of them are persistent in both aerobic and anaerobic biodegradation processes of treatment, they can easily be accumulated in the sludge. This will prohibit the potential use of a large amount of sludge as a fertilizer. The impacts associated with heavy metals in sludge are adverse, irreversible, of high significance and long term.

Mitigation Measures

- Close monitoring of the facility to ensure it functions as planned, this involves monitoring of ground and surface waters in the surroundings of the FSTP, and
- Ensuring that the facility's effluent complies with the national effluent standards.

Impact on downstream and riverine flora: During the operation phase aquatic plants, riverine trees and shrubs will get better water for their growth that is free from toxic substances. By using treated water, it will be possible to develop riverside green areas and botanical gardens. This impact is beneficiary impact and rated as very high. However, if the treatment plant releases for some unforeseen reasons any untreated or practically treated waste effluent into downstream rivers, it would adversely affect the riverine and aquatic plants. This impact is less probable and rated to be low significance.

Mitigation measures

- Monitor the proper functioning of the treatment plant,
- Regularly check the effluent quality for its compliance with acceptable effluent discharge standard,
- Whenever the quality of effluent fails to meet the standard, stop discharging the effluent into receiving streams and rivers,
- As appropriate, promote integrated watershed management schemes around the WWTP and FSTP which enable to reduce any potential spillover of the liquid wastes into the natural environment.

Impacts on Fauna: The overall impact of properly operating the treatment plant on fauna is highly positive. However, if improperly treated wastewater is released to rivers, it may affect bird species resting near the rivers through contaminants production and reduce the necessary nutrients available for their growth and development due to eutrophication and hence birds‟ variety and number will reduce. Bird species and some domestic animals living in the surrounding of the FSTPs, such as horses, cows, and oxen, may be affected by the discharge of improperly treated wastewater and sludge production from the FSTPs. This problem is improbable, of low significance and of long-term duration in the sense that the risk is always there, but reversible.

Mitigation measure

- Ensure proper quality control of "treated" wastewater and sludge before releasing.

- Control any accidental spill of untreated or partially treated wastewater into the environment.
- Install a regular monitoring system on the quality of water discharged.

Occupational Safety: Hydrogen sulfide is a colorless, toxic gas with a characteristic rotten egg odor. It is considered a broad-spectrum poison, meaning it can poison several different systems in the body. Breathing very high levels of hydrogen sulfide can cause death within just a few breaths. Loss of consciousness can result after fewer than three breaths. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. The OSHA permissible exposure limits for hydrogen sulfide are 10 ppm (time-weighted average) and 15 ppm (short-term exposure limit). Other potential health and safety impacts include accidents and plant malfunctions. The probability and impact of the following events were categorized; Spills, Process Upset, Natural Hazards, Power Failures, Fires, Injury/Death. The impact is adverse, possible, reversible, of moderate significance, and long-term.

Mitigation measures

- Provision of adequate and appropriate Personal Protective Equipment (PPE) to workers.
- Regular checking of the adequacy of the facility, particularly when beds are (nearly) full and during the rainy season.
- Timely heightening of the bund surrounding the facility and / or increasing the bed capacity.
- Organize and ensure medical checkup for the relevant employees at least on every six months,

Gender and Gender Based Violence (GBV)/Sexual exploitation Abuse (SEA) Risks: During Operation phase there might be risk of Gender Based Violence (GBV)/ SEA at different infrastructure projects sites due to lack of knowledge. Hence, there is a potential that gender inequality might occur during the operation of the wastewater treatment plant and sewer line through unequal distribution of work, sexual harassment, discrimination against women, and unequal pay for women, among others.

Mitigation measures

- Ensure that women workers do not face GBV and sexual harassment,
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all workers including international workers if involved and subcontract workers, and
- Ensure equal pay for women and men for equal jobs.

8.6.1.3. Decommissioning phase

At the end of the design life of the FSTPs, HWSSA could upgrade or decommission the treatment plants. Most probably upgrading the system will be expected. If the treatment plants are decided to be decommissioned, impacts associated with disposal of contaminated soils from the treatment plant sites and solid waste generated from the demolishing of treatment plant structures would be the expected impacts. The following impacts are predicted assuming that the waste treatment plants will be decommissioned at the end of their design lifetime.

Air pollution: During the decommissioning, structures installed to aid the treatment plants will be dismantled and demolished, which will cause release of dust and other pollutants embedded in the demolished structures. This impact is temporary, local and low significance.

Proposed mitigation measures

- Systematically demolish structures considering reuse of materials for other use,
- Wet the materials before demolishing to suppress release of dust,
- Avoid burning of any material.

Impacts on Soil and Water Bodies: During the decommissioning phase, it would be necessary to remove contaminated soil from the treatment site and dispose at designated disposal sites. If the contaminated soil is dumped outside the designated area or outside the properly designed and constructed sanitary landfill, it would pollute the soil and water resources including ground water. However, the effect is of medium significance. However, decommissioning of the sites without availing a better substitute for the treatment of ever-increasing waste water would adversely affect the soil and water resources of the area and its downstream. Downstream reservoirs would be exposed for eutrophication and hyper eutrophication and fish and other aquatic organisms would be killed.

Proposed mitigation measures

- Remove all the contaminated soil from the treatment plant site and dispose of it at a designated waste disposal site or at sanitary landfill.
- Level the ground in such a way that it will be used for other purposes.
- Avail advanced wastewater treatment plants that technology of the time offers before decommissioning the one at hand.

Loss of Job Opportunity: During decommissioning of the treatment plants, previous jobs which were enjoyed by a large number of skilled and unskilled workers during the operation phase will not be continued. This loss of jobs would adversely affect workers and their families who were dependent on it for their livelihood.

Mitigation measures

- Give job priority in other related projects,
- Secure pension benefit if the age of the job loser is in the set range of pension,
- Organize, train and promote to establish their own small-scale enterprises through the facilitation of loan or financial support.
- Put in place another treatment plant before the decommissioning of this one to skew the lack of irrigation water at the downstream areas who were using treated effluent for irrigation purposes.

Health Impact: Expansion of HIV/AIDS and other STDIs is expected to be very low during the decommissioning phase of the project. Hence, except commonly used care and precautions no additional measures are required.

In addition, health impacts associated with dismantling of concrete structures and reinstatement of the area could occur. In addition, health impact from the removal process of contaminated sludge and soil could adversely affect the workers involved in demolishing works.

Mitigation measures

- Create appropriate awareness before starting the operation to the local community and local administration including (agriculture, water and energy and health offices as key stakeholders).
- Plan the decommissioning work ahead to avoid sudden stop of the treatment plant before completely treating the influent reached to the treatment plant.
- Provide appropriate PPE for the workers to be involved in decommissioning works.

Site Reclamation: The treatment plant sites should be reinstated after the plants stop their function. In order to make the site productive, properly planned reinstatement work needs to be conducted by the project owner or subcontracted entities. All the unwanted structures should be removed and disposed of at a designated waste disposal landfill. The reinstated area could be developed as a recreational site or assigned for other development purposes. Site reclamation work is very essential and highly positive. However, if the reinstatement work is not conducted properly, the area would be lost and the value of the land would be undermined.

Mitigation measures

- Properly reinstate the abandoned waste water treatment plant sites,
- After reinstatement, HWSSA could use the area for other purpose, or
- Develop the areas for recreational park or plant trees to increase the aesthetic value of the area or handover to the nearby community in consultation with their respective Woreda administrations so that they can develop what they think important for the community
- Integrate with the micro-watershed management plan.

Impact of Spoil Disposal: Spoil from demolishing of structures and scraped contaminated soil has to be dumped at a designated spoil dump site. If the spoil is simply dumped at an unauthorized area, it will adversely affect the environment and cause loss of valuable land. This impact is expected to be low since the amount of spoil materials to be generated during the decommission phase is not big in quantity.

Mitigation measures

- Properly collect all the debris generated while demolishing the structures and transport to the authorized disposal site,
- Scrap any contaminated soils from the demolished treatment site and safely collect and transport to the authorized waste disposal site or authorized sanitary fill site,
- Reinstate the treatment plant site including tree plantation unless the site is reserved for other construction purposes. Or integrate it with the micro-watershed management system in collaboration with the bureau of agriculture and natural resource.

Gender and Gender Based Violence/SH Risks: Gender and gender-based violation and sexual harassment is expected to be very low during the decommissioning phase of the project. This is because the number of workers expected to be involved in the decommissioning phase activities will be few.

Mitigation measures

- Provide appropriate awareness training to the staff and local communities.
- Provide and avail a separate sanitation facility for women and men,
- Provide women friendly occupational health and safety equipment and materials,
- Assign women in works that do not affect their biological condition,
- Ensure that women workers do not face GBV and sexual harassment,

- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all employees
- Ensure equal pay for women and men for equal jobs.

8.6.2. Impacts in WWTP subproject activities

8.6.2.1. Construction phase

Loss of land: Farm lands will be taken for construction of the proposed treatment plant at site. This will entail loss of livelihood sources of the farmers that are currently using the land. The number of households affected due to land acquisition for WWTP is two households as well as one business. Total area of farm land required for construction of the proposed treatment plant is 2.51ha and 10 trees to be removed. Therefore, all the PAPs at proposed WWTP sites need to be compensated ahead of mobilization and commencement of construction works. The significance of impact on land resources is rated to be high impact.

Mitigation measures

- Ensure that an appropriate resettlement action plan is conducted.
- Prepare an appropriate compensation plan for the affected households and implement it before the start of mobilization and construction works.
- Pay adequate compensation for loss of farmlands as per the new compensation law and regulation;
- Promote project affected households (PAHs) who have farming skills through irrigation system using the treated effluent water;
- Give priority for the project affected people for job opportunities created by the project;
- Give on job training to build capacity of PAPs so that they would fit for the available job rather than filtering out using education or training level requirements.
- Prepare and implement livelihood restoration program,
- Provide special support for vulnerable project affected people.
- HWWSA has to redress grievances raised by former land owners amicably.

Soil Compaction, and Erosion: Potential impacts on soils during the project construction phase include soil compaction, soil erosion, and soil contamination by hazardous substances. Among the activities that would affect the soil resources include site clearing, stripping of topsoil, excavation in soil, and loading of spoils and hauling of the same to disposal sites; these activities would involve operation of heavy-duty equipment and dump trucks. These undertakings have the potential to cause soil compaction as well as damages to soil structure and expose the soil to runoff water erosion. This will increase the risk of soil erosion and silt transport to rivers, streams and other watercourses.

In addition, there will be a risk of soil contamination from leakages of hazardous substances such as fuel and oils from equipment and vehicles. Soil pollution could also occur due to spillages of toxic substances (fuel, lubricants, and oil) resulting from poor handling of the substances especially during maintenance of machinery and vehicles can contaminate the soil. The impacts on soils are predicted to be moderate, localized and temporary without applying any mitigation measures.

Mitigation measures

- Limit land clearing and excavation works only to what is absolutely necessary and carry out the works in the dry season only to reduce exposure of soil to runoff water erosion.
- Careful removal and proper stockpiling of the topsoil removed from the WWTP sites, and re-using it for site restoration when construction works are finished.
- Reduce the time exposed surfaces or excavated soils remain bare following completion of works and implement restoration measures such as re-vegetating exposed areas as quickly as possible.
- Prevent environmental pollution by hazardous substances such as fuel, oil, cement sludge, and detergents through proper storage and handling of the substances. Among the precautions to be taken is that the Contractor shall install drip pans and fuel funnels at dispensing points of fuels and lubricants. Oil exchange should take place only in the pre-prepared workshop area. Washing of vehicles and machinery should only be conducted in the workshop area and never done in rivers and open soils.
- Use only existing roads to the extent possible and do not drive through farm lands or unpaved soil.
- Park all the vehicles and machineries at only designated parking areas.
- If a temporary access road is constructed, scarify and loosen the compacted soil when use for the access road is completed or no more needed.
- Construction sequencing, locating stockpiles away from watercourses, and disposing of grit, screenings, and sludge from existing lagoons in a landfill.

Risk of flooding, erosion, and landslide: During construction phase the damages from flooding, erosion and landslides in the surrounding infrastructure is less in its occurrence. The impact is less adverse, unlikely, reversible, of moderate significance, and short-term the following measures are implemented However, a precautionary action shall be taken before the start of the construction and site preparation works to avoid any unseen risks of flooding/erosion and landslide. The following activities shall be considered to avoid and protect the surrounding environment and social infrastructure from risks of flooding, erosion and landslides.

- Pre-preparation for the waste way/flood ways in the project construction and providing appropriate waterways or not blocking the natural waterways.
- Removing/clearing any materials including soils and other construction materials from the natural waterways.
- Providing awareness to the construction site manager and the employee on flood/erosion and landslide management as appropriate.

Impacts on Ambient Air Quality: Construction time air pollution would be one of the potential adverse impacts of the construction of the WWTPs. The emission sources in the construction phase are:

- Site clearance;
- Excavation and earthmoving activities;
- Dust emissions from handling and transportation of excavated materials, construction inputs, and auxiliary materials;
- Vehicular traffic movements on unpaved roads and earth moving activities;
- Gaseous emissions from vehicles and construction equipment; and
- Cutting and welding operations.

The impact on air quality is rated as moderate, localized, short-term and reversible without applying any mitigation measures.

Mitigation measures

- Implement measures that will reduce dust emission including regular spraying of water on unpaved access roads, exposed earth and any stockpiles on site, and where feasible, covering stockpiles on site with plastic materials;
- Use updated technology or modern equipment in excavation works that will minimize dust generation from earthen materials.
- Regular vehicle inspections and maintenance of equipment and vehicles to reduce excessive exhaust emissions;
- Minimize excavation and earth moving to only what is required for the specific nature and type of construction;
- Backfill of borrow pits and exposed excavation sites as soon as possible;
- Limit stockpiling of excavated topsoil to the maximum of 2m height;
- As much as possible use paved roads; and
- Limit speed of vehicles to 30km/hr on unpaved access roads esp. in the vicinity of sensitive areas (residential and business areas, social services, religious places).

