World Bank

Ministry of Water & Energy

SECOND URBAN WATER SUPPLY AND SANITATION PROJECT

CONSULTANCY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY OF THE FAECAL SLUDGE TREATMENT PLANT FOR ADIGRAT TOWN

(Final Report)

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

ARAP	Abbreviated Resettlement Action Plan
CBOs	Community Based Organizations
CITES	Convention on International Trade in Endangered Species
CRGE	Climate Resilient Green Economy
CSA	Central Statistical Agency
CSOs	Civil Society Organizations
EFCCC	Environment Forest and Climate Change Commission
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
FDRE	Federal Democratic Republic of Ethiopia
FGD	Focused Group Discussion
GHG	Greenhouse Gas
Ha	Hectare
HIV	Human Immunodeficiency Virus
IFC	International Financial Corporation
ILO	International Labor Organization
IUCN	International Union for the Conservation of Nature
KII	Key Informant Interview
Km	Kilometer
m.a.s.l	Meters Above Sea Level
MoWE	Ministry of Water & Energy
AWSSO	Adigrat Water Supply and Sewerage Office
NBSAP	National Biodiversity Strategy and Action Plan
NGOs	Non-Governmental Organizations
NOx	NOx (Nitrogen compounds)
OHS	Occupational Health and Safety
PAPs	Project-Affected-Persons
PIO	Project Implementation Office
PM	Particulate Matter
PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SEP	Stakeholder Engagement Plan
TEPCCA	Tigray Environmental Protection and Climate Change Authority
STD	Sexually Transmitted Disease

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EXECUTIVE SUMMARY

1. Project Background and Objectives

The Ministry of Water and Energy, in collaboration with the World Bank, is implementing the Second Urban Water Supply and Sanitation Program (UWSSP-II) to improve sanitation service coverage in 23 cities, including Adigrat. This initiative confronts severe public health and environmental threats caused by the complete absence of organized faecal sludge management. Current practices of uncontrolled waste disposal in open areas pose significant risks to community health and environmental quality, necessitating urgent intervention through the Faecal Sludge Treatment Plant (FSTP) project.

2. Project Design and Technical Specifications

The proposed FSTP will utilize environmentally sustainable technology featuring solid-liquid separation with drying beds and thickening tanks, followed by wastewater disinfection before safe discharge or reuse. Designed with a treatment capacity of 53 m^3/day, the facility will serve the town's sanitation needs for the next 45 years. The infrastructure will include administrative buildings, laboratories, and operational facilities, with comprehensive planning for all project phases from construction through decommissioning. The project will serve as an interim solution until the development of a comprehensive Wastewater Treatment Plant in western Adigrat. Details are addressed in Chapter 2.

3. Site Selection and Project Description

Following a comprehensive multi-criteria evaluation, a 7-hectare site in the Shibida locality, 2.7 km east of Adigrat's town center, was selected for the Faecal Sludge Treatment Plant (FSTP). The site, currently used for grazing and agriculture, was chosen for its favorable transportation access, hydrological conditions, and minimal social disruption, as no settlements are present. The project will include the construction of an access road to connect the facility to the town's infrastructure network.

4. Key Environmental and Social Considerations

The primary social impact is the economic displacement of 38 Project-Affected Households (PAHHs), who will lose farmland, grazing land, and economically valuable cactus plants. Environmentally, the project will result in the permanent loss of existing vegetation, though the area's biodiversity is already limited. Potential impacts during construction and operation include localized air pollution, odors, and pest attraction. A comprehensive Environmental and Social Management Plan (ESMP) has been developed to mitigate these adverse effects.

5. Analysis of Alternatives and Technology

An evaluation of technological alternatives determined that a system incorporating drying beds and waste stabilization ponds is the most appropriate, given its cost-effectiveness, use of local materials, and low energy requirements. Analysis of the "without project" scenario confirmed the unacceptable status quo of uncontrolled faecal sludge disposal, underscoring that project implementation is essential to address critical public health and environmental risks in Adigrat.

6. Stakeholder Engagement and Community Response

Comprehensive stakeholder engagement confirmed strong community support for the FSTP. However, the 38 Project-Affected Persons (PAPs) emphasized the critical need for proper and timely compensation and livelihood restoration for their lost assets, which include farmland, fences, and cactus plants. Key community concerns also focused on odor management, compensation implementation, and potential pollution. In response, the project commits to fair compensation per national regulations, creating employment opportunities, and implementing robust mitigation measures.

7. Environmental and Social Impacts and Mitigations

The FSTP will deliver substantial benefits, including improved public health from reduced sanitation-related diseases, enhanced surface and groundwater quality, and the production of agricultural compost. Socio-economic benefits will include job creation and improved local connectivity from the access road.

These are balanced against significant adverse impacts, primarily the loss of livelihoods for PAPs and environmental disturbances during construction (air/noise pollution, soil erosion, water pollution risks).. Operational challenges include odor and sludge management. A comprehensive ESMP provides the framework for mitigation, including an Abbreviated Resettlement Action Plan (ARAP) for livelihood restoration, strict construction controls, odor-abatement technologies, and rigorous operational monitoring.

8. Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP) and Monitoring Plan have been established with a total indicative budget of Birr 6,610,000. The Adigrat Water Supply and Sewerage Office (AWSSO) will be responsible for long-term operation, with contractors implementing ESMP measures during construction. Regulatory oversight will be provided by the Tigray Environmental Protection and Land Administration Agency, with federal audits as needed.

9. Summary

The FSTP project offers transformative benefits for Adigrat's sanitation and public health. While the project entails manageable adverse impacts, the benefits substantially outweigh these risks. It is strongly recommended that the project proceeds with strict adherence to the proposed ESMP and ARAP to ensure positive and sustainable outcomes.

1. INTRODUCTION

1.1. Background

Safe sanitation is fundamental to human health, preventing infectious diseases and promoting physical, mental, and social well-being. It is also critical for environmental protection and socioeconomic development. Global attention is increasingly focused on wastewater and faecal sludge management (FSM), particularly in low-income countries like Ethiopia that rely heavily on on-site sanitation systems.

The town of Adigrat exemplifies this challenge, as it currently lacks any formal liquid waste management system. Faecal sludge from across the town is disposed of indiscriminately by a limited number of private vacuum trucks. While the solid waste management system is more developed, featuring an engineered disposal site on the eastern outskirts, indiscriminate dumping within the city, especially along riverbanks, remains a serious issue.

These improper practices involving liquid and solid waste pose a significant public health risk, compounded by reports that some truck operators sell raw faecal sludge to farmers for use as fertilizer. Widespread open defecation further exacerbates the town's critical sanitation problems.

To address this, the Government of Ethiopia, with support from the World Bank, is implementing a town-wide faecal sludge management program, which includes constructing Faecal Sludge Treatment Plants (FSTPs) and public toilets in various cities, including Adigrat. This ESIA for the proposed FSTP is a crucial planning tool. It provides an objective basis for project approval and helps identify potential impacts early, facilitating the development of essential management and mitigation systems.
This study, part of the Second Urban Water Supply and Sanitation Project (UWSSP-II), was conducted in compliance with Federal and Regional environmental regulations and World Bank safeguard policies. It provides a comprehensive evaluation of the project's potential impacts and proposes a detailed management and monitoring plan with an indicative budget for stakeholders.

1.2. Project Rationale

Ethiopia's sanitation sector is hindered by low prioritization, poverty, a shortage of skilled professionals, and an unclear institutional framework. According to the Ministry of Water and Energy (2017), only 4% of rural and 16% of urban households use improved toilets. A significant portion of the population relies on unimproved or shared facilities, and approximately one-third practice open defecation. This poor sanitation contributes to high rates of diarrheal diseases, a leading cause of child mortality.
Rapid population growth, particularly in urban centers like Adigrat, which are expanding at 5.1% annually, intensifies these challenges. The construction of an FSTP is urgently justified by several key factors:

1) Public Health Crisis: The current sanitation conditions facilitate the spread of disease. The FSTP is a critical intervention to mitigate this health crisis and reduce the incidence of waterborne illnesses.
2) Inadequate FSM Infrastructure: With less than 10% of urban areas served by sewers, Ethiopia depends on on-site sanitation. However, the management of the resulting faecal sludge is severely lacking. In Adigrat, the absence of a treatment facility means sludge is dumped untreated into the environment. The FSTP will provide a safe and effective management solution.
3) Lack of Disposal Options: The limited services provided by the municipality and private operators are undermined by the absence of a designated, engineered disposal site. The FSTP will create the necessary infrastructure for proper disposal and treatment, reducing the spread of disease and environmental pollution.

4) Sustainable Development Benefits: Implementing the FSTP will yield significant social, economic, and environmental advantages. It will improve overall hygienic conditions, protect groundwater and surface water from contamination, and foster a healthier, more productive population. This project is a vital step toward sustainable development for Adigrat and its surrounding environment.

1.3. Objectives

The general objective of this assignment is to conduct an ESIA for the proposed FSTP. This study is based on national and regional policies, regulations, and World Bank Safeguard Policies. A further objective is to provide indicative data on Project-Affected Persons (PAPs) and their socio-economic and demographic characteristics, which will inform a future independent Abbreviated Resettlement Action Plan (ARAP) or Resettlement Action Plan (RAP).

The specific objectives include, but are not limited to, the following:

- To identify and analyze applicable Federal and Regional laws and regulations, as well as World Bank environmental and safeguard policies, relevant to all phases of the FSTP project (construction, operation, and decommissioning).
- To document the views and concerns of the public and key stakeholders, particularly PAPs and vulnerable groups, regarding the proposed project.
- To collect baseline data on the biophysical, socio-economic, and cultural characteristics within the project's area of influence.
- To analyze alternatives to the proposed FSTP, including technological, design, and operational options, as well as the consequences of the 'without project' scenario.
- To identify and evaluate both potential adverse and beneficial project impacts, and to propose appropriate mitigation measures for adverse impacts and enhancement measures for beneficial ones.
- To prepare a comprehensive Environmental and Social Management Plan (ESMP) specific to the FSTP, including an environmental monitoring plan with an indicative budget.

1.4. Scope of the Project

The scope of this assignment entails a comprehensive investigation of existing baseline conditions and an assessment of the potential environmental and social impacts of the proposed FSTP sub-project. This includes proposing practical mitigation measures for identified adverse impacts and developing detailed environmental and social management and monitoring plans.The study area for this assessment is explicitly defined as the proposed FSTP site and its immediate surroundings areas along the proposed access road. The baseline investigation involved detailed site visits and data collection within a 400-meter radius buffer zone around the proposed location.

This ESIA has been prepared within the framework of the World Bank's Environmental and Social Framework (ESF) and relevant national social safeguard instruments. The assessment specifically informs the preparation of social safeguard documents, including a Resettlement Policy Framework (RPF) and an Abbreviated Resettlement Action Plan (ARAP), which will be developed to address and mitigate any potential involuntary resettlement and livelihood impacts in accordance with established standards.

The assignment involves different tasks as summarized in the table below. It should be noted that Tasks 9 and 19 are in part addressed by the client at latter stages in the process of ARAP consideration and actual implementation of the project.

Table 1.1. Key Tasks

Task	Task Description
Task 1: Description of the Proposed FSTP Sub-Project	Overview of the sub-project's design, technology, construction, and operations within the wastewater management context.
Task 2: Review of Regulatory and Policy Framework	Review of relevant national and local policies, legal instruments, and international standards applicable to the FSTP.
Task 3: Public Participation and Consultations	Stakeholder engagement and household surveys targeting project-affected communities in the study area.

Task	Task Description
Task 4: Assessment of Baseline Conditions	Assessment of biological, physical, social, cultural, and economic conditions within a 400-meter radius, including site visits and data collection.
Task 5: Impact Identification, Characterization, and Evaluation	Identification and evaluation of potential environmental and social impacts from the FSTP's construction and operation.
Task 6: Analysis of Alternatives	Development of feasible alternatives for siting, technology, and design to justify the selected proposal.
Task 7: Development of Mitigation and Management Plans	Formulation of mitigation measures and creation of a detailed Environmental and Social Management Plan (ESMP).
Task 8: Development of an Environmental and Social Monitoring Plan	Creation of a plan to monitor mitigation measures' effectiveness, including indicators, responsibilities, and costs.
Task 9: Institutional Arrangement and Capacity Building Plan	Proposal for human resources and institutional responsibilities for implementing the ESMP.
Task 10: Grievance Redress Mechanism	Design of a grievance redress mechanism to address concerns from affected parties promptly and transparently.

2. THE UWSSP-II PROJECT AND THE FSTP SUB-PROJECT PROCESSES AND TECHNOLOGIES

2.1. The UWSSP-II Project

Rapid population growth in Ethiopian cities is overwhelming their ability to manage waste, sanitation, and environmental health. Key issues include a lack of well-maintained public toilets, unsafe drinking water, and ineffective waste management systems. These problems are made worse by a shortage of funding and skilled workers. As a result, many urban areas have inadequate or a lack of access to public sanitary facilities and clean water. Government-provided sanitary facilities and clean water access remain insufficient or entirely lacking in some areas. To effectively address these issues, urban sanitation must be integrated with water supply, waste management, and broader urban infrastructure systems. Inadequate (poor) sanitation systems make it difficult to manage human waste and sewage sludge. Current practices, like using pit latrines and septic tanks or open defecation, lead to pollution and health risks. It's crucial to have an efficient system for managing sludge, which could involve reusing it, recovering resources from it, or safely disposing of it through incineration or landfills if other options aren't feasible. The best end-use or disposal method should be decided upon early in the planning of waste management systems.

In response, the Ministry of Water and Energy (MoWE) has initiated the second Urban Water Supply and Sanitation Project (UWSSP-II), with funding from the World Bank. This program continues the World Bank's support in improving Ethiopia's urban water and sanitation sectors. Its goal is to strengthen sanitation services through a city-wide, integrated approach that accommodates various settlement patterns and service levels. It aims to provide end-to-end solutions for liquid waste management collection, transportation, treatment, and reuse or disposal while promoting public awareness, community involvement, and private sector participation to enhance service delivery and operational efficiency.

The overarching objective of UWSSP-II is to expand access to improved sanitation and enhance water supply service efficiency in Addis Ababa and 22 secondary cities. The project consists of three core components:

1) Upgrading water and sanitation services in Addis Ababa,
2) Enhancing similar sanitation and water supply services in selected secondary cities, and
3) Supporting project management and institutional capacity building.

Improved access to these services is expected to boost public health and productivity, supporting broader economic development.

Under the second component (ii), the project targets 22 cities across all regional states and the Dire Dawa city administration. While these cities currently lack sewerage systems, urban health extension programs are in place to promote better hygiene and latrine use. However, progress has been limited, raising concerns about meeting Sustainable Development Goal (SDG) targets. UWSSP-II seeks to accelerate and scale these efforts across the country. Therefore, Adigrat town has been identified for the implementation of a Fecal Sludge Treatment Plant (FSTP) sub-project. This report outlines the findings of the ESIA conducted for the proposed FSTP in Adigrat, which includes its study, design, and construction as part of the city's sanitation development plan.

2.2. FSTP Sub-Project Descriptions

The Fecal Sludge Treatment Plant (FSTP) sub-project is a key component of the Urban Water Supply and Sanitation Project II (UWSSP-II). It aims to address critical challenges related to fecal sludge management, sanitation, hygiene, and environmental pollution issues that have been exacerbated by rapid population growth and urbanization. The management of fecal sludge has long been a major concern in Adigrat town, worsening over time due to urban expansion, a shortage of public toilets,

unreliable water sources for Water, Sanitation, and Hygiene (WASH) services, and the lack of both a designated fecal sludge disposal site and a central treatment facility.

To tackle these growing sanitation and hygiene challenges, the Ethiopian government aims to enhance sanitation systems in secondary cities through a well-structured faecal sludge management (FSM) value chain. Faecal sludge, which consists of human excreta in a partially digested, semisolid state, is mainly collected from onsite sanitation facilities and is frequently discharged into land, open drains, or water bodies. A well-planned FSM system is crucial to ensure the safe collection, transportation, treatment, and disposal of onsite collected excreta, thereby preventing environmental pollution and safeguarding public health.

Recognizing sanitation as a pressing issue in secondary cities, the government seeks to mitigate this problem and make densely populated areas more attractive for tourism and agribusiness. The expansion of collective sanitation initiatives also presents opportunities to reuse urban wastewater for irrigation after it has been efficiently treated at the proposed FSTP facility. This facility will eventually operate in conjunction with a future wastewater treatment plant.

In light of the increasing sanitation needs in Adigrat town and 21 other secondary cities, the Government of Ethiopia, with funding from the World Bank, is implementing the establishment of a modern FSTP. This project is expected to address the critical challenges of faecal sludge and water management systems in the city. This specific assignment focuses on evaluating the ESIA of the proposed FSTP sub-project, which will incorporate a large wastewater treatment plant in its next phase.

As part of the ESIA study, significant efforts have been dedicated to assessing the direct and immediate impacts arising from the establishment of the FSTP at the designated site and its surroundings. The primary objective was to identify the nature of land use and properties that may be affected, as well as to quantify the number of individuals directly impacted by the project's implementation. Section 8 of the study outlines the baseline conditions of the site, providing a comprehensive understanding of its current state.

It is important to note that the complex processes of land acquisition, compensation, and property valuation will be conducted after the approval of this ESIA study. The findings presented in this document aim to provide a preliminary assessment of the potential repercussions on the community and affected persons (PAPs) and their properties. This assessment serves as a foundational framework for developing a comprehensive ARAP, which will address compensation for affected properties, livelihood restoration, land expropriation procedures, and accurate property valuations. These components are essential for ensuring a fair compensation process and successful resettlement efforts, should they be necessary.

2.3. Brief Description of the FSTP Project Site

Adigrat town faces significant challenges in its sanitation infrastructure. The city lacks a centralized wastewater collection and treatment system, resulting in widespread reliance on pit latrines, cesspools, and, in some areas, open defecation.

Currently, fecal sludge management is handled by a small fleet of four privately owned vacuum trucks. However, the availability of these trucks is often reduced due to maintenance issues or their deployment to nearby cities for similar operations. Critically, the city lacks a designated fecal sludge treatment plant (FSTP), drying beds, or any regulated disposal site. As a result, collected sludge is frequently dumped in open spaces such as riverbanks, farmlands, rangelands, and drainage channels. This practice poses significant risks to public health and the environment.

The city also lacks a managed and designated faecal sludge disposal site, which is further exacerbating the sanitation crisis. To address these pressing challenges, a new FSTP sub-project has been initiated. This project aims to develop a comprehensive and sustainable system for faecal sludge treatment and

safe disposal. Once completed, it is expected to significantly improve urban sanitation services, protect the environment, and enhance public health outcomes across Adigrat town.

Figure 2.1: Vacuum trucks collecting faecal sludge from pit latrines (left) and uncontrolled faecal sludge disposal in the open field

Rapid urbanization of the city in recent years is putting more stress on the already inadequate sanitation system in the highly urban areas. The capacity of the city to adequately dispose of faecal sludge is low and challenging, exposing the socio-economic and natural resources to pollution and posing a risk to human health. To reduce the problem, this project is proposed to be realized.

The Detailed Design of the FSTP for Adigrat town has been prepared by another company. Furthermore, in 2022 ESIA study was also carried out for the proposed FSTP along with wastewater treatment plant for the city. However, the proposed system was not constructed. The project was primarily aimed at improving sanitation situation of Adigrat town equitably by providing FSTP only. In the current phase (phase A), it is proposed to construct a complete unit for the faecal sludge management so that it can be fully and effectively treated in order to ensure its safe disposal in the natural environment. However, in the future (in the phase B'), the wastewater treatment plant will be constructed, and then, there will be a possibility of co-treatment for the FS management. As a result, in this phase (B), the pretreated liquid from the FSTP will be fed into the main wastewater treatment plant for co-treatment with the wastewater of the network.

The FSTP will be constructed on a 7-hectare site in the Shibida locality, approximately 2.7 km east of Adigrat's center. The land is currently used for agriculture and grazing and contains no residential structures, ensuring no physical displacement. A 400-meter buffer zone provides separation from the community. Datil characteristics of the project site is addressed in the following chapters,

The project site was selected after a systematic evaluation of alternatives. Key advantages include its sufficient size for current and future needs, a natural buffer distance from residential areas, a favorable wind pattern to minimize odor impact, and reasonable access via a gravel road. This makes it the most environmentally and socially suitable location for the facility.

2.4. Faecal Sludge Treatment Process Units, Units and Technologies

Adigrat town is currently experiencing critical challenges in faecal sludge management due to the absence of dedicated infrastructure and municipal services. At present, the collection of faecal sludge is carried out by private operators using vacuum trucks. These trucks collect fecal sludge from a range of sanitation facilities, including pit latrines, cesspools, and septic tanks, which are widely used by households, institutions, and commercial establishments. However, in the absence of a city-owned fleet and an official faecal sludge disposal site, collected waste is often discharged indiscriminately into open areas, drains, and water bodies. This practice poses serious environmental and public health risks, including contamination of surface and groundwater sources, foul odors, and the spread of waterborne diseases.

To address these issues, the city is currently in Phase A of the Urban Water Supply and Sanitation Project (UWSSP), which includes the construction of a FSTP. The goal of the FSTP is to ensure the

safe and effective treatment of faecal sludge before its final disposal or reuse. A comprehensive Feasibility and Design Report has been prepared, detailing the technical specifications, plant layout, and operational plan for the proposed facility. In parallel, this ESIA document has been developed to identify, assess, and propose mitigation measures for potential environmental and social impacts related to the construction and operation of the FSTP. The ESIA ensures that the project complies with both national regulatory frameworks and international environmental and social safeguards.

2.4.1. The Chosen Faecal Sludge Treatment Process

The treatment of faecal sludge involves several key steps:

- **Transport and Preliminary Treatment:** Faecal sludge is first transported to the treatment facility, where it undergoes initial screening and preliminary treatment to remove large debris and prepare it for further processing.
- **Separation into Liquid and Sludge Streams:** After preliminary treatment, the sludge is separated into two components - liquid and solid (sludge).
- **Sludge Dewatering:** The solid fraction is processed to remove excess water, resulting in a dewatered sludge (commonly referred to as sludge cake) with high dry solids content.
- **Pathogen Reduction:** The sludge cake may undergo additional treatment processes to reduce pathogen levels before being safely disposed of or reused, for example, in agriculture or composting.
- **Liquid Treatment**: The liquid fraction from both the initial separation and the sludge dewatering process undergoes further treatment. It first passes through an Anaerobic Baffled Reactor (ABR), followed by an Anaerobic Filter (AF), which significantly reduces organic matter and pathogens.
- **Natural Disinfection:** Finally, the treated liquid flows into a maturation pond or cascaded rectangular channels. In this unit, natural processes involving sunlight exposure and biological activity (algae), extended retention time further reduce pathogenic microorganisms.

After completing the treatment process, the final effluent meets environmental discharge standards and can be safely released into nearby water bodies or reused, such as for agricultural irrigation.

2.4.1.1. Fecal Sludge Treatment Units

The Adiga's proposed faecal sludge treatment system integrates multiple treatment units to process an average capacity of 53.4 m^3/day, producing effluent suitable for safe discharge or reuse. The system comprises receiving and screening units, Unplanted Sludge Drying Beds (DB), an Anaerobic Baffled Reactor (ABR) combined with an Anaerobic Filter (AF), and a maturation pond or cascaded rectangular channels. Essential auxiliary facilities including access roads, a service building, and warehouse ensure operational sustainability.

The treatment sequence operates as follows:

- **Transport and Preliminary Treatment:** Faecal sludge is delivered to the facility where receiving and screening units remove large debris.
- **Separation and Sludge Dewatering:** Preliminary treated sludge undergoes solid-liquid separation, with solids directed to Unplanted Sludge Drying Beds (DB) for dewatering into sludge cake.
- **Liquid Treatment:** The liquid fraction undergoes biological treatment through the Anaerobic Baffled Reactor (ABR) followed by an Anaerobic Filter (AF), significantly reducing organic matter (BOD/COD) and pathogens.

- **Natural Disinfection:** Treated liquid flows to maturation ponds or cascaded rectangular channels where extended retention time, sunlight exposure, and biological activity provide final disinfection.

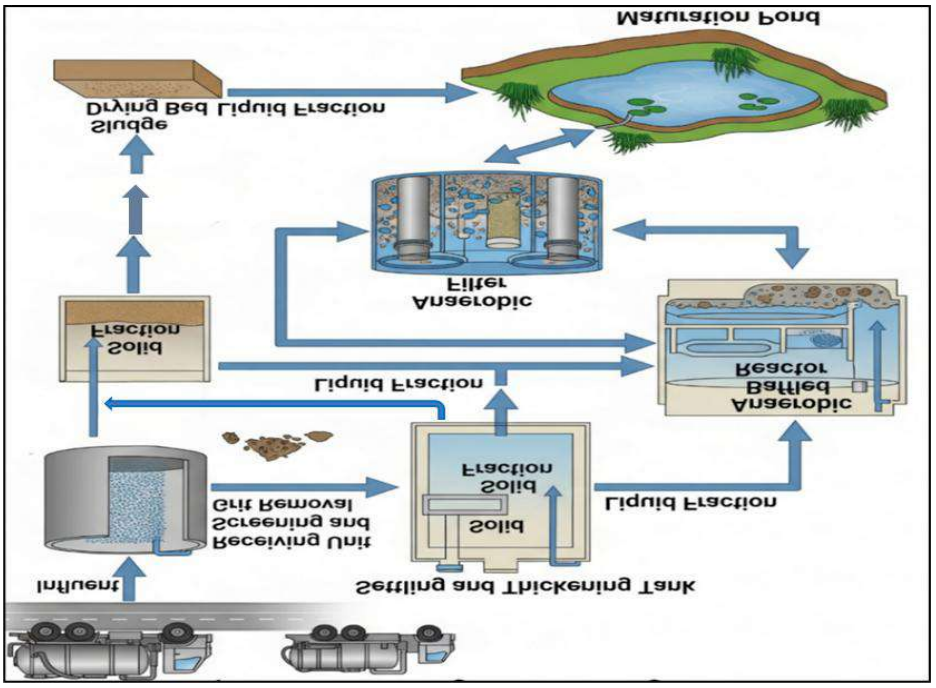

Figure 2.2: The selected FSTP Process flow diagram with the components

The hydraulic profile maximizes gravity flow, with pumps deployed only where elevation differences require additional force. Sludge flows from the receiving chamber to the settling tank by gravity, while separated solids are pumped to drying beds. Liquid transfer between the settling tank and ABR occurs through gravity or pumps depending on topography, with HDPE pipes ensuring controlled transport throughout the system. Chlorination serves as tertiary treatment when required to meet regulatory standards.

The treated final effluent meets environmental discharge standards for safe release into water bodies or agricultural reuse. The dewatered sludge cake may undergo additional stabilization (e.g., composting) for pathogen reduction before agricultural application. For details on alternative technology assessment, refer to Section 7.3.

2.4.2. The Faecal Sludge Treatment Units

The proposed treatment system includes receiving and screening units, Unplanted sludge drying beds (DB), an Anaerobic Baffled Reactor (ABR) combined with an Anaerobic Filter (AF), and a maturation pond or cascaded rectangular channels. These facilities are designed to improve the quality of discharged effluent, making it safe for release into the environment or for potential reuse. Specially, the system effectively reduces sludge volume and ensures the treated effluent meets key quality standards for BOD, COD, and pathogen levels, allowing for safe disposal or potential reuse. Besides, the design also includes essential auxiliary/support facilities such as access roads, a service building, and a warehouse. This integrated approach ensures the system is both sustainable in the long term and adaptable to future expansion while addressing current sanitation challenges.

In general, the faecal sludge treatment units will comprise several processes steps the Key FSTP Components

- Truck Reception / Faecal Sludge Feeding Unit - Designated area for receiving and offloading sludge from vacuum trucks.
- Preliminary Treatment Unit - Screens and grit removal system to eliminate large debris and inorganic materials.

- Solid-Liquid Separation Unit - Sludge thickening tanks (using settling tank) to separate solids from liquid components.
- Solids Treatment Line - Non-planted sludge drying beds for dewatering and drying of thickened sludge.
- Liquid Treatment Line - Anaerobic baffled reactor combined with anaerobic filter for the biological treatment of the separated liquid fraction. Finally, pass through the maturation pond or cascaded rectangular channels.
- Dried Sludge Management - Storage of dried sludge for extended periods, allowing for further pathogen die-off and potential reuse.
- Treated Effluent Tank and Discharge Pipeline - Final storage and safe discharge of treated effluent.
- Dedicated Laboratory Unit- Equipped for monitoring and testing to ensure treatment performance and compliance with regulatory standards.
- Besides, there will be auxiliary facilities such as
    - Dried sludge storage facilities
    - Access roads connecting the city with the FSTP Site, as well as internal access roads
    - Fencing, Gate, and Gatehouse of the FSTP facility site
    - Office Building - small office building comprising an office for the operator and recordkeeping, and a store
    - ablution block
    - Interconnecting pipework between treatment units and discharge pipelines
    - Flood protection and drainage canals
    - Landscape design to enhance site aesthetics and functionality
    - Portable laboratory equipment is proposed, which shall be kept at the Sanitation section of the utility

2.4.2.1. Receiving and Screeining Units

The FSTP process starts with the receiving unit, where the raw fecal sludge, called influent, is first unloaded from collection vacuum trucks. This unit's primary function is to remove large solid materials (screening) and heavy inorganic particles like sand and gravel (grit).

The FSTP Receiving and Screening units comprise a manually cleaned coarse screen and followed by a mechanically cleaned fine screen with bar spacing of 60 mm and 30 mm, respectively. The vacuum trucks will discharge directly into coarse screens and fine screens step-by-step, followed by the gritting and settling tank, and then the solid and liquid will incorporate into each drying bed and liquid treatment units, respectively. The coarse screens are recommended to remove potential hard items, such as those used for anal cleansing paper, textile, etc. The screenings will be dried and disposed of through burial in excavated trenches within the treatment plant, and with the possibility of incineration. Typical receiving and screening units for the proposed project will be as displayed in Figure 2.3. Specific design considerations are detailed in the final design document. This step is crucial for protecting downstream equipment from damage and blockages.

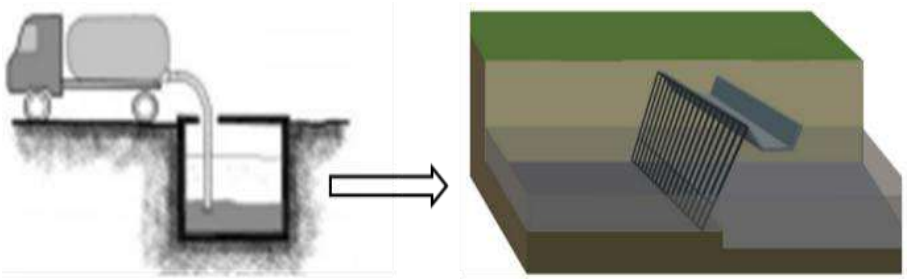

Figure 2.3: Typical Receiving and Screening Structural Units

Table 2.2: Dimensions of the screen

Parameter	Values	Unit
Bar Width	10	mm
Bar height	500	mm
Space between bars	40	mm
Angle to horizontal	50	degrees

2.4.2.2. Faecal Sludge Thickening /Solid-Liquid Separation

After initial screening, the influent flows into a settling and thickening tank. In this step, the heavier solid particles in the sludge settle to the bottom by gravity, separating from the liquid. This process creates a solid fraction (thickened sludge) at the bottom and a liquid fraction (supernatant) at the top. The thickened sludge is then sent to a sludge drying bed, while the liquid fraction proceeds to the anaerobic baffled reactor connected with an anaerobic filter and followed by a maturation pond.

Solid-liquid separation will be carried out in thickening tanks. Faecal sludge enters the tank at one end and flows out over a weir at the other end. Solids settle along the length of the tank, as in a conventional rectangular sedimentation tank. The thickening tanks operate in batch mode, with each tank loaded for several days and then allowed to rest before sludge is removed. Two thickening tanks of 2,217.6 m^3 each with dimensions of 14 m Width and 72 m Length will be provided for the solid-liquid separation.

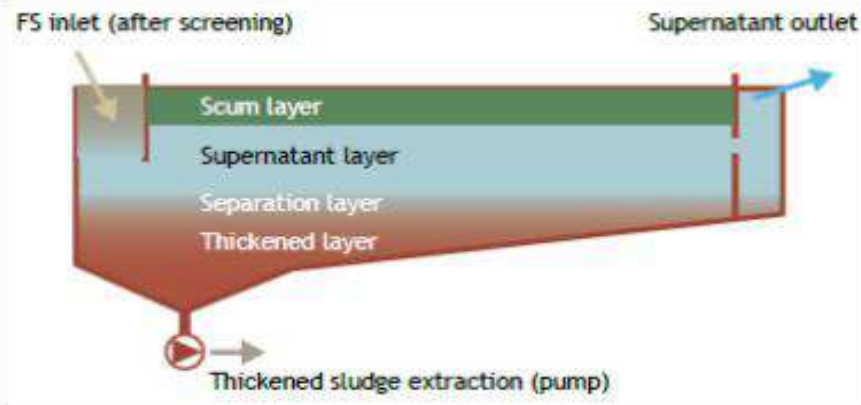

Figure 2.4: Sketch for the Faecal Sludge Thickening/ Solid Liquid Separation

Table 2.2: Dimensions of proposed Faecal Sludge Settling Tank

Parameters	Units	Value
Length	M	1.3
Volume	m3	9.8
HRT	Hours	13.3
Length	M	1.3

2.4.2.3. Unplanted Drying Beds

The solid fraction from the settling tank is transported to the sludge drying bed (DB). This unit is a shallow bed filled with layers of sand and gravel. The sludge is spread out, and water is removed through two main processes: drainage (the water percolates through the sand) and evaporation (the sun and wind dry the sludge). The liquid that drains from the bed is recycled back into the main treatment process, while the dried sludge can be used as a soil conditioner or disposed of.

Sludge drying beds are the longest-established and simplest option for sludge dewatering. It is a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the

sludge to dry by percolation and evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates.

Unplanted drying beds are preferable and suitable for developing countries due to their low capital and operating costs, simplicity of operation, and good dewatering efficiency, especially in dry and hot climates. Moreover, dried sludge can be used for composting, an important input in agricultural production. However, this treatment technology requires large land areas; it is labor-intensive, especially for the dried sludge removal; and it has limitations in stabilization, pathogen, odor, and flies' reduction. The FSTP will have 18 non-planted drying beds.

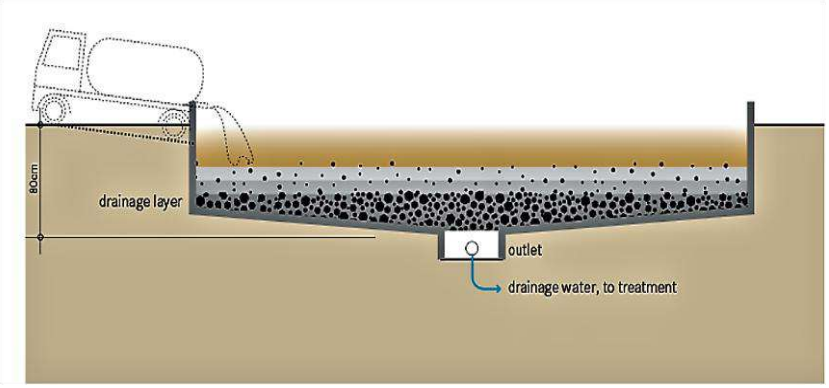

Figure 2.5: Unplanted drying bed (Source: Tilley et al., 2014)

Table 2.3: Proposed drying beds dimensions

Parameters	Units	Values
Number of beds	No	18
Unit length	m	22
Unit width	m	12.5
Unit Depth	m	0.2
Single bed drying area	m^2	275
Total drying area	m^2	4950
Total DB area requirement	m^2	322.64232
Effective sludge loading rate	kg TSS/m^2/yea	104.236364
Dewatering cycle	days	21

2.4.2.4. Anaerobic Baffled Reactors Combined with Anaerobic Filter

2.4.2.4.1. Anaerobic baffled reactor

The liquid fraction from a settling tank flows into an Anaerobic Baffled Reactor (ABR). An ABR is essentially a multi-compartment septic tank with internal baffles (Figure 2.4). This underground system is designed with multiple compartments through which the liquid from the settling tank flows sequentially.

The baffles guide the flow in an alternating upward and downward pattern. This unique design creates multiple treatment zones and ensures excellent contact between the wastewater and the anaerobic biomass (microorganisms that thrive without oxygen).

Within each compartment, these anaerobic bacteria break down organic matter in the wastewater, significantly reducing the organic load (measured as BOD and COD). The design promotes efficient solids retention and a longer contact time, which leads to higher treatment performance compared to standard septic systems. Therefore, the ABR acts as a robust primary treatment step, effectively reducing solids and biodegradable pollutants before the wastewater proceeds to the next stage, an Anaerobic Filter for further purification (Figure 2.5).

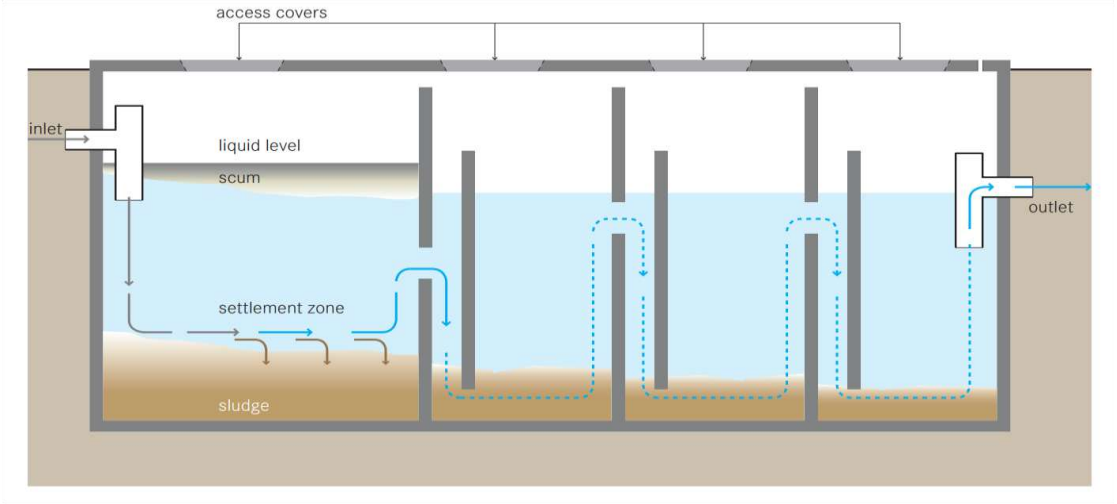

Figure 2.6: Anaerobic baffled reactor (Source: Tilley et al., 2014)

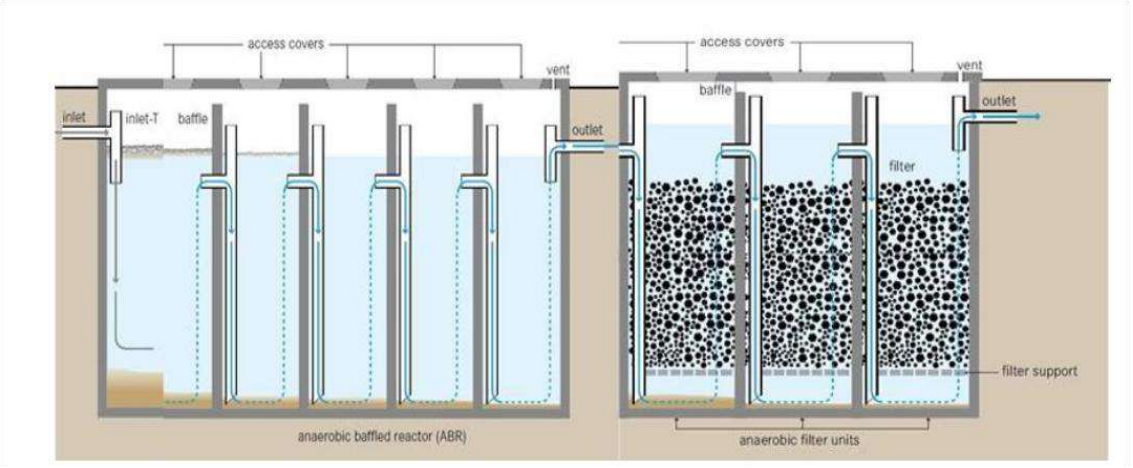

Figure 2.7.: Sketch of the ABR combined with AF

2.4.2.4.2. Anaerobic filter

After the Anaerobic Baffled Reactor (ABR), the liquid fraction flows into the Anaerobic Filter (AF) for further treatment (Figure 2.6). The AF is designed to remove remaining organic pollutants and nutrients from the effluent, including leachate from drying beds. It serves as a secondary treatment unit, improving effluent quality before final polishing.