Noise and Vibration Impact: Similar to air pollution, noise pollution is one of the adverse impacts of construction activities that involve operation of vehicles and heavy equipment. Especially, high noise levels above WHO and Ethiopian noise standards can cause health impact on recipients. The Ethiopian noise standard for day time at residential areas is 55 dB and for night time it is 45 dB. The long-term exposure to noise level above this standard at residential areas is expected to cause health impact.

The activities that are expected to generate significant noise and/or vibration include:

- Operation of the traffic that will deliver construction materials to and from the lay down areas and to site;
- Excavation works to construct the proposed wastewater treatment plants;
- Excavation and materials moving activities;
- Drilling of pipe jacking to install underground pipes;
- The activities involved in the production of concrete pipes; and
- Operation of quarries to extract rocks and production of the aggregates required for concrete works.

Considering the nature and extent of construction works and machineries involved, the noise impact of the project is rated as moderate, localized, short-term and reversible impact.

Mitigation Measures

- Carryout noisy construction activities in the vicinity of sensitive areas during normal working hours only;
- Use update technology or modern equipment in excavation works that will minimize noise emissions and vibration.
- Keep noise level near sensitive areas such as residential areas, health facilities, schools, religious sites and camps below the WHO and Ethiopian maximum allowable noise level standards;
- Provide ear protection equipment (earplugs) for workers in vicinity of noise emissions;
- Incorporate low-noise equipment in the design and/or locate such mechanical equipment in properly acoustically lined buildings or enclosures.

Pollution of Water Bodies: Pollution of water bodies could be anticipated during the construction phase due to inadequate handling and spillage of pollutants (like fuel, oils and paints). Release of solid and liquid wastes from construction camps has the potential to affect the surface and groundwater quality. In addition, spillages of hazardous substances such as fuel and oils from workshops may affect the water quality of nearby streams. Moreover, there will be increased silt loading of the Erer River downstream of the project sites due to increased soil erosion from areas cleared off vegetation cover and excavated for construction of the WWTPs.

The impact on surface water bodies before mitigation measures is anticipated to be moderate, while the impact on groundwater is rated to be low.

Mitigation Measures

- Perform excavation works and earth moving activities during the dry season only thereby minimizing erosion or transport of excavated materials by runoff water to water bodies;
- Prevent environmental pollution by hazardous substances such as oil, fuel, cement sludge, and detergents through proper storage and handling of these substances. Among the precautions to be taken is that the Contractor shall install drip pans and fuel funnels at dispensing points of fuels and lubricants. Oil exchange should take place only in the pre-prepared workshop area. Washing of vehicles and machinery should only be conducted in the workshop area and never done in rivers and open soils.
- Properly collect used oil and other chemicals and safely dispose of them through accredited oil reprocessing or disposal agency or in other manner approved by the Supervision Engineer.
- Adopt good site management that considers good pollution prevention measures such as locating storage areas and compounds away from watercourses, appropriate storage of fuel and materials, providing suitable facilities for workers, disposing of waste according to approved waste management plan.

Traffic Accident Risks: During construction, there will be increased traffic volume on the roads along the construction of WWTPs and commensurately this may result in increased traffic accident risks to the workers.

In general, the factors that could contribute to traffic accidents include:

- Low awareness of many drivers about traffic safety and traffic regulations and signs as well as lack of discipline;
- Lack of awareness of pedestrians about traffic about traffic safety and traffic regulations and signs;
- Presence of roadside poles, trees, ditches, and barriers that impair the visibility of the road.
- Absence of adequate zebra crossings, lack of parking areas, and bus stop arrangements.

Traffic accident risks during construction are anticipated to be moderate, short-term and direct adverse impacts.

Mitigation measures

- Develop and strictly implement and follow up a well-designed work program and traffic management plan (TMP) that would consider local conditions like the normal traffic and socio-economic conditions;
- Provide necessary information such as speed limits, hazard locations, sensitive sites (e.g., schools, religious areas, health centers, etc.) by putting appropriate signs and hazard markings;

- Assign traffic regulators or traffic police to control traffic flows at critical sections or periods where/when traffic safety is a significant issue.
- Provide awareness training for operators of equipment and construction vehicles in traffic safety measures;
- Establish speed limits and controls for construction vehicles and discipline for the drivers;
- Provide awareness education for the nearby residents in traffic safety measures at public meetings, social gatherings, schools, mosques and churches, etc.

Impacts on Vegetation and Flora: As the project impact areas (the WWTP sites) have little natural vegetation cover, construction of the proposed WWTPs is not expected to cause significant adverse impacts on vegetation and flora. However, there are neither indigenous nor exotic trees at the proposed wastewater treatment plant site.

The whole area is farmland used for cultivation of cereal crops dominantly Chat. There are also fruit trees mainly planted along the proposed sites like few mangos. Inventory of fruit trees showed that a total of 10 trees of various types were identified.
In general, the impact on flora during the construction phase is considered as minor, localized and temporary.

Mitigation measures

- Planting of appropriate trees and shrubs either indigenous or exotic species, which are friendly to the environment is proposed to compensate for the unavoidable losses during the construction.
- The selection of appropriate tree species and locations of planting shall only be done in consultation with the concerned Environmental Protection Office.
- Plant appropriate trees at the boundaries of the WWTPs to improve the aesthetic value of the areas, to absorb air pollutants from the air, and to serve as a windbreak as well as to increase the biodiversity of the area.
- Pay compensation for fruit trees as well as other issues.

Impact on Cultural, religious and Archaeological Sites: According to site observations, the proposed wastewater treatment plant sites are far from Harar Jogel, identified cultural and archaeological sites that are unlikely to be affected. However, the Project Contractor must take appropriate measures not to affect any chance to find or discover cultural or archaeological assets during the project construction and immediately report to the relevant Culture and Tourism Office.

Mitigation measures

If archaeological, cultural and religious resources are discovered during excavation for construction of the proposed WWTPs, the Contractor shall stop the construction at that specific location and report to the relevant Culture and Tourism Office. After the culture and tourism bureau takes necessary measures, construction work could be resumed.

Security risk: security risk is very low reversible and short-time and easily managed if proper consultation is conducted with the local people and PAP in the proposed project area. The security situation in Harar city is not critical concern for the WWTP construction. Accordingly, the WWTP security situation will not be a

serious problem. However, there might be few insecurity cases that need to take a precautionary action at various project phases. If the risks of the security raised, it might affect the construction of the WWTP infrastructure and may cause delay the project implementation, quality of construction and environmental problems.

Occupational Health and Safety Impact: Large scale construction work by its nature is a hazardous job, and hence it requires adopting appropriate occupational health and safety measures. There could be safety risks related to storage and use of hazardous chemicals and explosives. Moreover, there might be accidents of various nature to project workers. Furthermore, dust and exhaust emissions may affect the respiratory tract of project workers and local people exposed to such emissions. The impact on the health and safety of project workers, local people and users of the existing roads or paths affected during construction of WWTP is anticipated to be a moderate to high, short term to long term and direct adverse impact.

Mitigation measures

- The contractor to take maximum care and minimize accident risks by applying internationally accepted standards and recognized occupational health and safety guidelines;
- The contractor to take appropriate care in storing and using hazardous chemicals and explosives and provide training to workers in handling hazardous chemicals;
- Provide workers with protective clothing and equipment and create awareness on safety issues;
- Provide awareness creation among the local community on the hazardous nature of chemicals, explosives if it is used during the construction works.
- Provide first aid kits at workshops, construction worksites, and inside vehicles;
- Provided workers with appropriate PPE such as hand gloves, eye goggles, safety shoes, reflective vests, helmets, etc., based on their work condition as much as possible and strictly inspect proper use of the same throughout the construction phase;
- Avail equipped ambulance at construction site for any emergency cases;
- Conduct general medical check-ups for recruits and subsequently, conduct periodic medical check for all employees and take appropriate action and keep all records;
- Hung-up fire extinguisher bearing detailed information about its status at appropriate places;
- All personnel, vehicles, and machinery should be covered under an appropriate Insurance System;
- Carefully record and keep all incidence of injuries and accidents including date, time, and place of occurrence, level of injuries, resources damage, people injured/dead, major causes for the accident, etc.;
- Provide awareness creation on safety procedures and HIV/AIDS and avail healthcare services;
- Regularly spray water in dusty roads and work areas; and
- Introduce a traffic management plan with speed and traffic regulation through the neighboring areas by using appropriate traffic signs.

Exposure to HIV/AIDS and Other Sexually Transmitted Infections (STIs): As it is well-known, large scale construction project workers are considered to have a high potential for the spread of HIV/AIDS and other sexually transmitted infections partly because construction workers are mostly young, sexually active group of the population, mobile and are partly because they are forced to live in hotel rooms or in construction camps.

It is obvious that the presence of a large number of workforces at construction sites attracts sex workers to the area and also entices young girls from the locality to go into the business. Hence, this makes the project area highly vulnerable and easily exposed to the spread of STIs and HIV/AIDS transmitting factors.

Mitigation Measures

- Contractors should assign experienced HIV/AIDS sub consultants to handle the issues related to HIV/AIDS awareness and prevention.
- Launch awareness and education campaigns about HIV/AIDS among the construction workers and community to make them informed. This has to be done on the one hand by the contractor's sub consultant and on the other hand by the local health institutes along the project road targeting especially women and sex workers.
- Condoms shall be provided at a subsidized rate or for free to construction workers and health facilities must be supported with a supply of condoms. To prevent young and school age people, schools should include information campaigns and/or special courses.
- Town administrations and health offices, HIV/AIDS Prevention and Control Office, Elders, and NGOs operating in the area need to work jointly to create positive impact and bring major attitudinal and behavioral changes.

Gender and Gender Based Violence/SH Risks: Experiences from different infrastructure projects show that there is lack of knowledge and understanding on Gender issues and GBV/SH and SEA by Contractors, consultants and construction workers. Due to this, female construction workers could face difficulties in their work places, such as, GVB and sexual harassment. Hence, there is a potential that gender abuse might occur during the construction of the proposed wastewater treatment plant and sewer line construction through unequal distribution of work, sexual harassment, discrimination against women, and unequal pay for women, among others. This impact is rated to be low for the reason that contractors are expected to include gender specialists among the workforce to create awareness to prevent GBV/SH and SEA.

Mitigation measures

- Provide and avail a separate sanitation facility for women at construction camp,
- Provide women friendly safety equipment and materials,
- Assign women in works that do not affect their biological condition,
- Ensure that women construction workers do not face GBV and sexual harassment,
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all workers including international workers if involved and subcontract workers,
- Ensure equal pay for women and men for equal job,
- Assign gender specialist at construction site to aware and prevent GBV and sexual harassment.

8.6.2.2. Operation Phase

Odor at WWTP Sites and Surroundings: Presence of foul odors is one of the most offensive conditions to people living near or working in wastewater treatment plants. Odors in the wet stream usually are associated with characteristics of the wastewater received at the plant or the existence of an improper environment in biological treatment plants.

Though the proposed treatment technology is believed to not produce offensive odor, there could be some odor at and around the treatment plant site. Offensive odor may be released mainly due to:

- Septage Receiving Station – Significant odor is generated at this step;
- Screenings if piled onsite and intermittently buried or trucked offsite;
- Grit Removal Chambers – if the grit from this process is piled onsite, and intermittently buried or trucked off-site;
- Anaerobic digesters – Anaerobic digestion causes the release of hydrogen sulphide;
- Sludge handling systems.

Hydrogen sulphide gas, a major odor source in wastewater treatment systems, results from septic (anaerobic) conditions in the wastewater or sludge. Metallic sulphide compounds in the wastewater produce black color, indicating the presence of dissolved sulphide. Ammonia and organic odors are also common. Odors may initially develop and later become worse due to poor design, such as insufficient ventilation or excessive turbulence. Offensive odor could also be released when the system requires maintenance work or when the efficiency of the treatment plant declines for one or other reasons or when unexpected situations interrupt the treatment process.

This impact is rated as moderate significance, local in coverage and would persist throughout the operation phase.

Mitigation measures

- Aeration, chemical dosing and oxidation or pH adjustment is used to reduce odors in plant influent.
- Covering tanks or installation of exhaust hoods may be necessary.
- Operating equipment at optimum/design conditions,
- Adopt effective and efficient housekeeping procedures (regular cleaning of the grit and screenings).
- Regular facility maintenance and monitoring operational practices including process control and chemical treatment, continuous process of the operation
- operating especially the secondary treatment processes at optimum condition,
- Planting shrubs and trees along the periphery and providing adequate stack height to exhaust emissions
- Provide adequate buffer zone for treatment plant site, particularly along the major windward.
- Introduce leakage detection and control mechanisms.

Noise and Vibration: The main sources of noise during the operations phase would include pumping stations, diesel generators, flare, and vehicular traffic.

Mitigation measures

- Noise problems can be reduced to normally acceptable levels by incorporating low noise equipment in the design and/or locating such mechanical equipment in properly acoustically lined buildings or enclosures.

Impacts on Water Bodies: The waste is treated inside properly designed units. Neither the sludge nor the drained water will be allowed to leave the WWTPs without proper treatment. For these reasons the impact of WWTPs is rated as very high positive for downstream areas and would minimize the existing uncontrolled discharge of wastewater into the water bodies. However, if there is leakage or overflow, the contamination risk will be high.

The heavy metals in the treated wastewater may have potential human and environmental health impacts. The proposed WWTPs will have the capability to retain a significant amount of such contaminants, but they can just transfer from the liquid phase into the solid phase (sludge) in case of primary and secondary treatment.