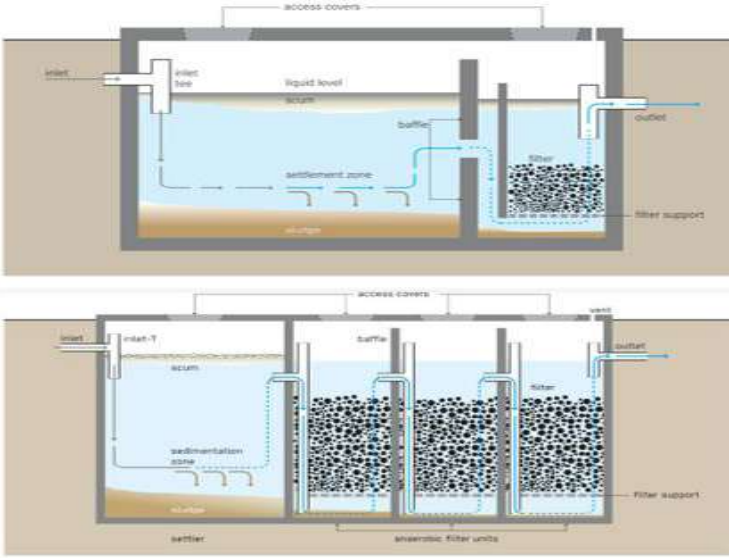

Figure 2.8: Anaerobic Filter (AF) with one chamber (top) - and with multi-filter chambers/units (bottom) (source: Tilley et al., 2014)

This system typically consists of a sedimentation chamber followed by one or more filter compartments filled with media such as gravel, crushed stone, cinder, or specially designed plastic pieces. These materials provide a surface for the growth of anaerobic biofilm communities of microorganisms that digest residual organic matter.

As the wastewater passes through the filter, suspended solids are trapped, and organic compounds are degraded by the biofilm attached to the media surfaces. Compared to septic tanks or ABRs alone, the anaerobic filter offers enhanced solid removal and more efficient organic matter breakdown.

The result is a clearer and better-treated effluent, making the anaerobic filter an effective intermediate step before tertiary treatment in systems like maturation ponds Figure 2, 8.

Table 2.2: Dimension and Design parameters for Settler, ABR and AF

Parameter	Value	Unit
Design discharge	17.6	m3/d
Design discharge	0.7	m3/hour
Depth	2.5	m
Width	3.0	m
Wall-thickness	0.2	m
Settler		
Length	1.3	m
Volume	9.8	m3
HRT	13.3	hours
ABR		
Length	1.0	m
Number of compartments	5.0	
HRT	51.2	hours
Volume	37.5	m^3
AF		
Length	1.0	m
Number of compartments	3.0	
HRT	30.7	hours
Volume	22.5	
Area needed		
Length	11.3	m
Width	3.0	m
Area for one unit	33.9	m^2
Total Area for the three unit	101.7	m^2

2.4.3. Maturation Pond

The Adigrat FSTP (Faecal Sludge Treatment Plant) uses a maturation pond as a final, tertiary treatment step to polish treated liquid from the anaerobic filter. This large, shallow pond disinfects the water before it's safely discharged or reused. The disinfection process relies on natural processes, primarily UV radiation from sunlight and natural bacteria, to inactivate any remaining pathogens.

The proposed maturation pond is designed as a series of shallow, rectangular channels cascaded along a hillside. Its key design criteria include:

Hydraulic Retention Time (HRT): A long HRT is crucial for effective pathogen inactivation.

Shallow Depth: A depth of 1.0 to 1.5 meters allows for effective sunlight penetration and oxygen transfer, which are vital for the disinfection processes.

High Length-to-Width Ratio: This ratio ensures uniform water flow and prevents short-circuiting, a phenomenon where water bypasses a significant portion of the treatment area, thus reducing its effective treatment time.

It is selected to optimize natural disinfection and flow efficiency. The specific design parameters are detailed in Table 2.3

Table 2.3: Proposed design parameters for cascaded channels used as a maturation pond

Parameter	Unit	Value	Formula Notes
Average Daily Flow, Q	m^3/day	53	design flow
Retention Time, HRT	days	10	5–20 days
No. of channel units	No	3	
Required Volume, V	m^3	530	V = Q * HRT
Volume per channel, v	m^3	177	v = (Q * HRT)/3
Channel Depth, d	m	1	1–1.5 m
Channel Surface Area, A	m^2	177	A = V / d
Pond Length to Width Ratio, L: W	-	7:1	W = √(A / (L:W))
Channel Width, W	m	5	5
Channel Length, L	m	36	
Pathogen Removal (E. coli)	log units	2–4	Typical 2–4 log reduction
Helminth egg reduction	eggs/L	< 1	< 1 egg/L if HRT ≥ 10–15 days

A review of various guidelines for treated effluent was performed, and therefore treatment will be designed to obtain an effluent with characteristics in the range of the following Table 2.4 values that follow the WHO "Health Guidelines for the Use of Wastewater in Agriculture" (2004). The effluent quality has to meet the standard values indicated within Annex IV of the UWSSP II environmental and social management framework (ESMF) (Table 2,4).

Table 2.4: Selected Effluent Quality Discharge Limit

Parameters	Unit	WASH ETH	Selected Values	UWSSP II ESMF	WHO maximum allowable concentration (mg/l)
pH		6--9		6-9	
COD	mg/l	250	150	125	120
BOD5	mg/l	50	40	30	40
Oil and grease	mg/l	10	10	10	
TSS	mg/l	50	50	50	45
TN	mg/l	10	10	10	0.025% by Weight
TP	mg/l	2	2	2	0.001% by Weight
Coliforms	Most probable no. per 100 ml	400	400	**400**	

2.4.4. Dried Sludge Management

A warehouse of 200 m^2 will be constructed on the FSTP site to receive the dried sludge from the drying beds and to store it for 18 months to achieve Class B bio solids reuse standards. This temporary storage contributes to further dehydration of the product and the die-off of pathogens before the end use is discussed and agreed upon. The sludge can be sufficiently stabilized or digested if the proposed design is well implemented and maintained. Hence, it can be reused for composting. The dried sludge with the proposed design procedure is also suitable for agricultural uses except for fruit and vegetable

growing. Moreover, it may be applied in forage development, but animals should be restricted from grazing for three weeks after the application of sludge on the grazing land.

To enhance awareness on the use of the sludge for fertilizer, there should be training and communication campaigns for the local community.

Bio-solids, which are not reused, will be disposed of in an appropriately designed and licensed solid waste disposal site landfill.

2.4.5. Other Auxiliary Facilities and Infrastructures

In addition to the main unit process operations, project components of the faecal sludge treatment plant include the following auxiliary facilities

- Sampling and monitoring equipment;
- Interconnecting pipework between process treatment units; and
- Bypass/diversion arrangements.
- Internal site roads and services required to ensure access to all areas of the plant for operation and maintenance purposes;
- Utilities and services, including power and water supply;
- Internal drainage for surface water run-off;
- Access gates and permanent security fencing;
- Flood protection measures; and
- Landscaping of the treatment works site.

Administrative Buildings - An administration building containing an operational staff office, store, and a laboratory, toilet, and similar facilities will be provided at the FS treatment facility. In addition, it will have fencing and a security guard house.

Laboratory Facilities - To ensure an accurate evaluation of the faecal sludge treatment plant's performance, it is expected to have a laboratory facility on site. This facility will be responsible for routine monitoring of various parameters related to the treatment processes and operations. These parameters include pH levels, total solids (TS), total suspended solids (TSS), chemical oxygen demand (COD), biochemical oxygen demand (BOD5), and nutrients such as total nitrogen and total phosphorus in the faecal sludge. Furthermore, assessing the quality of the dried faecal sludge will require analysis of additional parameters such as pH, moisture content, nutrients (nitrogen and phosphorus), calorific value, presence of Ascaris eggs (for safety considerations), and heavy metal concentrations (such as cadmium, lead, and chromium). Operators working at the faecal sludge treatment plant and within the laboratory should always wear appropriate personal protective equipment, focusing on hygiene and safety measures.

Interconnecting Pipework Between Process Treatment Units and Bypass - The connection between the different ponds in the faecal sludge treatment plant will be made using DN 200 pipes equipped with valves.

The effluent discharge pipeline will be an approximately 680 meter long, 600-millimeter diameter HOPE-lined concrete sewer which discharges into a storm water head wall, surrounded by Reno-mattress (rock mattress) on the banks of the river to protect it from erosion under periods of high velocity flows.

Water Supply, Electrical Installations and Sanitary Facilities - The treatment plant will have a water tank to allow regular water access at the plant with appropriate connection and sanitary facilities. Electrical installations will be provided for the operation building, roads, lanes, and corners of the ponds to ensure proper illumination.

Other Facilities - Other facilities include internal roads, walkways, and parking areas. It has appropriate drainage for the whole site to avoid flooding conditions. Landscaping of the treatment works site will be worked on and open areas shall be covered with trees, attractive plants, and bushes.

2.5. Design Features for Social Inclusion, Equitable Access, and Safety

To ensure that the FSTP in Adigrat town promotes social inclusion, equitable access, and safety for all community members particularly women and persons with disabilities the project design should incorporate the features outlined in Tables 2.4 and 2.5 below. By explicitly integrating these elements, the project will show its commitment not only to technical improvements in sanitation but also to advancing social equity and sustainable development, in alignment with World Bank and national environmental and social standards.

Table 2.5. Equitable Physical Access (Universal Design)

Feature	**Objective**	**Target Groups**
Ramps and Handrails	Ensure smooth movement within the administrative, maintenance, and public access areas.	Persons with disabilities (wheelchair users, crutch users), the elderly, pregnant women, and workers transporting materials.
Accessible Restrooms	Provide dedicated, clearly marked, and lockable gender-segregated toilets and changing facilities for staff and any necessary visitors.	All staff and visitors, especially women and persons with disabilities.
Clear, Multi-Format Signage	Use international symbols, large font sizes, and potentially tactile elements (Braille) for key areas like entrances, offices, and safety points.	Persons with visual impairments, low-literacy users, and international project visitors.
Designated Waiting/Rest Areas	Provide shaded seating areas for vacuum truck operators (including potential female operators) and visitors.	All staff, particularly older workers or those with health conditions.

Table 2.6 Safety and Security Features

Feature	Objective	Target Groups
Gender-Segregated Facilities	Ensure separate and private changing rooms, lockers, and washing areas for male and female staff.	Women staff, promoting dignity and encouraging female participation in the workforce.
Adequate Lighting	Install reliable, bright lighting across all access roads, entrances, pathways, and around the perimeter to prevent accidents and enhance security.	Women staff, especially during early morning or late-night shifts, and security personnel.
Security Protocols	Implement clear, gender-sensitive protocols for site entry/exit, emergency response, and handling of external disturbances.	All personnel.
Perimeter Fencing and Restricted Access	Ensure the site is securely fenced with restricted access points to prevent unauthorized entry, particularly by children, which is a major safety hazard around sludge treatment facilities.	Children and the general public, preventing exposure to health hazards.

3. APPROACH AND METHODOLOGY

3.1. The ESIA Study Process and Approach

The ESIA study for the FSTP was conducted in strict compliance with the Ethiopian Environmental Protection Authority's proclamations and the World Bank's Operational and Environmental and Social Safeguard policies. The methodology integrated a review of relevant previous studies, international best practices, and applicable guidelines with primary data collection.

The approach combined field observations, baseline data collection, and multi-level stakeholder consultations. Field surveys were undertaken at the project site and its surroundings to gather on-ground information, identify potential impacts, conduct stakeholder interviews, and perform in-situ testing of key biophysical parameters.

Key Informant Interviews (KIIs) were held with experts from relevant government agencies and private faecal sludge transport companies to gather critical insights into potential impacts and mitigation measures.

Given the project's nature, a comprehensive ESIA process was followed. Instead, the valued environmental components (VECs) for the FSTP were defined through a review of project design, site visits, technical team consultations, and literature review.

The standard ESIA process for a project of this scale encompasses the following key stages, as summarized in Figure 3.1 and Table 3.1:

- Scoping is used to identify potentially significant environmental impacts of a proposed project. This process involves detecting the environmental components that might be affected, such as air, water, soil, ecology, human health, and cultural heritage.
- Baseline Survey: Detailed data collection on the biophysical and socioeconomic environment.
- Impact Identification & Prediction: Identifying and evaluating potential positive and negative environmental and social impacts.
- Stakeholder Engagement: Ensuring transparency and inclusivity through consultation with affected communities, government agencies, and experts.
- Mitigation and Management: Developing measures to avoid, minimize, and manage adverse impacts.
- Reporting: Documenting the process, findings, and recommended measures in a comprehensive ESIA report.
- Monitoring and Compliance: Establishing a plan to track the effectiveness of mitigation measures and ensure adherence to standards.

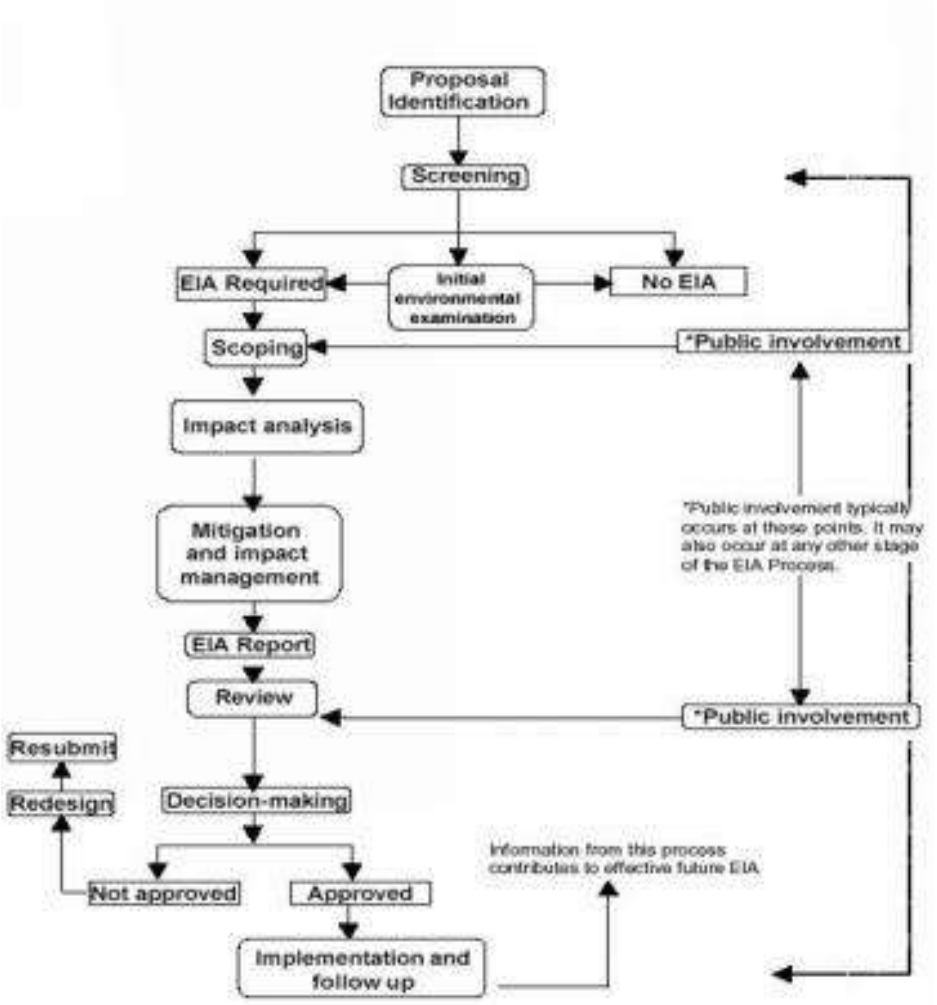

Figure 3.1: The ESIA study process

3.2. Methodology

3.2.1. Desk Study

A comprehensive desk review was undertaken of relevant previous studies, regional and town-level data, and project feasibility and design documents. This provided critical background information and context for the assessment. National and regional policies, legislation, and guidelines on environmental protection and social safeguards were reviewed to determine the regulatory framework and assess the project's alignment with its requirements.

3.2.2. Field Investigation

Field investigations were conducted to collect detailed primary data on the social and natural environments within the project's area of influence. The survey aimed to establish baseline conditions and identify environmentally and socially sensitive receptors using structured checklists.

Stakeholder consultations were central to the methodology. A meeting was held with 12 concerned stakeholders at the AWSSO on March 30, 2024. Further consultations with local communities near the project site (Enda Arbaete Ensesa Church area) were conducted on April 2, 2024. These engagements served to disseminate project information, gather views and concerns, and incorporate valuable local knowledge into the assessment. Consultations were also held with design consultants and federal-level officials.

The information gathered pertained to the existing waste management system, local environmental and social features, potential project-related impacts, and stakeholder attitudes. These inputs directly informed the impact analysis and the development of the Environmental and Social Management Plan

(ESMP). A summary of consultation outcomes is provided in Section 5.

3.2.3. Ethical Considerations

Ethical considerations are crucial in ESIA studies to protect participants' rights and well-being. Key principles include obtaining Free, Prior, and Informed Consent (FPIC), ensuring voluntary participation, avoiding harm, maintaining confidentiality, and protecting participants' privacy. These principles promote responsible and respectful data collection and storage practices. All these were observed.

3.2.4. Environmental Impact Receptors and Evaluation Criteria

Identification of key impacts brings together the previous steps with the aim of ensuring that all potentially significant environmental impacts (adverse and beneficial) are identified and taken into account in the process. To identify the project's environmental and social impacts, all proposed activities during the mobilization, construction, operation, and decommissioning phases of the project have been accounted.

Following the identification of all project activities, environmental and socio-economic receptors are identified (Tables 3.1-3.3). The key inputs for the identification of receptors included the legislative review, the environmental baseline, the socio-economic baseline, and stakeholder consultation.

Table 3.1: Physical environmental receptors

Receptors	Description
Air	Air quality in and around the proposed project development sites
Surface water and groundwater	The surface waters in streams in which project activities are proposed to occur
Soil	The soils of areas in which project activities are proposed to occur
Land	Landforms that can be modified by earth-moving machines and construction activities

Table 3.2: Biological environmental receptors

Receptors	Description
Flora	Plant species that occur in areas where project activities are proposed to take place
Terrestrial fauna (Birds, Mammals, Amphibians, and Reptiles)	Animal species that inhabit the terrestrial habitats where the project activities are proposed to occur

As previously described, the environmental and socio-economic baseline data were compiled using a combination of existing data and the results of a number of data acquisition-focused baseline surveys and stakeholder consultation programs. All key issues that were raised by stakeholders during the different consultations were recorded and minuted. In this way, it is assured that the ESIA study process has addressed outstanding community and/or stakeholders' concerns.

Table 3.3: Socioeconomic environmental receptors

Receptors	Description
Population growth	Population growth will take place in the area and the nearby towns.
Employment	Employment opportunities are the perceived benefits in the project area and the nearby towns.
Local economic development	Promotion of various small and micro-businesses
Resettlement	Though there is no physical displacement, the project will have economic displacement through land acquisition process.
Cost of living	Increase of the cost of living, mainly for the employees
Vulnerable people	The land acquisition process could affect very few vulnerable groups.
Diseases	Incidence of communicable diseases
Community health	Presence of commercial sex workers) not relevant in this project)

In assessing the level of impact that an activity may cause, five key elements are considered.

- Spatial Scale (site specific, local, town wide)
- Duration (short term, medium term, and long term)
- Reversibility (reversible, irreversible)
- Probability (the likelihood that an activity will occur)
- Direction beneficial or adverse)
- Significance (low, medium, high)

Table 3.4: Detailed Impacts Classification Approach

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 will the impact 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 shall the impact 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
		Long Term	The impact shall be permanent
Spatial scale	What would be the spatial scale of the impact?	Site specific	Requires site-specific intervention.
		Local	Impact of little importance, needs limited mitigation
		Town-wide/Zonal	Impact has influence and requires mitigation
		Regional/National	Impact of great importance, mitigation is a must
Cumulative effects		Low	Impact of little importance, needs limited mitigation
		Medium	Impact has influence and requires mitigation
		High	Impact of great importance, mitigation is a must
Reversibility	Can the influence be removed once the impact ends, or will the influence remain?	Reversible	The influence of the impact can be reversed
		Irreversible	The influence of the impact cannot be reversed and shall be permanent

The criteria are defined as follows:

Spatial Scale: Site specific (restricted to the site), Local (the site and surrounds), Town wide (affecting parts of the town).

Duration: Short-term (up to 1 year), medium-term (1 year to 2 years), long-term (life cycle of the project), or permanent.

Intensity: The effects of the impact will be quantified as low, medium-low, medium-high, or high, and the rationale for this is discussed in the written evaluation of the impact.

Probability of occurrence: Improbable (unlikely), probable, highly probable, or definite (certain).

- Based on a synthesis of the information contained in (i) to (iv) above, and taking mitigation measures into account, an evaluation of the significance of the impact is undertaken in terms of

the following significance criteria:f

- No significance - requires no further investigation and no mitigation or management;
- Low Significance -an impact which has little importance and is not sufficient to warrant further reduction if this involves unreasonable cost.
- Medium Significance -an impact which should be mitig=ted, if possible, to reduce it to acceptable levels;
- High significance - an impact that requires extensive mitigation and management to reduce impacts to acceptable levels.

3.2.5. Social Inclusion and Vulnerable Groups Engagement

A targeted approach, aligned with World Bank Environmental and Social Standards (ESS1 and ESS5), was implemented to ensure the meaningful participation of vulnerable and marginalized groups who may be disproportionately affected by the project. These groups were identified through a multi-pronged strategy combining desk study reviews of census and community data, deliberate Key Informant Interviews (KIIs) with local administrators, community leaders, women's associations, and proactive community liaison during field visits to identify less visible households.

To enable a nuanced analysis of dif[ferential impacts, all primary socio-economic data collected through surveys and consultations was designed to be disaggregated by key demographic variables, including gender, age, disability status, livelihood, and proximity to the project site. This ensures that the baseline and impact assessment can accurately track how effects vary across sub-populations. Specific inclusive methods were employed to facilitate safe and meaningful engagement, including holding Focus Group Discussions (FGDs), ensuring consultations were held in physically accessible venues.

4. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1. Introduction

Environmental and Social Impact Assessments (ESIAs) for development projects are governed by a national legal and administrative framework. This framework regulates project execution, limits harmful emissions and effluents, and addresses socioeconomic implications. The proposed Adigrat FSTP project will generate both positive and negative effects, necessitating strict adherence to all prevailing policies and laws.

Ethiopia has established distinct institutional and regulatory structures to oversee environmental management and provide directives for environmentally sound project implementation. International financiers, such as the World Bank, further prioritize environmental and social safeguards. This section outlines the critical policy and legal considerations relevant to this project. Oversight of environmental compliance is primarily the jurisdiction of the federal Environmental Protection Authority (EPA) and relevant line offices at various administrative levels and ministries engaged in environment-related issues.

4.2. Policies and Strategies

4.2.1. The Federal Democratic Republic of Ethiopia Constitution

The Constitution of the Federal Democratic Republic of Ethiopia serves as the supreme law of the land, providing the foundational guidance for all subsequent policies, regulations, and institutional frameworks. It explicitly enshrines the principles of sustainable development and environmental rights, including the right to development, the right to a clean and healthy environment, and the right to just compensation for persons adversely affected by state-sponsored programs. The Constitution stipulates that the government must provide fair compensation for any property or livelihoods impacted by development projects, including through relocation with adequate state assistance. It also permits the expropriation of private property for public purposes, subject to the advance payment of commensurate compensation. Furthermore, the Constitution grants citizens the right to participate in national development and to be consulted on policies and projects that affect their communities. It mandates that the design and implementation of programs or projects shall not damage or destroy the environment, and it affirms that people have the right to be fully consulted and to express their views in the planning and implementation of environmental policies and projects.

4.2.2. Environmental Policy of Ethiopia

In 1997, the Council of Ministers of Ethiopia approved the national Environmental Policy, which was informed by the findings and recommendations of the National Conservation Strategy. This policy document emphasizes the critical importance of mainstreaming socio-ecological dimensions into development programs and projects. The overarching purpose of the Environmental Policy is to improve and enhance the health and quality of life of all Ethiopians through the sustainable use and management of natural resources and the environment. To achieve this objective, the policy encourages the establishment of organizational and institutional frameworks for environmental management at federal, regional, and community levels. The Environmental Policy provides specific guiding principles for sustainable development, particularly pertaining to Environmental Impact Assessment (EIA). These principles stipulate that an EIA must consider impacts on both human and natural environments, provide for the early consideration of environmental impacts in project and program design, recognize public consultation as an integral component, include mitigation and contingency plans, and provide for auditing and monitoring. Importantly, the policy makes the conduct of an EIA a legally binding requirement for prescribed projects. This comprehensive Environmental Policy framework demonstrates Ethiopia's commitment to ensuring that development activities are carried out in an environmentally and socially responsible manner.

4.2.3. Environmental and Social Impact Assessment Proclamation No. 1317/2025:

This proclamation replaced the Environmental Impact Assessment Proclamation No. 299/2002.

Ethiopia's Environmental and Social Impact Assessment Proclamation No. 1317/2025 (the "New Proclamation") replaces the earlier Proclamation No. 299/2002, aiming to modernize and enhance the environmental assessment framework. The New Proclamation reflects the country's evolving development priorities, aligns with international best practices, and integrates broader social considerations into development planning. The New Proclamation significantly broadens the assessment scope beyond environmental impacts to include social, economic, and cultural factors. Unlike the Previous Proclamation, which narrowly defined environmental impact assessments, the New Proclamation adopts an integrated approach. It focuses on evaluating impacts on social structures, community organization, and local ways of life. This shift emphasizes the importance of holistic development, recognizing that environmental sustainability must be considered alongside social and economic dimensions in project planning and approval.

4.2.4. Ethiopian Water Resources Management Policy (Proclamation No. 299/2002)

The Ethiopian Water Resources Management Policy aims to ensure efficient, equitable, and sustainable utilization of the nation's water resources for socioeconomic development. It mandates Environmental Impact Assessments for all water resources schemes and emphasizes protecting water sources from contamination.

Relevance: This policy is directly relevant as the FSTP will treat faecal sludge that could otherwise contaminate groundwater and surface water sources. The project supports the policy's goals by preventing water pollution and promoting public health. Compliance ensures alignment with national water conservation priorities and fulfills the ESIA requirement for wastewater infrastructure projects.

4.2.5. Biodiversity Conservation and Research Policy

Approved in 1998, this policy emphasizes conservation, sustainable development, and utilization of Ethiopia's biodiversity. It requires public participation in conservation efforts and ensures communities benefit from genetic resources and traditional knowledge.

Relevance: The policy mandates that projects affecting ecosystems follow ESIA procedures. The FSTP must incorporate measures to protect local flora and fauna during construction and operation, particularly given the project's proximity to natural areas. The policy further requires engaging local communities in environmental protection efforts related to the project.

4.2.6. Health Policy and Public Health Proclamation No. 200/2000

Ethiopia's Health Policy emphasizes establishing safe waste disposal systems and preventing pollution from hazardous waste. The Public Health Proclamation specifically mandates proper waste collection and disposal methods to safeguard public health.

Relevance: The FSTP directly addresses these provisions by providing sanctioned treatment and disposal solutions for faecal sludge. The project will reduce uncontrolled dumping and associated health risks, complying with national health standards and improving urban sanitation. Proper treatment of faecal waste aligns with the proclamation's requirements for protecting community well-being.

4.2.7. National Occupational Health and Safety (OHS) Policy

Ethiopia's OHS framework, including the Constitution (Article 42/2) and various proclamations and directives, guarantees workers' right to a safe working environment. The Ministry of Labor and Skill Development oversees compliance through regional departments.

Relevance: These regulations are crucial for ensuring worker safety during both construction and operation phases. The project must implement comprehensive OHS measures for all personnel involved in sludge handling, treatment processes, and facility maintenance. Compliance demonstrates adherence to national labor standards and protects workers from occupational hazards.

4.2.8. National Policy on Women (1993)

This policy promotes gender equality and enhances women's access to basic services and productive resources. It established women's affairs offices at all government levels to address gender gaps.

Relevance: The policy requires ensuring the equitable distribution of project benefits and women's participation in development initiatives. The FSTP should engage women in consultations and consider their specific sanitation needs. The project may also create economic opportunities that particularly benefit women, thereby supporting broader social equity goals and aligning with national gender mainstreaming efforts.

4.2.9. The National Social Protection Policy (NSPP) and Strategy (NSPS)

Approved in 2014, the National Social Protection Policy envisions enhancing the social and economic well-being, security, and justice for all Ethiopians. It establishes a comprehensive social protection system with five focus areas: safety nets, employment opportunities, social insurance, access to basic services, and legal protection.

Relevance: This policy is relevant as the project may generate employment opportunities during construction and operation phases, particularly for local communities. The FSTP's improvement of sanitation services directly contributes to enhanced access to basic services, a key focus area of the NSPP. Additionally, the project should consider how its implementation can support social safety nets and ensure that vulnerable groups benefit from the improved sanitation infrastructure.

4.2.10. The National HIV/AIDS Policy (1998)

Ethiopia's National HIV/AIDS Policy aims to create an enabling environment for HIV/AIDS prevention and control. Its objectives include establishing effective preventive strategies, promoting multi-sectoral responses, coordinating interventions, mobilizing resources, and encouraging various stakeholders to alleviate the epidemic's social and economic impacts.

Relevance: This policy is relevant as construction projects involving migrant workers may potentially increase HIV transmission risks. The FSTP implementation should incorporate awareness programs and preventive measures as part of worker welfare initiatives. The project can contribute to the policy's objectives by ensuring health education reaches workers and surrounding communities, aligning with the multi-sectoral approach to HIV prevention.

4.2.11. National Policy and Strategy on Disaster Risk Management (2013)

This policy aims to reduce disaster risks and potential damage through a comprehensive disaster risk management system. It focuses on integrating risk reduction into development plans, implementing activities throughout the disaster cycle, and building resilience of vulnerable populations.

Relevance: The policy is relevant for ensuring the FSTP's resilience to natural hazards and climate-related risks. The project design must incorporate disaster risk assessments and appropriate mitigation measures. The treatment plant's operation should include contingency planning for extreme weather events that could affect facility operations or cause environmental contamination, thereby contributing to community resilience.

4.2.12. Land Tenure and Land Use Policy

The Constitution vests land ownership exclusively in the State and People of Ethiopia, prohibiting land sales or transfers. Proclamation 456/2005 governs rural land administration and use, emphasizing forest conservation and land-use planning. The policy requires attractive resettlement strategies for displaced persons, including full compensation and participation.

Relevance: This policy framework is critically relevant as the project requires land allocation for the treatment facility. Compliance with land acquisition procedures and consultation requirements with local communities is essential. If any displacement occurs, the project must develop comprehensive resettlement action plans ensuring fair compensation and livelihood restoration, in strict adherence to constitutional provisions and implementing regulations.

4.2.13. Forestry Policy

Ethiopia's forestry framework includes the Ethiopian Forestry Action Plan (1994) and Proclamation No. 94/1994 on forest conservation, development, and utilization. These instruments emphasize sustainable

forest management and conservation efforts.

Relevance: This policy is relevant if the project area involves or is adjacent to forest resources. The FSTP must ensure no unauthorized clearing of forest areas and implement appropriate measures to protect nearby vegetation. The project should consider opportunities for landscape restoration and tree planting as part of its environmental management plan, contributing to national forest conservation objectives.

4.2.14. Energy Policy

Ethiopia's Energy Policy emphasizes expanding renewable energy sources, including biomass, hydro, wind, and geothermal power. It also focuses on improving energy efficiency across production, transportation, and utilization sectors.

Relevance: This policy is relevant for optimizing the project's energy footprint. The FSTP design should incorporate energy-efficient technologies and consider renewable energy options. Implementing energy-saving mechanisms aligns with national policy objectives and can reduce operational costs while contributing to Ethiopia's sustainable energy goals.

4.3. Legislative Frameworks

4.3.1. Environmental Protection Organs Establishment (Proclamation No. 295/2002)

This proclamation establishes a coordinated system of environmental governance with differentiated responsibilities among federal and regional environmental agencies and sectoral environmental units. It aims to foster sustainable use of environmental resources while preventing conflicts of interest and duplication of efforts.

Relevance: This proclamation is directly relevant as it establishes the institutional framework for environmental oversight of the project. The FSTP must engage with both federal and regional environmental protection organs throughout the project cycle to ensure compliance and coordinate environmental management responsibilities. The proclamation ensures clear lines of authority and prevents regulatory duplication in the project's environmental compliance process.

4.3.2. Environmental Impact Assessment (Proclamation No. 299/2002)

This proclamation establishes the legal requirement for Environmental Impact Assessments for specific project categories. It mandates that designated projects undergo ESIA scrutiny and secure EPA authorization before initiation. The legislation categorizes projects into three schedules based on their potential environmental impact and requires close cooperation between project proponents and environmental authorities.

Relevance: As a Schedule 1 project likely to have significant environmental impacts, the FSTP requires a full Environmental Impact Assessment. This proclamation mandates the preparation of an Environmental and Social Impact Statement for EPA examination and approval. It further requires the development of an Environmental and Social Management Plan (ESMP) to ensure adherence to environmental safety measures throughout the project lifecycle.

4.3.3. Environmental Pollution Control (Proclamation No. 300/2002)

This proclamation focuses on safeguarding citizens' right to a healthy environment and establishes comprehensive pollution control measures. It covers hazardous waste management, municipal waste, environmental quality standards for air, water, and soil, and pollution monitoring. The law grants environmental inspectors extensive powers to enforce standards.

Relevance: This proclamation is critically relevant as the FSTP involves handling and treating potentially hazardous faecal waste. The project must comply with established environmental quality standards and implement robust pollution monitoring systems. The extensive powers granted to environmental inspectors mean the facility must maintain continuous compliance with pollution control measures to avoid enforcement actions.

4.3.4. Proclamation on Solid Waste Management (Proclamation No. 513/2007)

This proclamation promotes community participation in solid waste management and requires urban local governments to prepare solid waste management action plans. It mandates participation of the lowest administrative levels and local communities in designing and implementing waste management plans.

Relevance: While focusing on faecal sludge, the FSTP operates within the broader waste management context governed by this proclamation. The project must align with local solid waste management plans and ensure community participation in its operations. The proclamation's emphasis on participatory approaches requires the project to engage local communities in waste management planning and implementation.

4.3.5. Prevention of Industrial Pollution Regulation 159/2008

This regulation, building on Proclamation 300/2002, aims to harmonize industrial growth with environmental preservation. It imposes significant responsibilities on industrial entities to prevent or reduce pollutant emissions to compliant levels, manage equipment and inputs safely, establish emergency response systems, and maintain environmental monitoring systems with annual reporting requirements.

Relevance: The FSTP is subject to these industrial pollution regulations as a waste treatment facility. The project must implement pollution prevention measures, establish emergency response systems for potential spills or accidents, and maintain comprehensive environmental monitoring with annual compliance reporting. The regulation's emphasis on pollution reduction aligns with the plant's core function of treating faecal waste to environmental standards.

4.3.6. Labor Proclamation (Proclamation No. 1156/2019)

This comprehensive labor law governs various aspects of labor relations and standards, including employment contracts, working conditions, occupational health and safety standards, minimum wage regulations, working hours, leave entitlements, and termination procedures. It emphasizes workers' rights protection and fair employment practices.

Relevance: This proclamation is essential for governing all employment aspects of the FSTP project. It requires compliance with occupational health and safety standards, particularly important for workers handling waste materials. The project must ensure fair labor practices, proper working conditions, and adherence to all labor standards throughout both construction and operational phases.

4.3.7. National Rural Land Administration and Use (Proclamation No. 456/2005)

This proclamation establishes state ownership of rural land while defining tenure rights for occupants. It grants various land use rights, including agricultural use, leasing, inheritance, and property acquisition rights. The legislation mandates registration and certification of tenure rights and emphasizes soil and water conservation.

Relevance: This proclamation is relevant if the project site involves rural land acquisition. It governs the process of securing land rights for the treatment facility and establishes compensation requirements for any land development. The emphasis on soil and water conservation aligns with the project's environmental protection objectives and must be integrated into the facility's design and operation.

4.3.8. Research and Conservation of Cultural Heritage (Proclamation No. 209/2000)

This proclamation provides for scientific registration and supervision of cultural heritage to ensure its protection and transmission to future generations. It aims to protect cultural heritage against disasters and enable its benefits to assist in national development while promoting the discovery and study of cultural assets.

Relevance: This proclamation requires assessment of potential impacts on cultural heritage during project siting and construction. If the project area contains or is near cultural heritage sites, appropriate protective measures must be implemented. The project must ensure that construction and operation do not adversely affect any registered cultural heritage resources in the area.

4.3.9. Public Health Proclamation (Proclamation No. 200/2000)

This proclamation explicitly prohibits the discharge of untreated liquid waste from septic tanks, seepage pits, and industries into water bodies or water convergence areas. It further forbids the disposal of any solid or liquid waste in a manner that contaminates the environment or jeopardizes public health.

Relevance: This proclamation is fundamentally relevant as it provides the core legal mandate for the FSTP's existence. The project directly addresses these prohibitions by providing a sanctioned facility for the treatment of faecal sludge, thereby preventing the uncontrolled discharge of untreated waste into the environment. Compliance with this law is the primary justification for the project, ensuring that waste management practices protect water resources and public health.

4.3.10. Expropriation of Land for Public Purposes (Proclamation No. 1161/2019 amended by Proc. No. 1336/2024)

This legal framework, recently amended by Proclamation No. 1336/2024, establishes comprehensive procedures for land acquisition, compensation valuation, and resettlement for public projects. It details principles for assessment, timelines for acquisition, and mandates the formulation of Resettlement Action Plans (RAPs). It includes methodologies for property valuation and establishes grievance redress mechanisms. A key provision grants landholders priority rights to develop their own land in accordance with approved plans. Supporting this, the FDRE Council of Ministers Regulation No. 472/2020 provides specific guidance on expropriation, valuation, and compensation to protect the rights of Project-Affected Persons (PAPs).