It is anticipated that most of the high molecular and non-polar petrochemicals can be efficiently retained in the proposed WWTPs. However, as some of them are persistent in both aerobic and anaerobic biodegradation processes of treatment, they can easily be accumulated in the sludge. This will prohibit the potential use of a large amount of sludge as a fertilizer. The impacts associated with heavy metals in sludge are adverse, irreversible, of high significance and long term.

Mitigation measures

- If dried sludge contains heavy metals and polynuclear aromatic hydrocarbons, it should be properly disposed of in a sanitary landfill with provision of sufficient protection of groundwater contamination.
- Adequate care should be taken to avoid leakages in the plant and sewer lines. Permissible limits for wastewater parameters should be closely monitored.

Impact on Landscape and Aesthetic Value: Operation of treatment site is expected to alter the existing scenic view of the area. The proposed treatment plant is expected to be inscribed by green plants that would improve the overall aesthetic value of the area.

Mitigation measures

- Plant indigenous as well as exotic trees and shrubs with attractive flowers such as Phoenix canariensis, Jacaranda Mimosifolia, Spathoda campanulate and *Cordia africana*;
- Reinstate borrow and quarry sites used for the construction purposes and plant trees preferably indigenous trees.

Impact on downstream and riverine flora: During the operation phase aquatic plants, riverine trees and shrubs will get better water for their growth that is free from toxic substances. By using treated water, it will be possible to develop riverside green areas and botanical gardens. This impact is beneficiary impact and rated as very high. However, if the treatment plant releases for some unforeseen reasons any untreated or practically treated waste effluent into downstream rivers, it would adversely affect the riverine and aquatic plants. This impact is less probable and rated to be low significance.

Mitigation measures

- Monitor the proper functioning of the treatment plant,
- Regularly check the effluent quality for its compliance with acceptable effluent discharge standard,
- Whenever the quality of effluent fails to meet the standard, stop discharging the effluent into receiving streams and rivers.

Risk of flooding, erosion, and landslide: During construction phase the damages from flooding, erosion and landslides in the surrounding infrastructure is less in its occurrence, less adverse, unlikely, reversible, of moderate significance, and short-term. However, a precautionary action shall be taken before the start of the construction and site preparation works to avoid any unforeseen risks of flooding/erosion and landslide.

The following activities shall be considered to avoid and protect the surrounding environment and social infrastructure from risks of flooding, erosion and landslides.

- Pre-preparation for the waste way/flood ways in the project construction and providing appropriate waterways or not blocking the natural waterways.
- Removing/clearing any materials including soils and other construction materials from the natural waterways.
- Providing awareness to the construction site manager and the employee on flood/erosion and landslide management as appropriate.

Impacts on Fauna: The overall impact of properly operating the treatment plant on fauna is highly positive. However, if improperly treated wastewater is released to rivers, it may affect bird species resting near the rivers through contaminants production and reduce the necessary nutrients available for their growth and development due to eutrophication and hence birds‟ variety and number will reduce. Bird species and some domestic animals living in the vicinity of the WWTPs, such as horses, cows, and oxen, may be affected by the discharge of improperly treated wastewater and sludge production from the WWTPs. This problem is improbable, of low significance and of long-term duration in the sense that the risk is always there, but reversible.

Mitigation measure

- Ensure proper quality control of “treated” wastewater and sludge before releasing.
- Control any accidental spill of untreated or partially treated wastewater into the environment.

Health and Safety: There is a potentially significant public health hazard problem that is related to spills, leakage, and discharge of sewage or uncontrolled spreading of sludge. The impact is adverse, possible, reversible, of moderate significance, and long-term.

Hydrogen sulphide is a colorless, toxic gas with a characteristic rotten egg odor. It is considered a broad-spectrum poison, meaning it can poison several different systems in the body. Breathing very high levels of hydrogen sulphide can cause death within just a few breaths. Loss of consciousness can result in fewer than three breaths. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. The OSHA permissible exposure limits for hydrogen sulphide are 10 ppm (time-weighted average) and 15 ppm (short-term exposure limit). Other potential health and safety impacts include accidents and plant malfunctions. The probability and impact of the following events were categorized: Spills; Process Upset; Natural Hazards; Power Failures; and Fires. Operators could also be exposed to microorganisms in wastewater and sludge may incur risks of infection and disease. Workers at treatment plant sites could be exposed to diseases like Hepatitis A infection and parasites. Of course, a necessary defense against viral and bacterial infections is good personal hygiene.

Mitigation measures

- It could be mitigated through the provision of buffer zones between the plant and the rest of the auxiliary buildings and any other facilities as required by the WWTPs. Proper planning of the project operation and maintenance, proper implementation of the Environmental Management and Monitoring Plan is very important.

- Adherence to national rules and regulations and appropriate contract specifications and guidelines, adopting confined-space entry procedures can be used for mitigation.
- Appropriate buffer zones space/distance of more than 30 meters has already been maintained by the design. This will be enhanced through the implementation of green compounds.
- As a general practice, fences enclose the plant site or, at least, the treatment process areas to guard against vandalism and to protect the public.
- Many of the materials and chemicals used in the wastewater treatment are corrosive, poisonous, explosive, or flammable. Hence, handling of these materials requires proper precautions.
- Keep good personal hygiene.

Gender and Gender Based Violence (GBV)/Sexual exploitation Abuse (SEA) Risks: During Operation phase there might be risk of GBV/ SEA at different infrastructure projects sites due to lack of knowledge. Hence, there is a potential that gender inequality might occur during the operation of the wastewater treatment plant and sewer line through unequal distribution of work, sexual harassment, discrimination against women, and unequal pay for women, among others.

Mitigation measures

- Ensure that women workers do not face GBV and sexual harassment,
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all workers including international workers if involved and subcontract workers, and
- Ensure equal pay for women and men for equal jobs.

Security risk: security risk is very low, reversible and short-time and easily managed if proper consultation is conducted with the local people and PAP in the proposed project area. The security situation in Harar city is not critical concern for the WWTP construction. Accordingly, the WWTP security situation will not be a serious problem. However, there might be few insecurity cases that need to be given attention at various project phases. If the risks of the security raised, it might affect the construction of the WWTP infrastructure and may cause delay of the project, affect quality of construction and cause environmental problems.

8.6.2.3. Decommissioning phase

At the end of the design life of the WWTPs, HWSSA could upgrade or decommission the treatment plants. Most probably upgrading the system will be expected. During upgrading, there would be some environmental and social impacts. These impacts would be assessed based on the TOR to be prepared by the client. If the treatment plants are decided to be decommissioned, impacts associated with disposal of contaminated soils from the treatment plant sites and solid waste generated from the demolishing of treatment plant structures would be the expected impacts. The following impacts are predicted assuming that the waste treatment plants will be decommissioned at the end of their design lifetime.

Air pollution: During the decommissioning, structures installed to aid the treatment plants will be dismantled and demolished, which will cause release of dust and other pollutants embedded in the demolished structures. This impact is temporary, local and of low significance.

Proposed mitigation measures

- Systematically demolish structures considering reuse of materials for other use,
- Wet the materials before demolishing to suppress release of dust,
- Avoid burning of material.

Impacts on Soil and Water Bodies: During the decommissioning phase, it would be necessary to remove contaminated soil from the treatment site and dispose at designated disposal sites. If the contaminated soil is dumped outside the designated area or outside the properly designed and constructed sanitary landfill, it would pollute the soil and water resources including ground water. However, the effect is of medium significance. However, decommissioning of the WWTPs without availing a better substitute for the treatment of ever-increasing wastewater would adversely affect the soil and water resources of the area and its downstream. Downstream reservoirs would be exposed for eutrophication and hyper eutrophication and fish and other aquatic organisms would be killed.

Proposed mitigation measures

- Remove all the contaminated soil from the treatment plant site and dispose of it at a designated waste disposal site or at sanitary landfill.
- Level the ground in such a way that it will be used for other purposes.
- Avail advanced waste water treatment plants that technology of the time offers before decommissioning the one at hand.

Loss of Job Opportunity: During decommissioning of the wastewater treatment plants, previous jobs which were enjoyed by a large number of skilled and unskilled workers during the operation phase will not be continued. This loss of jobs would adversely affect workers and their families who were dependent on it for their livelihood.

Mitigation measures

- Give job priority in other related projects,
- Secure pension benefit if the age of the job loser is in the set range of pension,
- Organize, train and promote to establish their own small-scale enterprises through the facilitation of loan or financial support.
- Put in place another treatment plant before the decommissioning of this one to skew the lack of irrigation water at the downstream areas who were using treated effluent for irrigation purposes.

Health Impact: Expansion of HIV/AIDS and other STDIs is expected to be very low during the decommissioning phase of the project. Hence, except commonly used care and precautions no additional measures are required.

In addition, health impacts associated with dismantling of concrete structures and reinstatement of the area could occur. In addition, health impact from the removal process of contaminated sludge and soil could adversely affect the workers involved in demolishing works.

Mitigation measures

- Plan the decommissioning work ahead to avoid sudden stop of the treatment plant before completely treating the influent reached to the treatment plant.
- Provide appropriate PPE for the workers to be involved in decommissioning works.

Site Reclamation: The treatment plant sites should be reinstated after the plants stop their function. In order to make the site productive, properly planned reinstatement work needs to be conducted by the project owner or subcontracted entities. All the unwanted structures should be removed and disposed of at a designated waste disposal landfill. The reinstated area could be developed as a recreational site or assigned for other development purposes. Site reclamation work is very essential and highly positive. However, if the reinstatement work is not conducted properly, the area would be lost and the value of the land would be undermined.

Mitigation measures

- Properly reinstate the abandoned waste water treatment plant sites,
- After reinstatement, HWSSA could use the area for other purpose, or
- Develop the areas for recreational park or plant trees to increase the aesthetic value of the area or handover to the nearby community in consultation with their respective Woreda administrations so that they can develop what they think important for the community.

Impact of Spoil Disposal: Spoil from demolishing of structures and scraped contaminated soil has to be dumped at a designated spoil dump site. If the spoil is simply dumped at an unauthorized area, it will adversely affect the environment and cause loss of valuable land. This impact is expected to be low since the amount of spoil materials to be generated during the decommission phase is not big in quantity.

Mitigation measures

- Properly collect all the debris generated while demolishing the structures and transport to the authorized disposal site,
- Scrap any contaminated soils from the demolished treatment site and safely collect and transport to the authorized waste disposal site or authorized sanitary fill site,
- Reinstate the treatment plant site including tree plantation unless the site is reserved for other construction purposes.

Gender and Gender Based Violence/SH Risks: Gender and gender-based violation and sexual harassment is expected to be very low during the decommissioning phase of the project. This is because the number of workers expected to be involved in the decommissioning phase activities will be few.

Mitigation measures

- Provide and avail a separate sanitation facility for women and men,
- Provide women friendly occupational health and safety equipment and materials,
- Assign women in works that do not affect their biological condition,
- Ensure that women workers do not face GBV and sexual harassment,
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all employees.
- Ensure equal pay for women and men for equal job.

8.6.3. Impacts in Sewer trunk lines subproject activities

8.6.3.1. Construction phase

Impacts on Ambient Air Quality: During construction, vehicular movements along the access roads to the construction sites could cause dust emission from unpaved access roads. In addition, land clearing and excavation works during construction of storages and camp sites may cause dust emission unless managed properly. Emissions from vehicles that transport machinery, equipment, construction materials, and workers to the site will occur.

The impact on air quality is rated as moderate, localized, short-term and reversible without applying any mitigation measures

Mitigation measures

- Spray water on dusty and unpaved access roads and dusty working areas to suppress dust emission,
- Limit speed of vehicles to 30 km/hr when they are driven through residential areas and on unpaved roads.

Noise and/or Vibration Impact: During the construction phase movement of construction machineries may produce high noise levels that could affect the health of people residing at or nearby the project sites. The noise level set by Ethiopian standard is 45dB for the residential area during the night and 55 dB during the daytime should be maintained. Exposure for a long time above these standard values may cause adverse impacts on the health of exposed people.

During the excavation of trench for laying sewer lines, vibration from the excavation process could occur and may adversely affect the stability of the nearby structures and may cause cracks on walls. Such impacts are expected to be low because the main sewer lines are proposed to be laid along existing road sides. Any impact related to vibration caused by the contractor's activities should be displayed by the contractor. The contract agreement needs to specify that any impact occurring due to the contractor's activities should be the responsibility of the contractor.

But considering the nature and extent of construction works and machinery involved, the noise impact of the project is rated as moderate, localized, short-term and reversible impact.

Mitigation measures

- Screen out noisy machineries,
- Do not mobilize noisy machineries during the rest time, particularly during the night time.
- Do not allow noise levels above 45dB at night and 55dB during the day time at residential areas.
- Contractor should conduct situation assessment before starting excavation works where there are sensitive buildings, fences and houses near the sewer line excavation sites,
- Use machineries that will not produce heavy vibration,
- If the houses, fences and buildings are cracked or damaged by the excavation work, the contractor has to fix the damage or pay compensation for the PAPs
- Include a clause in the contract document that clearly indicates the contractor's responsibility to fix any damage caused by his activities.

Risk of flooding, erosion, and landslide: Damages from flooding, erosion and landslides in the surrounding infrastructure is less in its occurrence, less adverse, unlikely, reversible, of moderate significance, and short-

term. However, a precautionary action shall be taken before the start of the construction and site preparation works to avoid any unforeseen risks of flooding/erosion and landslide. The following activities shall be considered to avoid and protect the surrounding environment and social infrastructure from risks of flooding, erosion and landslides.

- Pre-preparation for the waste way/flood ways in the project construction and providing appropriate waterways or not blocking the natural waterways.
- Removing/clearing any materials including soils and other construction materials from the natural waterways.
- Providing awareness to the construction site manager and the employee on flood/erosion and landslide management as appropriate.