Relevance: This proclamation is critically relevant if the project site requires the acquisition of private land or results in the physical or economic displacement of people. It legally obligates the project to conduct a census of PAPs, undertake a detailed valuation of affected assets, pay fair compensation at replacement cost, and develop a full Resettlement Action Plan. The project must adhere to the stipulated timelines and establish a functional grievance mechanism, ensuring the entire process is conducted in a fair, transparent, and participatory manner.

4.3.11. Action on Health Response to Gender Based Violence/Sexual Violence (2020-2025)

This strategic policy document, prepared by the Federal Ministry of Health, aims to promote a supportive environment for survivors of GBV/SV at the community level, create an equitable health system for response, and strengthen multi-sectoral collaborations and partnerships.

Relevance: This policy is relevant for promoting the safety and well-being of all workers and community members associated with the project. The FSTP implementation, particularly during the construction phase involving a transient workforce, should incorporate awareness-raising and preventive measures against GBV/SV. The project can contribute to the policy's objectives by ensuring its operational practices, including security arrangements and worker codes of conduct, create a safe environment and provide clear reporting pathways, aligning with the national multi-sectoral approach to addressing GBV.

4.3.12. Regional Environmental Agencies

Established under Proclamation No. 295/2002, these agencies are responsible for environmental protection at the regional level. Their mandates include formulating and implementing regional conservation strategies, environmental monitoring, protection, and regulation. They are empowered to ensure the implementation of federal environmental standards or issue their own, provided they are no less stringent. They are also responsible for reviewing and approving ESIAs for projects under regional mandate and monitoring the implementation of EIA recommendations.

Relevance: This institutional framework is directly relevant as the project must obtain all necessary environmental permits and approvals from the Tigray Environmental Protection, Land Administration and Use Agency (or relevant zonal/woreda offices). The project proponent is legally required to cooperate closely with these agencies throughout the project cycle to ensure adverse impacts are properly identified and that mitigation measures are incorporated into the project design and effectively implemented. Their oversight is crucial for ensuring ongoing compliance with regional and federal

environmental standards.

4.3.13. Tigray Regional State Relevant Proclamations

1) Urban and Rural Water Supply and Sewerage Services Proclamation (Procl. No. 122/ 1999): This proclamation contains provisions specifically relevant to wastewater management within the Tigray region. It grants the relevant office authority to expropriate fixed assets and land for wastewater management activities with appropriate compensation. It emphasizes cooperation in establishing sewerage systems, mandates the maintenance of water and sewerage infrastructure, and encourages private investment in sewerage services, particularly through vacuum truck operations.

Relevance: This proclamation is directly relevant as it provides the regional legal basis for the FSTP's establishment and operation. It authorizes the acquisition of necessary land for the treatment plant and facilitates public-private partnerships in faecal sludge management. The proclamation's emphasis on sewerage system development and maintenance supports the project's integration into the broader urban sanitation infrastructure.

2) Hygiene and Environmental Health Protection Regulation (Regulation No. 4/1989): This regulation addresses environmental health protection, including liquid waste management. It obligates individuals and organizations to construct and use proper sanitation facilities, allows connection to sewerage systems with permission, and prohibits waste disposal in unauthorized areas, including roads, rivers, and dams. It specifically prohibits various liquid waste disposal practices and holds residents responsible for waste within a 20-meter radius of their homes.

Relevance: This regulation is fundamentally relevant as it legally mandates proper liquid waste management practices that the FSTP is designed to support. The project provides the necessary infrastructure to enable compliance with these regulations by offering sanctioned disposal options for faecal sludge, thereby helping to eliminate the prohibited practices of uncontrolled dumping.

3) Proclamation for Establishment of Regional Environmental Body (Proclamation No. 77/2004): This proclamation established TEPCCA as an autonomous body accountable to the regional president. Its main objectives are to ensure sustainable utilization, protection and development of environmental and natural resources during socioeconomic development, and to create appropriate frameworks for rural land management, administration and use.

Relevance: TEPCCA serves as the primary regional regulatory body for environmental compliance. The FSTP must obtain approvals from and work closely with this agency throughout the project lifecycle to ensure adherence to regional environmental standards and sustainable development principles.

4) Proclamation on Tigray Rural Land Administration and Use (Proclamation No. 48/2000): This proclamation, amended in 2007, governs rural land administration in the Tigray region. It establishes procedures for land committees at the Tabia and Kushet levels and addresses land holding rights, transfer and rental rights, redistribution procedures, and conditions for deprivation of holding rights. The region has also adopted Regulation No. 4/2016 in line with federal compensation standards.

Relevance: If the project site involves rural land, this proclamation governs the land acquisition process. It establishes the framework for securing land rights and requires compliance with regional procedures for compensation and resettlement of affected landholders.

5) Urban Land Use Lease Regulation (Regulation No. 6/2016 EC): The Tigray Region Interim Administration, Bureau of Land and Mines, has officially endorsed the Urban Land Use Lease Regulation No. 6/2016. This regulation outlines the comprehensive procedures and guidelines governing the leasing of urban land, ensuring a structured and equitable approach to land management in the region.

Relevance: This regulation is essential for projects involving urban land, as it provides a clear framework for leasing urban properties. It ensures that the land acquisition process is structured and equitable, which is crucial for maintaining legal compliance and protecting the rights of urban landholders. Adhering to these guidelines is necessary for securing the necessary permits and approvals for urban development projects.

6) Compensation for Land and Property Regulation (Regulation No. 4/2016 EC): The Tigray Region Interim Administration, Bureau of Land and Mines, has officially endorsed the land and property expropriation for public purposes in line with the federal procalmations. This regulation outlines the comprehensive procedures and guidelines governing the compensationm of land and prioprarty when in use for public purposes.

Relevance: This regulation is critical for any project that may require expropriation of land and property for public use. It outlines the procedures for compensating affected landowners, ensuring that they are fairly compensated in accordance with federal standards. Compliance with this regulation is vital for minimizing disputes and ensuring that the project is carried out in a socially responsible manner, thereby fostering community support and cooperation.

7) Proclamation on Environmental Impact Assessment (Proclamation No. 200/2003): This regional EIA proclamation implements regional environmental laws and is based on principles of avoiding, minimizing, or mitigating adverse impacts, early application in project planning, developing management plans, and ensuring transparency and stakeholder participation. It applies to all projects in Tigray and defines the responsibilities of TEPCCA, licensing bodies, and project proponents.

Relevance: This proclamation mandates the ESIA process at the regional level. The FSTP must comply with its requirements for impact assessment, public consultation, and development of environmental management and monitoring plans specific to the Tigray region.

8) Proclamation on Environmental Pollution Control (Proclamation No. 199/2003): Based on the constitutional right to a healthy environment, this proclamation addresses pollution control and handling of hazardous materials, chemicals, and radiation-emitting substances. It contains provisions for environmental regulation and rights to claim.

Relevance: This proclamation is critically relevant as it establishes regional pollution control standards that the FSTP must meet. The project must ensure its operations do not create new pollution hazards and must implement measures to control emissions and effluents in accordance with regional requirements.

9) Solid Waste Management Proclamation (Proclamation No. 191/2003): This proclamation aims to enhance awareness and capacities for solid waste management, create economic benefits from waste, and support comfortable human settlements. It describes the duties and responsibilities of various actors, waste management methods, sewage disposal services, and penalty modalities.

Relevance: While focusing on faecal sludge, the FSTP operates within the broader context of regional waste management governed by this proclamation. The project must align with regional solid waste management strategies and may create opportunities for resource recovery from waste in accordance with the proclamation's objectives.

4.4. Other Standards and Directives

The following national standards, directives, and guidelines have been identified to be relevant to the proposed Project

- Environmental Standards for Industrial Pollution Control in Ethiopia - These standards present pollution limits for emissions to (i) atmosphere, (ii) water resources, and (iii) noise emissions.
- EIA Directive No. 1/ 2008, A Directive to Determine Projects Subject to Environmental Impact Assessment - The directive lists the various activities that require the undertaking of an EIA prior to the commencement of that specific activity.
- Guideline for Environmental Management Plan for the Identified Sectorial Developments in the Ethiopian Sustainable Development & Poverty Reduction Program, May 2004 - The guideline outlines the necessary measures for the preparation of an EMP for proposed developments in Ethiopia and the institutional arrangements for implementation of EMPs.
- The Federal Environmental Protection Authority, Environmental Assessment Reporting Guide,

2004, Addis Ababa which provides a standardized reporting framework for environmental assessments. It is, however the responsibility of proponents and associated assessors to ensure that sufficient information is included in environmental assessments and that this information is forwarded onto all concerned and interested environmental agencies for review and consideration.

4.5. International, Treaties, Conventions and Protocols

Ethiopia is signatory to a number of international conventions/treaties and agreements, and in certain cases, these have influenced the development of policies, guidelines, and regulations. The ESIA will need to consider these conventions and agreements and ensure compliance during the different phases of development projects. These treaties include, among others, the Framework Convention on Climate Change, the Convention on Biological Diversity, and the Convention to Combat Desertification, etc. Among others, the most relevant conventions/treaties include:

- Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal
- Libreville Declaration on Health and Environment in Africa;
- The United Nations Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora, 1973;
- The United Nations Convention on Biological Diversity (Rio Convention), 1992.
- Ramsar Convention (1971) on the protection of wetlands
- The United Nations Convention for the Safeguarding of the Intangible Cultural Heritage;
- The Vienna Convention for the Protection of the Ozone Layer;
- International Labor Organization (ILO) Forced Labor Convention, 1930 (No. 29);
- ILO Abolition of Forced Labor Convention, 1957 (No. 105)
- ILO Tripartite Consultation (International Labor Standards) Convention, 1976 (No. 144);
- ILO Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87)

4.6. World Bank Safeguard Policies

The World Bank has ten operational policies (OP) designed to safeguard the environment and human populations to be protected during the development process, which are applicable to the implementation of UWSSP II. Five of the ten WB safeguards Policies are triggered as part of the implementation of the UWSSP II. These include: Environmental Assessment (OP/BP 4.01), Safety of Dams (OP/BP 4.37), Physical Cultural Resources (OP/BP 4.11), Involuntary Resettlement (OP/BP 4.12), and Projects on International Waterways OP/BP 7.50). Additionally, the World Bank Group (WBG) Environment, Health and Safety Guideline (EHSG) shall be applicable as deemed necessary. However, for the proposed FSTP subproject, the most relevant and applicable safeguard policies are discussed as follows:

- **Environmental Assessment (OP/BP 4.01):** This policy ensures that projects financed by the World Bank are environmentally sound and sustainable. Based on OP 4.01 and Ethiopia's National EIA Guideline (2003), the Adigrat Fecal Sludge Treatment Plant (FSTP) is classified as a Category B project and Schedule II activity, respectively, indicating moderate environmental impacts. The Environmental and Social Impact Assessment (ESIA) was prepared accordingly and will be endorsed by the World Bank.
- **Projects on International Waterways (OP/BP 7.50):** Triggered due to the project's location within the Ethiopian Rift Valley Basin, which shares groundwater resources with Kenya. The policy ensures that trans boundary water impacts are assessed and neighboring countries are notified as required.
- **Physical Cultural Resources (OP/BP 4.11)**: Although no known cultural heritage sites are directly affected, this policy is triggered to safeguard against potential impacts on

undiscovered physical cultural resources. A chance finds procedure will be implemented during excavation activities.

- **Involuntary Resettlement (OP/BP 4.12):** Applicable due to potential land acquisition and displacement. A Resettlement Policy Framework (RPF) has been developed to guide compensation and resettlement. Where discrepancies exist between national laws and World Bank standards, the more stringent provisions will be applied.
- **Safety of Dams (OP/BP 4.37)** Triggered due to the inclusion of wastewater treatment infrastructure that may involve containment structures. The policy ensures that dam safety measures are integrated into the design and implementation phases.

Environmental and Social Management Plan (ESMP): As required byOP/BP 4.01, the ESIA process will lead to the preparation of a comprehensive ESMP. This plan will set out the specific mitigation, monitoring, and institutional measures to be taken during project construction and operation to avoid, minimize, or reduce adverse environmental and social impacts to acceptable levels. The ESMP will be a core compliance document for the project.

4.7. ESMF and RPF and World Bank Requirements

4.7.1. ESMF and RPF

The UWSSP has been classified by the World Bank as environmental category B but it will be determined because of additional activities come with project restructuring. Both the ESMF and RPF have been prepared because the actual subproject sites and their potential adverse environmental and social impacts could not be identified prior to appraisal. Instead, the environmental and social screening process outlined in the ESMF will be applied by qualified project personnel to ensure that potential negative environmental and social impacts are identified and mitigated at the planning stage of the planned subprojects. The UWSSP is a combination of subprojects. As the "parent project" in general has been classified as "Category B", it is to be determined after considering project restructuring activities and no subproject within the UWSSP can be funded if it would fall under "Category A". According to the guideline of WB and the EIA guideline of the Government of Ethiopia the proposed subproject falls under category B.

1. The World Bank Safeguard Requirements

The following are World Bank Environmental and Social Safeguards and Their Policy Objectives (OP/BP Safeguard Policy objectives)

- OP 4.01 Environmental Assessment help ensure the environmental and social soundness and sustainability of investment projects. Support integration of environmental and social aspects of projects in the decision-making process.
- OP 4.04 Natural Habitats* Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.
- OP 4.09 Pest Management Minimize and manage the environmental and health risks associated with pesticide use and promote and support safe, effective, and environmentally sound pest management.
- OP 4.11 Physical Cultural Resources (PCR)* Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archeological, paleontological, historical, architectural, and religious (including graveyards and burial sites), aesthetic, or other cultural significance.
- OP 4.12 Involuntary Resettlement* Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

- OP 4.20 Indigenous Peoples* Design and implement projects in a way that fosters full respect for indigenous peoples' dignity, human rights, and cultural uniqueness and so that they (1) receive culturally compatible social and economic benefits, and (2) do not suffer adverse effects during the development process. 4.36 Forests* Realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.
- OP 4.37 Safety of Dams Ensure quality and safety in the design and construction of new dams and the rehabilitation of existing dams, and in carrying out activities that may be affected by an existing dam.
- OP 7.60 Projects in Disputed Areas Ensure that other claimants to the disputed area have no objection to the project, or that the special circumstances of the case warrant the Bank's support of the project notwithstanding any objection or lack of approval by the other claimants.

2. The World Bank Environment, Health and Safety Requirement

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards.

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

Environmental issues associated with water and sanitation projects may principally occur during the construction and operational phases, depending on project-specific characteristics and components. Recommendations for the management of EHS issues associated with construction activities as would typically apply to the construction of civil works are provided in the General EHS Guidelines. The WBG EHS guideline for water and sanitation recommended measures include:

- Manage wastewater effluents
- Prevent, minimize, and control releases of sewage and other fecal sludge
- Prevent, minimize, and control industrial discharges to the sewerage system
- Prevent, minimize, and control liquid effluents
- Prevent, minimize, and control physical hazards to the community
- Prevent, minimize, and control exposure to pathogens and vectors

Consultation and Disclosure Requirements: OP 4.01 requires that for "all Category A and B projects, the borrower consults project- affected groups and local nongovernmental organizations (NGOs) about the project's environmental and social aspects and takes their views into account. The borrower initiates such consultations as early as possible. For Category A projects, the borrower consults these groups at least twice: (a) shortly after environmental screening and before the terms of

reference for the EA are finalized; and (b) once a draft EA report is prepared." OP 4.01 further requires that "for meaningful consultations between the borrower and project affected groups and local NGOs on all Category A and B projects proposed for IBRD or IDA financing, the borrower provides relevant material in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted". Category B reports for a project proposed for IDA financing are to be made available to project-affected groups and local NGOs, and public availability in the borrowing country of any Category B EA report for projects proposed for IDA funding are prerequisites to Bank appraisal.

Even though public consultation and disclosure are addressed by various pieces of Ethiopian legislation and guidelines, including the Constitution itself, they include no clear requirements nor arrangements, but rather recommendations. The EPA (now EFCCC) confirms that it is indeed including public consultation as a good practice recommendation in the environmental screening and EIA process. However, as the EFCCC does not have the resources to involve itself strongly in all projects in the regions, that would require public consultation as part of the environmental assessment process, it has to rely on regional EPAs, where these exist or on local authorities in general to organize and document public consultation. There are little experience and capacity in Ethiopia in this respect and this is undoubtedly an area where the UWSSP will have to strengthen capacity (see chapter 9 of the ESMF, Capacity building and Training).

While Ethiopian legislation is to-date less stringent than World Bank policies in this respect, there is, however, no limitation in the Ethiopian legislation as to the extent and scope of consultation and disclosure, nor as to who should be consulted. Therefore, there is no real contradiction between Ethiopian legislation and World Bank policies, which can be applied in their public consultation and disclosure aspects without violating Ethiopian law.

Environmental and social screening process for small-scale subprojects: As mentioned earlier, Ethiopian guidelines do not make provisions for the screening of small- scale sub- projects which could nevertheless have negative localized environmental and social impacts requiring mitigation. Therefore, the provisions of OP 4.01 for screening, assignment of environmental category, application of appropriate environmental mitigation measures and/or preparation of separate EIA reports, review and clearance of screening results and/or separate EIA reports, consultations, and monitoring are applied to the UWSSP.

4.7.2. Comparison between Ethiopian Legislation and World Bank Policies

Project Categorization in World Bank and Ethiopian legislation in environmental screening is the cornerstone of both Ethiopian legislation and World Bank policies pertaining to EA. Both screening processes address the need for further EA and its level and scope. 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 demands a full-fledged EIA. In a similar manner, "Schedule 2" and "Category B" projects are more or less similar in their definitions; both categories refer 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 EA or the implementation of mitigation measures in the context of an environmental and social screening process as outlined in this ESMF.

This approach is not in contradiction with the Ethiopian guidelines. 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. "Schedule 3" and "Category C" are also equivalent (they require no further environmental assessment).

Ethiopia has a comprehensive framework for assessing and managing environmental impacts of development projects. However, the Ethiopian framework does not provide clear requirements or guidance on the following two aspects:

- Public consultation and disclosure, and

- Environmental and social screening process for small-scale sub-projects that could have negative localized impacts;

Another issue is that while most of the responsibility for assessing, mitigating and monitoring environmental impacts falls under regional environmental agencies, these either do not exist or lack the capability to carry out the tasks assigned to them by law. Otherwise, Ethiopian requirements are generally consistent with World Bank policies. Table 1.2 provides the comparison of World Bank safeguard polices and environmental policies

Table 4.7. Comparison of World Bank Safeguard Polices and Environmental Policies of Ethiopia

Item	World Bank Safeguard Polices	Government policies/laws	Gaps identified	Resolution
Environmental screening	OP 4.01 require screening of sub project investments in order to determine if further environmental assessments (ESIAs) are needed- Category B projects need ESIA	EIA guidelines define the criteria for undertaking an EIA. According to this EIA procedural guideline, projects are categorized into three schedules- Schedule 2	Do not make provisions for the screening of sub-projects of a smaller scale than those listed in Schedules 1 and 2	In this case, the screening requirements of subproject investments stipulated under OP 4.01 of the WB will be prevail
ESIA	Require ESIA before project design and implementation (which also includes an assessment of social impacts)	Require EIA before implementation (which also includes an assessment of social impacts)	No gaps	No resolution needed
Public consultation and disclosure	Requires stakeholder's consultation during planning, implementation and operational phases of the project and has clear guidance	Requires public consultation at initial stage	Procedures for public consultations not explicitly stated	In this case, the stakeholder's consultation requirements of subproject investments stipulated under OP 4.01 of the WB will be prevail
Monitoring of environmental data	Requires regular monitoring of environmental data to evaluate the success of mitigation	Requires monitoring of environmental data	There are no procedures provided on the conduct of monitoring activities in the collection of environmental data	In this case, the procedures to conduct monitoring activities of subproject investments stipulated under OP 4.01 of the WB will be prevail
Involuntary resettlement of persons	OP 4.12 Involuntary Resettlement covers the involuntary taking of land, resulting in loss of shelter or loss of assets: a hierarchy has been provided that seeks to minimize losses to affected persons	There is similar law to address Involuntary resettlement	No gap	No resolution needed

4.8. Administrative and Institutional Framework

4.8.1. Administrative Framework

The Federal Democratic Republic of Ethiopia (FDRE) has a parliamentary system of government with two houses: the House of Peoples' Representatives and the House of the Federation. Ethiopia comprises twelve regional states and two city administrations (Addis Ababa and Dire Dawa), each with legislative, executive, and judicial powers.

For administrative purposes, regions are divided into zones, which are subdivided into woredas (districts). Each woreda is further divided into kebeles, which serve as the lowest administrative units—except in Addis Ababa, where the woreda is currently the lowest level. The powers and duties of federal, regional, and local governments are defined under Proclamations No. 33/1992, 41/1993, and 4/1995. Regional states are responsible for protecting natural resources and planning, directing, and implementing social

and economic development programs.

Environmental management is the responsibility of the project proponent, while overall environmental auditing falls under the Federal Environmental Protection Agency and its branch offices at various administrative levels. These agencies are also responsible for quality control, pollution regulation, and the protection of public health and the biophysical environment. The Ministry of Agriculture and urban agriculture offices in some cities are responsible for providing agricultural extension services in urban and peri-urban areas.

4.8.2. Institutional Framework

To ensure the project is implemented in an environmentally and socially acceptable manner, the Government of Ethiopia has prepared two key safeguard policy documents: an Environmental and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF). These documents, along with the World Bank Operational Guidelines, must be consulted throughout project implementation. The project's ESIA study is conducted in accordance with the ESMF requirements.

1) Federal Institutions Working on Environmental Issues: The federal Environmental Protection Agency (EPA) is responsible for providing guidelines and legislation for environmental protection and conservation. This includes formulating policies, strategies, laws, and standards that foster socioeconomic development while enhancing human welfare and environmental sustainability.

All project proponents and executing agencies must cooperate closely with the Commission to ensure proper mitigation measures are designed and implemented, particularly for projects with significant adverse environmental impacts. The Commission is responsible for evaluating the project's Environmental and Social Management Plan (ESMP) document. The ESMP preparation process aims to ensure proponent compliance with requirements, maintain cooperation between sectoral environmental agencies, foster close relationships with environmental offices, and evaluate documents arising from the ESIA process.

2) Regional Environmental Agencies: As per Proclamation No. 295/2002, each regional state and town government shall establish an independent environmental agency or designate an existing agency. Based on the Ethiopian Environmental Policy and Conservation Strategy, and ensuring public participation, these agencies are responsible for coordinating the formulation, implementation, review, and revision of regional conservation strategies, as well as environmental monitoring, protection, and regulation. Accordingly, the Tigray Environmental Protection and Climate Change Agency (TEPCCA), has been established to handle environmental issues and rural land administration in the region.

3) Sectoral Environmental Units: According to Proclamation No. 295/2002, every competent agency must establish or designate an environmental unit responsible for coordination and follow-up to ensure the agency's activities comply with environmental protection requirements.

4) Ministry of Water and Energy: The ministry manages the country's water resources, including development, planning, policy-making, and regulation. It is mandated to ensure the adequacy of water and sanitation services. Through the Environmental and Social Management Plan (ESMP), the ministry aims to safeguard surface water and groundwater systems from pollution, ensuring sustainable management and protection of water bodies for societal benefit.

5) Ministry of Health: Tasked with overseeing healthcare services in Ethiopia, the Ministry focuses on policy development, strategic planning, program implementation, and health regulation. Implementing the ESMP is vital for protecting public health by safeguarding water systems. The Ministry collaborates with various stakeholders to address environmental and social determinants of health, aiming to enhance healthcare accessibility, disease prevention, and the overall healthcare system. For this project, it oversees the health and wellbeing of the workforce and surrounding communities through close supervision of FSTP activities.

6) Ministry of Urban and Infrastructures: The Ministry plays a pivotal role in urban planning and infrastructure development. For the FSTP project, it develops policies and guidelines, establishes

regulations and standards for planning, construction, and operation, and provides technical assistance and capacity building programs for town administrations and relevant stakeholders. It collaborates with regional and town environmental agencies and other ministries to ensure alignment with national environmental policies.

7) Ministry of Agriculture: Following the amendment of Proclamation No. 300/2004, the Ministry of Agriculture and Natural Resources (MoANR) succeeded the former Ministry of Agriculture and Rural Development. Its responsibilities encompass forest and wildlife conservation, food security programs, agricultural development monitoring, market-oriented agricultural growth, agricultural input evaluation, and training in agriculture and rural technology. The ministry could support cooperatives in producing organic fertilizer (compost) from FSTP byproducts.

8) AWSSO: This entity is responsible for construction phase supervision and, during operation, for running the FSTP and monitoring its environmental and social performance according to the ESMP. It may operate the FSTP directly by hiring professional, skilled, and unskilled labor, or contract the management to a third party while maintaining oversight of overall performance.

9) Adigrat Town Administration: The municipality is crucial for the effective implementation and operation of the FSTP within its jurisdiction. It oversees the construction phase to ensure compliance with design specifications and environmental standards, manages day-to-day operations, including monitoring treatment processes and environmental performance, and ensures ESMP adherence to mitigate environmental impacts and safeguard public health. The municipality engages with the local community, relevant ministries, and environmental agencies to promote transparency and address concerns. It also oversees third-party contractors to ensure adherence to the ESMP and operational guidelines. Currently the Adigrat Water Supply and Sanitation office under the project has assigned two environmental and social afeguard specialists following up the progress of the project.

10) The Private Sector: The establishment of the FSTP will involve several private sector stakeholders. Construction companies will build the facility, while engineering and design firms will ensure compliance with technical and environmental standards. Environmental consultants will conduct impact assessments and guide regulatory adherence. Waste management companies may oversee collection, transportation, and disposal operations. Technology providers will supply specialized equipment, and local businesses are expected to benefit from increased demand for goods and services. Financial institutions may offer funding, and Public-Private Partnerships (PPPs) can leverage private sector expertise. Research organizations may contribute innovative solutions, and Community-Based Organizations (CBOs) will represent local interests. Effective engagement with these stakeholders is crucial for project success.

It is important to note that the construction contractor and supervising consultant contracted by the client must recruit or assign one environmental specialist and one social development specialist each. Furthermore, the construction contractor is required to prepare a site-specific Environmental and Social Management Plan (C-ESMP) that includes road safety measures, Occupational Health And Safety (OHS) considerations, community health and safety issues, and a Code of Conduct (CoC). This plan must be reviewed and approved by the supervising consultant prior to the commencement of any civil work activities.

5. STAKEHOLDER CONSULTATION, AND LAND EXPROPRIATION

One of the key components of the ESIA study process is identifying stakeholders and understanding their perspectives regarding the proposed FSTP project. To gather insights, community views and feedback from key stakeholders were collected through FGDs, KIIs, and household surveys. Additionally, an indicative survey was conducted to assess the potential impacts of the project, particularly in relation to future land expropriation and the preparation of the ARAP. The following sections address these issues in detail.

5.1. Stakeholder Identification and the Consultation Process

Before initiating fieldwork, primary stakeholders were identified for engagement at various administrative

levels (Table 5.1). Efforts were made to reach out to key stakeholders during interviews and discussions. Many of these stakeholders were identified in consultation with the AWSSO and assigned field project officers. In instances where in rare cases stakeholders were unavailable for in-person meetings, their views were gathered through phone calls.

Table 5.1: Target stakeholders for consultation and engagement

Stakeholders	Beneficaries And or Negatively Impacted Groups	Level of involvement
Local community members/groups having property inside the project area	• Farmers using stream and groundwater • The farming community using communal grazing and farmland including trees	Directly affected
Adigrat town community memebers	• Insititutions and residents of the city of Adigrat that benefits from the improvement of sanitation services	Directly affected
Local residents in Shibida	• Community members located around the project area	Directly affected
Public Institutions	• Educational facilities • WASH facilities • Medical facilities (hospitals, clinics, medical centers) • Religious entities (mosques/churches) • Utilities (electricity, water supply, road, telecommunication facility and others)	Directly or indirectly affected
Business and Service Providers	• Shops, markets (not at a close distance) • Petrol stations, car wash & service, others (not at a close distance) • Hotels and restaurants (not at a close distance) • Financial services (banks) (are not at a close distance)	Indirectly affected
Administrative bodies and Authorities	• Federal and Regional Authorities • Ministry of Water and Energy • AWSSO • TEPRLUA • Town Government (Municipality) of Adigrat • Woreda and kebele administrations	Indirectly affected, but may have also direct influence over the implementation of the project
International donors	• World Bank	Financer
Non-governmental Organizations (NGOs) and Civil Society Organizations (CSOs)	• Specialized environmental & social organizations • NGOs/CSOs - engaged in WASH activities • Relevant experts working in WaSH services	Indirectly affecting/affected
Local CBOs and Cooperatives	• Small-scale enterprises which are engaged in farming, dairy/poultry and in manufacturing activities • Vaccum truck owners disposing faecal sludge • Traders that provide materials for the WaSH related sevices	Directly affected
Consultants and Contractors	• Consultants for feasibility study • Contractor(s) (management, staff) • Sub-contractor(s) • Supervision contractor (the Engineer) • Material suppliers	Directly affected, may also have influence over the implementation of the project

5.2. The Consultation Process

The stakeholder consultation process involved a number of steps to ensure effective communication with stakeholders and PAPs. Prior to meetings, arrangements were made to facilitate consultations, which included identifying relevant stakeholders, designing data collection instruments, and formulating discussion topics. The field activities in relation to consultation followed project briefing, stakeholder feedback, and site visits to observe issues on the ground.

Stakeholder consultation was conducted using three methods: household surveys, KIIs, and FGDs. FGDs were held with local community members, PAPs, experts from different government offices, community leaders, and representatives from the private sector. These discussions fostered productive exchanges of ideas, allowing concerns and viewpoints to be reflected and documented. KIIs was made with purposefully selected stakeholders, particularly government line office experts, enabling in-depth exploration of specific issues. Household surveys assessed the socioeconomic profiles and opinions of potentially affected households and residents of the project area, predominantly PAPs.

Through this comprehensive approach, the consultation process aimed to ensure that all relevant perspectives were considered, fostering transparency and inclusivity in the development of the FSTP project. The findings from the different consultation methods is presented briefly below.

5.3. Consultation Findings

5.3.1. Consultation with Key Stakeholders through FGD and KII

Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were conducted with a range of stakeholders, including experts from relevant sectors, Project-Affected Persons (PAPs), and local community representatives (see Figures 5.1 and 5.2). The consulting team provided comprehensive briefings on the Faecal Sludge Treatment Plant (FSTP) project, detailing its potential benefits, challenges, adverse impacts, and proposed mitigation measures. Participants were encouraged to share their views openly, with assurances of confidentiality. The generally positive existing relationship between the Adigrat Water Supply Office (AWSSO), project experts, and local stakeholders contributed to a well-informed dialogue. Overwhelming support was expressed for the project's timely implementation in compliance with national and regional regulations, with repeated emphasis on the critical importance of environmental protection.

The consultations yielded valuable insights that significantly informed impact identification, mitigation planning, and the preparation of the Environmental and Social Management Plan (ESMP). Key issues and recommendations raised consistently across the discussions include:

- Project Urgency and Benefits: Widespread recognition of the project's necessity for improving waste management and enhancing public and environmental safety.
- Compensation and Livelihoods: A strong emphasis on the need for timely and fair compensation for assets and land acquired for the project. Additionally, stakeholders highlighted the importance of creating employment opportunities for PAPs and local communities to ensure sustainable livelihood enhancement.
- Environmental and Health Safeguards: Significant concern regarding potential negative impacts on human and animal health from FSTP effluent. This underscores the necessity for rigorous effluent treatment, continuous monitoring by the AWSSO and relevant authorities, and the adoption of advanced technology to ensure compliance with environmental standards before any release into the environment.
- Public Awareness and Participation: An identified need for comprehensive public awareness campaigns to educate the community on the project's benefits and mitigation strategies, fostering local ownership and support.
- Gender-Based Violence and Safety: Participants raised concerns about the potential for gender-based violence, including physical and sexual harassment, particularly targeting female laborers in construction camps. Recommendations included implementing targeted awareness campaigns and establishing robust mechanisms to prevent and address these issues effectively.
- Job creation: several job creation concerns and expectations were raised by community members. These insights reflect both the aspirations and apprehensions of local residents regarding employment opportunities linked to the project.

Figure 5.1: Key informant interviews of the utility and the private sector (vacuum truck owners)

Figure 5.2: Focus Group Discussion with the PAPs and key experts from different offices

Prior to consultations, PAPs were identified and an indicative survey was conducted to assess affected property types. The consultant team outlined the general guidelines for compensation and explained the established Grievance Redress Mechanism (GRM). It was clarified that a detailed ARAP would be developed by an independent body to address compensation for properties affected by the FSTP and its access road.

Sectoral office experts from the woreda and kebele levels acknowledged the project's positive potential to address inadequate faecal sludge management. However, they concurrently cautioned that without proper management, wastewater treatment plants could become a source of pollution, highlighting the critical need for improved technology and effective mitigation measures as outlined in the ESMP.

5.3.2. Consultation Meeting with the Local Community

Public consultation meetings were held with PAPs and the broader local community, including sectoral office experts, community leaders, women, and youth (Figure 5.2). Kebele/Tabia administrators pledged their support for the project, including assistance for vulnerable groups such as elders and women, potentially through opportunities for participation in income-generating activities.

A paramount concern reiterated by the community was the necessity for timely and adequate compensation for affected properties, coupled with measures to improve economic conditions and maintain social cohesion for PAPs. The community expressed a strong desire for enhanced job opportunities and a more favorable business environment.

Following detailed explanations from the consultant team, community members conveyed their anticipation for the project's by-products, specifically the production of organic fertilizer/compost and the use of treated water for local irrigation to boost agricultural productivity. They strongly reaffirmed the need for appropriate compensation and follow-up measures to ensure the economic well-being of those directly affected.

Overall, the community demonstrated strong support for the project, believing it would significantly improve public health and reduce disease risk, provided it is implemented in accordance with the design and recommendations stipulated in the ESMP. The findings from the FGDs, KIIs, and household surveys consistently reflect a favorable view towards the project's implementation.

5.3.3. Findings of the Household Survey

To gather critical baseline data for the ESIA, a targeted household survey was administered to residents in the sparsely populated villages adjacent to the proposed FSTP site. The primary objectives were to understand the demographic and socio-economic profile of the community, assess current Water, Sanitation, and Hygiene (WaSH) conditions, and gauge local awareness and perceptions of the proposed project. The proposed FSTP project is situated in Gola Genahti Kebele, specifically within the Mayawli Village at the Shibida locality. For the purpose of this survey, a representative sample of 37 households was randomly drawn from the total population of 1,702 household heads residing in the kebele. This sample size was determined to be statistically appropriate during the project's inception phase, reflecting the low population density in the immediate project area. The findings provide a robust and representative snapshot of the community and are highly consistent with the issues raised during separate community consultations and key informant interviews.

5.3.3.1. Demographic Profile Respondents

The survey recorded a gender distribution among respondents of 51.4% male and 48.6% female. The respondents were overwhelmingly the heads of their households, with 43.2% being fathers and 48.6% being mothers, ensuring the data reflects the views of primary decision-makers. The data indicates an older population structure, with more than half (51.4%) of respondents over the age of 50 and a further 29.7% between 41 and 50 years old. This age distribution is significant for the ESIA as it may influence the community's capacity to engage with project-related activities and their vulnerability to change. The vast majority (67.6%) are married, with a notable proportion being divorced (21.6%) or widowed (8.1%), which is an important consideration for understanding household stability and support networks.

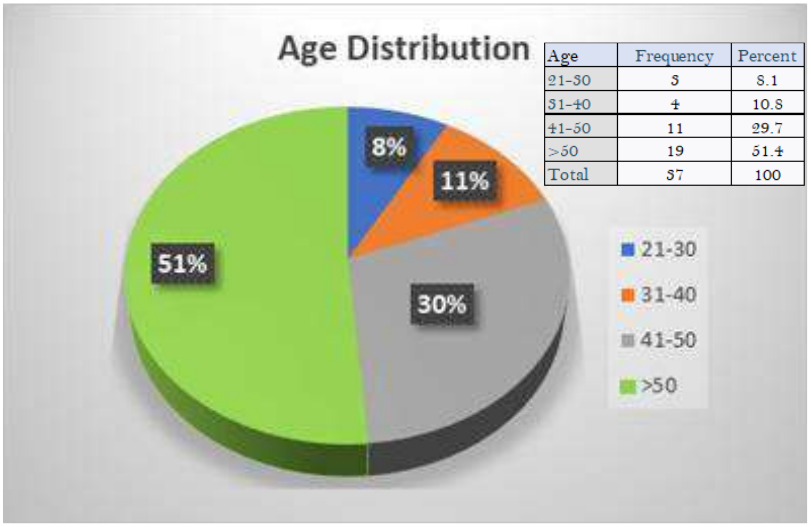

Figure 5.3. Age distribution of respondents

5.3.3.2. Socio-Economic and Household Characteristics

The survey revealed significant socio-economic indicators directly relevant to the project's social management plan. A striking 86.5% of respondents have no formal education or only basic literacy skills,

highlighting a potential communication challenge that must be addressed through clear, accessible, and non-technical stakeholder engagement materials. The local economy is predominantly agrarian, with 81.1% of respondents engaged in farming, underscoring the community's deep connection to the land and its resources. Household sizes are generally large, with most homes containing multiple members. This is a crucial factor for the ESIA, as it relates to the density of any potential project impacts and the number of people who stand to benefit from improved sanitation services.

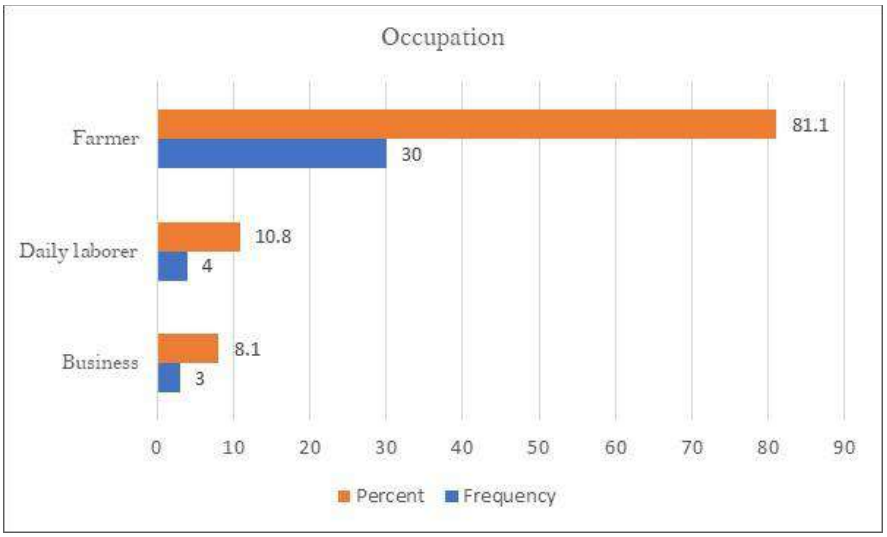

Figure 5.4. Occupation of respondents

5.3.3.3. Project Awareness, Perception, and Social Factors

A key finding for project stakeholder engagement is the exceptionally high level of community awareness, with 97.3% of respondents informed about the proposed faecal sludge treatment plant. This demonstrates the effectiveness of prior communications by the utility and the close relationship **between** the residents and the service provider. Furthermore, project support is unanimous among all surveyed households (100%), indicating strong social acceptance and a recognized need for improved sanitation infrastructure-which is a significant asset for the project's successful implementation.

Regarding potential impacts, a large majority (89.2%) do not anticipate any negative effects on their property, except the identified sites along the access road and the FSTP site. However, a minority (10.8%) expressed concerns about potential impacts on structures such as WaSH facilities and houses very close to the access road if expanded in width. While the number is small, this group requires focused attention to ensure their concerns are fully investigated and mitigated, aligning with the ESIA's principle of identifying and addressing all potential impacts. The survey also inquired about disabilities within households, with 91.9% reporting none such as hearing impairment. This data is essential for ensuring that inclusive measures are part of the project's design and employment opportunities, catering to all segments of the community.

5.3.3.4. Income and Livelihood

The survey confirms that the local economy is almost entirely dependent on subsistence agriculture, with 86.5% of respondents engaged in farming. This economic profile is characterized by very low cash income, with more than half of households (56.8%) surviving on less than 1,500 Birr per month. Despite reporting a recent increase in annual income, this context of economic vulnerability is critical for the ESIA. It highlights both a potential risk (livelihood disruption must be minimized) and a significant opportunity: the project can serve as a catalyst for local economic development.

However, a major gap exists between the project's potential benefits and current community awareness. An overwhelming 81.1% of respondents have never received training on composting, which are key by-products of a faecal sludge treatment plant. Consequently, current interest in using or being engaged in the preparation of these recycled products is low (24.3%). This underscores a vital need for the project's

stakeholder engagement plan: to launch comprehensive awareness and training campaigns that clearly articulate the economic opportunities, such as the production and sale of safe compost for farmers and the potential for alternative energy sources. The strong expressed interest (76.9% of non-members) in joining savings and credit cooperatives further indicates a community eager for financial inclusion, which could be leveraged to support small businesses around these new value chains.

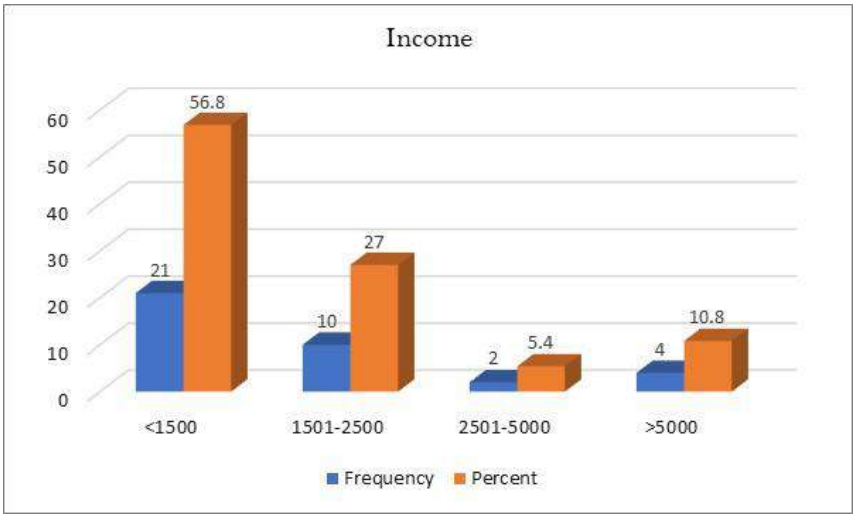

Figure 5.5. Monthly income of respondents (in Birr)

5.3.3.5. Water, Sanitation, and Hygiene (WaSH) Conditions

The WaSH data paints a picture of a community facing severe public health challenges, powerfully validating the core need for the faecal sludge treatment plant. While access to water is relatively good for most, sanitation infrastructure is critically inadequate. A concerning 21.6% of households have no toilet facility at all, and the majority (70.3%) use unimproved latrines. Emptying services are virtually non-existent or unknown; 54.1% of residents believe no emptying services are available, and another 43.2% are unsure. Open deffication is a common practice. Solid waste management is also very poor (Figure 5.6.)

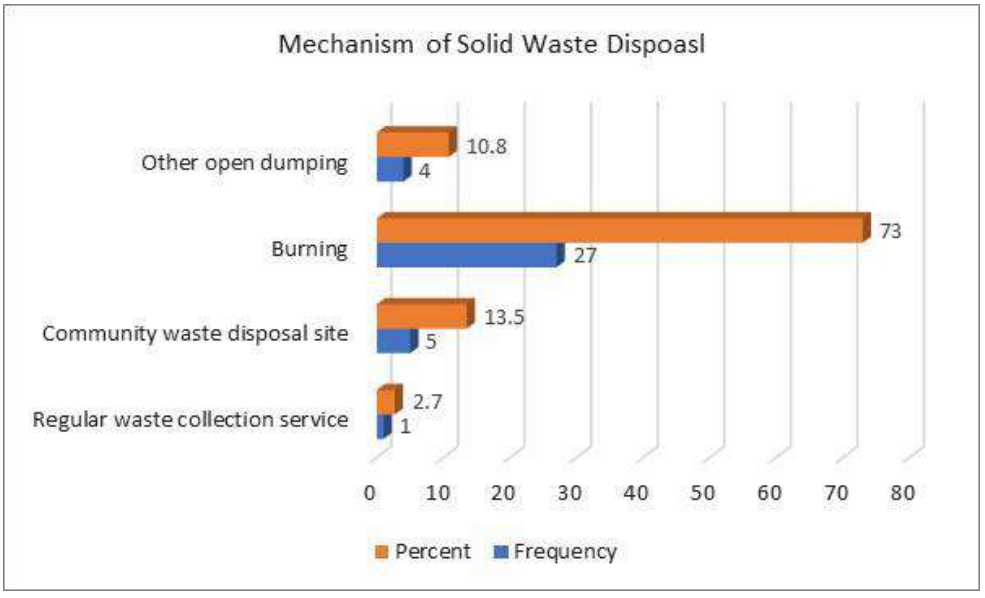

Figure 5.6. Mechanism of solid waste disposal

The consequences of these conditions are dire. Handwashing practices are poor, with over half of households having no facility near their toilet and 51.4% of families rarely or never using soap. Most strikingly, 100% of surveyed households reported cases of diarrhoea in the three months prior to the survey, primarily affecting children under five years old. This devastating public health outcome underscores the urgent necessity of this project.

While theoretical awareness of the health links to poor sanitation is high (75.7%), practical knowledge is lacking, as nearly half of the respondents do not know what to do when their pit latrine is full. The management of existing water infrastructure is successfully community-based, led by WASH committees and Kebele councils, providing a strong, pre-existing structure for the project to partner with for hygiene promotion and the management of new sanitation services.

In summary, the survey findings necessitate an integrated set of recommendations that address both immediate public health concerns and the long-term sustainability of the faecal sludge treatment plant. Firstly, an immediate public health response is critical to parallel the project's construction. This should involve targeted hygiene promotion campaigns, delivered through the established network of Health Extension Workers (HEWs), focusing on practical demonstrations of handwashing with soap and safe water handling. Secondly, core project communication must clearly and repeatedly articulate the plant's primary function: to provide the reliable, safe emptying service that over 97% of the community currently does not believe exists. This messaging should be disseminated by formally partnering with and leveraging the existing management structures of WASH committees and Kebele councils, which are already trusted entities within the community.

Furthermore, the project presents a significant opportunity to transcend its basic utility function and become a catalyst for local economic development. A dedicated livelihoods and training program should be established to educate residents on the benefits and safe handling of the plant's by-products, such as composts. This initiative would transform waste into valuable resources for this agrarian community, creating economic opportunities and fostering greater project ownership. In summary, while the baseline findings illustrate a clear and urgent unmet need for sanitation services that the plant directly addresses, its ultimate success hinges on a holistic approach that combines urgent health interventions, clear communication, and the creation of tangible economic benefits for the supportive local population.

5.3.3.6. Vulnerability Mapping and Profiling of Project-Affected Persons (PAPs)

Vulnerability mapping was integrated into the survey and consultation process to identify groups requiring specific support measures. The assessment confirms that the Project-Affected Persons will be drawn from a community characterized by significant economic and social vulnerability. The vast majority of the population are subsistence farmers with very low cash incomes, making them highly sensitive to any loss of land or disruption of their agricultural livelihoods.

The community also faces considerable barriers due to low levels of formal education, which necessitates that all project-related communication, including compensation procedures and grievance mechanisms, be delivered in clear, accessible, and non-technical formats. Furthermore, a substantial segment of the population consists of female-headed households and elderly residents, groups that often have a reduced capacity to adapt to change and will require prioritized livelihood support.

Specific vulnerable individuals, including persons with disabilities identified during the consultations, will be documented and receive targeted assistance. The ARAP will be designed to ensure equitable compensation and livelihood restoration for all affected persons, with particular attention to the needs of these vulnerable groups.

5.4. Land Acquisition Issue and Indcative Survey for ARAP

5.4.1. Land Acqusition Issues

From the perspective of land acquisition and expropriation, Ethiopia's legal framework emphasizes the fundamental right of individuals to own private property, which includes land, buildings, and any other property for improvements resulting from their investments. When the government requisitions land for public purposes, the owner is entitled to compensation in accordance with the Constitution and related policy.

The 1960 Civil Code of Ethiopia outlines the procedures governing land expropriation and compensation for public projects, empowering competent authorities to mandate the relinquishment of immovable property for initiatives deemed to serve the public interest. It stipulates that compensation must

correspond to the actual damages incurred due to expropriation, adhering to the principle of replacement cost.

Proclamation No. 1161/2019 (amended by Proc. No. 1336/2024) establishes a comprehensive framework for land acquisition, compensation, and resettlement for public projects which is amended by the recent Proclamation No. 1336/2024 on Expropriation of land holding for public purpose payment of compensation and Resettlement which details procedures, principles for assessments, and timelines for land acquisition, compensation valuation, and displacement compensation. It also addresses the formulation for a Fullf-ledged Resettlment Plan, RAP (if the PAPs are more than 200), and Abbreviated Resettlement Action Plans, ARAP (if the the PAPs are less than 200) and methodologies for property valuation, including mechanisms for addressing grievances. Accordingly, since the total number of project affected peoples PAPs is less than 200, only an ARAP will be consdiered.

Under Article 40 (7) of the Ethiopian Constitution, individuals retain complete ownership rights over private property, with provisions ensuring compensation in cases of expropriation for public purposes. Article 44(2) guarantees those affected by state programs the right to appropriate monetary or alternative compensation, including relocation assistance from the government. The regional laws and regulations which are inline with the federal laws and the constiutution of Ethiopiaa needs to be implemented in the course of the compensation process.

The legal provisions within the Civil Code and the recent legal framework underscore Ethiopia's commitment to ensuring equitable compensation for individuals affected by land expropriation, aligning with constitutional rights and international standards of property rights protection.

The Ethiopian constitution and land laws establish that all land, urban or rural, is state-owned, prohibiting private ownership. Users like farmers and herders have rights to use the land they work but cannot sell, mortgage, or trade it. Regional authorities manage land activities in accordance with federal laws, focusing on factors like residency, agricultural involvement, and land management to uphold land rights. Violations will lead to penalties, including loss of land rights.

The government can expropriate land for public or investor use, with compensation offered, though often deemed insufficient by affected landowners. Despite land certification efforts, land expropriation persists, causing many smallholders to lose land to private investors. Land rights in Ethiopia are conditional and subject to state control, reflecting power dynamics between the government and local communities.

The presence of valuable farmland and government incentives in Adigrat is crucial for the current project, as land acquisition for the FSTP is essential to effectively address the needs of stakeholders. The issues of land acquisition, compensation, and livelihood restoration have emerged as key topics during community consultations and stakeholder meetings, as detailed above.

5.4.2. Indicative Survey from ARAP Perspective

As part of the ESIA study, potential direct impacts resulting from the implementation of the FSTP project were assessed within the project site, its immediate environs, and along the access road. The objective was to identify the types of properties likely to be affected and determine the number of PAPs. The baseline conditions of the FSTP site and its environs are detailed in Chapter 8. Figure 5.3 illustrates existing land use features along the access road, within the project area, and in the surrounding buffer zone. Table 5.2 summerizes the type of property to be affected. Detailed measurements, chracterization and valuation of the property is to be done in the course of the implementation of the ARAP before construction commences.

Figure 5.7. Land use features along the access road and at the FSTP site (Remark: The arrow position is the site where the photograph was taken)

The assessment confirms that no residential structures will be demolished, thereby avoiding physical displacement. Affected properties are primarily limited agricultural plots, scattered trees, and simple fences made of wood or natural bushes. It is important to note that detailed property valuation and comprehensive socio-economic surveys of PAPs-essential for formal Abbreviated Resettlement Action Plan (ARAP) preparation-fall outside the scope of this assignment. Subsequent compensation procedures will be administered by local authorities in accordance with national and regional regulations, as outlined in Chapter 3. Table 5.2. Indicative information for ARAP on the type of property to be affected.

Table 5.2. Characteristics of FSTP site, buffer zone and access road route corridor

Within the FSTP Site	Buffer Zone	Along the Access Road
• No houses or permanent/temporary structures. • Loss of farmland/grazing land requires compensation. • Area consists of farmland with scattered bushes and trees. • No fruit trees or vegetable cultivation. • Primary crops: wheat, barley, maize. • No irrigated agriculture or infrastructure • No utility poles or cables. • No boundary disputes with adjacent kebeles. • No historical, cultural, or ecological sensitivities.	• No houses or permanent settlements • Small farmland areas with bushes and trees. • Limited presence of vegetables and fruit trees. • Contains a small seepage detention pond to the west. • Similar crops as FSTP site; terraced sloped area with non-indigenous trees. • Gravel roads and footpaths present. • No telecommunication cables or public/private infrastructure. • No boundary issues with neighboring kebeles.	• Predominantly farmland, bushes, and trees. • Within first 1.5 km: proximity to houses and few fruit trees. • Fencing mainly cactus, bushes, and limited wood or stone masonry. • Largely follows existing seasonal gravel road. • Section at 1.5 km passes through forested terraced slope requiring cut-and-fill. • No irrigated land or associated infrastructure. • No utility infrastructure affected. • No cultural, historical, or ecological sensitivities.

6. GRIEVANCE REDRESS MECHANISM AND MONITORING AND EVALUATION FRAMEWORK

6.1. Grievance Redress Mechanism

6.1.1. Need for Grievance Redress

Implementation of ARAP is a complex process, which can involve conflicts, disagreements and grievances on the part of PAPs and other stakeholders, mainly because it involves the expropriation and/or compensation of land and other assets.

The most important step in conflict resolution is conflict avoidance. Therefore, the consultative and participatory nature of decision making under the implementation of this RAP is aimed at reducing the occurrence of disagreements and conflicting positions. In instances where disagreements do occur, it is important that they are resolved quickly before positions harden and the conflict escalates. Different approaches may be required according to the level that any conflict has reached. It is critical to recognize that the sooner a potential conflict is identified and dealt with, the greater the chance of a successful outcome. These phases of conflict development and appropriate interventions can be summarized as follows:

- Consultation and participation in planning & decision making
- Simple disagreements: Informal negotiation, discussion and mediation
- Early conflict development: Consult KRC Representative
- Conflicting positions taken: Refer conflict to GRC
- Intractable conflict: Refer conflict to regular court

The best means of addressing any complaints or claims is through dialogue. Thus, when a PAP has a grievance, she/he will first discuss the issue with the Resettlement Implementation Team (RIT). If the RIT is not able to address the grievance, the complaints should be passed on to the Grievance Redressing Committee (GRC). The grievance redress system for the implementation of the ARAP is outlined below.

6.1.2. Types of Grievances

The Adigrat FSTP Project does not involve physical displacement of PAPs. However, it involves economic displacement in the form of land acquisition for which all affected PAPs will receive monetary compensation. Both the Ethiopian laws as well as the WB's O&S require that the ARAP include procedures for dealing with concerns or complaints raised by individuals or groups about the project land acquisition and associated mitigation measures, such as payment of compensation and livelihood restoration measures.

It is recognized that complaints are likely to arise that, if not dealt with in a timely and fair manner, could lead to conflict between the community and other stakeholders, notably AWSSO, but also other Federal and Regional government entities.

It is important to underscore that the GRM does not impede access to the country's judicial or administrative remedies, if and when such remedies are required to resolve grievances.

Several types of grievances or disputes could potentially arise that present a risk to the provided on Adigrat FSTP Project. The following are some of the potential sources of project related grievances:

- Rates applied for monetary compensation for affected property;
- Ownership disputes of the land and the assets affected;
- Implementation of the livelihood's restoration programme (e.g. eligibility and entitlements to restoration measures etc.);

- Misidentification of assets or land owners due to registration errors or inaccurate or misleading information during assets surveys;
- Disagreement over the valuation or quality of an asset where compensation is payable;
- Disagreement over the type, quality and quantity of measures applied to achieve livelihoods restoration;
- Impacts of the construction and operation of the FSTP Project; and
- Disagreement over the cut-off date applied.

6.1.3. Grievance Management Approach

The proposed approach for grievance resolution combines traditional or community-based resolution, and potential use of the legal system if complainants prefer. It provides for multiple entry points to the system, formal recording of concerns, multiple resolution pathways depending on the nature of the grievance, use of traditional conflict resolution mechanisms where possible, active consultation, and an appeal system.

Although they remain largely informal and traditional, communities in the Project area have effective community-based conflict resolution processes. For some of the potential conflicts that may arise in relation to the Project's land acquisition, it is both less expensive and more appropriate to consider the use of traditional conflict resolution mechanisms. For example, issues such as PAPs' land ownership (title deeds) and boundaries between plots owned by different PAPs, can best be resolved through traditional conflict resolution processes within the community. To enhance the effectiveness of the community-based conflict resolution processes, AWSSO, working with community traditional leaders and community elders, will develop a detailed protocol for their use.

For minor grievances between PAPs, or between PAPs on the one hand and other community members on the other, EEP will refer the matter to relevant community elders for resolution. If the grievances are deemed significant, then AWSSO will facilitate a mediation or negotiation between the parties.

AWSSO, will continue to work closely with representatives of the communities to run this grievance redress mechanism for the Project and to address affected communities' concerns and complaints. Combined with effective community engagement, this grievance redress mechanism that is a joint effort between the Project and communities is expected to promote trust and enhance communication.

Where a grievance relates to AWSSO's management of the ARAP and to compensation will be dealt with in accordance with the GRM set out in the section below. Project construction and operation impacts shall also be managed in accordance with the GRM.

Any grievances raised with the contractors and AWSSO's staff relating to construction or operational grievances will be referred to the appropriate entity in accordance with the grievance mechanism.

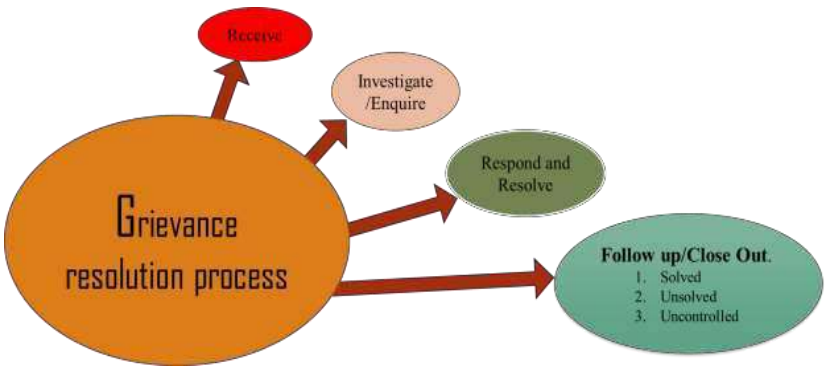

Figure 6.1. Project GRM procedure

6.1.4. Mechanism for Dealing with Grievances

To ensure that the basic rights and interests of PAPs are protected, that concerns are adequately addressed and that entitlements are delivered, a grievance procedure has to be designed for the FSTP project as outlined below.

The proposed GRM shall establish a. seven-member Grievance Redress Committee (GRC). A schematic process for dealing with issues, grievances and complaints is presented in Figure 6.1. The Project Implementation Office and Community Liaison Officer will establish and maintain a system for the following:

- Receiving and recording complaints and concerns regarding land acquisition and livelihoods restoration;
- Allocating the complaint/grievance to the appropriate persons and process for investigation;
- Consulting with the interested parties;
- Investigating the grievance, including drawing on the census enumeration and property registration survey data, GPS locational data, and photographic evidence;
- Achieving resolution of received complaints and grievances, including agreement- making;
- Reporting back to the complainant;
- Sign-off/closeout;
- Follow up and monitoring; and
- Reporting on the grievance system as part of the overall project monitoring and reporting.

Any comments or concerns can be brought to the attention of the project verbally or in writing or by filling in a grievance form.

6.1.5. Grievance Redress Committee

GRCs will be established at the Woreda and Kebele level. The main function of the GRCs would be arbitration and negotiation based on a transparent and fair hearing of the cases of the parties in dispute, mainly PAPs and the project implementing agency and local government. They are responsible to hear the grievances of PAPs and other stakeholders and arbitrate disputes in order to arrive at amicable solutions based on negotiation and in a transparent and fair manner.

The GRCs will be independent and careful selection of the members is crucial to ensure its autonomy. For this purpose, there will not be overlap of membership in Grievance Redress Committee (GRC) and Woreda Resettlement Committee (WRC). The composition of the GRCs is shown in Table 6.1.

Presence of female members on the GRCs is crucial in order to ensure better consideration of gender issues for grievance resolution. With the help of their leaders, PAPs will democratically elect and nominate their representatives.

Table 6.1. Composition of Woreda Grievance Redress Committees

No.	*GRC members*	*Position*
1	Representative of Chief Woreda Administration Office	Chair-Person
2	Representative from Women, Children & Social Affairs Office	Secretary
3	Representative from Woreda Office of Agriculture	Member
4	Representative of Kebele Social Court (from appellant Kebele)	Member
5	Witness NGO/CBO (Active within the Woreda)	Member
6	PAPs Representatives from appellant Kebele (1 Male & 1 Female)	Member
	Total	7

Remark: Depending on the local context the number of members could be changed

6.1.6. Grievances Monitoring and Reporting

The Resettlement Implementation Team (RIT) will monitor grievances routinely as part of the broader management of the Project. This entails good record keeping. Grievance records must be made available to management and interested stakeholders at all times.

Monthly internal reports will be compiled by the RIT and these grievance reports will include:

- The number of grievances logged in the proceeding period by category;
- Number of PAPs that came back stating they are not satisfied with the resolution;
- The number of grievances unresolved after 30 days by category;
- The number of grievances resolved between the RIT and PAPs without accessing legal or third-party mediators, by category;
- The number of grievances of the same or similar issue;
- The RIT's responses to concerns raised by the various stakeholders; and
- Measures taken to incorporate these responses in the resettlement implementation plan.

An appropriate grievance report shall be part of the AWSSO's monthly progress reporting. These reports and other records will be made available to the public and other external stakeholders review if required.

6.2. Monitoring, Review and Evaluation Framework

The principal purpose of monitoring will be to check whether the compensation and livelihoods restoration activities are being delivered as intended, and whether the livelihoods of PAPs are being sustained and possibly improved.

The main type of monitoring to be adopted for the purpose of this ARAP will be Internal Performance Monitoring (IPM). Accordingly, the implementing agency and the main units and institutions charged with the implementation of the ARAP will undertake continuous and systematic IPM of the ARAP.

The framework presented below provides a brief description focusing on aspects such as the purpose, indicators, information sources, reporting procedures, and responsible bodies for monitoring, review and evaluation of the ARAP. For ease of reference, the main aspects of the monitoring, review and evaluation framework.

6.2.1. Internal Performance Monitoring

The main issues and points for the application of IPM for the implementation of the ARAP are outlined below.

6.2.1.1. Nature and Purpose of IPM

The nature and purpose of internal performance monitoring include the following:

- The main purpose of IPM is to serve as a tool for AWSSO and other relevant stakeholders to have up-to-date information. It also enables tracking and performance assessment measured against targets set in the ARAP and facilitates the taking of corrective measures if problems arise or when there are deviations from targets.
- IPM largely focuses on input-output performance measured against the financial and physical input-output targets set in the ARAP.
- An effective and functioning IPM depends on a continuous two-way flow of information. An efficient system for measuring, recording and reporting data and information is vital for IPM. This underlines the importance of having an effective documentation and data base system as part of the institutional capacity building measures for the implementation of the ARAP.
- IPM is a continuous process lasting throughout the entire life period of implementation of the ARAP and covering all components and activities of the ARAP. Therefore, the allocation of resources for monitoring as well as for review and evaluation should take into account the long-lasting and intensive nature of the set activities.

The basic source of reference for undertaking IPM is the ARAP document. The ARAP document provides the baseline for implementation of the ARAP, including the types of components and activities to be undertaken, the financial and physical targets to be achieved in relation to the timetable and the schedule established in the ARAP document.

6.2.1.2. IPM Approach and Methodology

The general approach for IPM include:

- Maintain and regularly update a database with socio-economic baseline, displacement, and restoration data for PAPs as well as a stakeholder engagement log;
- Maintain and regularly update a database of all project grievances, including date of grievance, name of aggrieved, nature of the grievance, and how and when the grievance was addressed at each level of the grievance mechanism;
- Monitor the development, delivery and impact of the livelihood programmes; and
- Recommend to the PIO leadership appropriate adjustment to improve resettlement and livelihood restoration initiatives.

All data will be disaggregated by age and gender.

To measure the outcomes and effects of the ARAP on PAPs, monitoring different aspects of the project will involve:

Day-to-day process/ Activity-level monitoring

This internal monitoring will be conducted by the RIT and focus on the physical progress of the ARAP and LRP implementation against the schedule in the approved plan. It will monitor:

- Baseline survey completion;
- Progress of verification of losses;
- Preparation and disclosure of updated resettlement and livelihood restoration plans and approvals;
- Compensation payment against allocated funds;
- Implementation of the GRM; and
- Availability of funds for implementation of the ARAP & LRP.

Periodic Socio-Economic Monitoring

Periodic socio-economic monitoring will be undertaken to measure the progress being made towards restoring or improving income levels and living standards for PAHs, and especially for vulnerable PAPs.

Project Impacts on Households

This will be indirectly measured and monitored by the conduct of socio-economic questionnaire surveys, the main aim of which will be to:

- Identify any socio-economic change in the project affected areas, whether positive or negative;
- Measure the level of poverty among PAHs; and
- Measure the distribution of wealth and resources to ensure that the compensation and livelihood restoration activities do not result in inequitable use or holdings of resources.

6.2.1.3. Monitoring, Data Sources and Information

IPM applies to all components and activities and will last throughout the period of the ARAP implementation. Key parameters to monitor include:

- Land acquisition against targets and vis-à-vis construction activities;
- Disbursement of compensation for different types of assets;
- Disbursement of relocation/transfer assistance and special assistance for vulnerable groups;

- Sufficiency and effectiveness of the assistance provided to vulnerable groups;
- The number and types of livelihoods restoration projects and activities initiated and the effectiveness of these projects;
- The number and types of community and social development projects initiated and the effectiveness of these projects;
- The number and types of grievances lodged by PAPs and related responses and decisions on these;
- The problems and challenges faced in the process of implementation of the above mentioned and other resettlement activities; and
- Effectiveness and timing of public participation and consultation activities.

6.2.1.4. Responsible Bodies and Reporting Procedures

The responsible entities and reporting procedures are outlined below:

- The main sources of data and information for IPM will be internal or in-house documents and records generated from the ARAP implementation (e.g. records on compensation) and the day-to-day observations by the RIT;
- The main responsible entity for IPM will be the PIO/ESAO (the monitoring, review and evaluation officer of the ARAP in particular). Monthly performance monitoring reports will be prepared by the Resettlement Officer and will be submitted to the Project Manager/PIO.

The consolidated reports will serve various purposes including:

- Being used by the RIT and other staff to track and assess performance and take corrective measures if needed;
- Being used by the Project Manager/PIO to brief relevant authorities; and
- The consolidated performance monitoring reports will serve as one source of data and information for presentations during the periodic progress review meetings. These meetings will be attended by EPA, Regional Office of Environment and Woreda Office of Agriculture.

6.2.2. ARAP External Evaluation

An external ARAP evaluation will be undertaken at the end of implementation. This will be undertaken by an external entity, preferably an independent consultant. AWSSO's rules and regulations for the contracting of external consultancy services will be followed and the consultant will be engaged on the basis of a Terms of Reference to be prepared by the PIO/ ESAO.

The terminal external evaluation will be generally comprehensive in nature in that its main purpose is to assess the outcomes and effects of the ARAP in relation to the objectives and aims. Accordingly, the focus of the evaluation will be on the impact of the project on PAHs and the outcomes of the compensation, livelihoods restoration, and social development programmes and projects on the income, livelihood and well-being of PAPs and local communities in the project affected areas.

6.2.2.1. Objectives of External Evaluation

The following will be the focus and purpose of the evaluation:

- Verify whether the outcomes of the ARAP comply with the national legislation and AfDB's OSs, in particular OS2;
- Assess whether or not the aims and objectives of the ARAP were achieved in terms of the actual implementation of the components and activities of the ARAP including the timely and full payment of compensation, the attainment of the objectives of the income restoration and community development projects and interventions in mitigating the adverse impacts of the project and in the improvement of the income and wellbeing of the PAHs;
- Identify and document the problems and challenges encountered in the process of implementing the ARAP; and

- Identify and assess the main lessons learned to inform the planning and implementation of similar AWSSO projects in the future.

6.2.2.2. External Monitoring and Evaluation

The following indicators should be included in the ARAP evaluation. All data collected should be disaggregated by gender to enable specific analysis of different impacts on women and age.

i) *Basic Information of PAPs:* The most important information and data for external monitoring include:
   - Location
   - Gender of household head
   - Housing type
   - Land type and uses
   - Income and sources of income
   - Agricultural production data
   - Values of assets, compensation and resettlement entitlement

ii) *Restoration of living standards* basic indicators include:
   - Compensation for houses as per the guidelines and laws;
   - Fair resettlement for PAHs and vulnerable groups, and achievement of the objectives of the ARAP; and
   - Noting unintended impacts of the ARAP implementation and of the project?

iii) *Restoration of livelihood* includes issues such as:
   - Whether compensation payments were sufficient to replace lost assets;
   - Whether transfer and relocation payments were sufficient to cover the costs;
   - Whether vulnerable groups have been provided with income earning mechanisms; and
   - Whether the current income levels match the pre-project income levels.

iv) *Effectiveness of the ARAP*: Issues to investigate effectiveness of the resettlement plan include:
   - Whether affected people and their assets were enumerated correctly and properly measured;
   - Whether the time frame and budget were sufficient to meet ARAP objectives;
   - Whether vulnerable groups were correctly identified and assisted;
   - Whether there were any unforeseen problems encountered and if so, how they were resolved;
   - The effectiveness of the institutional arrangement for the implementation of the ARAP; and
   - The effectiveness of the grievance redress mechanism and procedure.

v) *Level of PAHs' satisfaction* includes issues such as:
   - How much PAPs know about their rights to file grievances;
   - The number of aggrieved people; and
   - Whether PAPs were informed about the grievance redress mechanism.

6.2.2.3. Reporting

The independent monitoring consultant will produce a report 6 to 12 months after the ARAP completion including livelihood restoration activities. The report will contain:

- Description of monitoring activities;
- Findings in relation to whether the project activities have been implemented and completed as planned and according to budget;
- Achievement of objectives and recommendations;
- GRM implementation and any residual grievances that remained behind; and
- Timetable and budget for addressing outstanding problems.

The draft monitoring report will be shared with AWSSO for their comments before being finalized and submitted to EPA, the regional Government, WB and other relevant stakeholders.

6.2.2.4. Proposed Team Composition

The Independent Consultant will consist of a specialist with extensive experience in implementation and/or monitoring of resettlement projects. The independent consultant shall be a Senior Resettlement Specialist with a strong background in livelihood restoration and monitoring and evaluation and experience in gender impact assessment and analysis.

6.3. ARAP/ LRP Progress Reviews

ARAP progress reviews are broader than IPM with respect to the participants, time period undertaken, and objectives and purposes.

The following are the main points and guidelines to be followed in conducting the ARAP progress review:

- All stakeholders, especially representatives of institutions and committees directly involved in the implementation of the ARAP will participate in the progress review meetings.
- The main purpose of the ARAP review is to share and disseminate information amongst stakeholders, review and assess the processes and problems of implementation, and based on the findings and the collective assessments, highlight achievements and best practices and provide solutions for outstanding and major problems and challenges faced.
- The early stages in the ARAP implementation are typically when problems and challenges are encountered. Therefore, it is important to hold the first review meeting as early as possible after the start of implementation.
- PIO/ ESAO (and its monitoring, review and evaluation officer) will assume the main responsibility for organizing the review meetings and presentations on the problems and process of implementation and all other necessary preparations and inputs for the meetings. The proceedings of the review meetings will be systematically compiled, edited and distributed to stakeholders

6.4. Public Disclosure

Transparency and public involvement are essential for environmental projects, as every citizen has a stake in these issues. It is important to disclose development projects to the public and engage stakeholders, including government organizations, civil society, and research institutes.

For the proposed project, initial consultations were held at the city administration level, but outreach to the local community was lacking. These meetings aimed to share information about the project's purpose, type, location, and Environmental and Social Impact Assessment (ESIA) requirements, while also gathering feedback from stakeholders and those potentially affected.

In line with World Bank policies, relevant project information will be made available on the Ministry of Water and Energy's website, including an Amharic executive summary and the full ESIA document. Additionally, this information will be shared on the World Bank's external website to solicit input from civil society and professionals. To address gaps in local awareness, public relations efforts must be intensified to better inform community members about the project.

6.5. Stakeholder Engagement

To foster positive relationships between the Project and its stakeholders, including affected communities, a Stakeholder Engagement Plan (SEP) should be developed. The project proponent is responsible for conducting public and stakeholder consultations throughout the project lifecycle.

Previous consultations during project identification, scoping, and Environmental and Social Impact Assessment (ESIA) revealed general stakeholder support. However, further discussions may be necessary to address any outstanding land-related issues. Engagement should continue during the construction

phase to tackle emerging concerns and facilitate communication between the construction workforce and the local community.

Key Objectives of the SEP – The SEP aims to identify relevant stakeholders, establish open dialogue with affected communities, and ensure the involvement of disadvantaged groups. It seeks to enhance social benefits while mitigating negative impacts, provide timely information to all stakeholders, monitor community concerns, prioritize local hiring, and notify the public of any planned or unplanned disruptions.

The contractor or client must prepare and regularly update the SEP during construction, aligning with these objectives. Stakeholder consultations can be initiated through existing administrative structures as needed.

Engaging stakeholders promotes community ownership of the project, enhances sustainability, and garners broad support for program implementation. It also offers communities the opportunity to contribute to the development program while minimizing negative impacts and reducing potential conflicts.

Importance of Stakeholder Analysis – Conducting a stakeholder analysis is crucial for understanding the social issues associated with the project as perceived by targeted communities. This process helps identify their needs, interests, and influence, while also exploring feedback on operational steps, land acquisition issues, compensation, grievance redress mechanisms, and broader implementation contexts. Selecting the appropriate consultation methodology for each stakeholder throughout the project lifecycle is essential.

Principles for Effective Stakeholder Engagement – To adhere to best practices, the client or administrator of the project will apply principles of openness and a lifecycle approach, maintaining public consultations throughout the project. Informed participation will be prioritized by providing information in accessible formats and incorporating stakeholder feedback into decision-making. Inclusiveness and sensitivity will ensure that all relevant stakeholders, including historically underserved and vulnerable groups, are identified and engaged appropriately.

Key Stakeholder Groups – The key stakeholder groups include local community members and others directly impacted by the project, as well as ministries, line offices, private sector entities, academic institutions, and other parties with indirect involvement. Special attention will be given to underserved and vulnerable groups, such as the elderly, female-headed households, low-income individuals, people with disabilities, unemployed youth, and landless households, who may be disproportionately affected and require special assistance.

6.5.1. Stakeholder Engagement Program and Plan

6.5.1.1. Stakeholder Engagement During Project Preparation

Public consultation and participation are crucial as they allow potentially affected individuals to contribute to the design and execution of sub-project activities. The initiation, planning, design, implementation, and operation of sub-projects will be driven by local communities and different stakeholders who will be engaged directly or indirectly, who naturally form part of the community and play a vital role. The success of the project hinges on local communities claiming ownership, utilizing their invaluable knowledge of local conditions.

6.5.1.2. Stakeholder Consultation Methods and Tools

Some of the most common methods of stakeholder consultation include (i) use of phone and email; (ii) interviews (one-to-one); (iii) distribution of leaflets and pamphlets; (iv) public meetings; (v) group discussion; (vi) use of local radios; and (vii) newsletters. When deciding the frequency and appropriate engagement technique to consult particular group of stakeholders, the following three criteria must be taken into consideration; (i) the extent of impact of the project, (ii) the extent of the influence of the stakeholder on the project, (iii) the culturally appropriate and acceptable engagement and information dissemination. It will also be important to ensure that vulnerable people, receive necessary information.

The details of public consultation for the ESIA have been addressed and described in the previous sections. The methodology used includes focus group discussions (FGD) using semi-structured checklist with community members. Attempts were made to include vulnerable community members like female household heads, people with disabilities, the old, and the poor. Key informant interview has been done by selecting all key stakeholders.

Stakeholders will be kept informed as the project develops, including reporting on project environmental and social performance and implementation of the stakeholder engagement plan and grievance redress mechanism. This will be important for the wider public, but specifically critical for the directly impacted community members.

6.5.2. Resources and Responsibilities for Stakeholder Engagement Activities

Resources - The Ministry of Water and Energy, its line offices at various administrative levels, regional/city governments, and woreda sectoral bureaus/offices are responsible for SEP implementation. Adequate resources will be allocated by the client for SEP implementation. The project will allocate a budget for broader environmental and social issues, including ESIA preparation, livelihood assessments, community consultations, and expert training, shaping the SEP approach.

Management Functions and Responsibilities - The project will utilize existing government organizational structures at federal, regional, woreda, and kebele levels for implementation. The client, in collaboration with AWSSO, oversees overall project implementation. Regional, zonal, and woreda sectoral bureaus and offices work alongside regional governments, city administrations, woreda, and kebele administrations. Committees or assigned individuals at different administrative levels oversee activities, ensuring adherence to project objectives, reviewing and approving work plans, monitoring project progress, and providing guidance.

Regional Level - At the regional and zonal levels, various sectoral bureaus are directly and indirectly involved, including Health, Agriculture, Water, Environmental Protection, Land Administration, Planning and Finance, Women and Social Affairs, Youth and Sports, Education, Universities, Development Partners, and Traditional Leaders. Responsibilities include ensuring adherence to government policies and project objectives, approving annual work plans, monitoring project progress, and providing guidance.

Woreda Level - Woreda committees/working groups will be established, comprising Sub-city/Woreda Cabinet members and heads of sectoral line offices. Responsibilities include ensuring project objectives are met, reviewing and approving work plans and budgets, monitoring project progress, resolving implementation issues, securing inter-departmental support, and providing guidance.

Kebele Level - Kebele administration serves as a crucial link between farmers and the project, facilitating effective farmer participation in project implementation. Responsibilities include planning, implementation support, supervision of community works, deployment of Development Agents (DAs), and signing agreements on behalf of the government. The Kebele Land Administration and Use Committee, established based on regional land laws, plays a key role in boundary demarcation, protecting rights of holders (especially women and vulnerable groups), resolving conflicts, and facilitating fieldwork.

Community Level - Farming communities, as project beneficiaries, are encouraged to participate directly and indirectly through community committees. Following regional and national guidelines, communities will elect representatives and active members to form a Community Committee. Membership includes community leaders, male and female household representatives from different social groups (including vulnerable individuals), youth representatives, religious representatives, and others as required by the community. Stakeholder engagement activities will be documented through quarterly and annual progress reports shared with key stakeholders.