Impact on Road Infrastructures: It is estimated that construction of the proposed sewer lines will affect road structures. This impact though it is temporary, would cause loss of money, time and energy to reconstruct it. Hence the impact on road infrastructure is rated to be high.

Mitigation measures

- Reinstate the affected sections of roads as soon as the construction works are completed;
- At the intersections of major roads with traffic volume, schedule construction of sewer lines for night when there is no or minimal traffic flows,
- Inform road users in advance about the scheduled construction works along or across existing roads and blockage of the roads and advise them to use alternative routes;
- Get support and advice from traffic police before starting construction of sewer lines along or across existing roads.
- Work in cooperation with the Roads Authority, Road Traffic Management Agency and Police Commission or concerned police office to obtain technical/professional and material support from the offices for traffic management activities at project sites.

Impact on Public Utilities: There are many public utility lines including water supply pipelines, telecommunication lines, electric distribution lines and storm drain lines in the corridor of the proposed sewer lines either buried under the ground or installed on the surface. In order to minimize/avoid damages of those utility lines, in most cases sewer lines are designed to follow the carriageway of existing roads and stream/river banks where there are less or no utility lines. Yet there are many utility lines that are crossed by the sewer lines and these are potentially affected during construction of the sewage lines.

There are few public utilities and infrastructure that will be affected during sewer line installation periods. These are cutting of Asphalt (example around Red Cross, mobile gas station and Ras Makonnen Condominiums-close to Silase church) and cobblestones roads while circling Jogel compound and other sites, and few meters of terrace/Veranda of the private business compound (Mobil gas station roundabout). The cost of each utility and infrastructure needs further cost analysis and detailed RAP. It was observed there will be no complete displacement of peoples due to construction of sewer line/truck lines.

Accidental damages of utility lines during construction of the sewer lines could result in unexpected interruption of utility services to users. This situation can lead to complaints from the users as well as the

service providers. In addition, it can result in wastage of resources or environmental pollution if damages were caused to water lines or sewer lines respectively.

Impacts on public utility networks during construction are estimated to be moderate, temporary and direct adverse impacts. The impact is expected to be moderate because during the design and design review stages, all possible measures will be taken to avoid or minimize damages to utility lines.

Mitigation measures

- During design the route of major utility lines were considered and sewer lines are placed away from the utility lines to the extent possible to avoid or minimize impacts on them, However, in case underground utility lines were encountered during construction, efforts shall be made by the project contractor in consultation with the supervising consultant to shift the sewer line as much as possible thereby to avoiding or minimizing impacts on the utility lines;
- Work in close coordination with utility agencies to relocate the potentially affected utility lines as quickly as possible prior to commencement of construction works at the particular locations,
- Re-connect the utility lines that have been disconnected before or during the beginning of the sewer line works as soon as the works have been completed;
- In case of unavoidable interruption of utility services due to the construction works, announce to users in advance of disturbing any services by construction of sewer lines and fix it as quick as possible; and
- At locations where primary utility lines intersect with sewer lines, adopting pipe jacking/drilling technique to install the envisaged sewer lines without causing damages to the utility lines.

Obstruction of Access for Human and Animals: Besides the anticipated impact on traffic flow, obstruction of access to humans and animals is expected during the construction of sewer lines. Depending on the contractor's management and efficiency of the construction activity, the impact duration can vary from a few days to months. When the construction completion delays, the significance of adverse impacts would increase and would affect the normal movement of people and animals. Unless the excavated trenches for laying sewer pipe lines are refilled as quickly as possible, the trenches would create obstruction for movement and could cause accidents to people esp. children and disabled people. For these reasons, obstruction of access during the construction phase is rated to high significance.

Mitigation measures

- Properly plan excavation works and stick to the plan and execute the work as per the plan,
- As soon as the excavation work is completed at a given site, immediately put sewer pipes and backfill the soil,
- Remove any leftover spoil materials from the excavation works and dispose at designated spoil disposal location only,
- If the excavated trench is not refilled immediately, provide temporary crossing structures so that people and animals can cross smoothly and safely.

Impacts on Road Traffic and Safety: construction of certain segments of the proposed sewer lines is expected to cause partial or total blockage of vehicular traffic flows along several link, internal or community access roads, which mostly have narrow widths of up to 6m. This impact is associated with excavation of trenches at the centerline or one side of those roads to install concrete pipes for construction

of sewer liens. This situation would cause damages to part of the carriageway while the project equipment on site would cause additional impediment to movements of vehicular traffic and pedestrians.

The impacts on road traffic flows and safety during construction are predicted to be moderate to major, short-term and direct adverse impacts.

Mitigation measures

Potential impacts on road traffic and safety will be reduced by implementing appropriate traffic management plan and a number of other mitigation measures including the following:

- Schedule construction works outside of the time of high traffic flows for sections of sewer lines that cross or run along operational roads;
- Post proper and clearly visible signs, barricades, reflectors at appropriate locations so that road users are aware of the active construction works/site and take precautions while driving through or at nearby project operational areas;
- Delineate or fence work zone esp. risky areas and provide sufficient information about the site through posting of clearly visible signs;
- Set and enforce speed limits for vehicular traffic by putting appropriate signals and assigning traffic regulators around project operational area;
- Minimize the duration of construction works through arrangement of capable and professionally trustful contractors and supervision consultants;
- Reinstate the damaged sections of roads as soon as the construction works have been completed;
- Applying pipe jacking/drilling technique to install sewer lines without damaging roads, and causing disruption to normal traffic flows.
- Inform road users in advance about the scheduled construction works along or across existing roads and blockage of the roads and advise them to use alternative routes;
- Get support and advice from traffic police before starting construction of sewer lines along or across existing roads.
- Work in cooperation with the Harar Road Construction Office, Traffic Management Agency and concerned police offices to obtain technical/professional and material support from the offices for traffic management activities at project sites.

Impact on Cultural, Religious and Archaeological Sites: The proposed sewer line networking will be developed inside the Harar Jogel which is one of the world heritages sites. Since this sewer line is relatively small in size, which can be flexible, installation of the trunk line is expected to be carried out using manual labor and simple equipment instead of heavy equipment.

Therefore, installation of the mentioned trunk line is not likely to cause impacts on the above-indicated sites of cultural value. Hence, the Project Contractor must take appropriate measures not to affect any cultural or archaeological assets during the project construction and immediately report to the relevant Culture and Tourism Office.

Mitigation measures

- Use of chance find procedures by the contractor. See Appendix for" Chance Find" procedures.

Impact on water bodies: During the construction phase, there may be a potential risk of water pollution due to spillage of fuel or oil into a water course or improper disposal of used oils. In addition, water quality can be impacted due to increased turbidity resulting from increased soil erosion from surfaces disturbed during cutting in soil and earthmoving activities.

The impact on surface water bodies before mitigation measures is anticipated to be moderate, while the impact on groundwater is rated to be low.

Mitigation Measures

- Locating Contractor's site facilities (camps, fuel storage etc.) at sufficient distance (minimum of 1km) from water bodies,
- Perform excavation works and earth moving activities during the dry season only thereby minimizing erosion or transport of excavated materials by runoff water to water bodies;
- Prevent environmental pollution by hazardous substances such as oil, fuel, cement sludge, and detergents through proper storage and handling of these substances. Among the precautions to be taken is that the Contractor shall install drip pans and fuel funnels at dispensing points of fuels and lubricants. Oil exchange should take place only in the pre-prepared workshop area. Washing of vehicles and machinery should only be conducted in the workshop area and never done in rivers and open soils.
- Properly collect used oil and other chemicals and safely dispose of them through accredited oil reprocessing or disposal agency or in other manner approved by the Supervision Engineer.
- Adopt good site management that considers good pollution prevention measures such as locating storage areas and compounds away from watercourses, appropriate storage of fuel and materials, providing suitable facilities for workers, disposing of waste according to approved waste management plan.

Occupational Health and Safety Impact: Large scale construction work by its nature is a hazardous job, and hence it requires adopting appropriate occupational health and safety measures. Construction of certain sections of the sewer lines will take place along existing roads that are usually busy with vehicular traffic as well as pedestrians. This situation could result in traffic accidents. There will also be a risk of falling in trenches excavated for burying concrete pipes for construction of sewer lines. In addition, there could be safety risks related to storage and use of hazardous chemicals and explosives. Moreover, there might be accidents of various nature to project workers.

Furthermore, dust and exhaust emissions may affect the respiratory tract of project workers and local people exposed to such emissions. The impact on the health and safety of project workers, local people and users of the existing roads or paths affected during construction of sewer lines is anticipated to be a moderate to high, short term to long term and direct adverse impact.

Mitigation measures

- The contractor to take maximum care and minimize accident risks by applying internationally accepted standards and recognized occupational health and safety guidelines;
- The contractor to take appropriate care in storing and using hazardous chemicals and explosives and provide training to workers in handling hazardous chemicals;
- Provide workers with protective clothing and equipment and create awareness on safety issues;

- Provide awareness creation among the local community on the hazardous nature of chemicals, explosives if it is used during the construction works.
- Provide first aid kits at workshops, construction worksites, and inside vehicles;
- Provided workers with appropriate PPE such as hand gloves, eye goggles, safety shoes, reflective vests, helmets, etc., based on their work condition as much as possible and strictly inspect proper use of the same throughout the construction phase;
- Avail equipped ambulance at construction site for any emergency cases;
- Conduct general medical check-ups for recruits and subsequently, conduct periodic medical check for all employees and take appropriate action and keep all records;
- Hung-up fire extinguisher bearing detailed information about its status at appropriate places;
- All personnel, vehicles, and machinery should be covered under an appropriate Insurance System;
- Carefully record and keep all incidence of injuries and accidents including date, time, and place of occurrence, level of injuries, resources damage, people injured/dead, major causes for the accident, etc.;
- Provide awareness creation on safety procedures and HIV/AIDS and avail healthcare services;
- Regularly spray water in dusty roads and work areas; and
- Introduce a traffic management plan with speed and traffic regulation through the neighboring areas by using appropriate traffic signs.

Exposure to HIV/AIDS and Other Sexually Transmitted Infections (STIs): It is obvious that the presence of a large number of workforces at construction sites attracts sex workers to the area and also entices young girls from the locality to go into the business. Hence, this makes the project area highly vulnerable and easily exposed to the spread of STIs and HIV/AIDS transmitting factors. This impact is expected to be high during construction for the reason that the number of workforces is expected to be large and duration of the phase is medium.

Mitigation Measures

- Contractors should assign experienced HIV/AIDS sub consultants to handle the issues related to HIV/AIDS awareness and prevention starting from the construction phase.
- Launch awareness and education campaigns about HIV/AIDS starting from construction phase,
- Condoms shall be provided at a subsidized rate or for free to workers and health facilities must be supported with a supply of condoms. To prevent young and school age people, schools should include information campaigns and/or special courses.
- Town administrations and health offices, HIV/AIDS Prevention and Control Office, Elders, and NGOs operating in the area need to work jointly to create positive impact and bring major attitudinal and behavioral changes.

Gender and Gender Based Violence/SH Risks: Due to lack of awareness and understanding on gender and GVB by Contractor and also by the construction workers, female workers could face difficulties in their work places, such as, GVB and sexual harassment. Hence, there is a potential that gender abuse might occur during the construction phase. However, this impact is rated to be low for the reason that contractor are expected to include gender specialists among the workforce to create awareness to prevent GBV/SH and SEA.

Mitigation measures

- Provide and avail a separate sanitation facility for women at temporary camp and office,
- Provide women friendly safety equipment and materials,
- Assign women in works that do not affect their biological condition,
- Ensure that women construction workers do not face GBV and sexual harassment,
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all workers including international workers if involved and subcontract workers,
- Ensure equal pay for women and men for equal job,
- Assign gender specialist at construction site to aware and prevent GBV and sexual harassment starting from mobilization phase.

Security risk: security risk is very low, reversible and short-time and easily managed if proper consultation is conducted with the local people and PAP in the proposed project area. The security situation in Harar city is not critical concern for the sewer line installation construction. However, there might be few insecurity cases that need to take a precautionary action. If the risks of the security raised, it might affect the construction of the sewer line, and may cause delay of the project, affect quality of construction and cause environmental problems if not properly functioned.

8.6.3.2. Operation Phase

Odor: Nonetheless low impact is expected to air quality when the sewer line is in operation phase, obnoxious odor may be released when the sewer pipelines leaked or broken as well as overflow through manholes due to internal blockage of the sewer pipes by solid materials thrown into the septic tanks or sewer lines by careless people.

Mitigation measures

Regularly inspect sewer lines and manholes to quickly fix if there is leakage or breakage of pipes and opening of manhole covers.

Risk of flooding, erosion, landslide: Damages from flooding, erosion and landslides in the surrounding infrastructure is less in its occurrence, impact is less adverse, unlikely, reversible, of moderate significance, and short-term. However, a precautionary action shall be taken before the start of the construction and site preparation works to avoid any unseen risks of flooding/erosion and landslide. The following activities shall be considered to avoid and protect the surrounding environment and social infrastructure from risks of flooding, erosion and landslides.

- Pre-preparation for the **waste way**/flood ways in the project construction and providing appropriate waterways or not blocking the natural waterways.
- Removing/clearing any materials including soils and other construction materials from the natural waterways.
- Providing awareness to the construction site manager and the employee on flood/erosion and landslide management as appropriate.

Security risk: security risk is very low, reversible and short-time and easily managed if proper consultation is conducted with the local people and PAP in the proposed project area. It is not critical concern for the sewer line installation. However, there might be few insecurity cases that need to take a precautionary

action at various project phases including construction. If the risks of the security raised, it might affect the construction of the sewer line installation infrastructure and may cause delay the project, quality of construction and environmental problems.