7. PROJECT ALTERNATIVES

7.1. General

The purpose of the alternatives analysis is to identify other options, including not implementing the project, to achieve the project objectives and compare their impacts with the original proposal. The analysis systematically compares feasible, less adverse, alternative technologies, designs, operations, and sites – including the "no project" option to the proposed project in terms of

- Their effectiveness in achieving the project objectives as well as potential trade-offs;
- Their potential environmental and social impacts;
- The feasibility of mitigating identified impacts;
- Operational requirements and their suitability under local conditions;
- Their institutional, training, and monitoring requirements; and
- Their estimated cost-effectiveness.

7.2. Location Alternatives

The selection of a suitable location involves assessing environmental and social impacts to quantify, avoid, and minimize these impacts based on potential sites' characteristics. In the course of the selection of appropriate sites best practices and World Bank guidelines have been consulted treatment+plant+selection+criteria+by+the+world+bank+qui&sa=X&ved=2ahUKEwjs2Imlib2QAxWxVKQEHd8ROCcQ1QJ6BAg4EAE&biw=1366&bih=650&dpr=1). Specific selection criteria were established to identify a preferable site for the FSTP:

- Adequate area for FSTP operations, considering future expansion.
- Presence of a buffer zone (minimum 400 meters) with limited impact on sensitive public facilities and utilities like roads.
- Factors like land tenure, displacement, and compensations.
- Proximity to the city, access to water, electricity, and transportation.
- Topography and land features.
- Potential effects on local fauna and flora, as well as human health.

A field survey was conducted by the ESIA team and AWSSO, in collaboration with the client's expert team, to identify the most environmentally, technically, and economically viable site for the proposed fecal sludge management project. Three potential sites were selected for evaluation: Site 1 - Genahiti /Ziban Gola, Adi Waei, located in Gola Genahti Kebele near St. Mariam Church (Coordinates: 0553498E, 1580140N); Site 2 - Shibida, May_Awilie, also in Gola Genahti Kebele (0554847E, 1578537N); and Site 3 - Awdi Dumu, Nihbi, located in Buket Kebele near an existing quarry site (0554847E, 1578537N) (Figure 7.1). All sites are situated within Ganta-Afeshum Woreda outskirt of the city(Figure 7.2). These locations were jointly visited and assessed by experts from AWSSO and the Project Coordination Office to determine their suitability for the project.

Each site was evaluated using a Multi-Criteria Analysis (MCA) matrix, taking into account the specific nature of the project and local socio-environmental conditions. The assessment criteria included operational suitability, land use, topography, geology, hydrology, proximity to social and cultural features, potential impacts on public well-being, access to natural resources, and distance from the city center (Table 7.1) . Each site was scored on a scale of 1 to 5, reflecting levels of suitability from *very poor* (1) to *excellent* (5). Additionally, each criterion was assigned a weight (ranging from 1% to 100%) based on its relative importance. Final scores were calculated by multiplying each score by its corresponding weight. Higher total weighted scores indicated greater overall suitability in terms of technical feasibility, environmental sustainability, and economic efficiency. The evaluation relied on expert judgment informed by professional knowledge, field observations, and experience with the project area. A summary of the comparison results is presented in Table 7.2.

Figure 7.1: Partial view of the three alternative sites

Table 7.1: Description and Comparison of the Three Potential Project Site Alternatives

Criteria	Site-1: Genahti /Ziban Gola, Adi Waei	Site-2: Shibida, May_Awilie	Site-3: Awdi_dumu, Nihbi
Location	8–10 km NE of city center (Lat: 15.80140°N, Long: 55.53498°E), Gola Genahti Kebele, Ganta-Afeshum Woreda.	7–9 km E of city center (Lat: 15.78537°N, Long: 55.4847°E), Gola Genahti Kebele, Ganta-Afeshum Woreda.	5–7 km SE of city center (Lat: 15.78537°N, Long: 55.4847°E), Buket Kebele, Ganta-Afeshum Woreda.
Operational Convenience & Space Availability	Sufficient land for current/future use. High pumping energy required (Elevation: 2546m). Close to settlements and St. Merry Church.	Sufficient land for the project but limited space for future expansion. Moderate pumping energy (Elevation: 2437m). No nearby settlement or church.	Sufficient space for the current use. Low pumping energy (Elevation: 2390m). Close to settlements and St. Michael Church.
Land Use & Suitability	Currently used for rural settlement and farmland.	Far from settlements; used for farmland and rangeland. Sufficient land for the project but limited for future expansion.	Used for rural settlement, active quarrying, and farmland. Sufficient land for the project.
Topography & Drainage	Elevated flat plateau draining to Midimar River.	Steep hillside with limited flat area. Runoff from upper catchment flows through site; drainage needs interceptors.	Steep hillside with moderate flat area. Drains toward Midimar River. affects river usage.
Access to Basic Services (Road, Electricity, Water)	Poor access: ~9 km gravel road needs upgrading and paving. No electricity/water.	No access road: Requires – ~7 km new road construction. No electricity/water.	Poor access: Requires ~7 km new road construction. No electricity/water.
Community Displacement	Significant displacement expected from site and 400 m buffer zone.	No displacement expected from site or buffer zone.	Significant displacement expected from site and buffer zone.
Social Acceptance	Highly unacceptable as the site having considerable settlement	Highly acceptable as the site doest have any settlement	Highly unacceptable as the site having considerable settlement
Environment pollution and health impact	Potential odor issues due to wind direction blowing towards the Adigirat town.	No odour risk — wind blows away from the town.	Potential odor risk since wind partially blows towards the town.
Impact on Flora	Minor clearance of shrubs and cactus trees (farmland).	Minor clearance of planted trees and natural shrubs along farmland.	Minor clearance of shrubs and cactus trees (farmland).
Impact on Fauna	Likely affects common fauna: hyena, rabbit, birds, reptiles.	Likely affects common fauna: hyena, rabbit, birds, reptiles.	Likely affects common fauna: hyena, rabbit, birds, reptiles.

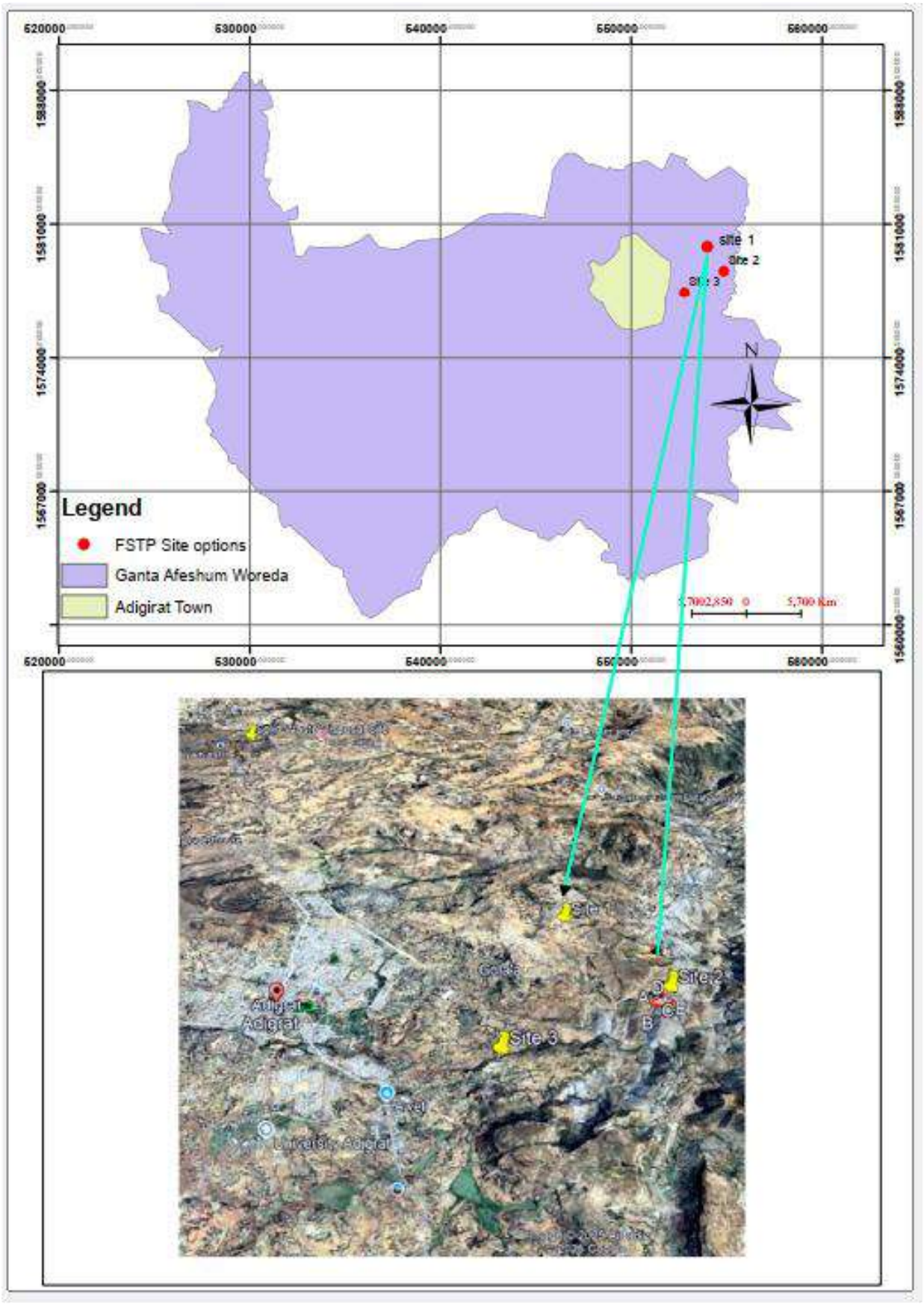

Figure 7.2: Compared sites for FSTP construction

Table 7.2: Summary of Criteria Weight and multi-criteria analysis for locating best FSTP site

Criteria Features	Criteria Weight(%)	Score Based on Criteria (1 -5)		
		Site 1	Site 2	Site 3
Location/distant from the city center	10	1	3	4
Operational convenience/ Space Availability	10	4	3	4
Operational requirements and Land Use	10	1	4	1
Topography and Drainage	10	1	3	3
Access to basic services	10	4	1	1
Environment pollution and health impact	10	1	5	1
Community displacement	10	1	5	1
Social acceptance	10	1	5	1
Impact on flora	10	3	2	2
Impact on fauna	10	3	3	3
Total Weight	100	-	-	-
Total weighted Score=∑(Score*Weight)	5	2.0	3.40	2.10
Total Normalized Score=∑(Score/5)*Weight*100	100	40	68	42

Based on the provided a comprehensive multi-criteria analysis of three alternative sites Site 1: Genahti /Ziban Gola, Site 2: Shibida (May_Awilie), and Site 3: Awdi Dumu. Site 2: Shibida has emerged as the most favorable option for the construction of the FSTP. While all three sites face challenges related to poor road access and the absence of municipal utilities, these issues are considered manageable across the board. Site 2 presents a more practical challenge interms of requiring new road construction; however, this is deemed less critical compared to the more serious issues at the other two sites, such as potential displacement, proximity to religious sites, and high energy requirements.

With the highest normalized MCA score of 66.00, Site 2 stands out as the most suitable location for the proposed project. It offers a strong balance of operational feasibility, minimal environmental and health impacts, and most importantly avoids community displacement. In contrast, Site 3: Awdi Dumu (score: 45.00) raises concerns due to its proximity to settlements and potential odor issues, while Site 1: Ziban Gola (score: 43.00) is disadvantaged by significant social impacts, accessibility problems, and higher operational demands.

Considering all technical, environmental, and social factors, Site 2 clearly emerges as the most viable and sustainable option. The boundary map alongwith its its GPS coordinate points of this selected FSTP site (Shibida, May_Awilie) is displayed in Figure 7.2 .

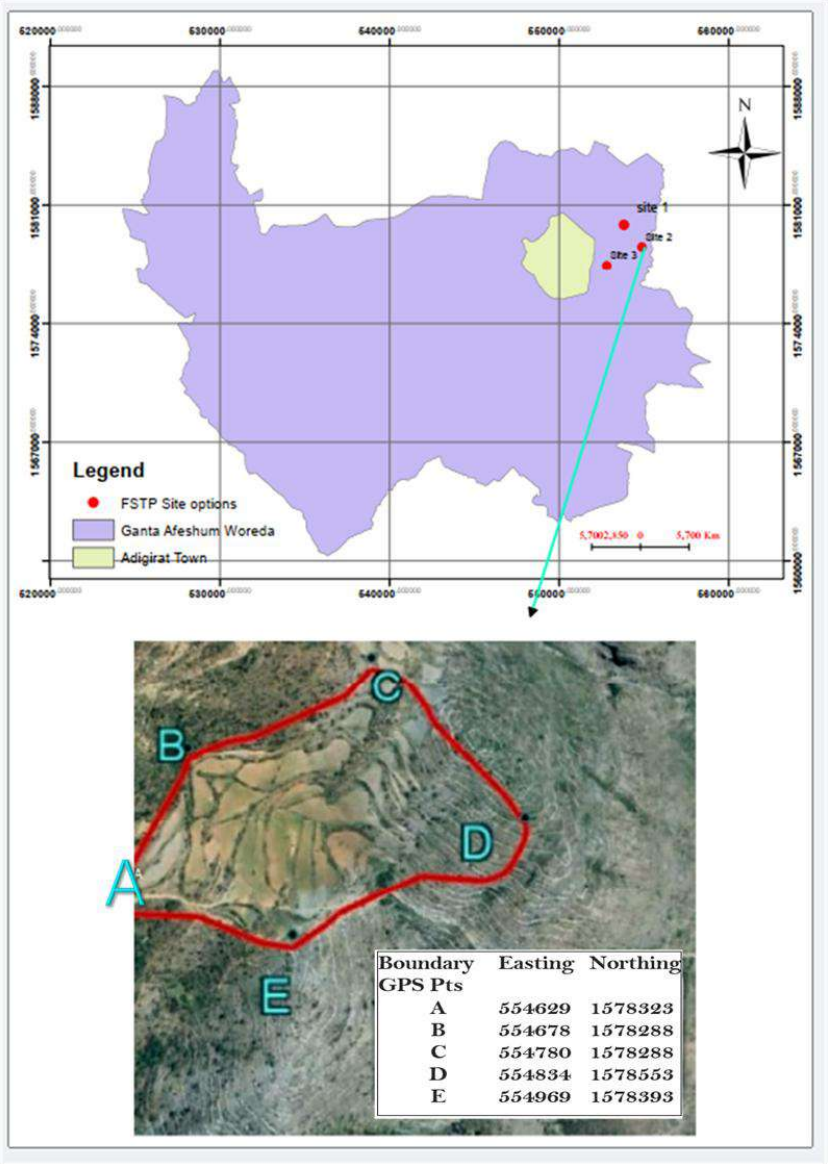

Figure 7.3: Boundary of the Select FSTP Site (Shibida, May_Awilie)

7.3. Technology Alternatives

Alternative technology assessment involves analyzing various treatment options and project designs through detailed design studies and literature reviews. Both the design consultant and the ESIA team focused on identifying treatment solutions for faecal sludge that are environmentally, economically viable and technologically appropriate.

Faecal sludge can be treated using a variety of methods, with no single solution universally applicable due to the diverse conditions present in urban areas. Typical treatment processes may include solid-liquid separation, liquid treatment, solid treatment, and pathogen removal. As part of the ESIA, a comprehensive evaluation of various faecal sludge treatment technologies was conducted. The primary objective was to identify economically viable and technologically appropriate solutions for Adigrat town, taking into account the specific local conditions. The selected approach aligns with technologies commonly used in developing countries, with a strong focus on sustainability and risk mitigation. To guide the selection, a multi-criteria matrix analysis was employed to assess four different technological options, based on several weighted evaluation criteria. This comprehensive analysis considers factors such as technical feasibility, cost, environmental impact, social considerations and treatment performance to guide the selection process. To conduct a select for the best combination of FSTP technological option,

The selection criteria used in the ESIA study includes:

- Land Requirement:- This is a major factor, as it determines the feasibility in urban areas especially for the case of with limited land availability like Adigrat town.
- Capital Cost :- This is the initial investment required to build the plant.
- Treatment Efficiency :- This measures the effectiveness in removing pollutants and pathogens.(Pathogens, BOD, COD, TSS, and nutrient removal).
- Feasibility (Operational/Technical Simplicity) :- This relates to the skill level and maintenance effort needed to run the plant.
- Suitability for Adigrat town context :-Socioeconomic, climatic, and infrastructural conditions in Adigrat must be considered.

The four technology options evaluated in this ESIA report are as described as follows:

Option 1: Combines Screening, Settling tank, sludge dry beds with an anaerobic baffled reactor (ABR) and a horizontal subsurface flow constructed wetland.

Option 2: Combines Screening, enhances sludge thickening with a settling tank before the ABR,.

Option 3: Combines Screening, Settling tank , sludge dry beds with an ABR and an anaerobic filter including maturation pond for pathogen removal.

Option 4: Combines Screening, Settling tank , sludge dry beds with a waste stabilization pond.

Table 7.4: Description of the four alternative four fecal sludge treatment technology selection options along with the criteria

Option	Technology Combination	Selection criteria			
		Land Requirement	Capital Cost	Treatment Efficiency	Feasibility (Operational/Technical Simplicity)
1	Screening + Settling tank + Sludge drying beds + ABR + Horizontal Subsurface Flow Constructed Wetland	High (wetlands need space) (~10 ha)	High (more units)	High (good BOD, COD, TSS, and pathogen removal)	Moderate (needs skilled maintenance of wetland and ABR)
2	Screening + enhances sludge thickening with a settling with Settling tank + ABR	Low(~3 ha)	High	Moderate (limited pathogen removal; good organic removal)	High (simple design, low O&M effort)
3	Screening + Settling tank + Sludge drying beds + ABR with Anaerobic filter + Maturation Pond	Moderate (maturation ponds take space) (~4-8 ha)	Moderate	High (especially with maturation pond)	Moderate (some skill needed for pond and drying bed management)
4	Screening + Settling tank + Sludge drying beds + Waste Stabilization Pond	Very High (~27 ha)	Moderate	High (WSPs are excellent for pathogen removal)	Low to Moderate (ponds need careful management to avoid issues like odor, mosquitoes)

Based on Table 7.4 and the multi-criteria analysis provided(Table 7.5), each option has breakdown as follows:

Option 1 includes screening, a settling tank, sludge drying beds, an anaerobic baffled reactor (ABR), and a horizontal subsurface flow constructed wetland. This combination offers high treatment efficiency, effectively removing BOD, COD, TSS, and pathogens. However, it requires a large land area (10 ha) due to the wetland component and involves high capital costs because of multiple treatment units. Its

operational feasibility is moderate, as it demands skilled maintenance, particularly for the wetland and ABR systems. This makes it desirable only if land isn't a constraint.

Option 2 consists of screening, enhances sludge thickening with a settling tank, and an ABR. It is the most compact solution, needing only about 3 hectares of land. It has high capital costs and is highly feasible due to its simple design and minimal operation and maintenance requirements. While it performs well in removing organic matter, its pathogen removal capacity is limited, making its overall treatment efficiency moderate, and its high capital cost due to electromechanical equipment makes it less desirable.

Option 3 uses a settling tank, sludge drying beds, an ABR with an anaerobic filter, and a maturation pond. It strikes a balance in land use (about 4–8 ha) and capital cost, both being moderate. Treatment efficiency is high, particularly due to the maturation pond's effectiveness in pathogen removal. It is considered the most feasible and cost-effective option, balancing good treatment efficiency with financial and land use constraints.

Option 4 includes screening, a settling tank, sludge drying beds, and a waste stabilization pond. It requires the largest land area (27 ha) among all options but maintains a moderate capital cost. It offers high treatment efficiency, especially in pathogen removal. However, its operational feasibility is lower due to the need for careful pond management to avoid issues such as odor and mosquito breeding.

In this report, a multicriteria analysis was conducted using a score-based system, where each option was rated on a scale from 1 to 5 (1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent). Each criterion was assigned a weight (ranging from 1% to 100%) based on its priority and relevance to the context of Adigrat Town, as presented in Table 7.5 below.

Table 7.5: Description and calculation of MCA Weights for Each Criterion and Score Each Option (1–5 scale) based on the criteria

Criterion	Weight (%)	Reason	Score Based on Criteria (1 -5 scale)			
			Option 1	Option 2	Option 3	Option 4
Land Requirement	30%	Land scarcity is a concern in urban/semi-urban towns like Adigrat	2 (High)	3 (Moderate)	5 (Low)	1 (Very High)
Capital Cost	20%	Budget constraints may limit choices	3	4	4	4
Treatment Efficiency	25%	Ensuring good effluent quality is essential	5	2	4	4
Feasibility (O&M)	15%	Prefer simple, low-maintenance systems	3	4	4	2
Suitability for Adigrat	10%	Overall contextual fit (climate, population, resources)	3	2	5	1
Total weighted Score	100	-	-	-	-	-
Total Score=∑(Score*Weight)	5	-	3.2	3	4.4	2.5
Total Normalized Score=∑(Score/5)*Weight*100	100%	-	64	60	88	50

Based on the multicriteria analysis, Option 3 emerges as the most suitable choice for Adigrat Town. It performs well across all evaluated categories, particularly in terms of land use, cost, treatment efficiency, and contextual suitability. Among the options considered, Option 3 offers the best balance between capital investment, land requirements, and operational effectiveness. Its relatively low capital cost and moderate land requirement make it especially appropriate for Adigrat, where land availability is limited posing challenges for implementing Options 1 and 4. Therefore, based on the available data, Option 3 is

recommended as the most feasible and practical solution for the city's fecal sludge treatment needs.

7.4. 'No Project' Option

The construction of a Fecal Sludge Treatment Plant (FSTP) in Adigrat town is a vital sub-project designed to significantly improve urban sanitation and public health. With the municipality's population growing rapidly, the town currently lacks adequate facilities for the safe collection, treatment, and disposal of fecal sludge. This gap presents serious environmental, health, and socio-economic challenges. From environmental, economic, and public health perspectives, the implementation of the FSTP is expected to bring the following key benefits:

- Improved sanitation services through the safe treatment and disposal of fecal sludge;
- Access to a modernized fecal sludge management system, enhancing service efficiency and sustainability;
- Reduction in environmental pollution, as well as a decrease in sanitation-related diseases and health risks;
- Creation of employment opportunities, particularly for local workers involved in construction, operation, and maintenance.

Choosing the "No Project" option is not a sustainable alternative. Without the FSTP, untreated fecal sludge will continue to be disposed of indiscriminately, leading to contamination of land and water sources, increased disease burden, and unsafe urban living conditions. In addition, illegal dumping practices are likely to persist, further degrading environmental quality and public health.

By contrast, implementing the FSTP will provide essential infrastructure for managing urban sanitation in a safe, efficient, and environmentally sound manner. It will contribute to improved quality of life, reduced public health risks, and support the town's sustainable development goals.

In conclusion, the FSTP project is not just beneficial it is essential for addressing Adigrat's growing sanitation needs and safeguarding both human and environmental health. Therefore, the project is essential to effectively address the city's sanitation issues and support its sustainable development.

8. THE BASELINE ENVIRONMENT

8.1. Physical Environment

8.1.1. Overview of Adigrat Town and the Project Site

8.1.1.1. Location

Adigrat is situated in northern Ethiopia, within the Tigray regional state, approximately 900 km north of Addis Ababa and 120 km north of Mekelle, the regional capital. It serves as the administrative center for the Eastern Zone of Tigray. The town is surrounded by the Ganta Afeshum woreda, from which it was established as a separate woreda (Figure 8.1). Currently, Adigrat town has a resident population of approximately 157,000 people as permanent residents and 54,375 IDPs. In addition to the town's permanent residents, it is also home to a significant number of internally displaced persons (IDPs), totaling around 54,295 individuals. This influx of IDPs has increased the town's total population to approximately 211,295, constraining basic services including water supply and sanitation.

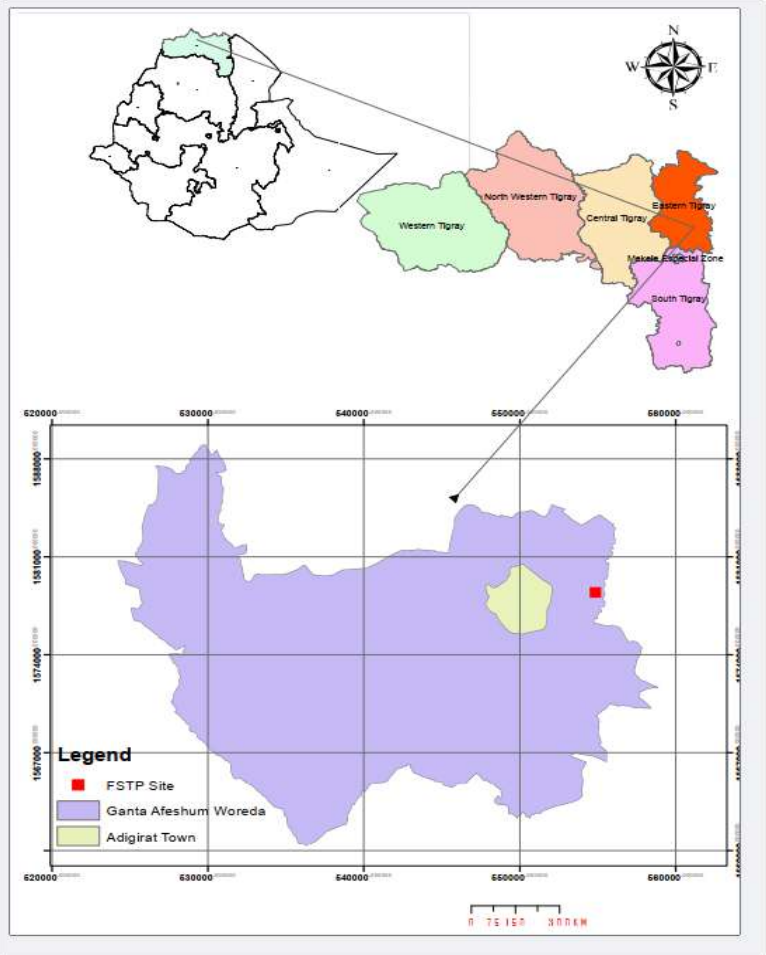

Figure 8.1. Location map of Adigrat area

The town encompasses an area of 1,867 hectares, while the broader study area covers 152 km² (UTM Zone 37: 1570000m N to 158,000mN and 543000mE to 562000mE) as the specific project site is located in Ganta Afeshum woreda located some 2.8 km east of the Italian Cemetry of Adigrat town. The town is currently expanding to the North and south directions.

As per the revised master plan of the town, which is at final stages, additional expansion areas were designated and the details will be known after the master plan is released. The existing built up area of the town is divided into six kebeles.

Adigrat occupies a strategic position at the intersection of routes connecting Adwa (west), Asmara and

Massawa (north), and Mekelle (south). The town is accessible via major asphalt roads that goes from Addis Ababa through Woldia and all the way to Asmara through Adigrat. The outskerts rural areas around Adigrat in Ganta Afeshum woreda are acessible through badly maintained gravel road. The FSTP site is not currently accesible with car. Access road construction has been considered as part of the implementation of the FSTP project.

8.1.1.2. The FSTP Site

The proposed FSTP will be constructed on the outskirts of Adigrat town, specifically in Shibida locality, within Golaa' Ganahiti Kebele of Ganta Afeshum Woreda. Ganta Afeshum is one of the seven woredas in the Eastern Zone of Tigray, excluding the urban areas of Adigrat and Wukro towns. The project site is situated approximately 2.8 km east of the Italian Cemetery and is accessible via a gravel road for about 1.8 km, with the remaining route reachable on foot or by motorcycle. The final site was selected after evaluating and comparing it with two alternative locations, using objective criteria. Table 8.1 presents the coordinates of the site's boundary corner points, while Figure 8.2 shows a labeled Google Earth image of the site and its boundaries.

Since the **FSTP (Faecal Sludge Treatment Plant)** is physically located in **Ganta Afeshum Woreda** but is **owned and managed by Adigrat Water Supply and Sanitation Office**, a **cross-woreda management and coordination framework** is required.

Since, the FSTP is physically located in Ganta Afeshum Woreda but is owned and managed by the Adigrat Water Supply and Sewerage Service Office an inter woreda administration mechanisms is indispensable. While Adigrat Woreda holds the operational mandate for the plant, including technical management, budgeting, and service delivery, Ganta Afeshum Woreda maintain responsibilities over locality land administration, environmental regulation and safeguarding, and community engagement within its jurisdiction. Moreover, the two woredas would ensure collaboration in areas includes conflict resolution mechanisms, communication channel, infrastructure protection, and compliance with local regulations. Regular joint monitoring and evaluation could further strengthen accountability and transparency in managing the project. As a result, the proposed FSTP project is expected to achieve its intended objectives while ensuring the protection of the environment and safeguarding the livelihoods of communities within the host Woreda.

The total dedicated FSTP project area is around 7 ha excluding the buffer zone which is 400 meters radius. The project site is mianly farmland with scattered trees. Limited area is a communal grazing land with planted trees and indigineous bushes. There is no single house in and around the project site including the buffer zone indicating that the project will not create physical displacement of people.

Table 8.1. GPS coordinate points for the proposed FSTP site (UTM, Adindan)

Corner Lebel	Corner Coordinates	
	Easting	Northing
A	554629	1578323
B	554678	1578288
C	554780	1578288
D	554834	1578553
E	554969	1578393

Figure 8.2. Location of the FSTP site with photograph showing the partial view of the site

8.1.1.3. Economic Activites

Adigrat town functions as the primary economic hub for Northeastern Tigray, transitioning from its historical administrative role into a dynamic urban economy. Its strategic position along major transport corridors supports a vibrant commercial sector with over 6,200 registered businesses, dominated by grocery retail (over 50% of enterprises), food services, and hospitality, according to municipal records.

Municipal revenue reflects this economic activity, with direct taxes comprising 41.2% of local income, municipal taxes at 25.5%, and indirect taxes at 2.8%. Expenditure prioritizes social services and infrastructure, accounting for over 90% of the budget and demonstrating commitment to public welfare and urban development.

The growing financial sector-including banks, insurance companies, and micro-finance institutions supports local entrepreneurship. While urban agriculture is limited, it contributes to food security through dairy farming and vegetable cultivation. Construction represents another significant economic activity, with many youth engaged in extracting and selling sandstone and sand from local deposits.

Surrounding rural communities primarily practice subsistence agriculture, growing teff, barley, and maize, and raising livestock. Cactus fruit cultivation has emerged as an important cash crop. Agricultural production mainly serves local consumption, with the primary growing season occurring from June to September.

The strong interconnection between urban and rural economies underscores the importance of sustainable practices. The proposed faecal sludge treatment plant will enhance public health and may support agricultural productivity through safe waste reuse, thereby strengthening community resilience and livelihoods.

Figure 8.3: Plates showing some economic activities

(Remark: A Agriculture; B: Business district of Adigrat; C: Small busness in street; D: quarrying and sand for sale)

8.1.2. Climate

Adigrat experiences a semi-arid climate characterized by mild temperatures and dry conditions for much of the year. According to Ethiopian climatic classifications, the town is located in the Woina Dega agro-climatic zone, at elevations between 2,000 and 3,000 meters, which moderates both temperature and rainfall patterns. Long-term average monthly climate data for Adigrat is summarized in Table 8.2 and Figure 8.4.

The mean annual temperature ranges from 15°C to 20°C. The hottest months are May and June, with average maximum temperatures around 27°C. The coldest month is December, when minimum temperatures can drop to approximately 6.6°C. The annual temperature cycle is relatively stable, with only modest year-to-year variations.

Annual precipitation typically ranges from 400 to 600 mm, occurring almost entirely during the main rainy season from June to September. August is the wettest month, averaging up to 195 mm of rainfall, while January is the driest, receiving as little as 6 to 8 mm. The short rainy season and prolonged dry spells significantly influence the region's agricultural and water management practices.

Relative humidity in Adigrat varies seasonally, reaching its lowest levels (35-40%) during the dry months of December to March, and peaking (65–75%) in the rainy season (July and August). The high humidity during the rainy months supports crop growth and replenishes local water sources.

Average wind speeds are generally moderate throughout the year, ranging from 2.0 to 3.5 km/h. Wind speeds tend to be slightly higher during the dry season, particularly in March and April, due to regional atmospheric circulation.

Table 8.2. Long-term average monthly climate data at Adigrat

Month	Avg. Temp (°C)	Precipitation (mm)	Humidity (%)	Wind Speed (km/h)
Feb	25	5	38	2.3
Mar	26	42	40	2.5

Apr	27	54	45	2.7
May	25.8	42	48	2.6
Jun	27	38	57	2.4
Jul	23	137	70	2.2
Aug	23	195	75	2.1
Sep	24	17	65	2
Oct	22	14	55	2
Nov	22	31	42	2.1
Dec	22	10	37	2
Minimum	22	5	37	2
Maximum	27	195	75	2.7
Average	24	591 (Annual)	51	2

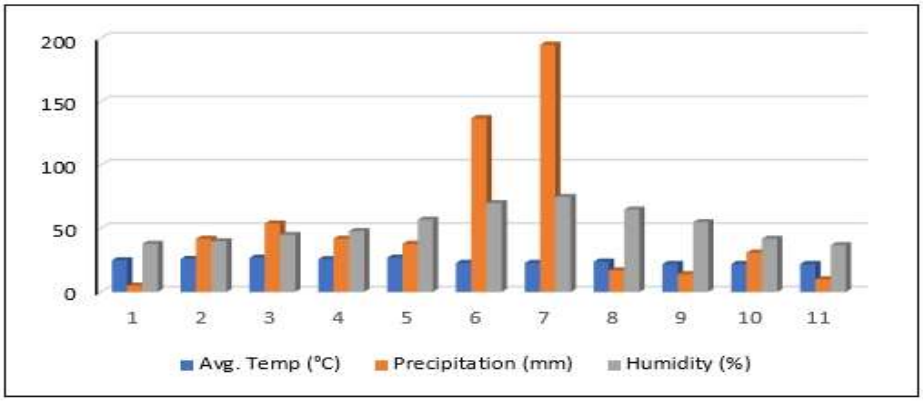

Figure 8.4. Average monthly climatic data at Adigrat

8.1.3. Topography and Drainage

The topography of Adigrat area is predominantly rugged and mountainous, shaped by a combination of high plateaus, steep escarpments, deep valleys, and flat-topped mountains known as Ambas. The landscape is punctuated by several notable peaks, including Emab Alequa (Andiyel) to the west, Erar to the northwest, Kenda'ero to the north, and Genahti to the northeast, with Alaqwa being the highest elevation in the vicinity of the town. The eastern edge of the town is marked by a dramatic escarpment that descends into the lowlands, emphasizing the striking relief that characterizes the region. The project site is flat adjacent to a steep cliff forming the boundary with the Amba top.

The elevation across the area varies significantly, ranging from about 2,000 meters above sea level in the eastern valleys to over 3,000 meters at the highest ridges and mountains in the west and southeast, such as the Andel ridge. Central Adigrat features relatively flatter terrain, with minor plateaus extending toward the eastern boundary.

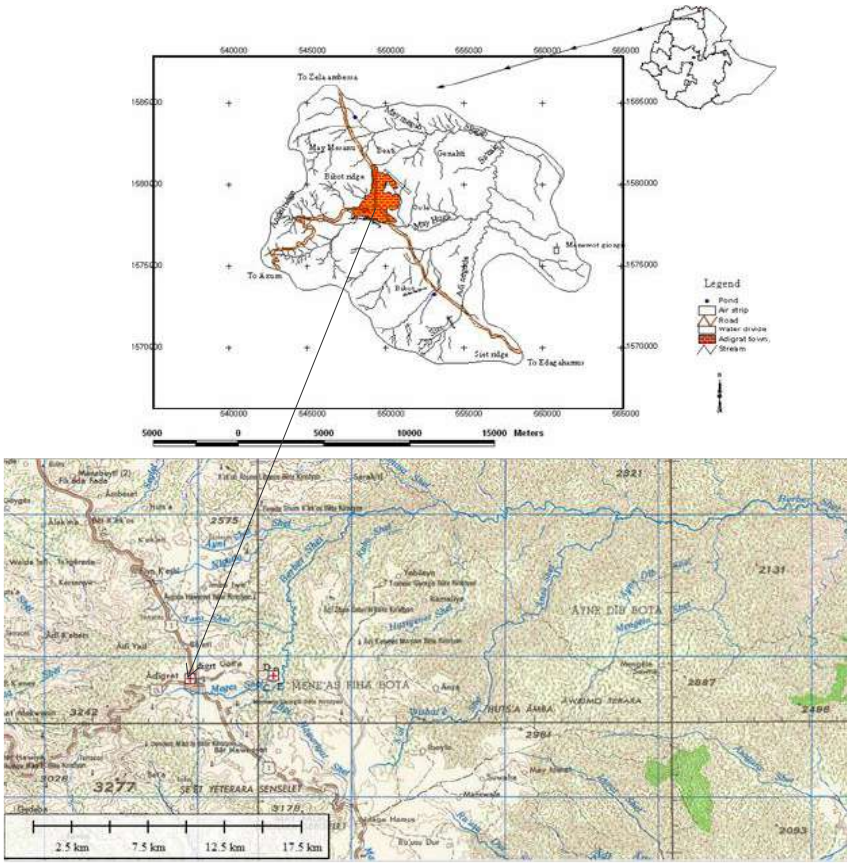

Fig 8.5. Drainage map of Adigrat area

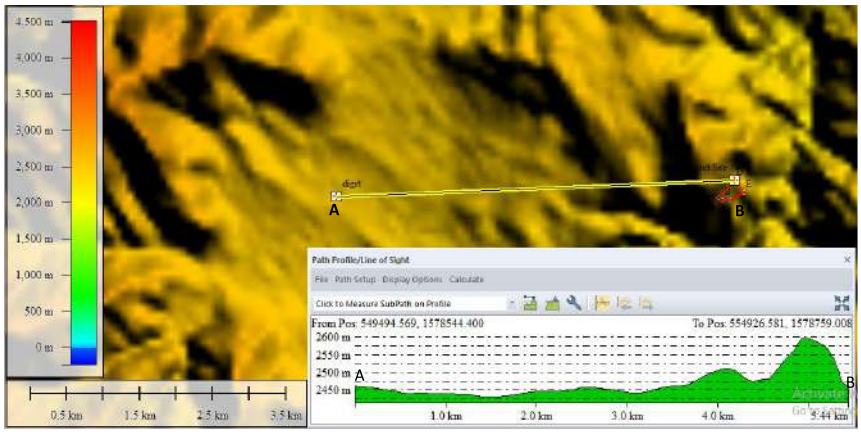

Figure 8.6. SRTM digital elevation model along Adigrat -Project site section

The drainage pattern is closely controlled by its topography. Geological factors also play a significant role in shaping topography and drainage. The Huga River is the principal watercourse traversing the town, receiving surface runoff from the surrounding ridges, particularly from Kenda'ero and Genahti. Numerous seasonal streams and minor tributaries dissect the mountainous terrain, channeling surface water into the larger rivers that drain towrds the Danakil basin. In the project site there is no trace of stream/river. It is right at the edge of a swteep slope that forms the xxx river. This river is planned to be dammed downstream of the FSTP, which is a concern of pollution, if in case the effluent will not meet the set standards in the design document.

The Adigrat ridge, forming the western boundary, serves as a prominent watershed divide, separating three major river basins: the Tekeze Basin to the south, the Mereb-Gasha Basin to the north, and the Danakil Basin to the east. As a result, the area lies in the upper catchment of the Danakil River Basin, highlighting its hydrological importance.

In the eastern part of the region, tectonic activity associated with the Ethiopian rift has produced faulting and fracturing, further influencing surface and subsurface drainage patterns. These areas are chracterized by steep gulleys and cliff forming Ambas. Extended flat plains are only confined around Adigrat town.

8.1.4. Soils

As the host rocks in the Adigrat area exhibit significant variability in composition, the soils are also diverse. Along river courses, particularly due to the dominance of the Adigrat and Enticho sandstones, the most prevalent soils are sandy, with varying proportions of silt and clay. Within the project site, the soil thickness is minimal, with the primary soil type being silty sand. The FSTP is expected to be constructed on bedrock primarily composed of sandstone, along with metamorphic slates and phyllites that exhibit a high degree of fracturing.

In Adigrat town, soils are categorized into sandy and silty types, each containing different proportions of clay. Sandy soils dominate the town, while clay soils are mainly found in the northern part and partially in the central area. Silt soils, which vary in color (dark, gray, and yellowish), are located in the northern and northwestern parts of the town. The thicker soils, primarily residual in origin, can be found in the northern and southern sections, displaying a yellowish to dark-gray hue. Clayey and silty sand soils cover a limited area, appearing as pockets of light gray. In contrast, sandy soils are widespread throughout the region.

8.1.5. Land Use/Land Cover

The structural plan for Adigrat town spans 32,000 hectares, which are organized into various zones, including residential, industrial, commercial, educational, and governmental areas. The new master plan introduces additional land use categories to support future development.

The study area is characterized by four primary land cover classes: cultivated farmland with limited grassland, areas of bushes and shrubs, sparse vegetation featuring eucalyptus and juniper trees, and terraced bare land. Cultivated land makes up the largest portion of the study area, followed by bushes and shrubs, while areas with trees and bare land are relatively small.

Figure 8.7. Typical thin soil cover within the project site (top) and typical urban and rural landscape and use (bottom)

The outskirts of the town primarily consist of farmlands, grazing areas, villages, and conservation zones, which include terraced land developed over the years through soil and water conservation initiatives. The area designated for the FSTP was previously used for agricultural purposes, and currently, there is no significant urban or peri-urban influence in the vicinity.

8.1.6. Geology

The regional geology of the Adigrat area is defined by a complex stratigraphy that spans from Precambrian basement rocks to Cenozoic sediments and Tertiary volcanics. The oldest rock units are the Precambrian metamorphic rocks, consisting of a lower complex of gneisses and amphibolites, and an upper complex of tightly folded but weakly metamorphosed phyllites, slates, and metavolcanics (notably the Tsaliet group), which collectively form the geological basement of the region. These rocks are locally intruded by syntectonic and post-tectonic granites, granodiorites, and diorites. Overlying the crystalline basement are Upper Paleozoic-Mesozoic sedimentary sequences, such as the Enticho and Adigrat sandstones, capped by the Antalo limestone and Agulae shale to the south of Adigrat, which are well-exposed in the area and form the distinctive terraced slopes and escarpments.

From the Tertiary period onward, the region was extensively covered by plateau basalts (Trap Series), with subsequent intrusion of trachytic and phonolitic plugs. The Cenozoic record is further represented by thick sedimentary and evaporitic sequences in the nearby Danakil depression, associated with active tectonism of the East African Rift system. The structural geology of the region is characterized by multiple generations of faulting-including ancient northeast-striking basement faults, younger west-northwest normal faults that displace Mesozoic sediments, and major north-south to northeast rift-related faults forming the Danakil escarpment and depression to the east. These features collectively record a long geological history of sedimentation, magmatism, and tectonic deformation, giving the Adigrat area its distinctive geological and geomorphological character.

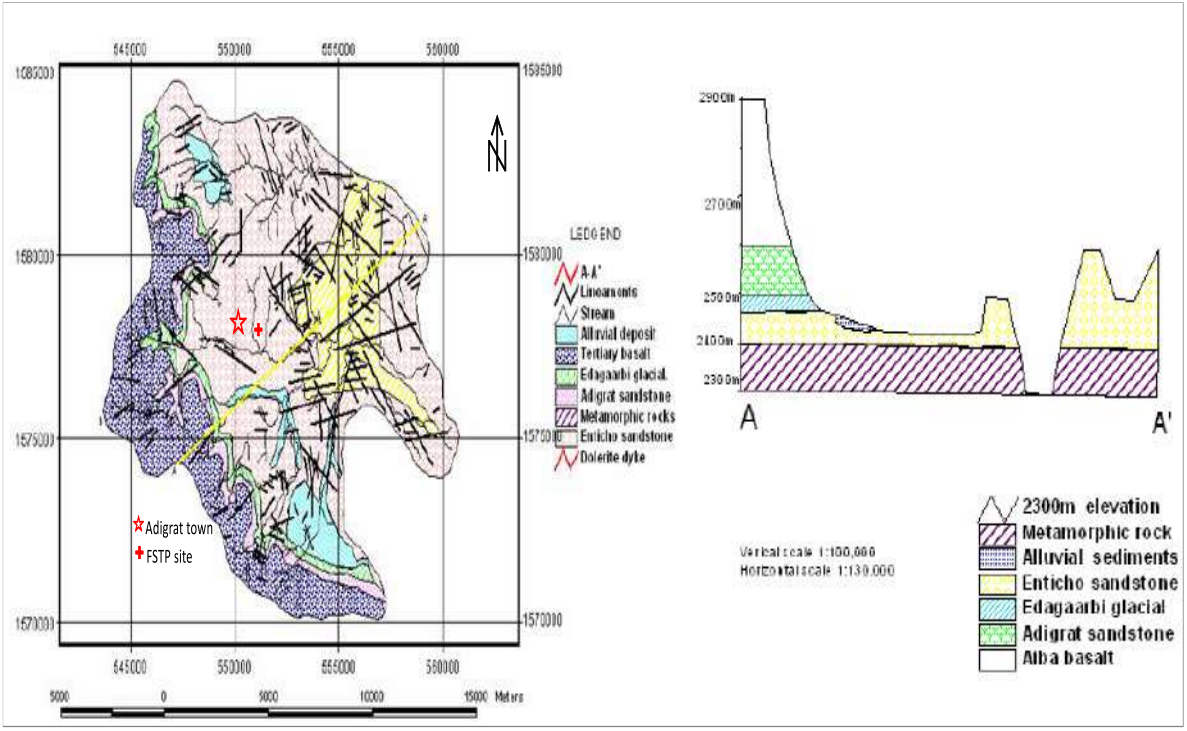

Figure 8.8. Simplified geological map of Adigrat Area (Modified from Nikodimos Kasaye, 2006)

Figure 8.9. Some Typical rock types of the project area

(Enticho sandston; B: Adigrat sandstone; C: Edaga Arbi glciars intruded by quartz veins; D: Basement metamorphic slates)

The local geology of the Adigrat area is marked by a diverse sequence of sedimentary, volcanic, metamorphic, and intrusive rocks, reflecting a complex geological history. The youngest deposits are unconsolidated alluvial sediments, which occupy river banks, flood plains, and valley bottoms-such as Bikot, Abunearegawi, Huga, Agoro, Ifla, Adimeskel, and May Mesanu. These are composed mainly of sand, clay, silt, gravel, and locally pebbles and cobbles, with thickness ranging from 0.5 to 10 meters, and are associated with recent fluvial processes forming flat, low-lying areas.

Overlying older sequences, the Aiba Basalt is a prominent volcanic unit in the western part of Adigrat, forming high ridges and steep cliffs such as Andel, Bikot, and Dibla ridges. This Oligocene basalt, dark and fine-grained, is affected by vertical to sub-vertical joints and shows signs of spheroidal weathering. Beneath the basalt lies the Adigrat Sandstone, a yellowish to pink, well-sorted, cross-bedded quartz sandstone, notable for forming high cliffs especially in the southern part of the FSTP site. Below the sandstone is the Edaga-Arbi Glacial unit, consisting of variegated silty shales, tillite, and erratic boulders, forming gentle slopes and conical hills. The Enticho Sandstone underlies the glacial deposits and covers large portions of the study area. It is a friable, horizontally bedded, whitish to yellowish sandstone with well-developed cross bedding and conglomeratic layers in places, and is characterized by a complex fracture network.

Metamorphic rocks, mainly slates, phyllites, and metagreywackes of the “upper complex,” crop out in parts of the area, particularly around Betermaria and Gola’, showing low-grade metamorphism and foliated structures. This unit and the sandstone feature the FSTP site and its immediate environment. The region also features intrusive bodies, including medium- to coarse-grained granites and granodiorites, which are silicified and variably fractured. This unit is common along the course of the Midmar River. Dolerite dykes are ubiquitous, generally basaltic in composition, cross-cutting the sedimentary and volcanic units, and trending predominantly NW-SE and SW-NE, with widths ranging from 2 to 6 meters.

Structurally, the area is dominated by a dense network of joints, fractures, and bedding planes, which control both surface morphology and groundwater movement. Bedding planes are well developed in the sedimentary units, while foliation is prominent in the metamorphic rocks, reflecting multiple phases of deformation that shaped the geological architecture of the Adigrat region. The figure shows typical rock units in the area.

8.1.7. Hydrology and Hydrogeology

8.1.7.1. Hydrology

The hydrology of Adigrat and its surrounding rural kebeles is closely tied to its rugged, mountainous terrain, which creates a complex network of drainage divides and catchments. Located in northern Ethiopia's Tigray region, the area features prominent mountain ridges that act as water divides for three major basins: Tekeze, Mereb, and Danakil. Adigrat town is positioned near a critical divide that separates the Tekeze Basin to the south and west from the Rift Valley basins (Danakil and Awash) to the east.

The region's high elevation and steep relief significantly influence runoff and shape the local drainage network. The site designated for the FSTP lies within the Danakil basin, right at the edge of a steep cliff descending toward the Midmar River. Its proximity to a local water divide results in low runoff and minimal flood risk.

Overall, the hydrological system is dominated by seasonal rivers and streams, reflecting the region's climatic seasonality and geological characteristics. While a few perennial rivers flow through Adigrat, they contribute little to groundwater recharge due to the steep slopes and less permeable basement rocks that characterize the terrain.

The hydrology of Adigrat is marked by seasonal and intermittent flows, limited surface water availability, and a strong reliance on groundwater. Unfortunately, groundwater levels are declining due to over-extraction. The FSTP site has no viable surface or groundwater resources because of its location near a steep slope and close to a local water divide.

This complex interplay of topography, geology, and climate makes effective water resource management crucial, especially in the face of recurring droughts and increasing demands from a growing population.

8.1.7.2. Hydrogeology

The Adigrat area in the Tigray Regional State of northern Ethiopia is characterized by a semi-arid climate and rugged topography. The population relies exclusively on groundwater resources for domestic, agricultural, and livestock needs due to the high variability and unreliability of rainfall and surface water sources. Groundwater occurrence, storage, and movement are primarily influenced by a complex interplay of lithostratigraphic units, structural features, and geomorphological settings. This hydrogeological classification is based on an integration of quantitative borehole data, qualitative field assessments including spring discharge, fracturing density, and weathering profiles—and supplementary data from adjacent areas with similar geological conditions.

1) Geological Framework: The geological framework of the area is dominated by Mesozoic and Paleozoic formations that influence groundwater flow. The key aquifer unit, the Enticho Sandstone, is composed of coarse-grained, moderately cemented, and fractured sandstone. Beneath it lie the low-permeability Precambrian metamorphic basement rocks, which serve as an aquifuge. Overlying this sequence in some areas is the Tertiary-age Aiba Basalt. The region is extensively faulted and fractured, with dolerite dykes significantly affecting groundwater flow and storage. While the Adigrat Sandstone formation is present, it is classified as a low-potential aquifer due to its topographic position and the restrictive layers above it.

2) Hydrostratigraphic Units and Aquifer Characteristics: The aquifer systems in the Adigrat area are categorized into four distinct hydrostratigraphic units based on permeability and yield. The first unit, characterized by high permeability, occupies the central and southern parts of the study area, featuring flat slopes conducive to infiltration. This includes alluvial sediments found along floodplains and

riverbanks, which range from 0.5 to 10 meters in thickness and act as perched aquifers with high primary porosity. They support shallow hand-dug wells with yields typically between 0.05 and 0.17 liters per second. The Enticho Sandstone is the most productive aquifer unit, benefiting from both primary and significant secondary porosity due to vertical joints and fractures. Dolerite dykes often function as subsurface dams, enhancing local storage. This aquifer sustains high-yield springs and productive wells, with an average permeability of 1.45 meters/day and transmissivity values between 45 and 114 m^2/day. Borehole yields from this formation typically range from 0.8 to 7 liters per second.

The second unit includes aquifers with high to moderate permeability, covering approximately 55.8% of the study area. These aquifers, consisting of moderately fractured Enticho Sandstone under flat to gentle slopes, yield between 1.5 and 7 liters per second. Quantitative analyses indicate a permeability range of 0.15 to 1.45 m/day and transmissivity values between 6 and 45 m^2/day.

The third unit contains aquifers with moderate to low permeability, including the Aiba Basalt, where groundwater occurrence depends on secondary porosity from weathering and fracturing. Springs emerge at geological contacts, and hand-dug wells yield between 0.03 and 0.63 liters per second, though quantitative pumping test data for this unit are limited. The metamorphic rocks in the area also provide limited groundwater storage, with adjacent data indicating a very low permeability of approximately 0.09 meters/day.

The fourth unit comprises aquifers with very low permeability, acting as aquicludes or aquifuges. The Aiba Basalt in the western scarp features steep slopes and thin soils, significantly reducing infiltration and classifying this zone as having very low permeability. The Adigrat Sandstone, despite having fractures, is positioned high and covered by an impermeable lateritic cap, drastically limiting recharge and designating it as a low-potential aquifer. The Edaga Arbi Glacial and basement rocks consist of silty shale and clay, functioning effectively as an aquiclude. Unfractured metamorphic and plutonic rocks possess negligible porosity (<2%) and extremely low permeability, ranging from 10^{-11} to 10^{-13} meters/second.

3) Groundwater Recharge and the Challenge of Declining Levels: Groundwater recharge in the Adigrat area is constrained by its semi-arid climate. Estimates indicate that recharge primarily occurs indirectly through stream beds during flash floods, accounting for 5% to 15% of the mean annual rainfall (approximately 700 mm). This results in a renewable recharge rate of roughly 35 to 100 mm per year, underscoring the resource's finite nature. Alarmingly, monitoring data reveal a trend of declining groundwater levels in the region, directly correlated with increasing population growth and rising abstraction to meet water demands. As reliance on groundwater intensifies, the rate of extraction is outpacing the natural recharge capacity in several localities, leading to a progressive drawdown of the water table.

In summary, the Enticho Sandstone stands out as the most productive aquifer in the Adigrat area, with quantifiable transmissivity up to 114 m^2/day and yields reaching 7 l/s, while alluvial sediments provide localized high yields. The Aiba Basalt and fractured basement rocks offer moderate to low potential, whereas the Adigrat Sandstone and Edaga Arbi Glacial units are classified as very low permeability aquifers. The pressing challenge for sustainable water resource management lies in the combination of heterogeneous aquifer properties, limited recharge, and escalating demand from a growing population that depends entirely on groundwater. The observed decline in groundwater levels necessitates urgent intervention. Sustainable development strategies must incorporate comprehensive groundwater monitoring, precise siting of new boreholes using geophysical methods to target high-yield fracture zones, implementation of water conservation measures, and exploration of managed aquifer recharge (MAR) techniques to enhance the natural replenishment of these vital aquifers.

8.1.8. Water Quality

A detailed hydrogeological and hydrochemical study conducted by Nikodimos Kasaye (2006) clearly

demonstrates the significant influence of lithology on the area's hydrochemistry. Given the diverse lithological composition, the hydrochemistry is extremely variable. In terms of water quality for drinking purposes, the primary concerns arise from elevated nitrate levels and, in some cases, high coliform counts from shallow wells and rivers. This finding aligns with observations made during the current study.

Limited in situ tests have been performed on various environmental parameters, including hydrochemistry (Figure 8.11). A summary of these in situ test+

+s is presented in Table 8.3. The results indicate that the electrical conductivity (EC) in the Midimar River is significantly elevated at 2.1 mS/cm, compared to only 0.12 mS/cm in the detention pond near the FSTP site. This high EC value for the river clearly reflects a level of contamination. Visual inspections reveal significant pollution, with visible garbage disposed of in the river along its entire course through the town.

The major source of pollution is likely anthropogenic, as previous studies have indicated that geogenic factors play a limited role. Almost all groundwater samples analyzed in the area meet both the WHO and national drinking water standards. However, shallow groundwater and surface waters along the river's course exhibit high bacteriological contamination and elevated nitrate levels, a common issue in urban and peri-urban areas of Ethiopia. The substantial presence of dissolved ions suggests pollution from human activities, including agricultural runoff and urban sewage, primarily stemming from improper fecal sludge disposal, solid waste management, and widespread open defecation practices throughout the town (Figure 8.11). Other parameters, such as pH, redox potential (Eh), and temperature, remain within normal ranges; however, the elevated EC alone indicates degraded water quality in the Midimar River, posing potential risks to aquatic life and human use downstream.

Table 8.3. In situ and laboratory test result of water samples

A. In Situ Test Result		
Parameters	Midimar River	Run off detention pond near FSTP Site
EC(mS/cm)	2.1	0.12
Eh(mV)	3.5	61.8
pH	6.9	6.8
Temperature (°C)	21.9	20.5
B. Laboratory Test Result		
Parameters	Results	
Temperature (°C)	19.1	
Electric conductivity (µs/cm)	962.3	
Turbidity (NTU)	92.6	
pH	7.92	
Total Dissolved Solids(mg/l)	481	
Ammonia (mg/l)	0.96	
Ammonium (mg/l)	1.04	
Nitrate (mg/l)	8.5	
Nitrite (mg/l)	0.79	
Fluoride(mg/l)	1.06	
Total coliforms (CFU/100ml)	TNTC (Too many To Count)	
Faecal coliform (E.coli, number) (CFU/100ml)	TNTC (Too many To Count)	

Figure 8.10. Polluted river and inappropriate solid waste disposal close to river banks

The high electrical conductivity (EC) observed in this urban river clearly indicates a level of contamination. This can be attributed to several factors, including the discharge of untreated domestic wastewater containing dissolved ions such as nitrates, phosphates, chlorides, and heavy metals; urban runoff during rainfall events, which can transport road salts, oils, fertilizers, and other pollutants into the river; and leaching from illegally dumped solid waste, which further increases the concentration of dissolved solids.

In contrast, the low EC in the detention pond near the FSTP site suggests minimal or no contamination, as water is detained for a short time following rainfall. Overall, the Midimar River shows clear signs of pollution.

Importantly, the Midimar River is slated to be dammed for Adigrat's water supply, with the dam site located downstream of the FSTP site. Although the river currently exhibits high bacteriological contamination, it is essential to treat the river water before using it for human consumption. Additionally, the effluents released from the FSTP must comply with national and international standards for effluent discharge to protect the proposed dam. Regarding groundwater, the FSTP site lacks a usable groundwater system, as it is situated close to a steep cliff where recharge water quickly escapes to the valley floors after infiltration.

8.1.9. Air Quality and Noise

In situ measurements were conducted to assess both air quality and ambient noise levels at the proposed FSTP site and its environs (Figure 8.12). These assessments included monitoring of key air quality parameters such as particulate matter (PM2.5 and PM10), nitrogen oxides (NOx), sulfur oxides (SOx), carbon monoxide (CO), as well as meteorological conditions including temperature and humidity.

The results indicate that the air quality at the project site is currently excellent, with all measured parameters falling well within the World Health Organization (WHO) permissible limits for both residential and occupational settings (Table 8.4). This favorable condition is largely attributed to the site's remote rural location, which experiences minimal traffic, industrial activities, or other sources of pollution.

A) Particulate Matter (PM):

Particulate matter is a complex mixture of airborne particles that can pose serious health risks, particularly when particles are small enough to penetrate deep into the lungs or bloodstream.

- PM2.5: The recorded PM2.5 concentrations were 8.9, 10.2, and 8.5 $\mu g/m^3$. These values are significantly below the WHO 24-hour average guideline of 15 $\mu g/m^3$ and fall within the "Very Good" category of the Air Quality Index (AQI), which corresponds to values below 12 $\mu g/m^3$.
- PM10: Measured levels of PM10 were 14.1, 19.24, and 11.9 $\mu g/m^3$. These are also well below the WHO guideline of 45 $\mu g/m^3$ for a 24-hour average, reinforcing the conclusion of excellent air quality.

B) Gaseous Pollutants (CO and NOx)

- Carbon Monoxide (CO): Measurements indicated a value of 0, which is below the detection limit of the instruments used. For reference, the U.S. EPA's 8-hour average standard for CO is 9 ppm (10 mg/m³). This result suggests a complete absence of notable CO sources at the site.
- Nitrogen Oxides (NOx): Similarly, NOx levels were measured at 0, indicating negligible concentrations of both nitric oxide (NO) and nitrogen dioxide (NO_2). These values are significantly below the U.S. EPA's 1-hour standard of 100 ppb and annual average of 53 ppb.
- Sulfur Oxides (SOx): No detectable levels of sulfur oxides were recorded, further confirming the low level of anthropogenic emissions in the area.

In summary, all monitored pollutants, including particulate matter and gaseous emissions, were found to be at very low concentrations, suggesting a clean and healthy environment with minimal human-induced pollution.

Although the current ambient air quality is excellent, some increase in pollutant levels may occur during the operational phase of the FSTP. However, given the project's small-scale nature and its location in a rural setting, any increase is expected to be minor. The implementation of modern treatment technologies and adherence to best operational practices will be key in minimizing potential air quality impacts.

C) Noise Level

Noise level measurements were also taken at three different locations across the proposed project area. The recorded levels ranged from 49 to 69 dB, which falls within acceptable limits for outdoor environments, according to WHO guidelines. Notably, Site 1 showed a slightly lower noise level compared to Sites 2 and 3. Despite these differences, all sites are considered acceptable from a noise pollution standpoint and are deemed suitable for the development of the FSTP.

Figure 8.11. Testing biophysical environmental parameters

Table 8.4. In situ air quality and noise level measurement

Parameter		Site 1 : Genahiti	Site 2: Shibida (Selected site)	Site 3:Awidi Dimu
Location GPS Coordinates	X	0553498	0554847	0552775
	Y	1580140	1578537	1577444
	Z	2546	2437	2390
Illumination(Lux)		1982	1970	1979
PM2.5 (µg/m²)		8.9	10.2	8.5
PM10 (µg/m²)		14.1	19.2	11.9
TPM (Total Particles)		12907	23173	12170
Humidity (%)		12	69	56
Temp (°F)		N/A	67	76
CO (PPM)		0	ND	0
SOx		N.D	ND	N.D
NOx (PPM)		0	ND	0
Noise (dB)		49	67.13	66.7

Measurements of noise level at different places within the proposed WWTP range from 43 to 55 dB, indicating that there is no noise concern at this stage. However, during the construction and operational phase, local concerns could be traced. The same may also happen to the level of GHG during the construction and operation levels.

8.2. The Biological Environment

The Adigrat and Ganta Afeshum Woreda, where the proposed Fecal Sludge Treatment Plant (FSTP) is located, lies in a semi-arid zone that supports sparse vegetation. The area, particularly around Adigrat town, has experienced extensive forest degradation over the years due to subsistence agriculture, rapid urbanization, and overgrazing. However, ongoing soil and water conservation measures, along with afforestation programs, have led to gradual ecological recovery in some areas.

8.2.1. Vegetation (Flora)

The original vegetation cover in and around the project area has been significantly impacted by human encroachment and land-use changes. Nonetheless, current soil conservation efforts, such as terracing and tree planting, have contributed to the rehabilitation of some landscapes. In contrast, certain zones continue to suffer degradation due to quarrying and sand mining, particularly on sloped terrain (Figure 8.14).

The FSTP site itself is not located within or near any nationally protected areas and has already been subjected to intensive farming and grazing. Therefore, the vegetation in this area is sparse and primarily composed of common shrubs, bushes, and a mix of indigenous and exotic trees. There is no presence of rare, endangered, or sensitive plant species at the site. Some typical vegetation types found in the project area and its surroundings are displayed in Figure 8.15 below.

Figure 8.12. Landscape under rehabilitation and Degradation

Common plant species in and around the FSTP project site include:

- Trees and Shrubs:
  - *Acacia seyal* (Chea'), *Acacia sieberiana* – drought-tolerant and ecologically important.
  - Dodonea angustifolia (Tahises), Casuarina equisetifolia (Shewishawie), Euclea racemosa (Siraw), Schinus molle (Tikur berber), Olea europaea (Awilie), Solanum aethiopicum (Tebeb).
  - *Eucalyptus globulus* and *Eucalyptus viminalis* – introduced species used for construction and firewood.
- Succulents and Medicinal Plants:
  - *Aloe percrassa* (Ere) -widely known for its medicinal value and drought resistance.
  - *Opuntia ficus-indica* (Prickly Pear or "Beles") - important for local food security and income.
- Fruit-bearing plants:
  - Carissa edulis, Carissa spinarum (Agam), Dovyalis abyssinica (Mengolhats).
- Ground Vegetation:
  - Various native grasses, herbs, and ruderal (weedy) species anf

- Commonly cultivated crops include maize, wheat, and sorghum.

Figure 8.13. Typical vegetation types found in the project area and its surroundings.

8.2.2. FaunaWildlife (Fauna)

The broader Adigrat area has undergone significant ecological disturbance due to human activities such as urban development, agriculture, overgrazing, and the extraction of construction materials. These changes have led to habitat fragmentation and a general decline in wildlife populations. Despite this, the area surrounding the FSTP still supports a limited range of fauna.

Mammals observed in the area include:

- Spotted hyena (*Crocuta crocuta*)
- Rock hyrax (Procavia capensis)
- Common jackal (*Canis aureus*)
- African civet (Civettictis civetta)
- Striped ground squirrel (*Xerus erythropus*)
- Vervet monkey (Cercopithecus aethiops)
- Porcupines (*Hystrix* spp.)

Common bird species include:

- Sunbirds (*Cinnyris* spp.)
- Blue-capped cordon-bleu (*Uraeginthus cyanocephalus*)
- Bateleur eagle (Terathopius ecaudatus)
- Wattled ibis (Bostrychia carunculata)
- White-collared pigeon (*Columba albitorquata*)
- Abyssinian slaty flycatcher (*Melaenornis chocolatinus*)
- White-backed black tit (*Melaniparus leuconotus*)
- Abyssinian black-headed oriole (*Oriolus monacha*)
- Speckled pigeon (*Columba guinea*)
- Spur-winged lapwing (*Vanellus spinosus*)
- Blue-naped mousebird (*Urocolius macrourus*)

Figure 8.14. Types of large bird species and wild animals in the project area and vicinity

These species represent a mix of endemic and widely distributed birds, making the region a notable location for bird observation. Figure 8.16 illustrates some of the typical birds and wild animals seen in the project area and vicinity.

Importantly, all flora and fauna species identified in the area are categorized as "Least Concern" under the IUCN Red List, indicating they are not currently under threat of extinction

8.3. Socio-Economic Environment

8.3.1. Demographic Characteristics and Settlement of Adigrat town

8.3.1.1. Demographic Characteristics of Adigrat town

Adigrat is one of Ethiopia's fastest-growing cities, experiencing significant increases in both population and land area. The population growth rate has been particularly notable, reaching 9.8% in the post-Derg era, 6.9% from 1995 to 2007, and 4.13% from 2007 to 2013. These figures do not include the populations of villages that have been integrated into Adigrat over time. By the end of the design period in 2045, the population is projected to reach approximately 1,208,063.

Between 1994 and 2005, the town's land area more than tripled. The estimated population in 2017/18 was around 447,000, with women constituting 51% of the population (see Table 8.6). Notably, about 72% of the population is under the age of 30. If current trends continue, the population of Adigrat is expected to double within the next decade.

Adigrat is organized into six kebeles, each subdivided into zones and gujiles. Data from these kebeles indicates a population of 99,471, while the Adigrat Town Planning and Programming Office estimates a total of 104,334, which includes university students and residents of newly developed areas (see Table 8.5). This information is corroborated by household counts and gender breakdowns, reflecting the dynamic nature of Adigrat's growth.

Recent estimates place the population at approximately 157,000, according to reports from the city planning office with additional 54,375 IDPs. The influx of internally displaced persons due to regional conflicts has further increased this number. The most accurate population figures can be obtained from the city administration and cross-verified with the national Central Statistical Agency (CSA) census. The population is predominantly Christian, with a strong presence of Orthodox Christians. Recent years have seen substantial growth driven by both migration and natural increase, contributing to a vibrant and diverse community.

Table 8.5. Population and household distribution in the six kebeles of Adigrat town

kebele	Population			Households		
	Male	Female	Total	Male	Female	Total
1	8235	9216	17451	2422	2711	5133
2	8913	11060	19973	2621	3253	5874
3	6801	7609	14410	2000	2238	4238
4	9012	10078	19090	2651	2964	5615
5	7743	8140	15883	2278	2394	4672
6	8535	8992	17527	2510	2645	5155
Total	49,239	55,095	104334	14,482	16,205	30,687

8.3.1.2. Socio-economic Profile , Vulenarability and Gender Roles of the Residents of the Project Area and the PAPs

The The local economy is predominantly low-income, with livelihoods in the project area centered on traditional subsistence agriculture, complemented by dairy farming, animal fattening, and small-scale poultry raising. Petty trading, small-scale manufacturing, and daily labor provide supplementary, often irregular, income (see Figure 8.15). The majority of residents are farmers with limited access to irrigated land, making them highly vulnerable to climatic and market fluctuations. The recent conflict has exacerbated this economic fragility by disrupting markets and destroying assets, leaving households with minimal financial buffers.

Figure 8.15. Typical economic activities for living in the area

(Remark: A: Traditional farming; B: Petty trading (cactus fruit selling) and C: quarrying for construction materials)

Feedback from focus group discussions and key informant interviews underscores critical social vulnerabilities. Women bear a pivotal yet burdensome role in Water, Sanitation, and Hygiene (WaSH) management, responsible for fetching water and managing household sanitation, which imposes significant time and physical demands. Despite this central role, women often have limited decision-making power over household resources. Furthermore, the community, including the identified Project Affected Persons (PAPs), has a substantial elderly population. This demographic faces distinct challenges, including reduced physical capacity, greater healthcare needs, and dependence on economically strained family support systems.

Among the 38 PAPs, these vulnerabilities are clearly reflected. The group includes 22 males and 15 females, with an age range from 28 to 90 years. The presence of several individuals over 60 highlights the need for tailored support for those with limited capacity to shift livelihoods. Family sizes vary considerably, from individuals living alone to one household with 12 members, cumulatively impacting 91 dependents. This variation underscores the project's wide-reaching effects and the necessity of mitigation strategies that account for diverse household structures and their specific economic and social vulnerabilities.

In summary, the intersection of a low-income economy, significant burdens on women, and a notable

elderly population creates a context of multi-dimensional vulnerability. This necessitates a project approach that is explicitly gender-sensitive and pro-poor, ensuring that mitigation and benefit-sharing programs are accessible to the most vulnerable and do not inadvertently increase existing burdens.

8.3.2. Basic Services

8.3.2.1. Education

Adigrat town offers a diverse range of educational institutions, catering to students from kindergarten all the way up to university level. Adigrat, along with the surrounding woreda of Ganta HAfeshum, hosts several educational institutions that cater to its residents. Adigrat University, established in 2011, is a prominent feature, with an enrollment of over 20,000 students across various departments. In addition to the university, the town has several private colleges, including Ethio-Image and New Millennium College. Primary and secondary education is supported by 13 public schools and 7 private schools, providing essential education to the community. Agazi Comprehensive High School, established in the 1950s, holds historical significance as the first high school in the area.

Ganta Afeshum Woreda has made significant strides in educational access, as evidenced by the establishment of a robust network of schools. The woreda is home to a total of 52 schools, comprising 48 primary schools (grades 1-8) and 4 secondary schools (grades 9-12). This infrastructure supports a substantial student population, with a total enrollment of 18,083 students reported in 2017. Among these, 8,717 are female students, highlighting efforts toward gender inclusivity in education. However, the woreda faces challenges in student retention, as indicated by a dropout rate of 762 students, with 464 of these being male. Addressing the factors contributing to dropout rates is essential for further improving educational outcomes.

The Tigray War has significantly impacted educational facilities in Adigrat and Ganta Afeshum. Adigrat University faced extensive damage. Additionally, the conflict led to the closure of schools for more than two years, disrupting the education of countless students in both Adigrat and its surrounding areas.

Following the conflict, efforts have been made to resume educational activities in Adigrat. In July 2023, Adigrat University announced the resumption of classes for regular students after a lengthy hiatus. The university has called on former educators to return and assist in the rebuilding of academic programs. Significant funding is required to restore educational infrastructure in both Adigrat and Ganta Afeshum, ensuring that students have access to quality education once again.

8.3.2.2. Health

Adigrat is equipped with several healthcare facilities that serve the local population and the surrounding woreda. The town features 1 General Hospital, which provides essential medical services and emergency care. In addition, there are 2 Health Centers offering outpatient services, maternal and child healthcare, and preventive care. Approximately 5 private clinics, including Health Medical Center Adigrat, Selam Clinic, and Qudus Clinic, contribute to the healthcare landscape. Furthermore, the woreda has over 10 health posts that serve rural areas by providing basic health services and health education.

In terms of healthcare, Ganta Afeshum Woreda is equipped with a network of facilities to serve its population. There are 17 health posts and 5 health centers in the woreda, providing essential medical services and health care to the community. These facilities play a crucial role in addressing the health needs of residents, although challenges such as accessibility and resource limitations may hinder their effectiveness. Ensuring that healthcare services are adequately staffed and resourced is vital for improving health outcomes in the woreda.

Like the educational facilities, the Tigray War has severely affected health facilities in Adigrat, leading to significant challenges in delivering care. Many health institutions suffered damage or were rendered non-functional due to the conflict. The disruption of services has resulted in a lack of access to essential healthcare, exacerbating health issues within the community. Furthermore, healthcare workers have faced challenges, including displacement and loss of personnel, which have further strained the already

limited resources available for healthcare in the region.

8.3.2.3. Water Supply, Sanitation and Waste Management System

8.3.2.3.1. Water Supply

The Adigrat faces significant challenges in its water supply, primarily due to a growing population and a lack of permanent surface water sources. The town's main watercourse, the Huga River, relies on floodwaters from the western mountains during the rainy season and does not provide a continuous flow during the dry season. As a result, the town's water supply is almost entirely dependent on groundwater from wells.

According to a June 2025 report from the AWSSO, Adigrat's primary water supply relies on over 25 boreholes located in two well fields. Of these, only 17 are currently operational, with a daily production rate of 3,758 cubic meters. This is significantly below the town's current water demand. However, this production is far below the current demand.

With a population of 157,000 residents (annual growth rate stands at 4.5%) and an additional 54,375 internally displaced persons (IDPs). Based on a per capita demand of 60 liters per day, the total daily water demand is approximately 12,738 cubic meters.

This significant shortfall means that the current water supply coverage is only 29.5%, a sharp decline from the 74% coverage the town had before the conflict.

To help meet the growing needs, two new wells are currently under construction. No new wells have been completed since the end of the conflict. In addition, Adigrat University provides a limited amount of water to the local community in its immediate vicinity, further contributing to the town's overall supply efforts.

Table 8.6. Adigirat town water supply conditions

S.No.	Water Supply Service Level	Coverage
1	Water supply Coverage	29.5%
2	Per capita water consumption	60 Liter
3	Functional water bore holes	17
4	House connection	15700
5	Governmental non-governmental	NA
6	Business & Industry	NA

Source: AWSSO

Access to clean water is another critical aspect of public health in Ganta Afeshum Woreda. The woreda has a variety of water sources, including 81 hand-dug wells, 5 deep wells, 350 shallow wells, and 70 springs, totaling 454 water sources. This diverse infrastructure is essential for providing residents with safe drinking water, which is fundamental for maintaining health and preventing waterborne diseases. Continued investment in water supply infrastructure is necessary to ensure that all community members have reliable access to clean water.

8.3.2.3.2. Sanitation

Adigrat town has immensechallanges in meeting the minimum standard of sanitation infrastructures. There is no any form of faecial sludge treatment system inlcuding designed seweregе line. Furthermore, open deffication and rampant disposal of faecial sludge with no control.

To tackle these issues, the proposed FSTP project is underway. Currently, many residents rely on cesspools and pit latrines, while some lack any toilet facilities and resort to open defecation. Adigrat lacks a conventional wastewater collection, treatment, or disposal system, resulting in untreated fecal sludge and wastewater being disposed of indiscriminately, which creates unsanitary conditions and significant

health risks.

A primary challenge is the absence of a designated disposal site and a main sewer line. Additionally, operational equipment is limited, with only four private vacuum trucks available for fecal sludge collection, while two municipal trucks are out of service due to institutional disputes over ownership. This situation exacerbates the operational paralysis often faced by sanitation projects in Ethiopia. However, the recent shift in responsibility for sanitation from the municipality to the AWSSO aims to clarify ownership and improve operational functionality.

The FSTP project intends to establish a formal, centralized system for treating and disposing of fecal sludge, thereby mitigating health risks and reducing environmental contamination. Enhancing solid waste disposal is also crucial for creating a cleaner environment and improving public health outcomes for Adigrat's residents.

8.3.2.3.3. Sold and Liquid Waste Management System

1) Solid Waste Management - Waste management is one of the most critical problem of the town of Adigrat. Especially, faecal sludge disposal is rampant and dangerous for public health. With regard to solid waste, Adigrat has a municipal solid waste collection system primarily operated by the local government. Waste is collected from residential, commercial, and institutional sources. The city typically employs a combination of door-to-door collection and communal bins placed at strategic locations. The collection frequency may vary, with urban areas receiving more regular pickups compared to rural zones.

Once collected, solid waste is transported to a designated engineered waste disposal site in the northeastern outskirt of the town. Unfortunately, the infrastructure for sorting and recycling is limited. Most waste ends up in landfills without proper segregation, leading to environmental issues. However, as per the municipality information segregation is being implemented by cooperatives. Efforts are being made to implement community awareness programs aimed at promoting waste segregation at the source, which would facilitate recycling and composting initiatives.

Figure 8.16. Solid waste sorting and landfill site

It was also stated that the solid waste management system faces several challenges, including inadequate resources, limited public awareness, and insufficient funding. Additionally, the lack of a comprehensive recycling program exacerbates the waste problem, as recyclable materials often contribute to landfill overflow.

As stated in previous sections, liquid waste management in Adigrat includes both sewage and stormwater management. The city has a basic sewage system, but coverage is limited, particularly in informal settlements. Many households rely on pit latrines, which can lead to groundwater contamination if not properly managed.

Currently, there are no treatment facilities for liquid waste in Adigrat, with the exception of the Adigrat University. Most sewage is directed to open drains or is discharged untreated into nearby water bodies, raising concerns about public health and environmental impact. As evidenced from the hydrochemical

testing, rivers draining through the town are polluted. Liquid and solid wastes are being disposed of uncontrolled in the rivers.

2) Liquid Waste Management - The liquid waste management system in Adigrat faces significant challenges, primarily due to inadequate infrastructure and insufficient investment in treatment facilities. The reliance on pit latrines and open drains poses health risks, particularly during the rainy season when flooding can exacerbate sanitation issues.