8.6.3.3. Decommissioning Phase

The activities in this phase includes digging the area surrounding the trunk line, removing of soil and concrete covers, demolishing manholes, dismantling of the sewer line, backfilling and transportation of recyclable and reusable (pipes) materials.

Air pollution: The impact is due to sewage odor, dust, and vehicular emission. The odor effect will be felt more by the workers. The noise pollution is due to the limited vehicular movement transporting tools, dismantled pipes, etc. The impact is of very short duration and insignificant.

Proposed mitigation measures

- Systematically demolish structures considering reuse of materials for other use,
- Wet the materials before demolishing to suppress release of dust.

Soil and Water bodies: Spillage of sewage waste is the main cause of soil contamination. The impact will be if spillage of sewage is washed or leached to water bodies.

Proposed mitigation measures

- Remove all the contaminated soil and dispose of it at a designated waste disposal site or at a sanitary landfill.
- Level the ground in such a way that it will be used for other purposes

Health and safety: Minor accidents, dust and other emissions are possible risks to workers. The impacts are of low significance, adverse, and temporary. In addition, contamination by sewage is possible. This may cause disease to the workers and the residents nearby. This impact is of high significance.

Mitigation measures

- Avoiding spillage of sewage
- Provide appropriate PPE for the workers to be involved in decommissioning works

Exposure to HIV/AIDS and Other Sexually Transmitted Infections (STIs): Expansion of HIV/AIDS and other STDIs is expected to be very low during the decommissioning phase of the project. Hence, except commonly used care and precautions no additional measures are required.

Gender and Gender Based Violence/SH Risks: Gender and gender-based violation and sexual harassment is expected to be very low during the decommissioning phase of the project. This is because the number of workers expected to be involved in the decommissioning phase activities will be few.

Mitigation measures

- Provide and avail a separate sanitation facility for women and men,
- Provide women friendly occupational health and safety equipment and materials,
- Assign women in works that do not affect their biological condition,
- Ensure that women workers do not face GBV and sexual harassment,
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment,

- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all employees
- Ensure equal pay for women and men for equal jobs.

9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Environmental and social management plan is the key to ensure that the environmental quality of the project area does not deteriorate due to the implementation of the proposed development subprojects. ESMP is generally used as the basis for establishing the environmental behavior that the proposed project requires during its various stages including the decommissioning phase.

The ESMP for the proposed project consists of a set of mitigation and institutional measures to be taken during the implementation and operation phases to eliminate the adverse environmental and social impacts identified and predicted in the previous stages, offset them, or reduce them to acceptable levels. The plan will also include the actions needed to implement these measures. The ESMP identifies feasible and cost-effective measures that will reduce potentially significant adverse environmental impacts to acceptable levels. The plan includes compensatory measures if mitigation measures are not feasible, cost effective, or sufficient. Mitigation plan is a key to ensure that the environmental qualities of the area will not deteriorate due to the implementation of the subprojects. The mitigation plan covers all aspects of implementation of the project in its different phases related to environment and health.

The purpose of the ESMP is to describe in detail the necessary actions to be taken to ensure that serious impacts will be mitigated. Where impacts cannot be mitigated, compensation will be paid, as well as any environmental enhancement activity that will be required to offset, where possible, those impacts that cannot be mitigated.

This ESMP provides a schedule for the implementation of recommended mitigation activities. Table 20 presents identified impact mitigation measures proposed in the ESIA, for the implementation arrangements, including responsibilities for implementation, the time frame, and the budgetary implications. The ESMP identifies measures to address any potential environmental and socio-economic impacts that might occur during the implementation of the sewer line installation, WWTP and FSTP.

The objective of this ESMP is to ensure the integration of environmental and social requirements and proposed mitigation and monitoring measures into the construction contractor's obligations. The ESMP shall be fully integrated into the construction activities, hereby addressing the responsibilities of the construction contractor (the contractor), the Engineer, and the Employer. Furthermore, an ESMP has been developed for impacts resulting from the operational phase, which shall be full integration in operational activities. Responding adequately to the nature of the envisaged sewer line installation, WWTP, and FSTP construction the ESMP is referring to the following issues:

- Environmental and Social Mitigation Measures during Construction,
- Environmental and Social Mitigation Measures during Operation,
- Environmental and Social Quality Monitoring during Construction,
- Environmental and Social Quality Monitoring during Operation, and
- Obligations, roles, and responsibilities amongst concerned parties.

Due to the long-term life of the intervention facilities and related components, a decommissioning assessment will be undertaken at least 1 year before the process for any of the components commences, following a notice to decommission. The decommissioning process will be guided by a comprehensive

decommissioning plan developed through the decommissioning audit process. However, the following features will need to be decommissioned upon completion of the works;

i. Contractor's camp and installations that will need to be removed without compromising on the safety and general welfare of the immediate residents. Special care to be given to associated wastes and dust emitted in the process,
ii. Materials stores that will comprise fresh materials and used items. Each category will be moved safely out of site ensuring minimal or no impacts to the related environment and social setting,
iii. Wastes and debris holding sites will be cleared with maximum re-use of the debris either on surfacing the passageways or other grounds such as schools and church compounds.
iv. Under normal circumstances the project will be maintained and sometimes rehabilitated. During rehabilitation, a new ESIA can be instituted or an environmental management plan can be prepared depending on the degree of rehabilitation.

The following table shows environmental and social management plans for proposed works for, FSTP WWTP, and sewer line networking.

Table 19: Environmental and Social Management Plan for Proposed Subprojects

Sr. No	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
				Implementation	Supervision		
	Construction Phase						
1.	Loss of land under various uses	The temporary and permanent acquisition or obtaining of land for onsite works shall be carried out in accordance with the RAP and entitled framework for the project. It shall be ensured that all RAP activities are reasonably completed before the construction activity starts. All grievances of the RAPs will be reasonably redressed, in accordance with the RAP implementation mechanism suggested for the project.	• FSTP • WWTP	HWSSA	HWSSA, GRM, Regional land administration	Before start of construction	Given elsewhere
2.	Impacts on soils (soil erosion, compaction& contamination)	• Execution of earthworks during the dry season and refilling the excavated soil soon. • Restricting land clearing to what is absolutely necessary. • -Refilling the trenches and other excavated/exposed places soon, covering with topsoil, leveling to surrounding landscape and replanting with appropriate grass, shrub and/or tree species as soon as possible. • Ploughing the compacted areas to restore and improve infiltration into the soil and reduce water runoff. • -Provision of well-designed and constructed culverts and side ditches for the access roads to minimize potential erosion particularly during the construction of WWTP. FSTP and Sewer lines.	• In all sub project development.	Construction Contractor	HWSSA/ Supervisory Consultant SC, Regional land administration and bureau of agriculture	Throughout Construction phase	Part of the construction and supervision cost to be covered by the contractor and consultant
3.	Air & noise pollution due to dust, exhaust emissions and noise generated by the	• Follow good site practices incorporating appropriate mitigation measures to reduce dust, nuisance noise and vehicle emissions. • Limit traffic speeds to minimize dust and spray water regularly on the dusty roads. • Use water spray systems as appropriate to prevent high dust emissions from the construction activities.	• FSTP • WWTP • Trunk line networking • The sewer line construction	Construction Contractor	Supervisory Consultant (SC), HEPA	Throughout Construction phase	Included in the contract for the Contractor & SC

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
	construction activities	• Service the exhaust systems of all vehicles and equipment on regular basis to ensure that noise and exhaust emissions are kept to appropriate levels. • All machinery and plants should conform to the applicable noise standards, and plants should be provided with effective noise mufflers. • Construction workers should adhere to health and safety standards pertaining to noise, such as wearing ear protection when operating plant or heavy machinery.					
4.	Vibration	• Conduct situation assessment before starting excavation works where there are sensitive buildings, fences and houses near the sewer line excavation sites, • Use machineries that will not produce heavy vibration, • If the houses, fences and buildings are cracked or damaged by the excavation work, the contractor has to fix the damage or pay compensation for the PAPs • Include a clause in the contract document that clearly indicates the contractor's responsibility to fix any damage caused by his activities.	• Trunk line networking	Construction Contractor	HWSSA/ Supervisory Consultant SC, HEPA	Before start of construction	Part of the construction and supervision cost to be covered by the contractor and consultant
5.	Impact on water bodies	• Minimize land clearance and earthworks to the imperative area necessary for the project works. • Minimize soil erosion through refilling the trenches and other excavated/exposed places soon, and establishing protective cover such as appropriate grasses and other vegetation • Locating storage areas and compounds away from watercourses. • Appropriate storage of fuel and materials • Providing suitable facilities for workers, • Avoid disposal of used oils in the field, by strictly controlling & documenting waste disposal process	• FSTP • WWTP	Construction Contractor	Supervisory Consultant, HWSSA, Harar water and energy	Throughout construction phase	Part of Contractor's Contract
6.	Impact on	• Work in close coordination with utility offices.	• Trunk line	HWSSA	-HWSSA/SC,	Before	Part of the

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
	Infrastructure and Utilities	• Restrict damages to the area absolutely necessary for laying the trunk lines, • Inform public in advance before disturbing any services by the construction of sewer lines and fix as quick as possible. • Where there is no other option and it requires temporary or permanent relocation of utility lines, relocate it as quickly as possible.	Networks	Utility owning offices Construction Contractor	ethio-telecom, ethio-electric and road authority	and during construction	construction and supervision cost to be covered by the contractor and consultant -Part of the RAP cost
7.	Impact on archaeological & cultural heritage sites	• Jogel is a historical site that needs a maximum care during Sewer line installation and construction • Use manual labor in construction works to extent possible • No known archaeological sites are expected on-site, however, if encountered the Contractor/ Supervising Consultant is to inform the local authority for further action. • Apply the chance finds procedure	• Trunk line Networks	Construction Contractor	Supervisory Consultant, Harar culture and tourism	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant
8.	Impact on agricultural lands, and other uses	• Pay adequate compensation for loss of farmlands as per the new compensation law and regulation; • Implement the construction works during the dry season, • Reinstate the affected areas to productive state. • Plough the compacted areas to prepare the surface for growing crops or pasture grasses. • Plant appropriate trees at the boundaries of the FSTP and WWTPs sites to improve the aesthetic value of the areas, to absorb air pollutants from the air, and to serve as a wind break.	• FSTP • WWTP	HWSSA Construction Contractor	Supervisory consultant Region and Woreda rural land officers, regional land administration	Prior to and during construction works	Part of the RAP cost Part of the construction and supervision cost to be covered by the contractor and consultant
9.	Impact on flora and fauna	• Demarcation and fencing off the construction areas prohibit poaching and killing of wildlife by the workforce backfilling of trenches and other excavated areas and grading to the natural topography. • Awareness creation for the project personnel. • Compensatory plantation program at least saplings of 10 seedlings for each tree felled (staggered to follow Civil Works) including 3 years of	• In all subproject activities	Construction Contractor	Supervisory Consultant Wildlife, HEPA, Agriculture and natural resource department	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		maintenance					
10.	Obstruction of access to human and animals during Excavation	• Appropriate warning signs shall be placed in areas where accidents are expected to occur, • Prohibit the construction sites for the people and animals. • For sections with critical space limitation, schedule construction for night and reserve a half-way for traffic mobility while working on the other half-way, • Provide detours where possible. • Collect and dump excess spoils as quickly as possible.	• Trunk line Networks development	Construction Contractor	Supervisory Consultant, City municipality and HWSSA	During construction	-Part of the construction and supervision cost to be covered by the contractor and consultant
11.	Occupational Health and safety	• Provision of protective wearing (gloves, gum boots, overalls and helmets), • Provide temporary toilets and bathrooms for the construction workers at the work sites • Provide onsite first aid kit accessible by the workers on need, • Contractor to provide a Healthy and Safety Plan prior to the commencement of works to be approved by the resident engineer. • There should be safety policy clearly displayed on the site. • Appropriate signs must be erected on the site to warn workers and visitors • Ensuring that the drivers and machine operators hired to work on the site are qualified.	• In all subproject development	Construction Contractor	Supervisory Consultant, labor and skill, Health office	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant
12.	Traffic	• Only essential traffic will be allowed to the project area during traffic peak hours when traffic is a problem. • Sensitization of the nearby communities about the increased traffic. • Materials hauling to tipping site and vice versa will be carried out during off peak periods during the day. • Alternatively finished materials as such ready-made concrete, precast elements or pre-	• In all subproject development	Construction Contractor	Supervisory Consultant Traffic management office	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		assembled materials can be delivered at site when the need arises.					
13.	Health impact (HIV AIDS/ STDs)	• Awareness raising and education programs about HIV/AIDS and other STIs • Ensure the availability of first-aid services for all site personnel, including the staff of the Engineer and visitors • Provide clinics with all necessary medication in camp. • Support nearby health facilities and work in cooperation with nearby health offices	• In all subproject	Contractor & Health Office	Supervisory Consultant & Health office HWSSA	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant
14.	Gender Equity, GBV/SEA and Sexual Harassment	• Create awareness among workers on gender and sexual harassment issues; • Issue a strong Workers Code of Conduct (CoC) that sufficiently addresses gender and sexual harassment issues; • Take appropriate actions on workers violating the CoC; • Provide women workers with appropriate type of safety equipment and protective materials; • Include in the employment contract for the construction workers that any GBV and sexual harassment against women workers will lead to administrative measures and also legal actions; • The Contractor is required to design gender core labor standards and employment and contract procedures; and also design gender responsive workers‟ manuals; • The Contractor should ensure that women are paid equal pay for equal work with their male counterparts. • Provision of gender disaggregated bathing, cloth changing areas & sanitation facilities • Include gender expert among the consultant's team to follow up Gender mainstreaming activities.	• In all subproject	Contractor	Supervisory Consultant -Office of Women, Children and Youth Affairs.	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant
	Operation Phase						

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
1.	Ambient air quality (Odor/obnoxious smell from the TPs and from open manholes) [including emission of biogas-CH4, CO2, H2S etc. into the atmosphere]	• Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills. • Covering swampy parts of the settlement and drying beds with a layer of earth or sand. • Aerate, adjust chemical dosing and oxidation or pH to reduce odor from plant influents. • Cover tanks or installation of exhaust hoods. • Operate equipment at optimum/design conditions, • Adopt effective and efficient housekeeping procedures (regular cleaning of the grit and screenings). • Regular facility maintenance and monitoring operational practices including process control and chemical treatment, continuous process of the operation • Operate especially the secondary treatment processes at optimum condition, • Plant layers of shrubs and trees along the periphery and provide adequate stack height to exhaust emissions. • Provide adequate buffer zone, particularly along the major windward. • Proper monitoring of the digestor and implementing GAS reduction technologies as indicated.	• FSTP • WWTP	- Facility manager	HWSSA, HEPA	Throughout the operation phase	Part of the FSTP/ WWTPs operation budget
2.	Soil	Dispose sludge with dangerous substances only in a designated sanitary landfill. Avoid the disposal of hazardous wastes at various stages of the project lifetime.	• FSTP • WWTP	HWSSA Facility manager	HWSSA HEPA, Land administration, agriculture and natural resources	Throughout the entire operation phase	Part of the FSTP/ WWTPs operation budget
3.	Water Bodies	• Seal the foundation of treatment plants and influence areas with concrete lining to avoid leakage of wastewater through permeable soils and weathered and fractured rocks into the	• FSTP • WWTP	HWSSA Facility manager	HWSSA Water and energy, local community	During design & Construction	Part of the FSTP/ WWTPs operation budget

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		groundwater system • All pipe work and fittings should be a class A rating more than the maximum pressure attained in service including any surge pressure. • Dispose the sludge with dangerous substances in designated landfill • Close monitoring of the facility to ensure it functions as planned, this involves monitoring of ground and surface waters in the surroundings of the TP, and ensuring that the facility's effluent complies with the national effluent standards				and operation of TPs	
4.	Fauna & Flora	• Proper quality control of "treated" wastewater and sludge before releasing • Develop green belt around the treatment plant sites to compensate trees removed during the construction phase and to increase the aesthetic view of the treatment plant sites as well as to sequestrate GHG gasses and to absorb bad odor and noise pollution.	• FSTP • WWTP	WWTP Quality Control	HWSSA, Env. Prot. Office, Wildlife, agriculture	Throughout the operation phase	Part of the FSTP/ WWTPs operation budget
5.	Safety	• Adherence to national rules and regulations • Appropriate warning signs shall be placed in areas where accidents are expected to occur • Provision and use of protective wears • Strict prohibition of operation of equipment by unauthorized personnel • Operators shall be provided with regular medical check-up and safety training	• FSTP • WWTP	HWSSA Facility manager	HWSSA, Labor and Skill, HEPA	Throughout the entire operation phase	Part of the FSTP/ WWTPs operation budget
6.	Impact on Aesthetic view	• Plant trees around the treatment plant and buffer zone • Keep the buffer zone and open areas within the treatment plant neat all the time	• FSTP • WWTP	HWSSA Facility manager	HWSSA, culture and tourism, local community	Throughout the entire operation phase	Part of the FSTP/ WWTPs operation budget
7.	Health Impact on people handling the sludge	• Careful handling of fecal sludge: • Use of protection clothes such as gloves and masks and a good hygiene (washing hands after work etc.). • Most important is that workers be aware of the	• FSTP • WWTP	HWSSA Facility manager	HWSSA Local community	Throughout the entire operation phase	Part of the FSTP/ WWTPs operation budget

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		nature of the health risks to which they are exposed and that they know how to protect themselves. • Training of staff and targeted information may therefore be the most successful measures. • HWSSA dealing with sludge should introduce rules for use of protection by their staff and care should be taken to enforce those rules					
8.	Health impact from use of untreated fecal sludge in agriculture	• Fecal sludge should always be treated prior to its use in agriculture. Treatment has then to provide sufficient pathogen reduction in the sludge to guarantee the safety of its use. The most resistant organisms in treatment are eggs of parasitic worms, in particular those of Ascaris lumbricoides. • These eggs can only be destroyed by exposure to temperatures above 60°C, by desiccation at moisture contents lower than 10%, or by awaiting the natural die off after at least ½ year. • Use thermophilic composting. If composting is well done (the substrate has the right composition, moisture • Content and aeration are optimized) the temperature in the heaps usually rises above 55°C for several days and all pathogens are destroyed. • Storage of sludge over a period long enough to allow natural pathogen die off (minimum 6 months) is the other possibility to disinfect sludge without using expensive technologies. However, in Harar for storage of sludge for long time might scarce. • Sun drying of sludge can enhance the pathogen destruction during storage and therefore increase the security of this method. To enhance the effect of sun • Drying, construct a separate sun drying floor, preferably concrete and coat with black color or lay black plastic so that it could absorb much solar energy that increases the temperature and kills	• FSTP • WWTP	HWSSA Facility manager	HWSSA, Agriculture and natural resources, local community	Throughout the entire operation phase	Part of the FSTP/ WWTPs operation budget

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		most of the pathogens. • Avoid Use of untreated sludge for growing food crops • Hygienic Education and Treatment • Avoid use of percolated liquid from the sludge dry bed for irrigation or any use before adequately treating and disinfecting; • Create awareness among these people who are potentially exposed to the direct and indirect health impact of the sludge; • Fence the area to prevent the entrance of dogs and other nocturnal animals; and • Keep the area neat and attractive so that flies and rodents could not be attracted.					
9.	Gender and Gender Based Violence/SH/ SEA Risks	• Provide and avail a separate sanitation facility for women and men at the treatment plants, • Provide women friendly safety equipment and materials, • Assign women in works that do not affect their biological condition, • Ensure that women workers do not face GBV and sexual harassment, • Incorporate measures to be taken against those workers who commit GBV and sexual harassment, • Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all employees • Ensure equal pay for women and men for equal job.	• FSTP • WWTP	HWSSA Facility manager	HWSSA, Women and youth, Health office and local community	Throughout the entire operation phase	Part of the FSTP/ WWTPs operation budget
10.	Risk of flooding, erosion, landslide	• Implementation of flood, erosion and landslide protection measures • Provide sufficient awareness raising training and emergency management strategies • Regular monitoring and taking the necessary action against the wrong activities that exposed the site the risks	• WWTP, FSTP, Sewer line	Sofi natural resource office, regional agriculture, Facility manager	HWSSA, Bureau of agriculture and natural resource, Harari EPA and land administratio	Construction and operation	Part of the FSTP/ WWTPs/sewer line operation budget

Sr.	Issue/ Main impacts	Proposed Mitigation measures	Subproject Component	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
					n		
11.	Security risk	• Abide to the rule of working procedure and respect the benefits of the locals • Create awareness about the important of the project and collaborate with the local peoples • Collaborate with the security services and police at local and regional level	• WWTP, FSCT, Sewer line	Harari police and security office	HWSSA, regional peace and security office and police including the local people	All phases	Part of the FSTP/ WWTPs/sewer line operation budget

10. ENVIRONMENTAL AND SOCIAL MONITORING PLAN

Environmental and social monitoring is applicable to the Sewer line networking, WWTP and FSTP. The updated ESIA will contain an ESMP to manage all identified impacts and enhance identified benefits. Issues that will be monitored during the development of the provincial water supply and sanitation utilities, capacity development and project management include:

- The development of utility environmental management plans, water quality monitoring plans, occupational health and safety plans, leakage monitoring plans, energy, and chemical management plans.
- The development of a Gender Policy for the sector which will be based on gender assessment and intensive consultations with relevant stakeholders.
- Strengthening of the environmental and social safeguards of the HWSSA and other relevant stakeholders.
- Capacity building of the existing environmental and social safeguards of the HWSSA through increased the capacity of the Environmental Health and Safety Safeguards expert, social mobilization initiatives and effective communication.
- Inclusive hygiene promotion.

The Environmental and Social Impact Assessment requires the developer to prepare and undertake a monitoring plan and regular auditing. Therefore, this is a supplement ESIA according to the aforementioned regulation. The objectives of environmental monitoring upon executing activities are to:

- Monitor the effective implementation during the construction and operation phases of: proposed mitigation measures.
- Confirm compliance with environmental, public health, and safety legislation/regulations during construction.
- Control the risks and ecological/social impacts.
- Ensure best practices management as a commitment for continuous improvement in environmental performance.
- Provide environmental information to community/stakeholders.
- Provide early warning signals on potential environmental degradation for appropriate actions to be taken to prevent or minimize environmental consequences. The system shall acquaint itself with national climate change adaptation and mitigation strategies including climate resilient WASH policy and emission reduction from waste.

Recommendations for monitoring responsibilities and estimated costs have been included under the implementation of the ESMP. Table 21 below provides the monitoring indicators and monitoring activities at various phases. Monitoring plan: As the Executing Agency, HWSSA will bear overall responsibility for monitoring the implementation of the ESMP. In addition the relevant Harar town stakeholders shall be engaged as deemed necessary.

However, for day-to-day monitoring, it is expected that the supervising Consultant will hold the Contractor(s) accountable for all ESMP implementation requirements, including implementation of all approval conditions as stated in the approval. It is expected that regional and Federal EPA, as the agency responsible for the environment will also conduct oversight monitoring on ESMP implementation as

appropriate. The WB, on the other hand, will conduct routine bi-annual supervision missions to ensure all activities, including ESMP implementation is on track. The individual ESIAs and ESMPs have identified areas for monitoring by the Authority, the contractor(s), and the Supervising Consultant(s). Key aspects of the monitoring program will include, among others; water quality monitoring, especially with respect to effluent discharged from WWTP and FSTP and receiving waters, sound operation of wastewater and fecal sludge treatment plants, reinstatement of areas disturbed by earthworks, occupational health and safety aspects, and related construction-related accidents and protection of workers as well as the status of PAPs livelihood programs after compensation.

The key verifiable indicators which will be used to monitor the impacts will mainly include pollution (noise, soil, air-dust, waste), erosion and loss of resources, occupational and health safety, land use change, the spread and occurrence of diseases (Pathogenic and nonpathogenic-HIVE/AIDS, COVID-19 etc.) and accidents as well as job creation.

Table 20: Environmental and Social Monitoring Plan

S/N	Issue/ Subproject main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement	Budget Estimate (Birr)
	CONSTRUCTION PHASE					
1.	Land acquisition and impacts on land use	• Area of land under various uses expropriated for the project activities categorizing as temporary or permanent land acquisition. • Number of households affected due to land expropriation or damages of properties and no. of HHs paid commensurate compensation. • Area of land reinstated to productive state after completion of woks, i.e., land area affected due to temporary activities.	Supervisory Consultant (SC) & Harar Environmental Protection Office Agriculture and natural resource department, land administration and the community	As required	Cadastral survey/ measurement, registration of HHs during inventory of properties affected	Included in SC's contract Part of the budget of the regulatory body
2.	Impacts on soils and landscape quality	• Evolution of erosion signs (sheet erosion, gully formation, siltation in nearby water courses or drains, erosion into the downstream farms). • Length/ area of trenches and other exposed surfaces properly refilled, leveled to surrounding landscape and replanted with appropriate plant species following completion of woks to minimize soil erosion, slope failures or to improve the quality of the affected landscape. • Area of land affected due to exploitation of quarries and borrow sites and area reinstated after exploitation has ceased. • Incidence of soil pollution by spillage of hazardous substances	As above	Minimum twice per month during the construction contract period	Visual observation, area measurement	450,000
3.	Impacts on water quality; sedimentation, pollution by hazardous substances and wastes generated	• Location/distance of the contractor's site facilities (camps, storage site, workshop/garage) from water bodies (min. of 1km is recommended). • Provision of a secondary containment system for fuel storage facilities. • Proper handling of hazardous substances (oil, fuel) and disposal system used oils. • Incidence of water pollution by spillage of hazardous substances.	SC HWSSA HEPA, Water and energy bureau/office	As required	Visual observations, water quality analysis in laboratory or using field kits	Part of the project supervision cost Part of the budget of the regulatory body 400,000

S/N	Issue/ Subproject main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement	Budget Estimate (Birr)
	by the project	• Sediment load/turbidity of nearby streams & rivers.				
4.	Impacts on air quality	• Dust levels or incidence of dust pollution in the construction areas & rate of application of dust suppressants (spraying water) on dusty areas. • Use of dust collectors or water spray systems in stone crushing or batch plant operations. • Noise and exhaust emission levels generated by construction vehicles and equipment. • No. of complaints due to nuisance noise or dust pollution.	Supervisory Consultant (SC), HWSSA, HEPA	As required	Visual observations & Recording of case	200,000
5.	Impacts on flora and fauna	• Area of vegetation cleared for the project within the boundary of the project site • Number of trees/land area replanted and survived to • Replace the trees removed and the plantation affected. • Number of wild animals killed during the construction works.	-Supervisory Consultant -Wildlife Enterprise -Harar EPA -Culture and tourism	As required during the contract period	Visual observations, surface area measurement & Recording of trees affected & Animal fatalities	500,000
6.	Impact on agricultural lands	• Area of agricultural land affected. • Area of affected agricultural land reinstated after completion of works. • Number of households paid compensation for loss of their farmlands.	-Supervisory Consultant -Harar EPA -Agriculture and natural resources and the local community	As required	Surface area measurement & recordings of compensation committee	Included in the contract for SC 350,000
7.	Impacts on cultural heritage sites	• Construction methods used for works nearby Jogel • Any impacts or potential risks to the sensitive sites.	-Supervisory Consultant, -Culture & Tourism Office and local community	every day during the works nearby the Harar Jogel sites	Visual observations	250,000
8.	Impacts on infrastructures	• Length or area of infrastructures (roads, drainage facilities & pedestrian walkways) damaged due to the project activities, • Length or area of damaged infrastructures reinstated to original state after completion of the works	Supervisory Consultant, Ethio-telecom and electricity Municipality	As required	Visual observations & measurement	350,000