Liquid waste in Adigrat comprises human waste, stormwater runoff, limited industrial wastewater, and other types of wastewater. Currently, the town lacks a centralized sewage network and treatment facility, resulting in poorer management compared to solid waste. Most residents depend on cesspools and pit latrines, with very few public toilets available.

The oversight of liquid waste management is complicated by overlapping responsibilities between the municipality's sanitation and beautification efforts and the Water Supply and Sewerage Service Office. Recently, sanitation issues have been integrated into the responsibilities of the AWSSO, aiming for a more streamlined approach.

Currently, the collection and disposal of faecal sludge face significant constraints. There is no official disposal site, and only a few privately owned vacuum trucks, capable of collecting 12.5 to 16 cubic meters of sludge, serve the town. Unfortunately, the collected sludge is often dumped in inappropriate locations, such as farmland and riverbanks, leading to severe health risks and environmental pollution. Clients typically pay between 4,000 and 5,000 Ethiopian Birr per truckload, but the absence of a regulated disposal system undermines the effectiveness of this service.

Community involvement is vital for the success of liquid waste management. Local authorities have initiated awareness campaigns to educate residents on proper waste disposal and sanitation practices. Engaging community members in clean-up activities can foster a sense of responsibility and enhance overall waste management.

Figure 8.16. Private vacuum trucks collecting faecal sludge from private houses

The proposed FSTP is expected to play a crucial role in improving sanitation and hygiene conditions in Adigrat. A well-designed faecal sludge management system will facilitate the safe collection, transportation, treatment, and disposal of waste, thereby mitigating environmental contamination and enhancing public health for the community. Implementing the FSTP is essential for addressing the current challenges in liquid waste management and safeguarding the well-being of Adigrat's residents.

8.3.2.4. Road Network

Adigrat is strategically located along Ethiopian Highway 20, which connects Addis Ababa with major cities of Nothern Ethiopia including Mekelle and Adigrat. This Ethiopian Highway extends northwards to Kokobay and Asmara in Eritrea. Within Adigrat, most kebeles are connected by cobblestone roads. The Adwa-Adigrat road project upgraded a 108-kilometer section from Adi Abun to Adigrat's outskirts with bituminous pavement, enhancing horizontal and vertical alignment and improving culverts and bridges. The woredas in the zone and woredas are connected with gravel road. In some remote areas

where the land is highly rugged travel by car is difficult including the FSTP site.

8.3.2.5. Electricity and Telecommunication

There is no electricity in the FSTP. There is no also landline telephone line in the project area. However, access to telecommunication services in Adigrat town is generally good and is is provided by Ethio Telecom. Mobile coverage is generally good in urban and rural areas, allowing residents to stay connected. However, coverage may be limited in the rural outskirts, where infrastructure is less developed.

Internet access has improved with the expansion of 4G networks. While many residents benefit from faster connectivity, issues such as speed and reliability can arise, particularly during peak usage times or in more remote areas. Additionally, the cost of mobile data and internet services can be a barrier for some users, limiting broader access.

Electricity supply in Adigrat is managed by the Ethiopian Electric Power Corporation. Urban areas tend to receive consistent electricity, but power outages can still occur, especially during peak demand periods or due to maintenance needs. These outages can disrupt daily life and economic activities. There is no elecricty in Shibida project area.

8.3.3. Industry and Commerce

Adigrat serves as a vital commercial and industrial hub. The town's strategic position along key trade routes facilitates diverse economic activities. The main market in Adigrat features approximately 250 stalls, supporting local commerce by offering a variety of goods, including agricultural products, textiles, and household items. In 2022, trade transactions in the town were valued at around ETB 150 million, reflecting a steady annual growth. The commerce sector employs over 3,500 individuals, contributing significantly to local livelihoods.

In terms of industry, Adigrat is home to many registered Small- and Medium-Sized Enterprises (SMEs) that focus on food processing, textiles, and construction materials. The industrial sector provides employment for approximately 1,200 individuals. Key industries include food processing, phqrmasticals, textile and construction. One of the most important industries hosted in the town is Adigrat Pharmasticals Factory.

Despite its potential, Adigrat faces challenges such as limited access to capital for SMEs, inadequate infrastructure, and competition from larger urban centers. However, there are ample opportunities for growth, including investment in infrastructure improvements, promotion of local products, and skill development programs for workers.

8.3.4. Tourism

Adigrat stands as a town that offers a thriving industry and commerce environment, successfully attracting investments and fostering economic growth while embracing its historical and cultural heritage. The town provides a range of tourist attractions that allow visitors to explore and appreciate its rich history and diverse cultural landscape.

Adigrat features significant religious and cultural sites, such as the 19th-century Adigrat Chirkos Church, adorned with vibrant murals, and the Cathedral of the Holy Saviour, the main place of worship for the Ethiopian Catholic Church. The 6th-century Debre Damo Monastery and the Gunda Gunde Monastery, known for its scriptorium, are also important historical landmarks in a few tens of kilometers distance. Additionally, the region is famous for its rock-hewn churches, and local cultural experiences, including bustling marketplaces and traditional dishes like Tihlo, particularly popular during festivals like Meskel.

As one of the most important cities in Tigray, Adigrat continues to evolve while honoring its historical roots, making it not only a center for economic activity but also a vibrant destination for tourism. The confluence of industry, commerce, and rich cultural heritage positions Adigrat as a key player in the region's growth and development, ensuring its significance for years to come in Northern Ethiopia

9. IMPACT IDENTIFICATION, ANALYSIS AND MITIGATION MEASURES

9.1. Impact Identification

This chapter evaluates the adverse and beneficial impacts of the FSTP project on the biophysical and socioeconomic environments. It also proposes measures to mitigate negative effects and enhance positive impacts. The assessment considers all phases of the project cycle, including construction, operation, and decommissioning.

Additionally, all elements of the project infrastructure and related activities, including actions by third parties that influence the project, are taken into account. The ultimate gol of the assessment is to ensure environmental and social sustainability by identifying potential impacts early and implementing appropriate management plans tailored to the context of the FSTP.

9.2. Impact Analysis Steps and Evaluation Criteria

The environmental and social impact analysis has passed through the following steps.

1) Impact identification: Baseline research, stakeholder consultation, and surveys were used to identify potential impact receptors and the current state of the environment and socioeconomic conditions.

2) Impact Description: The features of a project's effect include whether it is positive or negative, direct or indirect, short, medium, or long-term, and permanent; if it affects people locally, regionally, or globally; whether it crosses borders; and whether it is cumulative or not.

3) Impact Evaluation: Based on the effect strength, size, duration, and intensity on the receiving biophysical and sociocultural environment, professionals use their professional opinion to give criteria for each significant impact. Comparing national and international laws, regulations, or accepted standards; consulting with the appropriate decision makers; referencing government policy objectives; and considering the concerns of the local community or the general public have all been used for impact evaluation (Table 9.1).

Table 9.1. Impact evaluation category

Category	Description	Elaboration/Example
Extent	The area across which the influence will be manifested is referred to as its extent. Since an impact's importance and severity typically have distinct scales, bracketing ranges are frequently needed. This is frequently helpful in further clarifying the determined relevance or severity of an influence during the project's comprehensive evaluation phase.	▪ On Site: Inside the building site. ▪ Local: Two kilometers around the building site. ▪ Regional: This scale takes into account effects on both the provincial level and certain areas of nearby provinces. ▪ National: the scale pertains to effects that will have an overall national influence.
Duration	Duration gives an estimate of the impact's lifetime.	▪ Temporary: less than one year ▪ Short term: under five years. ▪ Medium-term: five to ten years. ▪ Long-term: ten to thirty years. ▪ Permanent: taking more than 30 years to produce a change that is both long-lasting and permanent.
Intensity	Whether an impact is damaging or not is determined by its intensity.	▪ Low: impact affects the environment without interfering with natural, cultural, or social processes. ▪ Moderate: The environment is changed, but social, cultural, and natural processes and functions carry on in a different form. ▪ High: Natural, cultural, and social processes and functions undergo such drastic changes that they momentarily stop.

Category	Description	Elaboration/Example
		▪ Extremely High: Functions and processes that are natural, cultural, and social are changed to the point where they end forever.
Probability of occurrence	Probability expresses the chance that an impact will be materialized.	▪ Improbable: There is extremely little chance that the impact will occur. ▪ Likely: The impact might happen. ▪ Certain: The impact's likelihood of happening is highest. Undoubtedly, there will be an impact.
Type	Type could refer to whether it is Adverse or Beneficial	▪ Adverse- Negative impact ▪ Beneficial- Positive impact
Significance	Significance is a measure of the impact's relevance in terms of its temporal and physical scope, which in turn determines the necessary mitigation level.	It may envisage the following negative and positive levels ▪ Negative (Very High, High, Moderate, Low) ▪ Neutral ▪ Positive (Very High, High, Moderate, Low)

9.3. Other Considerations of the Impact Assessments

The following are the key considerations of the impact assessment/analysis

- All project infrastructure components and related activities, as well as the construction, operation, and decommissioning phases of the project cycle, should have their effects evaluated.
- Evaluating third-party actions that are essential to the project, regardless of whether they are financed by the project itself or by other sources, is worth consideration;
- Potential effects of the project on the social, economic, cultural, and physical environments, as well as on the health and safety of the project personnel and local people, should be covered in the evaluation.
- Both positive and negative effects should be considered in the assessment, and both mitigation strategies for the negative effects and strategies to improve the benefit impacts should be suggested. The baseline environment, a suitable project description, and any future positive and negative changes that are expected as a result of project implementation should all be taken into consideration when conducting any impact study.

9.4. Features of the Identified Environmental and Social Impacts of the FSTP Project

The main advantage of these subprojects will be the establishment of a strong institutional capacity for providing sanitation and hygiene services, which will ultimately lead to a cleaner living and natural environment, as well as significantly higher health standards in the Adigrat town that each subproject is focused on. Improved economic productivity and development will result from this, especially in the tourism industry, which depends heavily on dependable and reasonably priced sanitation and hygiene facilities.

Both Adigrat town and the nearby Ganata-afeshum woreda will benefit socioeconomically and environmentally from the subprojects. Better access to safe sanitation and hygiene facilities and treatment units is anticipated as a result of the project, which will raise living standards by lowering the prevalence of diseases, improving access to essential services, and creating both temporary and permanent jobs during construction and operation. Except for a few households that lose some of their plots, this activity does not include long-term negative environmental or social effects because it does not involve permanent changes in the socioeconomic and environmental surroundings. It will mainly benefit the poor in the town areas by providing access to clean and affordable sanitation and hygiene facilities.

The wastewater treatment plant and fecal sludge treatment plant will help mitigate the negative environmental effects of current open dumping and uncontrolled fecal waste disposal, including unpleasant odors, unsightly conditions, and the possibility of groundwater contamination. Positive effects of the suggested sub-project activities were found by the impact analysis that was previously given. Based on their expected effects during the building, operation, and decommissioning stages, the positive effects have been graded.

The following sections provide an overview of the most important environmental and social impacts (positive or negative) as well as their improvement or mitigation strategies, based on the main conclusions of the ESIA. It counts the main tasks and phases of the side project, the possible social and environmental impacts (beneficial or adverse), as well as the improvement or mitigation actions for the impacts that have been identified.

9.4.1. Beneficial Impacts of the Project and Enhancement Measures

The proposed FSTP comes with several advantageous aspects. It will help lessen the negative effects of uncontrolled faecal waste disposal into the environment, such as unpleasant odors, unsightly conditions, and the possibility of groundwater and surface water pollution or contamination. It will also improve public health, household health, and hygiene, improve infrastructure, transfer skills and technologies, and create jobs during the construction and operation stages. Furthermore, preventing septic tank overflow onto roadways and drainage ditches when the FSTP is operating will significantly enhance the beautiful appearance of Adigrat town. During the stages of construction and operation, the following are some of the recognized beneficial impacts predicted and the desired actions to improve them.

1) Business Opportunities and the Creation of Jobs: Both expert and unskilled workers, including machine operators, engineers, technicians, surveyors, and other staff members with varying skill levels, will be engaged in the subproject. Families participating in the project, whether directly or indirectly, will gain socioeconomically from the development of both temporary and permanent jobs as well as business prospects. Most employment opportunities produced during construction will be temporary, and permanent jobs will be created after the project is finalized and operational. Furthermore, it is anticipated that the local population will have access to trade possibilities and direct employment. The subproject will ensure that when it comes to economic opportunities and employment development in the project region, local communities, especially PAPs, women, and youths, are prioritized.

- **Improvement Actions**: Giving PAPs and vulnerable groups like women, female-headed HHs, the kids, and the disabled priority and special treatment can increase the benefits of employment and business prospects. Furthermore, it is possible to guarantee that skills are transferred and that the workplace is favorable by offering unskilled and semi-skilled laborers sufficient on-the-job training and capacity building.

2) Transfer of Knowledge and Skill: Various capacity development sessions, both organized and unstructured, will be provided to unskilled workers primarily through the transfer of new technologies and skills, as FSTP is new to Adigrat town. Thus, both skilled and unskilled local personnel will encounter and gain experience from the installation, operation, maintenance, and administration of the FSTP during the building and operating stages. This might be accomplished by exposure to contemporary management, logistics, and practice methods in addition to on-the-job training. The transfer of skills will benefit local subcontractors and companies as well, since it will increase local capacity.

- **Improvement Actions**: Locals, especially the vulnerable group, should be given priority when the necessary information and skills are available locally, taking into account their degree of interest, knowledge, and competence. Furthermore, it is feasible to improve the skill and knowledge transfer of semi-skilled and unskilled laborers from the neighborhood by offering on-the-job training and capacity building.

3) Revenue to Contractors and Suppliers of Materials and Equipment: Many tools and supplies (such as cement for civil works, bricks, gravel, plumbing supplies, and steel reinforcement) may be found in Adigrat Town and the surrounding areas. As a result, nearby vendors of equipment and building supplies in the project region will profit monetarily. This is a beneficial effect that is only temporary and reversible while the building is underway.

- **Improvement Actions**: Contractors must be contractually obligated to get building supplies from suppliers that are lawfully licensed or authorized by the relevant district authorities. The

alternative means of improvement is to organize young people without jobs to provide local building materials till the conclusion of the construction stage.

4) Health Issues: By carrying out the suggested subprojects, health issues will be avoided, especially those resulting from waste-related disease outbreaks (such as cholera, dysentery sickness, which is brought on by inadequate sanitation). According to health reports from the Adigrat municipal health office, diseases linked to poor sanitation and hygiene are a significant health issue in the town. Typhoid fever, bacterial intestinal infections, and diarrhea were listed as the top 10 illnesses that caused morbidity by the Adigrat local health office. The suggested subprojects will have a beneficial impact on Adigrat Town's community health and environmental sanitation.

- **Improvement Actions**: By educating people about the use of clean water and problems associated with dirty water, as well as its benefits and drawbacks, the health benefits of cleaning wastewater would be increased. Recommending that locals set up an environmental health council and monitor the state of their environmental sanitation. In places without medical facilities, the relevant government offices provide health centers. It is obvious that the environment cannot be made clean by wastewater treatment alone. The advantages of the wastewater treatment process would be increased with proper solid waste collection, treatment, and disposal.

5) Reduced Associated Treatment Expenses and Risks to Public Health: The baseline section of this ESIA clearly states that there are no standardized disposal sites and that the current town's liquid waste treatment system is of inadequate quality. Because of this, the faecal sludge from septic tanks and toilets is presently collected and disposed of using vacuum trucks near the proposed FSTP site, but without proper and controlled drying beds. Diseases linked to poor sanitation and hygiene are a significant public health concern in the town due to the free and uncontrolled exposure of humans and animals in the area.

Thus, putting the suggested FSTP into practice would be crucial to enhancing environmental sanitation and preventing illnesses linked to inadequate sanitation across the town. This contributes to the reduction of medical expenses related to illness prevention and treatment.

- **Improvement Actions**: Efficient and effective evacuation of filled private and municipal septic tanks is necessary to improve the health of town dwellers. The evacuation cost needs to be within the means of low-income households, or the municipal government should provide financial assistance. It is important to carry out timely maintenance and effective and efficient exploitation of malfunctioning systems per the necessary standards. The suggested subproject will provide better results if it incorporates hygiene promotion, awareness development initiatives, and hardware components. Implementing capacity-building initiatives within WSSE and the municipality is the other major intervention area needed to maximize the identified beneficial outcomes.

6) Reduced Infiltration of Soils and Groundwater, Sewage Spills: The installation of a suitable FSTP in Adigrat Town will minimize or completely eradicate any substantial possibility of sewage seeping into the ground, soil, and water streams. Overflowing and poorly maintained septic tanks and restrooms may be the source of sewage released into the earth, surface waterways, and natural soils. Therefore, collecting and treating toilet sludge will lessen the chance of uncontrolled waste discharge into water bodies and lower the danger of contamination of surface and groundwater resources.

- **Improvement Actions**: It is important to design and conduct faecal sludge management that is both ecologically and socially acceptable. This involves a wide range of issues, including both technical and non-technical ones, and involves all levels of stakeholders. Checking if the effluent quality conforms to Ethiopian effluent discharge guidelines and conducting quarterly routine effluent quality monitoring during release to downstream rivers will boost the beneficial impacts on natural water quality.

7) Air Quality: The catchment's overall air quality will improve, notwithstanding the anticipated negative localized odor near treatment sites and their borders. This is because hazardous components will be removed from liquid waste that is currently being released into the environment untreated after being collected at treatment facilities. The project's goal is to reduce pollution in the environment. As a result, the project will have a very good effect on air quality.

- **Improvement Actions**: Measures to improve the air quality in Adigrat town and the nearby Ganta-Afeshum woreda include establishing connections between all unconnected areas and encouraging the development and deployment of decentralized treatment systems in places where topography precludes the installation of central treatment systems.

8) Water Quality: Treating fecal sludge is crucial to safeguarding water, one of our most precious resources. By making positive changes to water quality metrics like BOD, COD, turbidity, color, pH, temperature, total dissolved and suspended solids, conductivity, coliforms, nutrients, and trace metals, the quality of water that flows from the FSTP to the surrounding rivers can be enhanced.

The main benefit of the FSTP functioning with regard to surface water, including bottom sediment, is the enhanced water quality both inside the project area and downstream of the Midimar River. Consequently, the new FSTP's discharge of treated wastewater will significantly contribute to the dilution of the otherwise polluted river water.

The quality of the groundwater will be significantly improved by the functioning of the FSTP. It is anticipated that the proposed treatment plants will produce high-quality treated wastewater, which will aid in groundwater recharge. As long as the treated effluent meets Ethiopian and other worldwide acceptable requirements for treated effluent quality, this beneficial impact is assessed as extremely high. Improvement Actions: It would be crucial to routinely check whether the effluent quality meets Ethiopian effluent discharge guidelines and monitor the effluent quality before releasing it into downstream rivers in order to maximize the beneficial effects on downstream water quality. The advantage would also be increased by treating localized wastewater from residential areas and other sources that cannot be treated at the central treatment plants due to topography or other reasons. If the regulatory body's ability to monitor and manage pollution is strengthened, the Midimar River's water quality can be further enhanced. In order to improve the quality of water resources and lessen the detrimental effects of FSTP residues, it is also advised to design and execute integrated watershed management in the micro-catchment. This can be carried out in coordination with the Ganta-Afeshum woreda agriculture and natural resource office and the Adigrat water supply and sewerage office.

9) Production of Compost/Fertilizer: The dewatered/treated sludge that is extracted from the FSTP processes can be used to condition and fertilize the soils both upstream and downstream, as well as in the immediate irrigated agricultural region. The agricultural office/bureau can use the biodegradable ingredients that are extracted throughout the process to produce natural fertilizers that might replace other products that might be more detrimental to both people and the environment. Additionally, resources can be mobilized by the Adigrat town water supply and sanitation office to utilize FSTP wastes to produce composts for homes and businesses.

If the treated effluent's content falls within an acceptable range, it can be utilized for irrigation. Urban irrigation plays a critical role in enhancing the standard of living for those engaged in urban agriculture by providing fresh produce for both domestic use and the market. The FSTP must be built and run to produce discharges that are under the maximum effluent quality standards to reap this benefit. Therefore, the construction of the FSTP will make it easier to get inexpensive organic fertilizers.

- **Improvement Actions**: It will be essential to create a demonstration site, organize farmers, and designate knowledgeable irrigation extension workers to apply the compost. Making marketable compost will increase its benefits and bring in money for the relevant authority (creating micro and small businesses that make marketable compost). It will also be helpful to collaborate closely with the agriculture office to guarantee that the compost meets standards for quality. Therefore,

building diversion canals, providing water pumps, and developing a sustainable market connection for the compost products would all incentivize farmers to employ irrigation. Enhancing the advantage would be a field demonstration and instruction for the farmers at the neighboring FSTP on how to use compost on their agricultural plots.

10) Road Access: For the FSTP project to be implemented, an access road (gravel road) must be built. Road access is one of the fundamental infrastructures that affects a town's socioeconomic development. The local community benefits greatly from the construction of the gravel road project, which closes the gap in people's communication and transportation. Additionally, it makes it simple for people to travel between locations in order to go about their everyday lives.

- EnhancementActions: Regular maintenance and the conversion of gravel roads to asphalt whenever feasible in order to improve road access and a safe transportation system.

11) Improvement on Socio-economic Development: The foundation and primary force behind the socioeconomic development that every community and nation aspires to is infrastructure. Building gravel roads will improve people's connectivity, connect villages, raise people's capacity to afford travel, open up commercial opportunities, and lower transportation costs.

- Improvement Actions: Regular maintenance and the conversion of gravel roads to asphalt whenever feasible to improve socio-economic interactions with the rural and semi-rural communities along the route and nearby.

12) Supplementary Measures: Other steps may be taken into consideration to increase the project's anticipated advantages in addition to the benefits already mentioned. These steps are intended to fortify several facets and guarantee the project's long-term viability. The extra measures that are suggested consist of:

- **Capacity Building:** To maximize the benefits of the project, Capacity Building initiatives must be carried out within the Drinking Water Supply and Sanitation Agency (AWSSO), the municipality, and other pertinent stakeholders. To enhance the knowledge and skills of workers in agriculture, healthcare, environmental protection, and other relevant industries, training and capacity-building programs should be implemented. Giving stakeholders the right knowledge will help the project accomplish its goals and maintain sustainability over the long run.
- **Strengthening the Legal Framework:** Another crucial step to take into account is improving the legal side of waste management. It is advised to focus on strengthening the current legislation about the management of solid and liquid waste, as well as disposal techniques. Any inadequacies or flaws in the current legal framework of Adigrat town administration should be addressed by reviewing and improving it. The implementation of these rules will need to be regularly monitored and evaluated in order to guarantee compliance and reduce any persistent gaps in waste management procedures. The initiative can provide the groundwork for Adigrat Town's sustainable waste management practices by fortifying the legislative framework.

9.5. Identified Negative Impacts of the FSTP Project and Mitigation Measures

For the construction, operation, and decommissioning stages of the project, probable negative effects have been identified. Mitigation strategies for each impact are suggested. Finally, an Environmental Impact Evaluation Matrix was created, and Table 9.3 provides a summary of it. The matrix takes into account variables at every stage of construction, operation, and decommissioning, including spatial size, length, level, chance of occurrence, and reversibility of the concerns. The evaluation concentrates on both physical and social factors, such as the socio-economy, health and safety, noise and vibration, and traffic accidents, as well as natural aspects including soils, ambient air, flora, and water bodies (both surface and ground). The objective is to pinpoint problem areas and provide a suitable plan for environmental management and observation, and each phase of the most important impacts is identified and described below:

9.5.1. Construction Phase Impacts

1) Change in Land Use and Effects on Fauna and Flora:

The land-use change (land clearing) would result from the proposed project activities. Farmland will be converted to other land uses as a result of the FSTP's intended implementation. Semi-built land use will be the next land use type. But this shift is irreversible, and the farmlands must be used as compensation. About 7 hectares of land are needed for the FSTP implementation. The study team noted that there were no residential buildings on the property other than the farmers' farmlands.

The project that is being proposed would convert a section of land that is presently covered in bushes and shrubs into an FSTP. This will change the landscape forever and necessitate removing plants. Due to its lengthy agricultural history and diverse environment, Ethiopia is one of the 12 Vavilov centers of crop genetic variation, making it one of the world's most biodiverse regions. An estimated 12% of the approximately 7,000 species of higher plants in Ethiopia's flora are indigenous. Woodlands are the vegetation types with the largest percentage of endemic species, followed by Afroalpine and Subafroalpine. The flora genetic resources in the project region may be adversely affected by the removal of bushes, Tid, seraw, and shrubs during the building phase. Moreover, because of the site's closeness to the Midimar River (about 1500m), wildlife movement may be disrupted and accident risk may rise. The effects on the flora and fauna are anticipated to be mild, confined, and long-lasting in the absence of mitigation efforts.

2) Loss on cactus (Beles) plantations due to access road construction: On cactus patches per square meter, beles (cacti) will be lost. One of the difficult tasks on this site was estimating compensation for beles (cacti). To do this, owners of the beles (cacti) were categorized. Accordingly, the two road sides in Goelea Genahti Tabya between the Talian Cemetery and the FSTP site would sustain damage.

3) Pollution and Erosion of the Soil and Land Slides: The FSTP may sustain damage from landslides and erosion during the construction phase. Therefore, to prevent any hidden hazards of erosion and landslides, a preventative measure must be performed prior to the commencement of construction and site preparation activities. Up to 400 tons of fertile soil per hectare are lost each year in Ethiopia from areas with inadequate vegetation cover and from areas where no practical soil conservation measures have been implemented.

An estimated 1.5 to 1.9 billion tons of soil are lost nationwide each year as a result of wind and water erosion. Numerous detrimental effects, both direct and indirect, have resulted from soil erosion. It has caused agricultural land to deteriorate, which has decreased agricultural output. Degradation of water resources and a reduction in dam lifespan have resulted from silt buildup in different water bodies. It is anticipated that landslides, erosion, and flooding would cause damage throughout the construction period. The impact is less negative, unlikely, reversible, of moderate magnitude, and short-term. To prevent any unanticipated hazards of flooding, erosion, and landslides, however, a preventative measure must be implemented prior to the commencement of construction and site preparation activities.

Construction operations have the potential to compact the soil, weaken its structure, and cause erosion and silt transport to the neighboring Midmar River. Soil pollution can also result from improper handling of hazardous materials while doing maintenance on machines and vehicles. Without mitigating measures, these consequences on soils are expected to be mild, confined, and transient.

4) Pollution of Water Bodies and Risks of Flooding: The quality of the neighboring Midmar River's surface as well as groundwater may be impacted by the discharge of hazardous materials, including gasoline and oils, as well as solid and liquid waste, from worker camps and workshops. Should it make its way to the groundwater, it will significantly impact the primary aquifers in the region. Surface water pollution increases nutrient levels, promotes the rapid growth of algae, leading to algal blooms. Some blooms can produce toxins harmful to aquatic life and humans. When algae die and decompose, the decomposition process consumes dissolved oxygen in the water. This can lead to hypoxia (low oxygen levels) or anoxia (no oxygen), creating "dead zones" where aquatic life cannot survive. Besides, the changes in water quality and oxygen levels can harm aquatic organisms, leading to a decline in species diversity. Eutrophication can also cause color changes in the water, bad odors, and reduced aesthetic value, making

it unsuitable. Besides, the risk of flooding and surface water pollution may occur during the construction phase.

5) Impacts on Ambient Air Quality: Heavy load rails, excavating equipment, and other concrete mixing tools will be used in the FSTP project. These tools are primarily used for foundation excavation, material development, and other purposes. Therefore, the project will have a significant impact on the surrounding air quality by generating dust and other pollutants from heavy machinery and vehicles. Emissions from hot mix plants, aggregate drying, and rock crushing operations additionally deteriorate air quality. Because particulate matter (PM2.5 and PM10) has the potential to significantly grow throughout the construction phase, it will be the most important air pollutant taken into consideration. The impact during the building phase can be attributed to the exhaust gas emissions from operational construction equipment, as well as the dust emissions from material handling and processing, and from construction vehicles on the roads. Hence, site clearance, excavation, dust emissions from material handling and transportation, vehicle traffic, and gaseous emissions from cars and construction equipment are only a few of the emission sources that contribute to air pollution during construction activities.

6) Noise and Vibration Impact: Construction operations, including the use of heavy machinery and automobiles, may produce noise pollution that surpasses Ethiopian and World Health Organization (WHO) noise guidelines. Ethiopian noise standards are 55 dB during the day and 45 dB at night in residential areas. It is anticipated that prolonged exposure to noise levels beyond this threshold in residential areas will harm health. Long-term exposure to loud noises can be harmful to the health of those who work and live close. It is anticipated that certain operations, like material delivery, traffic, excavation, material transportation, and concrete production, will produce a lot of noise.

7) Risks of Traffic Accidents: During the construction phase, there may be a greater volume of traffic surrounding the construction sites of the FSTP, which could raise the risk of traffic accidents, particularly for workers. Unbelievably high rates of accidents are caused by drivers who are not aware of traffic laws and safety precautions, reckless driving, a lack of awareness of pedestrian safety, and obstructions that impede vision. Use of substances like beer and chat/khat can increase the danger even further.

8) Road Access Congestion: Access may be closed and road traffic may become unsafe as a result of the FSTP project construction. People are using the current road to enter and exit Adigrat town, and the access road may be closed for the Sasie people in particular. Everybody and the surrounding property should be protected from construction hazards by the contractor. The contractor should use flagmen, put up warning signs, and provide other temporary routes for cars and pedestrians in order to oversee the closure of the access road.

9) Impact on Occupational Health and Safety: Uncontrolled access to the construction site and a lack of safety rules lead to accidents involving both local residents and employees. Workplace mishaps and worker injuries are also possible. Although effects are unpredictable, history has shown that most accidents can be avoided if the building contractor pays attention to the right safety precautions in the job. Training and suitable incentives to adhere to health and safety regulations are examples of preventive measures. The contractor will create and maintain a safety and accident prevention program that includes measures to address deficiencies that lead to accidents, training for employees to ensure they are properly skilled in their jobs, well-maintained construction equipment, adequate protective gear and clothing, and recordkeeping pertaining to accident frequency. The contractor shall guarantee that first aid kits are available on construction sites. The contractor will assume full responsibility for the prompt evacuation of any injured parties to the closest medical facilities in the case of an accident. Additionally, the contractor will be in charge of the construction workers' health and safety insurance.

There are dangers and hazards associated with large-scale building operations. Risks to one's health and safety while working include the use and storage of hazardous materials, different kinds of accidents, and exposure to dust and exhaust fumes. There will likely be both immediate and long-term effects on the health and safety of project personnel during construction, with impacts ranging from mild to high. To protect worker well-being, these negative effects require close monitoring and management.

10) The Influx of Labor and Possible Clash with the Community: It is anticipated that the project will present labor-related difficulties in the project region. Labor-intensive operations will require people from other regions, which could cause problems with the local populace. Behavioral changes may also be brought about by a population influx. The impact is expected to be medium in size and short-lived. It is essential to address labor-related issues through community involvement, effective communication, and suitable labor management techniques in order to reduce the likelihood of disputes and foster goodwill among neighbors.

11) Exposure to Sexually Transmitted Infections (STIs) and HIV/AIDS: Extensive Large-scale construction projects frequently create an atmosphere where the transmission of STIs, including HIV/AIDS, is quite likely. The majority of young, sexually active construction workers live in hotels or construction sites on a nomadic basis. A huge workforce may draw sex workers, which could increase the risk of HIV/AIDS and STIs spreading. To address this impact, it is imperative to implement comprehensive awareness and preventive initiatives that include education, access to healthcare, and promotion of safe practices.

12) Risks Related to Gender and Gender-Based Violence

Limited knowledge and comprehension of gender issues, gender-based violence (GBV), sexual harassment (SH), and sexual exploitation and assault (SEA) among contractors, consultants, and construction workers have been found in previous infrastructure project experiences. For female construction workers, this ignorance can result in issues like gender-based violence and sexual harassment at work. It is crucial to address these problems by enlisting the help of gender specialists, spreading awareness, and putting policies and procedures in place that support gender equality and guard against GBV/SH. The implementation of proactive measures to prevent gender abuse during the building of the proposed FSTP is predicted to have little impact.

13) Impact on Religious, Cultural, and Archaeological Sites: Based on on-site inspections, it appears unlikely that the proposed project site will have a direct influence on any known historical, cultural, or archaeological sites. Nonetheless, the Project Contractor must take the necessary precautions to prevent unintentional damage to cultural or archaeological assets during the construction phase. It is imperative to promptly notify the appropriate Culture and Tourism Office of any artifacts or significant discoveries made during construction to identify and mitigate any potential impacts on cultural assets.

14) Impact on Climate Change and Resilience: The project implementation will bring disturbances to ecological and social systems. Besides, dust and emissions from construction vehicles/equipment and waste from materials used will contribute to the temporal and local climate and resilience impacts. Implementing measures to minimise disturbance, emission and dust control, and consideration of the waste management plan will be useful to mitigate the negative impacts on climate change and resilience. Moreover, integration and use of adaptation measures, implementing proactive management and climate emergency plans (project-induced or natural climate hazard) shall be considered as valuable mitigation measures.

9.5.2. Operation Phase Impacts

The identified impacts during operation may have a greater temporal and spatial extent than those discovered during the construction and decommissioning phases. Furthermore, there are more of them. The following is a quick description of the main effects anticipated at this stage of the project.

1) Odor (Foul smell): The FSTP may smell foul due to the regular discharge of truckloads of faecal sludge. Nonetheless, given that the FSTP is situated outside of the town, a strong stench coming from the treatment plant area is anticipated to have minimal impact. However, the impact on the worker is expected to sustain.

2) Imapct on ambient air quality: The discharges of various polluting gases (CH_4, CO_2, and H_2S) into the atmosphere from faecal sludge treatment plants have harmful effect on the environment by producing unpleasant aromas. In actuality, these gases will be produced by fecal sludge treatment facilities and released into the atmosphere, where they will have an adverse effect on the environment by producing unpleasant aromas. The effects are long-lasting, negative, reversible, and of moderate importance. To lessen annoyance and unpleasant odors, it is therefore preferable to use treatment procedures such as alkaline, oxidation, and chemical precipitation treatments in the FSTP. To limit or completely eradicate H_2S production, a more sophisticated approach is to control important operating factors (PH, temperature, etc.) and inhibit sulphate-reducing bacteria.

Depending on the Adigrat water supply and sanitation office's capability, hydrogen-trophic biotechnologies like chemolithotrophic H_2S oxidation (desulphurization), algal-bacterial symbiosis, or (decarbonation) CO_2 reduction to CH_4 (power-to-gas) can be used to lessen their effects. For the elimination of H_2S, there are two technologies. The first is post-treatment, which is effective but may result in further treatment expenses. The second option is the pre-treatment procedure, which is an easy and inexpensive tactic. By lowering H_2S production during anaerobic digestion, it eliminates a sizable amount of H_2S from the sludge/anaerobic digester. This process lowers the amount of sulfur in the sludge or substrate by precipitating it out before anaerobic digestion, followed by liquid-solid separation and the inhibition of sulphate-reducing bacteria. The effects are long-term, moderately significant, reversible, negative, and of moderate relevance.

3) Effect on soil and water bodies: The waste is handled in facilities that are appropriately designed. Without adequate treatment, neither the sludge nor the drained water will be permitted to exit the FSTPs. Because of this, FSTPs have a very good influence on downstream areas and would reduce the current unregulated wastewater discharge into aquatic bodies. However, there will be a significant risk of contamination if there is leakage or overflow. Potential effects on human and environmental health could result from the heavy metals present in the treated wastewater. Though they can simply go from the liquid phase into the solid phase (sludge) in the case of primary and secondary treatment, the proposed FSTPs will be able to retain a sizable percentage of such contaminants. However, they can readily collect in the sludge since some of them are tenacious in both aerobic and anaerobic biodegradation phases of treatment. This will make it impossible to use a significant quantity of sludge as fertilizer. The effects of heavy metals in sludge are detrimental, permanent, significant, and long-lasting.

Generally, appropriately constructed units handle the waste. Without the necessary treatment, neither the sludge nor the drained water will be permitted to exit the FSTPs. On the other hand, there is a considerable risk of contamination in the event of leakage or overflow. The presence of heavy metals in the treated wastewater may have negative effects on the health of people and the environment. Heavy metals in sludge have detrimental, irreversible, highly significant effects that are long-term.

4) Faecal Effects on Fauna: If poorly treated wastewater is dumped into rivers, it may affect bird species that are resting nearby by producing contaminants and decreasing the amount of nutrients available for their growth and development (a process known as eutrophication), which will lead to a decrease in the variety and quantity of birds. The release of inadequately treated wastewater and the generation of sludge from the FSTPs may have an impact on bird species and several domestic animals that live nearby, including camels, cows, goats, shoats, and oxen. Because the risk is constant but reversible, this issue is unlikely, of modest importance, and has a long-term duration.

5) Eutrophication Effect: Eutrophication can occur when the Midimar River receives excess nutrients, primarily from the FSTP discharger. This leads to several significant effects. Increased nutrient levels promote the rapid growth of algae, leading to algal blooms. Some blooms can produce toxins harmful to

aquatic life and humans. When algae die and decompose, the decomposition process consumes dissolved oxygen in the water. This can lead to hypoxia (low oxygen levels) or anoxia (no oxygen), creating "dead zones" where aquatic life cannot survive. Besides, the changes in water quality and oxygen levels can harm aquatic organisms, leading to a decline in species diversity. Eutrophication can also cause color changes in the water, bad odors, and reduced aesthetic value, making it unsuitable.

6) Impacts on occupational health and safety: Workers may be impacted by handling partially treated dry sludge or by the treatment plant's harmful gas emission, hydrogen sulphide. Plant breakdowns and accidents are other possible health and safety effects. The following incidents were grouped based on their likelihood and consequences: spills, process upsets, natural disasters, power outages, fires, injuries, and fatalities. The effect is long-term, moderately significant, reversible, negative, and probable.

7) Risks and impact on Health: Improper handling of partially dried sludge can have negative consequences on both the environment and human health. Pathogenic organisms found in the sludge include bacteria, viruses, and other types of eggs and cysts that might endanger the health of people living nearby as well as system operators. Farmer illnesses can result from using untreated sludge as fertilizer in agricultural settings where farmers come into touch with dried sludge that has not been properly treated. Additionally, worm eggs and bacteria can adhere to plants, perhaps infecting consumers if the produce is eaten raw and not properly cleaned. The condition of grazing grounds and the well-being of grazing livestock can be impacted by improperly treated sludge. Another possible risk is chemical contamination because heavy metals from the sludge might affect water and soil. In addition, non-biodegradable particles like glass splinters that are present in the sludge give rise to non-pathogenic dangers. Disease-carrying vectors such as rats, flies, birds, monkeys, hyenas, and dogs might be drawn to poorly managed sludge treatment and disposal sites, increasing contamination and the risk of disease transmission.

8) Effects on public health / Mosquito breeding and disease transmission: The waste stabilization pond could provide an ideal habitat for mosquito reproduction and disease transmission if the project is not adequately maintained, which could worsen the already infected area. On the other hand, the impact is long-term, moderate, and confined when appropriate mitigation measures are taken.

9) Impact on aesthetic value: Sludge, drying beds, and stabilizing bonds may detract from the surrounding area's attractiveness while the procedure is underway. Aesthetic qualities and visuals from the waste stabilization ponds will be impacted during the FSTP operation.