S/N	Issue/ Subproject main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement	Budget Estimate (Birr)
9.	Impacts on traffic mobility and safety issues	• Number of construction sites provided with appropriate signals to minimize obstruction to traffic mobility & safety hazards. • Number of risky construction sites prohibited for the people and animals or fenced to minimize safety risks. • Timely collection and disposal of excess spoil materials availability of adequate number of protective kits and whether workers are using protective kit	Supervisory Consultant, Municipality Traffic management office	Once per day or as required construction works are ongoing at road crossings or pedestrian access	Visual observations	150,000
10.	Impacts on public health	Number of awareness raising and education campaigns about HIV/AIDS given for project workers and vulnerable local population.	SC, Health Office, local community	As required	Communication with the implementers & Interviewing the vulnerable groups	450,000
11.	Gender and Gender Based Violence/SH/SEA Risks	• GBV Action Plan • Mitigation plan for GBV occurring at the community level as a result of project implementation • Discrete GBV reporting pathway • Number of GBV cases at the community level that receive survivor-centered referral and care • Number of trainings on GBV	Contractor(s) & Supervision GBV/gender Expert, Health office	during the contract period	-Discrete GBV reporting pathway -Training participant list on GBV	250,000
	OPERATION PHASE					
1.	Odor	Intensity of odor and spatial coverage around the treatment plant and nearby surrounding areas	HEPA, HWSSA, local community	Whenever there is compliant from the affected people	Visual observations & Recording of cases	150,000
2.	Sludge water treatment & disposal of the cake	• Proper functioning of the installed drying lagoons as thickeners for sludge water. • Proper disposal & control of the dewatered sludge at the properly located dumping/landfill site	HWSSA HEPA, Health office, local community	As required	Visual observation	Part of HWSSA operation cost and cost of regulatory body (350,000)
3.	Water quality	Physical-chemical indicators such as PH, turbidity,	HWSSA, Water and	Twice/yr for	Sampling & testing	Part of HWSSA

S/N	Issue/ Subproject main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement	Budget Estimate (Birr)
	monitoring	total dissolved solids, electrical conductivity, nutrients (nitrate, phosphate), residual chlorine, etc. Bacteriological indicators such as Escherchia coli (E. coli) – an indicator of fecal contamination	Energy, Health office	nearby source water intake), once per month for treated water at WTP	in laboratory or using field kits with portable incubators for microbiological testing	operation cost and cost of regulatory body (450,000)
4.	Public health & Environmental sanitation issues	• Number or availability of adequate drainage facilities for disposal of wastewater. • Wastewater disposal situation by the local people using available facilities	Municipality HWSSA Health office, local community	As required	Visual observations, review of drainage plans & documents	Part of the regular budget of regulatory Body (350,000)
5.	Operation and Maintenance of the TP System	• Adequacy of implementation of preventive and all unscheduled/ emergency maintenance work • Periodic housekeeping of the system, • Allocation of human and financial resources for the preventive and unscheduled maintenance	HWSSA, Water and Energy Office/Bureau	Monthly	Performance reports	Part of HWSSA regular maintenance cost (250,000)
6.		Total of stakeholders' monitoring costs				4,900,000

10.1. Institutions Responsible for the Implementation of ESMP

It is recognized that effective environmental and social management will only be achieved only if it is undertaken as a fully integrated part of the overall project management. In order to effectively implement a comprehensive ESMP, the coordination of efforts of the various Federal and Regional Agencies is necessary with a concept comprising three sub-components, namely:

- A clear framework of inter-organizational coordination measures;
- A specific information strategy; and
- A tailored capacity building program.

The key organizations for the implementation of the ESMP during the construction phase are Construction contractor; Supervision consultant; HWSSA and the bureau of Health. The actual physical implementation works are carried out mostly at this stage.

Mitigation measures proposed for socio-economic issues like compensation to damaged properties, lost/ degraded plots of land should be handled by a committee, composed of representatives of all stakeholders, including HWSSA, local government administrative organs, NGOs, and the affected group.

Environmental issues during the operation phase of the sub projects shall be handled by the owner of the infrastructure (HWSSA), the relevant department of HWSSA and Harar Environmental Protection Authority. The staff of HWSSA from the relevant department or a designated unit in the department should acquire basic knowledge of the environmental management activities to effectively assume the responsibility. Training of personnel is, therefore, essential. Accordingly, HESSA shall fill the environmental and social safeguard expert positions prior to initiation of the subproject physical activities.

Regarding HWSSA, it has an established position for an Environmental Officer and positions for sociologists which will provide oversight on the implementation of the environment (ESIA) and social (RAP) components of the UWSSP program. It is further planned that oversight on environmental issues will further be supplemented through the recruitment of additional environment expertise by the contractor and supervising consultant once the project commences. It is assumed that the E&S expert will be hired during project operation. However, currently the city utility assigned an expert to look after all E&S issues of the current project.

The responsibility for implementing the ESMP of the supplement ESIA during construction will be of the contractor, HWSSA, and the bureau of Health. The regional environmental authority is also mandated for the follow up and compliance monitoring of the E&S related aspects. During the operation and maintenance of the Sewer lines installation, WWTP, and FSTP, the responsibility will be mainly under the HWSSA with the regulatory role of Health Bureau and Environmental Protection Authority. The main responsible institutions for implementation, coordination and administration of the Environmental management plan set out in this ESMP is summarized in table 22 below.

Table 21: Institutions Responsible for the Implementation of ESMP

Stakeholders	Roles and Responsibilities
Harar Town Administration	Allocate Budget to the Client project office and monitor its utilization; Monitor the implementation and operation of the proposed project; Coordinate the activities of the Cities and Woreda Administrations for the successful implementation of the project including the resettlement process.
HWSSA	Responsible for the implementation of the proposed project as proponent; Coordinate the efforts of the different organizations responsible for the management and monitoring plan; Follow-up the rehabilitation of the affected part
HEPA	Provide technical advice about environmental protection during the project implementation; Audit the project from an environmental protection point of view
MoWE and Regional Bureau	Monitoring 2nd UWSSP development activity in the region
Harar Health Bureau	Monitoring public health and occupational health and safety Awareness promotion about health, sanitation and hygiene
The World Bank	Finance the project as per the agreement Monitor and evaluate the progress of the work and check the correct use of the allocated fund Demand work progress reports on the implementation of the project
Contractor	The Contractor has to prepare Construction's ESMP and implement it. To this end the contractor should mobilize environmentalist, sociologist, health and safety expert and gender specialist at construction site.
Supervision Consultant	The Consultant's EHS team in cooperation with HWSSA social and environmental impact assessment & monitoring and evaluation sub process will conduct regular monitoring of the project activities and give advice and instruction to the Contractor to perform environmental, social and health and safety issues as per the ESIA, ESMP and financers environmental, social and health safeguard guidelines.

10.2. Training and Capacity Building

The environmental sustainability of the sewer line networking, WWTP and FSTP sub-projects are dependent on the capacity of institutions at all levels (i. e. staffing, training, and other necessary support services) to carry out the associated ESMP implementation work. Thus, it is vital that HWSSA allocate sufficient resources for training and capacity building. These efforts will not only benefit the authorities but will also build local capacity to undertake other development initiatives.

The institutional capacity to implement, enforce and monitor the subproject environment and health was assessed based on the technical, financial, and physical capability of the Community leaders and HWSSA. They are responsible for carrying out ESMP and monitoring activities. The findings indicated that these different groups have different capacity building and training needs in terms of raised awareness, sensitization to the issues, and detailed technical training. The HWSSA is found to have a limited institutional capacity to implement the provisions of the ESMP, especially regarding the WWTP and FSTP management sub-project. Although general awareness on environmental issues exists within the steering committee stakeholders and HWSSA professional staff, focused training and capacity building would enhance the ESMP implementation capacity substantially on their part.

It is recommended that capacity building interventions including training should take place at all levels i.e., CBOs, relevant government officials, community leaders, HWSSA management team. The HWSSA

environmental and social experts should be exposed to short-term training in the management of environmental and social issues. The training program for various role-players will include an orientation program on the ESMP, Environmental Assessment Processes, Participatory Methodologies, and Project Management and monitoring. The training on ESMP may be integrated with the social framework and another related training program for cost-effectiveness.

Training programs are developed and shall be delivered to the project developer for the implementation of environmental safeguards of the proposed subprojects. Following training needs assessment; specific and tailored training will be developed and agreed upon by developers and key stakeholders for implementation of safeguards in the course of project implementation.

- Target groups for the training: HWSSA Civil and Sanitary Engineers, Environmental, Community development Officers, Contractors and community representatives in the project area.
- Training schedule: at least 1 month before construction starts.
- In service and refresher Training: The training programs proposed below will take place every six months on a yearly basis and their content updated and adapted to implementation issues. Training frequency and the content will be reviewed in the course of the sub project's operation lifespan depending on needs or technical requirements.

Table 22: Training Programs for Capacity Building and Associated Costs

Target Group	**WSSE Staff, MoWE (regional water and energy bureau), Health officers, EPA, and other relevant stakeholders**	**Cost estimation in birr**
Training title	Environmental supervision, monitoring and reporting	750,000
Participants	Environmental staff and social workers of WSSE and other stakeholders who are going to engaged in the management and monitoring (total 15 participants)	
Training frequency	Soon after project effectiveness but at least 2 weeks -1 month before the start of subprojects work. In-service /refresher training during operation.	
Time	Training twice a year, and then to be repeated on a yearly basis until year three of implementation.	
Training content	• Public health and safety of FSTP management. • Social mitigations for environmental projects • Community participation in environmental supervision monitoring • Supervision of contractors, Subcontractors, and community representatives in the implementation of environmental supervision • Risk assessment, response, and control • Awareness creation •	
Responsibilities	WSSE with the facilitation from the MoWE environmental and social safeguard specialists	
Training title	Implementation of mitigation measures	650,000
Participants	On-site construction management staff; environmental and social safeguard staffs; village/group authorities.	
Duration	After bidding, and determining based on needs	
Time	3 days of training for contractors and 2 days of training for others, to be repeated twice a year on an annual basis depending on needs	
Training Content	• Overview of environmental monitoring • Requirements of environmental monitoring • Role and responsibilities of contractors • Scope and methods of environmental monitoring	

Target Group	WSSE Staff, MoWE (regional water and energy bureau), Health officers, EPA, and other relevant stakeholders	Cost estimation in birr
	• Response and risk control • Propagate monitoring forms and guide how to fill in the forms and risk report • Preparation and submission of reports • Other areas to be determined • Grievance handling and reporting • GBV reporting	
Responsibilities	HWSSE with facilitation from the MoWE	
Target groups	Local communities/ stakeholders, WSSE, Health Officers and, municipality, urban infrastructure technicians/ Engineers/EPA	
Training title	Environmental sanitation and safety	750,000
Participants	Representatives of community and/or worker leaders (as appropriate) (up to 30 participants)	
Training frequency	Bi-yearly or every 6 months for the first two years	
Time	One-day presentation and one-day on-the job training twice a year, to be repeated on as needed basis	
Training content	• Environmental and Social safeguards • Safety and health issues • Environmental Pollution risks and management • Management of environmental safety and sanitation on work sites • Mitigation measures at construction sites • Procedures to deal with emergency situations • Other areas to be determined	
Responsibilities	WSSE and another relevant stakeholder	
Subtotal 1		2,150,000
Training title	Customer service management:	550,000
Course content	Marketing (promotion), customer handling, record keeping and reporting, financial management	
Target group	Head of Core Process, Fecal Sludge (FS) Emptying Customer Service Team Leader, Head of Finance Accountant (up to 20 participants)	
Responsibilities	WSSE and another relevant stakeholder	
Training title	Safety measures for proper FS emptying	700,000
Course content	Training on risks, safety measures and good practices for FS sludge collection and conveyance	
Target group	Head of Core Process, FS Emptying Customer Service Team Leader Sludge Truck Drivers Sludge Emptying Crew	
Responsibilities	WSSE and another relevant stakeholder	
Training title	Operation and maintenance of treatment plant	750,000
Course content	Treatment plant operation principles, operation and maintenance procedures, and treatment processes	
Target group	Head of Core Process FSTP Team Leader FSTP operators	
Responsibilities	WSSE and another relevant stakeholder	
Training title	Leadership and communication	600,000
Course content	Training on group coordination, team leading and communication	
Target group	Utility Director General Head of Core Process, FS Emptying Customer Service Team Leader FSTP Team Leader Finance Team Leader	
Responsibilities	WSSE and another relevant stakeholder	
Subtotal 2		2,600,000
Total estimated cost		4,750,000

10.3. ESMP Implementation Costs

Environmental and social management/monitoring is essential for ensuring that identified impacts are maintained within the allowable levels, unanticipated impacts are mitigated at an early stage (before they become a problem), and the expected project benefits are realized. Thus, the aim of an ESMP is to assist in the systematic and prompt recognition of problems and the effective actions to correct them, and ultimately good environmental performance is achieved. Since the cost of most of the proposed mitigation measures will have been included in the main engineering Bills of Quantities and therefore need not be included in the Environmental mitigation costs.

To support this, the ESIAs have provided a budget estimate for ESMP implementation, and this will be included in the overall project implementation budget. Thus, the overall cost, i.e., including mitigation and monitoring as detailed in Table 24 becomes about ETB **13,662,000.00**.

Table 23: Summary of Budget Estimate for ESMP, Monitoring and Training

No	Component	Project phase	Unit/Reference	Estimated cost in ETB
1.	**ESMP**			
	Buffer zone protection for intake site	Throughout all phases	Lump sum	400,000.00
	Implementation of replanting program to compensate for trees or plantation forest lost	construction phases	Lump sum	500,000.00
	HIV/AIDS awareness and prevention	construction phases		300,000.00
	ESMP enhancing beneficial impacts	All phases	Table 18	750,000.00
	Subtotal 1			1,950,000.00
2.	**Environmental and Social Monitoring Costs**			
	Air quality monitoring	Throughout all phases	Table 20	380,000.00
	Noise quality monitoring	Throughout all phases	Table 20	120,000.00
	Water quality monitoring	Throughout all phases	Table 20	320,000.00
	Stakeholder Monitoring Cost	All phases	Table 20	4,900,000
	Subtotal 2			5,720,000.00
3.	**Training cost (including skill development)**			4,750,000.00
	SUBTOTAL 1+2+3			12,420,000.00
	Contingency 10%			1,242,000.00
	TOTAL			**13,662,000.00**

10.4. Grievance Redressing Mechanisms

A grievance redress mechanism (GRM) is expected to outline procedures to respond to project-related grievances in an efficient and effective manner. As per OP 4.12 of the WB, GRM should be accessible and appropriate to bring about remedial measures for complaints. Appropriateness and accessibility basically signify the need to have a workable GRM arrangement tailored to local context. Without these main ingredients of GRM, complaint procedures will have no expected outcome in redressing grievances. In case of complaints by PAPs on project related activities, the preferred way of settlement is through amicable means so as to save time and resources as opposed to taking the matter to formal courts.

To ensure that the PAPs have avenues for redressing grievances related to any aspect of environmental and social impacts, compensation, construction management negligence, and any other relevant project related matters procedures for the redress of grievances should be established for the project. The objective is to respond to the complaints of the PAPs efficiently, i.e., the mechanism to be easily accessible, transparent

and fair and to avoid the need to resort to complicated formal channels to redress grievances. Accessible and appropriate GRM not only helps to have more effective and efficient procedures but it also has strong bearing on the project implementation progress, as PAPs grievances tend to thwart timely accomplishments of project activities. For the project at hand, a grievance redress committee needs to be established that consists of members from project administration office, PAPs, elders/religious leaders and local NGOs.

Procedure

- Complainants can log/file their complaint(s) in written form, verbally, through telephone call, text message or any means of channels convenient to them.
- Complaint to be registered in a standard format prepared for the same purpose.
- The filed complaint(s) need to be itemized, clear and concise with remedial suggestions
- Present the form for the relevant designated officer (first contact point, in this case secretary of the Grievance Redress Committee-GRC)
- Address of the PAP or PAPs (Telephone, kebele, etc.)

Obligation of the GRC

- Check the complaint is project-induced
- Registering all complaints and organize them properly (Secretary of the GRC)
- Forwarding the case to the committee
- If it is not settled by the GRC, inform/forward the same to project owner /client
- Feedback from the project owner to be communicated
- Feedback /or GRC committees‟ decisions should be communicated to the PAP(s) at a maximum of 30 working days.
- Amicable dispute settlement continues to be explored
- In case amicable arbitration not working, PAP (PAPs) can use their own right in formal court procedures
- As it has been repeatedly mentioned, the GRM should be based on the core principles of: fairness, objectiveness, simplicity (localized and contextual), accessibility to PAPs, responsiveness and efficiency. In addition, GRM should not only deal with compensation issues, rather it also takes into account all other project –induced complaints partly listed above.
- Capacity building and awareness creation interventions for local level GRC are essential. The project owner/client is expected to facilitate such training for better performance of the project at large.

The following steps will be followed in order to achieve consensus for any grievance related to any aspect of the project.

- PAPs can complain orally or in writing to the established GRC. If it is an oral complaint, the GRC must record the complaint in writing and must respond to the complaint within one week.
- If PAPs are not satisfied with the respondent, PAPs can appeal to the court for a final decision.

10.5. Code of Conduct

The project shall develop and implement a Code of Conduct to deal with the environmental and social risks related to construction. The Code of Conduct shall be applied to all staff, laborers and other employees at the construction site or any other places where construction related activities are being carried out. It also

applies to the personnel of each contractor, subcontractor, consultant and any other personnel assisting the contractor in the execution of the Works.

The purpose of the Code of Conduct is to ensure an environment where unsafe, offensive, abusive or violent behavior should not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation. More specifically, the Code of Conduct should include the following core requirements applicable to the project workers.

Every person involved in the project activities should:

- Carry out his/her duties competently and diligently;
- Comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the environment, health, safety and well-being of other contractor's personnel and any other person;
- Maintain a safe working environment including by:
  - ✓ ensuring that workplaces, machinery, equipment and processes under each person's control is safe and without risk to health; wearing required personal protective equipment;
  - ✓ using appropriate measures relating to chemical, physical and biological substances and agents; and
  - ✓ Following applicable emergency operating procedures.
- Report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;
- Treat other people with respect, and not discriminate against specific groups such as women, people with disabilities or migrant workers;
- Not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other unwanted verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
- Not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust for sexual purposes, including but not limited to profiting monetarily, socially or politically from the sexual exploitation of another.
- Not engage in Sexual Assault, which means sexual activity with another person who does not consent.
- Not engage in any form of sexual activity with individuals under the age of 18, except in case of a pre-existing marriage.
- Complete relevant training courses that shall be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation and Assault (SEA).
- Report violations of this Code of Conduct. Any violation of this Code of Conduct by contractor's personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.
- The contractor shall require all employees and the employees of sub-Contractor to individually sign the Code of Conduct, and shall proactively address any breach to the Code of Conduct.
- A copy of the Code of Conduct in Amharic shall be displayed in a location easily accessible to workers.

11. LIMITATION OF THE ASSESSMENT

Even though some progress is made regarding ESIA on the various projects in the country, there are lots of issues to be done to realize objectives of the ESIA in developing countries like Ethiopia. Lack of similar study like UWSSPII sub projects in the country are others limits that might affect the quality of the ESIA study. The following limitations have been made/identified during the assessment process and in the compilation of this ESIA Report:

- Getting sufficient and reliable primary and secondary data of the baseline for the existing socio-economic activities.
- Lack of systemic networking among concerned government organizations so as to accomplish the study as per the guideline of ESIA.
- The duration allotted for the specific task was short and more secondary data were used to analyze the impact.
- Unavailability or lack of previous works on similar sub project in the country.

The limitations listed above can be taken as the drawback for systematic, complete and scientific analysis of the environmental and social impacts of the sub-projects.

The implication of these identified gaps is that the limitations should be considered in decision making though the impact assessment could only indicate the most likely cause of the subproject activities on the social and environmental aspects. The limitation can be avoided if more time is given for the task so that more primary site-specific data can be included in the study.

12. CONCLUSION AND RECOMMENDATIONS

12.1. Conclusions

Implementation of the proposed Harar town sewer line networking, WWTP and FSTP will substantially improve the overall development of the town. The present coverage of the proposed projects of the town is a great contribution to the overall sanitation improvement of the historical town of Harar. The existing sewer lines cannot accommodate the high volume of sewage waste as a result of which sewage overflows onto streets and into the watercourses. Septic pump-out trucks do not access all areas to service the new high-volume customers, particularly with the Jogel. Sewage from septic tanks and toilets continue to pollute groundwater and surface water. There are uncontrolled and open wastewater disposal, illegal connections of sewerage to storm drainage lines and to nearby rivers is a common practice in some sites. The situation is affecting the public health and the aesthetics of the town. Considering all this condition of the town, the need for an improved wastewater and fecal sludge management system (wastewater and fecal sludge treatment plants and collection system) is indisputable.

It is therefore planned to expand the existing sewer line and install a new wastewater and fecal sludge treatment plants. The new treatment plants will be installed in newly designated lands, WWTP (at Awomur site) and FSTP (at Herwi near to the landfill site at Kili). In order to maintain current treatment as well as future goals, UASB and high-rate Trickling Filtration systems are recommended for the new treatment plant for WWTP and ARB, maturation pond, drying bed for FSTP. In the first phase, the new WW plant will have a capacity to treat 14000m^3/d during phase I. The new sewer trunks that will be built will relieve the existing sewer lines and increase its capacity.

The selected technology for the wastewater and fecal sludge treatment plants allows the proper management and creates new capacity to the municipality and opportunity. The selection of the treatment technology was carried out based on construction and operation cost, space requirement, ease of operation, etc. Accordingly, the selected treatment technology is appropriate.

The preference for use of gravity systems for the installation of sewer line networking systems is commendable since it will avoid problems associated with power interruptions and will minimize the operating cost of the sewer lines. Therefore, the selected routes for the sewer trunk lines are appropriate. The analysis of various alternatives carried out indicates that selected options are environmentally sound. The environmental and social impacts of the project have been studied dividing the project into four parts: the area where the sewer lines networking system, are constructed, the WWTP and the FSTP.

The ESIA study results show some limited negative environmental implications of the project activities, the proposed works will have high socio-economic benefits to the residents of Harar town and project intervention Kebele. The associated negative impacts will be significantly reduced or eliminated through careful engineering design, best construction practices, and effective implementation of mitigation measures. Specific mitigation measures have been suggested in this report to offset some of the inherent adverse impacts, especially those linked to the natural, human, and social environment. Effects in the construction phase include effects on ambient air quality due to dust, noise pollution, soil erosion, poor solid waste disposal, and storm water. In addition, interference to business and residential access, occupational health, and spread of social diseases e.g., COVID-19 risk may result from project activities.

Many of the adverse environmental and socio-economic impacts in the FSTP and WWTP sites are minor and can be easily mitigated. The identified “major impacts” are all subjective which may happen under rare conditions, as in case of negligence, accident, etc. These also have appropriate mitigation measures and are indicated in the ESMP.

It is, therefore, concluded that effective implementation of the proposed subprojects works will mitigate the predicted impacts to non-harmful or near non-harmful levels. Their implementation should be adequate and timely. The ESMP has been prepared. Overall, the anticipated positive impacts will outweigh the negative ones by far. In particular, sanitary facility improvement decreased the socio-environmental impacts of the poor sanitary facility hence increasing social development and welfare for the community of the municipality.

Predicted impacts shall be managed through the proposed mitigation measures and implementation regime laid down in this ESIA. Harar water supply and sanitation authority is committed to implementing all the proposed recommendations and further carrying out environmental auditing and monitoring schedules as well as enhancing the anticipated positive impacts, especially the creation of a healthy environment. The summary of recommended mitigation and management measures to minimize the potential impacts are:

- Proper design to accommodate measures for storm water effects and soil erosion, and slopes destabilization during sewer line installation, WWTP and FSTP construction.
- Measures to safeguard job opportunities and gender balance during both construction and operation of subprojects.
- Measures to encourage local employment.
- Mitigation measures against workplace health and safety
- Measures against noise and dust effects.
- Management of traffic accidents.
- Measures against the possible increase of social diseases COVID-19 prevalence
- Monitor compliance to environmental, health, and safety measure

In general, the ESIA study indicates that the implementation of the project is expected to have enormous significance. The positive impacts by far outweigh the negative impacts. The implementation of the project will improve the health and livelihood of the town residents and downstream users of polluted river waters as it reduces the prevalence of waterborne diseases and other diseases born due to poor sanitation. The project will also create short and long-term employment opportunities and potentially enable reuse of the treated wastewater for agriculture and industrial purposes and allows the production of biogas for energy and organic fertilizer (compost) from the by-products of wastewater/fecal sludge treatment process in the future.

The project is important and timely to reduce the problems associated with the disposal of wastewater/fecal sludge in the town of Harar. The project will certainly play an important role in bringing about a more ecologically, socio-culturally and economically sustainable and equitable environment in the Sofi sewer catchment of Harar town.

12.2. Recommendations

Overall, the ESIA shows that the benefits of the Hara Sewer line installation expansion, WWTP and FSTP construction and rehabilitation projects outweigh much more significantly than the adverse effects. The adverse impacts identified can be mitigated through implementing the proposed management and monitoring plans to acceptable limits. Therefore, it is recommended to implement the project with strict observation to the environmental and social management and monitoring plans. However, the project contractor once mobilized should prepare Construction's ESMP before the beginning of construction works and this plan should be part of the contract. In addition, the environmental management plans should be made part of the contract documents of the contractor so that ESMP compliance is ensured. The ESMP recommends environmental monitoring at the different phases of the project. The monitoring should be conducted to check the efficacy of mitigation measures. An environmental checklist should be developed by the Environment and Safety Division for the daily environmental audit of the project activities. This should be filled up by the environmental expert of the contractor and should be verified by the Harari EPA.

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APPENDIXES

Appendixes	Appendix title	Appendix Attachment
1	Minutes of community consultation	Appendix 1 Minutes of commun
2	Lists of participants	Appendix 2 Lists of participants.docx
3	Primary data collection checklist	Appendix 3 Primary data collection chec
4	Secondary data collection Checklists	Appendix 4 Secondary data colle
5	Checklist and Formats	Appendix 5 Other checklist and Forma
6	Effluent Discharge Requirements	Appendix 6 Proposed Effluent D
7	FAO Guideline	Appendix 7 FAO Guideline for Waste
8	Ambient Factors	Appendix 8 Environment-Ambie
9	Global Positioning System (GPS) Points	Appendix 9 Selected communal
10	The ESIA Team	Appendix 10 The ESIA Team.docx
11	Environmental and Social Clause for Construction Contractor	Appendix 11 Environmental and S
12	Chance Find Procedure	Appendix 12 Chance Find Proced

13	GAP	Appendix 13 Gender Action Plan.
14	Grievance Documentation Forms	Appendix 14 GRM Form.docx
15	Scoping checklist	Appendix 12 Scoping Checklist.d

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MINISTRY OF WATER AND ENERGY

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Prepared By: Motion Consultancy and Training PLC

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MOTION

Trust Keeps Motion!