10) Risks of Gender-Based Violence (GBV) and Sexual Exploitation Abuse (SEA): Given the state of ignorance during the operation period, there may be a chance of Gender-Based Violence (GBV) and Sexual Exploitation Abuse (SEA). Additionally, there's a chance that gender inequality could manifest itself while the FSTP is in existence, through, among other things, unfair compensation for women, sexual harassment, and discriminatory job distribution.

11) Flooding, erosion and landslide risks

It is anticipated that the projected FSTP's structure and related infrastructure may be impacted by landslides, erosion, and flooding. If it happens, the effects are short-term, mild, reversible, unpleasant, and unlikely. Precautionary measures must so be taken to reduce the possibility of landslides, erosion, and flooding. To prevent and safeguard the infrastructure against the dangers of erosion, landslides, and flooding, the following actions should be taken into consideration. Because of the site's propensity for flooding, appropriate flood protection measures are required.

12) Impact on Climate Change and Resilience: Improper operation and management of the facility will lead to GHG emissions like CO_2, CH_4, and N_2O that will contribute to the temporal and local climate and resilience impacts associated with the septic tanks and FSTP operations. Besides, traditional and energy-intensive vacuum trucks used for sludge transportation will contribute to the CO_2 emissions. In this context, reducing storage duration under anaerobic conditions, implementing energy efficiency measures and using renewable energy and resource recovery (compost) and considering resilient design infrastructures will mitigate the associated climate change and resilience impacts. Implementing measures to minimise emissions and considering desirable operational standards and waste management plan will

be useful to mitigate the negative impacts. Moreover, integration and use of adaptation measures, implementing proactive management and climate emergency plans (project-induced or natural climate hazard) shall be considered as valuable mitigation measures.

9.5.3. Decommissioning`Phase

The treatment plants could be decommissioned or upgraded by the client. A system upgrade will likely be required. Assume that at the end of their design life, the treatment plants are decided to be decommissioned. The removal of contaminated soils from the treatment plant locations and the production of solid waste from the demolition of the treatment plant buildings will thereafter have an influence. Assuming the waste treatment plants are shut down, these effects are anticipated.

1) Air pollution: When structures built to support the treatment, facilities are dismantled and demolished during decommissioning, and dust and other pollutants embedded in the demolished structures will be released. This effect is small-scale, transient, and unimportant.

2) Effects on Soil and Water Bodies: There will be a lot of debris left over after breaking down buildings and removing toxic soil, which will contaminate the land and water sources, including groundwater, during the decommissioning phase. The soil and water resources, including groundwater, would be affected if the contaminated soil were disposed of outside the approved area or outside the sanitary landfill that was properly planned and built. Nevertheless, closing the sites without a more effective way to handle the region's growing wastewater would harm the area's water and soil resources as well as downstream.

3) Health Impact: Workers engaged in demolition operations may suffer negative health effects from the demolition of concrete structures and the restoration of the region following the disposal of contaminated soil and sludge.

4) Loss of Job Opportunity: Previous occupations that skilled and unskilled individuals enjoyed during the operation period will not be continued after the decommissioning of the treatment plants. Workers and their families, who relied on these occupations for their subsistence, would suffer from their loss.

5) Gender-Based Violence/SH Risks: During the project's decommissioning phase, it is anticipated that there will be low to moderate levels of sexual harassment and gender-based violence. This is because the decommissioning phase activities are anticipated to require a small number of workers.

6) Site Reclamation: After the FSTP plant ceases to operate, the treatment plant location ought to be restored. The project owner or subcontracted companies must carry out well-planned reinstatement work in order to make the site productive. It is necessary to remove and dispose of all undesired constructions at a landfill authorized for waste disposal. The restored space might be used for additional construction projects or turned into a leisure area. Reclamation work on the site is crucial and very beneficial. However, the area would be lost and the land's worth would be diminished if the decommissioning work is not done correctly.

9.6. Impact Evaluation Matrix

Throughout the project's lifespan, the impacts were assessed and forecasted based on several variables, including impact type (positive or negative), length, nature (temporary or permanent), magnitude, and importance. The importance of the impacts was assessed by taking into account many parameters, including the extent of the impacts, probability of occurrence, temporal and geographical scope, capacity for environmental recovery, degree of public concern, and political ramifications. In addition, the possible environmental sustainability arising from the indicated consequences was evaluated, as was the carrying capacity of natural resources.

It is crucial to do an impact study of a new project in relation to the environment's current baseline circumstances. Experts assess the importance of each impact based on their knowledge, observations from the field, input from stakeholders, and pertinent laws, rules, and guidelines. Every influence is given a significance rating (low, medium, or high) by each expert; the sum of these values yields the overall importance rating.

The chance of occurrence and the effect of each impact are taken into account when determining the overall importance of the impacts. The degree of necessary mitigating actions, the impact's closeness, its length, its temporal influence, and its reversibility, the capacity to go back to the pre-impact state after putting mitigation measures in place, are all considered significant factors. Table 9.3 below provides a thorough categorization of the impacts.

The Environmental and Social Impact Assessment (ESIA) process and the creation of an Environmental and Social Management Plan (ESMP) depend heavily on the identification, assessment, and significance of impacts. Identification, forecasting, and assessment of possible effects related to project execution and decommissioning are all part of this process.

The impact assessment and methodology outlined in this ESIA outline the social and environmental effects of the planned FSTP. Three categories of possible consequences have been identified during the construction, operation, and decommissioning phases, as described in Table 9.2

Table 9.2: Prediction and Significance of Potential Impacts of the proposed FSTP Project Activities

		Type of Impact		Likelihood of Occurrence			Consequence			Spatial Influence		Temporal Influence			Reversibility		Significance without Mitigation / Enhancement Measures			
No	Identified Potential Impacts	Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
PHASE 1: CONSTRUCTION STAGE																				
1	Land use change		x			x	x			x				x	x					x
2	Impact on flora and fauna		x		x		x			x				x	x				x	
3	Loss on cactus (Beles) plantations due to access road construction		x			x		x		x				x		x				x
4	Impact on soil		x		x		x			x		x			x				x	
5	Impact on water quality due to pollution		x		x		x			x		x			x				x	
6	Dust and air pollution		x			x		x		x		x			x				x	
7	Occupational Health and Safety of Workers		x		x		x					x				x				x
8	Exposure to HIV/AIDS and STIs diseases		x		x			x		x			x			x			x	
9	Violations of Social Customs due to labor influx and conflicts		x		x		x			x		x			x				x	
10	Gender-Based Violence and SEAH		x		x			x		x		x			x			x		
11	Permanent and temporary loss of grazing and farmland on livelihood		x			x			x	x				x		x				x
12	Impact on Archaeological & Cultural Heritage Sites		x	x				x			x			x		x				x
13	Road Access	x				x				x				x		x				x
14	Traffic congestion /restrictions and accidents		x		x		x			x		x			x				x	
15	Direct and indirect job creation	x				x				x			x		x					x
16	Skill transfer to local workers	x				x				x		x				x				x
17	Impact on public services	x			x					x		x			x				x	
18	Impact on Climate Change and Resilience		x		x		x			x		x			x			x		

		Type of Impact		Likelihood of Occurrence			Consequence			Spatial Influence		Temporal Influence			Reversibility		Significance without Mitigation / Enhancement Measures			
No	Identified Potential Impacts	Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
PHASE 2: OPERATIONAL STAGE																				
1	Impact on soil and water due to leaks and overflows		x		x		x			x			x		x					x
2	Gas emissions and air pollution		x			x	x			x				x	x				x	
3	Impact on fauna		x		x			x		x			x		x				x	
4	Road Access	x				x				x				x		x				x
5	Impact due to chemicals that may be used in the process of faecal treatment		x		x		x			x			x		x			x		
6	Noise pollution		x		x		x			x					x			x		
7	Impacts of bad Odor (foul smell)		x			x		x		x				x	x				x	
8	Impact on Public Health and Amenity		x		x			x		x			x			x			x	
9	Occupational Health and Safety (OHS)/		x		x			x		x			x			x			x	
10	GBV/SA		x		x			x					x	x	x	x			x	
11	Job creation	x			x			x		x				x		x			x	
12	Compost/fertilizer production from sludge	x			x			x		x				x		x			x	
13	Impact related to faecal sludge and septage collection		x		x			x		x				x	x			x		
14	Impact on Climate Change and Resilience		x		x			x		x			x		x				x	
PHASE 3: DECOMMISSIONING STAGE																				
1	Dust and Odor Impact on Air Quality		x			x	x			x		x			x				x	
2	Impact on water bodies		x		x		x			x		x			x				x	
3	Noise pollution		x		x			x		x				x	x			x		
4	Spoil disposal		x		x		x			x			x		x				x	
5	Soil compaction and erosion		x		x		x			x			x		x				x	
6	Occupational health and safety		x		x			x		x				x	x			x		
7	Public Health Impact		x		x					x			x		x			x		

		Type of Impact		Likelihood of Occurrence			Consequence			Spatial Influence		Temporal Influence			Reversibility		Significance without Mitigation / Enhancement Measures			
No	Identified Potential Impacts	Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
8	GBV/SA		x		x		x			x				x		x		x		
9	Loss of Job Opportunity		x		x				x	x				x		x				x
10	Impact on Climate Change and Resilience		x		x			x		x				x	x				x	

9.7. Summary of Identified Adverse Impacts and Mitigation Measures

In compliance with pertinent national laws, regulations, guidelines, and norms as well as World Bank policies (including the Environment, Health, and Safety General Guidelines and specific Guidelines for Water and Sanitation Environment, Health, and Safety), the following mitigation measures are designed to address the identified negative impacts of the design, construction operation, and decommissioning stages of the proposed FSTP project. Table 9.3 summarizes the identified negative impacts and proposed mitigation measures.

Table 9.3: Mitigation Measures for the Identified Adverse Environmental and Social Impacts

Mitigation Measures Schedule	Category of Impact	Potential Impacts	Proposed Mitigation Measures
Before and/or during the project site's Handover	Land Use Change	Permanent and temporary loss of grazing and farmland on the FSTP site, and fruit-bearing cactus (Beles) commercial plants loss along the access road	○ Make PAPs aware of the possible effects of the project and remuneration ○ Before beginning any building, a thorough ARAP should be carried out in the project region. ○ PAPs shall be given preference when it comes to job opportunities; ○ They shall also be given priority when it comes to preparing and implementing a livelihood restoration program; ○ Vulnerable community groups, such as female-headed HHs, shall receive priority when it comes to compensation, land delivery, and post-livelihood ○ The date of the PAP census will be used as the cut-off date, ○ Provide appropriate compensation to those impacted by the short- and long-term loss of assets and land; ○ Provide land replacement to the community impacted by the loss of grazing land, agricultural, and Beles farm.
CONSTRUCTION STAGE			
Construction Stage	Biophysical Impact	Impact on flora and fauna ○	○ Minimize the amount of destruction caused by machinery by promoting non-mechanized methods of clearing trees; ○ Re-plant Indigenous vegetation that is friendly to the environment as much as practical once work is completed; ○ For each species removed during the construction stage at least ten individual seedlings shall be planted along with watering of the plants until they reach at least 1.5 meters in height. ○ The selection of appropriate tree species and locations of planting shall only be done in consultation with the town EPA. ○ 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. ○ Participating community to plant trees around the construction time, where applicable, is essential and highly recommended. ○
		Loss on Cactus (Beles) plantations due to access road construction	○ Create awareness and consensus among the cactus owners and the project. ○ A detailed Abbreviated resettlement action plan (ARAP) should be conducted in the project area before any construction. ○ 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 (Monetary compensation for loss of cactus); ○ Give priority to the project-affected people for job opportunities created by the project; ○ Prepare and implement a livelihood restoration program. ○ Provide special support for vulnerable project-affected people; and ○ The Adigrat water supply and sanitation office, and the Grievance Redress Committee (GRC) have to redress grievances raised by former cactus owners amicably.

Mitigation Measures Schedule	Category of Impact	Potential Impacts	Proposed Mitigation Measures
		Dust and air pollution	○ Water should be sprayed on construction sites and transportation routes up to three times a day; ○ All cars and construction equipment should be operated following applicable vehicle emission standards and should undergo routine maintenance to minimize air pollution; ○ Personal protective masks, safety goggles, earplugs, and helmets should be worn by workers near dust and loud noise areas, and their working hours should be limited to maximize time spent in the noisy environment. ○ Manual trench digging for trunk lines should be done to avoid having too many trucks and machinery in the area. ○ Piled up in the open air should be reduced as much as possible, or ensure the piled-up material's moisture rate during the construction stage. ○ Particulate Matter (PM) monitoring should be undertaken by using the Dust Track Monitor to set mitigation measures.
		Impact on water quality	○ All chemicals and hazardous substances must be stored on an impermeable surface in a designated bounded area that can contain 10% more than the total volume of materials stored at any given time; ○ Material safety data sheets (MSDSs) are to be displayed for all hazardous materials; ○ Regular inspections of the impermeable surface and maintenance reports are required; ○ Develop and display an emergency response plan for accidental oil and chemical spills. ○ It is imperative to prevent construction materials and waste, such as aggregate, cement, and fresh concrete, from infiltrating the current drainage system and infrastructure. ○ Make sure the environment of the water body is protected by managing construction materials properly when doing civil works.
		Impact on soil	○ Develop and use a strategy for managing the excavated soil before beginning any building work. The construction should be done during the dry season to prevent runoff-enhanced sediment movement. ○ Use sandbags, diversion berms, culverts, or other physical means to prevent sheet and rill erosion of soil; ○ Carefully remove and properly stockpile the topsoil removed from the site and re-use it for site restoration when construction works are finished; ○ Oil exchange should only take place in the pre-prepared workshop area; ○ Vehicle and machinery washing should only be done in the workshop area and never on open soil. ○ Avoid using old (> 10 years) and properly unmaintained machinery as this can most likely result in oil, grease, and fuel leaks; ○ Drive on existing roads wherever feasible; avoid driving on unpaved ground. ○ After construction is finished, immediately restore the area by distributing heaped top soil. ○ Create temporary drainage channels or holding ponds to reduce soil erosion;
		Impact on habitat	○ Like other sections of the nation, the habitat for wildlife has already been converted to agricultural land and populated areas. As a result, just a few common bird species were found in the project area. ○ Conduct pre-construction surveys to identify and avoid active nests or burrows. ○ Schedule noisy construction activities outside of key breeding seasons for local birds. ○ If any protected species are unexpectedly encountered, work with the relevant environmental authority to develop a protection plan.Information provided by the locals also confirmed the presence of only a few kinds of animals in the region.

Mitigation Measures Schedule	Category of Impact	Potential Impacts	Proposed Mitigation Measures
			○ Besides, the project's impact on its surroundings does not include any parks or other protected areas. ○ Consequently, there will be relatively little effect of the planned project on the local natural animals.
		Impact on climate change and resilience	○ Implement measures to minimise disturbance on the ecological and social systems ○ Control dust and missions from construction vehicles/equipment ○ Plan and consider an appropriate waste management plan to minimise waste generation and ensure proper disposal ○ Implement energy efficiency measures and use of renewable energy and climate emergency plans
	Socio-economic Impact	Noise and vibration	○ Use a sound level meter to assess the primary sensitive receptors' exposure status regularly. ○ Steer clear of heavy machinery building projects throughout the night, close to residential areas. It is recommended to avoid using noisy machinery within 50 meters of residential areas or near institutions like schools and hospitals. ○ Additionally, construction machinery should be properly maintained and operated to minimize noise generation. ○ Transport routes should be chosen to minimize noise pollution in sensitive areas. ○ Whenever possible, non-mechanized construction machinery should be used, and a local labor force should be used during trench excavation. ○ Workers in construction will be informed about the acceptable noise levels in the surrounding area and at work. ○ The recommended noise levels for construction sites are 70 dBA at night and 75 dBA during the day, respectively. ○ When it is not in use, equipment will be turned off; well-maintained and functioning equipment will be used; ○ Personnel will be given the required personal protective equipment (PPE), such as ear muffs, if needed and as deemed appropriate;
		Traffic congestion and accidents	○ Create and carry out a traffic management plan while collaborating closely with the local traffic police; ○ Educate workers and the community about traffic accident prevention; ○ Provide protective gear for workers and place temporary signs or notices to indicate construction sites; ○ Ensure that only qualified drivers operate vehicles on the site and park in designated areas; ○ Hire young people to assist with traffic management activities on both sides of the construction site; ○ Fence or erect obstacles in ditches and trenches to prevent interference and accidents involving children and domestic and wild animals; ○ The resident engineer and the contractor should plan ahead to avoid peak traffic periods; ○ The resident engineer must make sure that construction vehicles are operated during off-peak hours; ○ To avoid traffic accidents in the area, the Resident Engineer and Contractor should agree on traffic routes.
		Occupational health and safety	○ Put into effect globally recognized standards and OHS guidelines before commencement of the project construction, and ensure safe work practices and guidelines and adhere to safe work practices; ○ Create a site-specific Health and Safety Management Plan (including training on safe work practices, risk reduction, and work-related accidents); Identify and designate a competent health and occupational safety officer to supervise OHS concerns daily; ○ Keep an eye on construction workers' adherence to safe work practices and guidelines (OHS); ○ First aid kits should be available in workshops, construction sites, and inside cars.

Mitigation Measures Schedule	Category of Impact	Potential Impacts	Proposed Mitigation Measures
			○ Workers should also be provided with the proper personal protective equipment (PPE). ○ The campsite should be kept fenced and hygienic, with enough facilities for firefighting and waste disposal. ○ All incidents of injuries and accidents should be meticulously recorded, including the date, time, and location of the occurrence, the extent of the injuries, the damage to resources, and the number of people hurt or killed. ○ Assign a health and safety officer for the duration of the construction period; ○ Train the project workforce on the basic use of emergency first aid. ○ Provide workers with appropriate personal protective equipment (PPE); ○ Use signage to warn staff and/or visitors about the construction activities of dangerous places and activities; ○ Plan to properly handle construction waste and dispose it on a site designated for this purpose; ○ Put signs on open trenches to avoid the risk of falls; ○ Refill open trenches within a maximum of seven days;
		Exposure to HIV/AIDS and communicable diseases	○ It is recommended to raise awareness among employees and the community about HIV/AIDS and communicable disease prevention and management through staff training, awareness campaigns, multimedia workshops, and community meetings. Additionally, town health and HIV/AIDS Prevention and Control offices should collaborate to bring about significant changes in attitudes and behaviors. ○ Hand washing facilities with enough running water and soap should be installed, as well as sanitizing areas around catering and sanitation areas. ○ Provide free distribution and provision of condoms to construction workers by the Contractor to avoid the spread of STDs and HIV/AIDS; ○ Put educational posters and flyers on HIV/AIDS, using local languages to minimize the spread of HIV/AIDS;
		Violations of Social Custom	○ To minimize the number of laborers entering the community, efforts should be made to hire both skilled and unskilled labor from within the community when available. ○ Good communication and teamwork are essential in addressing the opportunities and challenges brought about by a labor influx. ○ New hires shall sign a code of conduct, and the contractor should provide proper identification and uniforms so that workers can quickly identify those with social difficulties.
		Gender-Based Violence and SEAH	○ A separate restroom for women should be available at the construction site. Women-friendly safety supplies and equipment should also be provided. Women should be assigned to jobs that do not negatively impact their biological condition. ○ A code of conduct that strictly prohibits sexual harassment and gender-based violence should be prepared and implemented, and all workers should sign it. ○ Ensure equitable distribution of employment opportunities between men and women and practice affirmative action if competent women are scarce. ○ Equal pay for equal work should be guaranteed. ○ Employees who experience GBV should also be given access to counseling, medical attention, and legal assistance. ○ Organize women's workforce to prevent gender-based violence by forming different sub-committees that will have a strong linkage with women's affairs offices at Woreda and Town administration levels
		Impact on public services	○ When possible, efforts should be made to engage both skilled and unskilled labor from within the community to reduce the number of laborers entering the area. ○ To handle the potential problems brought about by a workforce surge, effective communication and cooperation are crucial.

Mitigation Measures Schedule	Category of Impact	Potential Impacts	Proposed Mitigation Measures
			○ To enable workers to promptly identify individuals with social challenges, the contractor should furnish appropriate identification and uniforms, and new hires will be required to sign a code of conduct. ○ ○ The entire construction site and FSTP compound should be fenced to restrict access and prevent potential community health risks during construction.
		Impact on Heritages	○ Apply the role of chance finds procedures, ○ Any archaeological artifact discovered must be submitted to the Culture and Tourism Office; ○ Contractors must cease excavation on any archaeological site and promptly notify the appropriate government agency for appropriate direction.
OPERATION STAGE			
Operational Stage	Biophysical Impact	Impact on Soil and water due to leaks and overflows	○ Make sure the treatment plants have enough hydraulic capacity to handle peak flows and that the gravity mains have an appropriate slope to prevent the buildup of solids and the generation of hydrogen sulphide; ○ Implement a leak detection program to identify aging pipes that need to be replaced to prevent major bursts and frequent repairs; ○ Limit the depth of the sewer wherever feasible (e.g., by avoiding routes beneath busy streets); Clean the grit chambers and sewage lines regularly to get rid of waste like grease and grit that might cause backups in the sewer system. ○ Problem locations should have cleanings done more often. Tree roots and other obstacles may need to be removed as part of cleaning operations. ○ Examine past sewer maintenance data to locate probable system failure sites and "hot spots," or regions with recurring maintenance issues; then, perform necessary preventive maintenance, rehabilitation, or line replacements.
		Effluent Impact on Water Resources	○ Conduct routine monitoring to make sure the proposed effluent standards are met before it is released into the river and the surrounding environment; this will help to ensure the proper functioning of all treatment facilities. Regular monitoring will also help to maintain the required effluent standard. ○ Plant trees in the buffer zone, such as reed lilies and other types of plants with the capacity to absorb pollutants; ○ Create a 400-meter-wide buffer zone within the boundaries of the treatment plant sites to absorb pollutants from the effluent and reduce the impact of pollution of the surrounding environment, especially during the wastewater treatment maintenance period; ○ Keep a close eye on the effluent quality emitted from the treatment plants to see whether it is above the suggested effluent limits so that remedial action may be taken to increase the treatment plants' efficiency; ○ Take into account building an emergency wastewater tank if an FSTP malfunction.
		Impact on Fauna	○ Before discharging any effluent and byproduct, the quality must meet the national and international standards to comply with environmental safety.
		Impact due to Chemicals used in the process of Wastewater Treatment	○ To guarantee their safe usage, chemicals should only be stored in covered sheds and kept out of direct sunlight and other sources of heat. ○ To maintain safety, containers containing these compounds shouldn't be kept near explosives, acids, turpentine, ether, anhydrous ammonia, finely split metals, or other flammable materials.
		Impact related to Faecal Sludge and Septage Collection	○ Encourage and assist in improving septic tank maintenance and proper septic tank design. Faecal sludge and septic waste should be collected systematically and regularly; septic tanks should be designed to balance maintenance requirements and effluent quality; and suitable collection trucks should be used. ○ To service every residence, a mix of vacuum tanker trucks and smaller hand-pushed vacuum tugs could be required;

Mitigation Measures Schedule	Category of Impact	Potential Impacts	Proposed Mitigation Measures
			○ Ensure that faecal sludge and septage are released from storage and treatment facilities, preventing untreated septage from being released into the environment.
		Impact due to the process of Eutrophication	○ The primary mitigation for eutrophication is ensuring nutrient levels (Nitrogen, Phosphorus) in the treated effluent are strictly controlled and meet national standards for discharge into surface waters. ○ Implement the effluent quality monitoring plan rigorously to prevent nutrient-rich discharges.
		Impact on climate change and resilience	○ Minimize the release of GHGs from fecal sludge realizing site-specific design, management, and adjustment of operating conditions of the FSTP ○ Control dust and missions during operational activities ○ Plan and consider an appropriate waste management plan to minimise waste generation and ensure proper handling and disposal ○ Implement energy efficiency measures and use of renewable energy and climate emergency plans ○ Treat and use biosolids/sludge as compost for regenerative agriculture and productivity enhancements ○ Adopt and promote regular emptying of septic tanks and latrine pits
	Socio-economic Impact	Impact on Public Health and Amenity	○ Ensure that workers and operators of wastewater treatment plants regularly inspect safety equipment; ○ Provide sufficient personal protective equipment to them; ○ Teach them how to use personal protective equipment; ○ Fence the FSTP compound to restrict access to the site to prevent community health risks of materializing during operation, ○ Regularly monitor waste storage and sludge collection facilities to prevent insect attraction and breeding;
		Occupational Health and Safety (OHS)	○ Maintain work locations to reduce sliding and tripping risks; ○ Wear personal flotation devices (PFDs) while working near rivers; ○ Use fall protection equipment when working at heights; ○ Establish a training program on safe handling techniques and emergency response protocols for operators who deal with ammonia and chlorine; ○ Establish safety showers and eye wash stations close to the equipment for ammonia and chlorine as well as other locations where hazardous chemicals are used or stored. ○ Develop escape routes from any areas where there may be a release of any of these gases. Provide the necessary personal protective equipment. ○ Place water treatment units and water treatment sludge regions as far away from common areas (such as offices) as feasible if the source water includes radioactive materials; ○ Provide spaces for employees to wash and change clothes before leaving work, as well as laundry services for work clothing ○ Prohibit eating, smoking, and drinking outside of these areas. Additionally, by maintaining proper housekeeping in sewage processing and storage sites, providing worker vaccination health monitoring, including routine physical examinations, and minimizing chemical and radioactive exposure, these risks are further mitigated by maintaining proper housekeeping... providing worker vaccination... and minimizing chemical and radioactive exposure.
		Impacts of bad Odor	○ To control Odor release and maintain anaerobic conditions, the volumetric BOD loading should be between 100 and 400 g/m3. ○ Increasing the oxygen supply guarantees that there is enough oxygen available for the aerobic bacteria to break down BOD aerobically. Anaerobic digestion will slow down as a result, which will help manage Odors. ○ Since odor-causing anaerobic digestion takes place at the bottom of an aeration basin, it is essential to make sure dissolved oxygen reaches this area to prevent Odors.

Mitigation Measures Schedule	Category of Impact	Potential Impacts	Proposed Mitigation Measures
			○ Effective wastewater circulation allows you to produce almost equal levels of dissolved oxygen throughout. This will so encourage aerobic digestion that is devoid of Odors. ○ The frequent completion of basic maintenance chores is necessary to minimize Odor, flies, and mosquitoes. ○ To minimize exposure to the community, carry wastewater and empty septic tanks using leak-free vehicles, and remove waste from grit and screens as well as the input system to minimize clogging. ○ To reduce wastewater spillage, it is important to regularly cut and dispose of grass and other herbaceous plants; clear the pond surface of floating scum and floating macrophytes, repair embankments damaged by rainfall, rodent damage, and livestock grazing; ○ Plant trees like Night Queen that emit a pleasant scent to mask the unpleasant smell emanating from the treatment plants;
○ **DECOMMISSIONING STAGE**			
Decommissioning Stage	Biophysical Environment	Dust and Odor Impact on Air Quality	○ Reduce dust from open area sources, such as storage heaps, by utilizing control techniques such as installing enclosures and covers and raising the moisture content. ○ Reduce dust from material handling sources by employing covers and/or control devices (water suppression, cover);
		Impacts on Site's Aesthetic Value	○ Following the facilities' shutdown, the treatment plant locations ought to be restored. ○ The project owner or subcontracted organizations must carry out well-planned reinstatement work to make the site profitable. ○ It is recommended that any undesired structures be taken down and dumped in a designated landfill. ○ The restored land might be used for additional development projects or turned into a leisure space. ○ Reclamation work on sites is crucial and very beneficial. However, the area would be lost and the land's worth would be diminished if the reinstatement work is not going to be done correctly.
		Impact on Climate Change and Resilience	○ Restore the site to its original condition or to a better beneficial use ○ Dispose of any remaining sludge or waste materials properly and to a designated site ○ Plan and consider emergency plans and adaptation measures with proactive management and responsive climate hazard warning
	Socio-economic Impacts	Noise	○ Making use of noise-cancelling equipment, such as exhaust muffling devices for combustion engines and temporary noise barriers and deflectors for impact and blasting operations; ○ Steer clear of or use minimal transit in congested residential neighborhoods;
		Job loss	○ Develop a severance and transition plan for affected employees, which may include career counseling, job placement services, and severance packages in accordance with national labor laws. ○ Provide advance notice of decommissioning to all staff to allow them time to seek new employment.
		Occupational Health and Safety	○ Apply the OHS mitigation strategies that were discussed during the construction stage.

10. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

10.1. General

The Environmental Social Management and Monitoring Plan (ESMP) has been carefully crafted to address the project's negative environmental and social impacts; suggest mitigation measures, roles and responsibilities of different bodies involved in the different phases of the project; set the implementation schedule, indicators, monitoring, and evaluation approaches, and the indicative budget needed to carry out the mitigation measures.

An ESMP's main goal is to make sure that any potential dangers to the environment and society that might be brought on by a project or activity are recognized, evaluated, and skillfully handled. To promote good social and economic results and reduce or eliminate negative impacts on the environment and local populations, the ESMP creates a thorough framework outlining the procedures and activities that will be done.

Below, the suggested mitigating actions for each of the corresponding negative effects noted in the previous chapter are covered. The goal of the suggested mitigation strategies is to reduce or completely eradicate any effects brought on by the FSTP sub-project. By incorporating consequences that would develop during mobilization and construction, operation, and decommissioning phases, as well as the suggested mitigation methods, the detailed ESMP (Table 10.1).

In particular, ESMP offers a detailed description of the institutional setup for implementing mitigation and monitoring measures in addition to identifying and summarizing the major adverse environmental and social consequences. The ESMP needs to follow the fundamentals of well-designed environmental performance that include:

- Appropriate facility management;
- Thorough knowledge of environmental laws, policies, and priorities;
- Being aware of legal obligations and maintaining current operating data; and
- Establishing proper coordination and alignment with the different stakeholders and key role players of the project.

10.2. Institutional Arrangements for the Implementation of Environmental and Social Safeguards

The Borrower has developed expertise in creating safeguarding tools, such as Environmental and Social Impact Assessments (ESIA) and Resettlement Action Plans (RAP), to identify and mitigate potential environmental and social risks associated with various infrastructure projects funded by the World Bank. The knowledge gained from the first phase of the Urban Water Supply and Sanitation Project and its sub-projects, including the lessons and best practices from the second urban water supply and sanitation project, will be applied in this specific project implementation and realisation, meeting the requirements and desired standards.

Currently, the AWSSO is responsible for implementing the ongoing UWSSP project, collaborating with the Ministry of Water and Energy at the federal level through Project Management Units (PMUs) staffed with environmental safety professionals. Within the PMU, the Ministry has employed safeguard experts, one specializing in environmental issues and another in social safeguards, who are dedicated to the successful continuation of UWSSP-II.

The key institutions and stakeholders at the local, regional, and federal levels that will be directly involved in the project are outlined below.

10.2.1. Adigrat Water Supply and Sewerage Office (AWSSO)

As the project's implementing agency, Adigrat Town Water Supply and Sanitation Utility is in charge of overseeing and monitoring the construction and maintenance activities, as well as the execution of the ESMP. The office hired environmental and social safeguard professionals to evaluate, verify, and validate

the project's overall environmental and social performance through regular environmental audits, inspections, and project submission reviews, according to consultation with the utility.

10.2.2. Local Governments (Kebele and Town Administration)

The successful implementation of the Environmental and Social Management Plan (ESMP) relies significantly on the involvement of local governments. While not directly responsible for executing the ESMP, the Adigrat Town Administration and the Ganta Afeshum Woreda Administration will play integral roles in the process. They have been actively engaged and consulted throughout the Environmental and Social Impact Assessment (ESIA) study to ensure their participation.
In the construction, operation, and decommissioning phases, personnel from the town administration and the kebele administration will monitor adherence to the ESMP closely. Before commencing construction projects, various entities, including the Agricultural Bureau, Health Bureau, Eduction Bureau, Adigrat AWSSO, Regional Rural Land Use Management and Administration Agency, Tigray Environmental Protection and Cllimate Change Authority (TEPCCA), the town administrations of the Ganta Afeshum woreda where the project is situated, representatives of affected parties, and community elders, will collaborate to address compensation and land acquisition matters. The compensation panels will include representatives of impacted parties to ensure fairness.

Working hand-in-hand with the communities, local government representatives, and relevant offices will facilitate land replacement arrangements when necessary and oversee population counts and compensation disbursements. Regional offices responsible for the Environment, Health, and Water Supply and Sanitation will collaborate to oversee environmental considerations. The project details, proposed mitigation measures, responsible institutions, and budgetary needs for implementing the ESMP are outlined for effective execution.

10.2.3. Regional Water Bureaus

The Regional Water Bureaus play a vital role in providing technical support to towns and cities. Environmental and social personnel assigned to the ongoing Urban Water Supply and Sanitation Project (UWSSP) will assist water utilities in conducting environmental and social screening, monitoring, and follow-up activities regarding the implementation of suggested mitigation measures for projects in their respective regions.

10.2.4. Design Consultants

The design consultant is in charge of making sure the design is made in an environmentally friendly manner by accounting for key issues included in the ESIA document. The task of designing the FSTP in detail has been given to a consultant, who will also be in charge of integrating the site modifications suggested by the ESIA study team into the technical requirements of the primary project report.

10.2.5. Construction Contractors

The contractors responsible for the FSTP are tasked with executing the construction process while ensuring strict adherence to the Environmental and Social Management Plan (ESMP) and environmental regulations. The Contractor will assign a dedicated Environmental, Health and Social (EHS) staff to prepare and implemnt C-ESMP and this ESMP, and as well to supervise the implementation and maintenance of the ESMPs, overseeing essential environmental and social monitoring activities. This team will be stationed on-site throughout the construction project's duration, serving as the primary contact for any environmental and social concerns raised by the contractor. Moreover, the team is responsible for regularly confirming that mitigation measures are effectively implemented and that construction activities align with the criteria outlined in the ESMP.

10.2.6. Consultant for Construction Oversight

The Supervision Consultant plays a crucial role in ensuring that the contractor complies with the environmental construction guidelines established by the consultant. This oversight is essential for

maintaining environmental standards throughout the construction process. Project implications, recommended mitigation strategies, responsible entities, and the financial requirements for implementing the Environmental and Social Management Plan (ESMP) are consolidated in Table 10.1. This comprehensive approach helps streamline the execution of the ESMP and ensures that the project aligns with environmental regulations and best practices. Accordingly, the supervising consultant shall deploy at least one EHS satff for the follow up and reporting of E&S pertinent issues.

10.2.7. Water Board

The Water Boards play a pivotal role in offering guidance and overseeing the provision of urban Water Supply and Sanitation (WSS) services. They are entrusted with enforcing social and environmental protections, ensuring that these services are delivered in a manner that is both sustainable and in compliance with regulations.

10.2.8. Water Resources Development Fund:

The staff of the Water Resources Development Fund holds the responsibility of evaluating baseline surveys, environmental and social management plans, and projects outlined in the Environmental and Social Management Plans (ESMPs) for all water supply facilities that have received funding from the fund. Their role is crucial in assessing the environmental and social impact of water projects and ensuring that these projects are implemented in alignment with sustainability goals.

10.2.9. Regional Environmental Protection and Climate Change Authority: Tigray Region Environmental Protection and Climate Change Authority. :

The Regional Environmental Protection and Climate Change Authority is responsible for reviewing and approving Environmental and Social Screening (ESS) and Environmental Significance Assessment (ESI) documents, as well as the safeguard components of projects. They conduct spot inspections to ensure effective implementation of ESMPs and environmental and social screening. Additionally, they offer guidance to project implementing organizations on addressing project implications beyond general issues, assessing the need for project redesign or suitable mitigation measures.

10.2.10. FDRE Environmental Protection Authority (FDRE EPA):

At the federal level, the EPA is responsible for overseeing Environmental and Social Impact Assessments (ESIAs) and environmental monitoring regulations for projects under federal jurisdiction. They issue guidelines, standards, and directives for these assessments. The EPA is a key authority in ensuring environmental compliance for infrastructure and economic development projects. The Regional States are mandated to establish their own Regional Environmental Agencies, as per the Environmental Protection Organs Proclamation, to handle ESIAs for regionally controlled projects, among other responsibilities.

Table 10.1: Summary of Environmental and Social Management Plans

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
Before Construction Stage						
1	Compensation for temporary and permanent loss of grazing and farmland due to the FSTP and access road construction (Social Impact)	• PAPs shall be made aware of the project's possible effects as well as the problems with compensating. • Comprehensive ARAP needs to be carried out throughout the project area by an impartial consultant; • Give the impacted parties fair compensation for the temporary and permanent loss of their assets and land; • Before any construction begins, consult a consultant. • Provide PAPs priority when it comes to job opportunities; • Develop and implement a livelihood restoration program for PAPs; • Prioritize vulnerable community groups, such as female-headed HHs, during compensation, land delivery, and post-livelihood rehabilitation works; • The start date of the PAP census will be used as the cut-off date;	• AWSSO, • Municipality & • Land Administration office	• MoWE • WB • Grievance Handling Committee, and • Regional Land Administration • (Before Construction, and During Compensation)	• Regional Government / Town Administration and/or WB. • (This is to be done based on the compensation procedure and in accordance with applicable law/guideline following the ARAP/RAP report.	• The procedure for estimation of the compensation rate shall be followed.
2	Compensation for the loss of cactus (Beles) plantations and PAPs owned tree species due to the access road clearance and construction (Social + Environmental)	• Avoid and/or minimize loss of cactus (Beles) and other tree species owned by PAPs • Design and implement the desired compensation measures as per the applicable and desired compensation procedure and plan	• AWSSO, • Municipality & • Land Administration office	• MoWE • WB • Grievance Handling Committee, and • Regional Land Administration • (Before Construction, and During Compensation)	• Regional Government / Town Administration and/or WB. • (This is to be done based on the compensation procedure and in accordance with applicable law/guideline following the ARAP/RAP report.	• Regional Government / Town Administration and/or WB. • (This is to be done based on the compensation procedure and in accordance with applicable law/guideline following the ARAP/RAP report.
• A. Construction Phase						
3	Loss of Vegetation Cover (Environmental Impact)	• Planting suitable native tree and shrub species. Planting ten or more individual seedlings for each tree removed; • Choose suitable tree types and planting areas after consulting the town's environmental protection agency.	• Contractor	• Supervision consultant, • AWSSO and • Regional/Town EPA	• 300,000.00	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
				• (During or Subsequent to the Construction Phase)		
4	Impacts on Soil (Environmental Impact)	• As soon as the construction is finished, disperse the heaped topsoil for restoration; • Temporary drainage channels or holding ponds might be used when it is determined that there is a risk of increased runoff or erosion of trenches during construction; • Create a plan for managing excavated dirt; • During the dry season, building work is to be completed; • Prevent soil erosion by using physical methods such as culverts, sandbags, or diversion berms. • Properly store the topsoil removed from the site and use it for site restoration after construction is finished. • Only oil exchange shall occur in the workshop area that has been prepared beforehand; • It is recommended that car and equipment washing be limited to the workshop area and never be done outside; also, outdated (older than ten years) and improperly maintained equipment shall not be used. • Whenever feasible, stick to the designated routes and avoid traversing unpaved ground;	• Contractor	• Supervision consultant • AWSSO and • Regional/Town EPA • (During or as soon as the construction phase is completed)	300,000.00	
5	Air Pollution and Dust (Environmental Impact)	• Assist all site visitors and construction workers by providing Personal Protective Equipment (PPE); • Set a 30 km/h speed limit for cars on dirt access roads, particularly when they're close to sensitive regions; • Avoid utilizing equipment that is too old (older than ten years) or broken; verify the daily and weekly functionality of all the machines on duty; • Cover the trucks when hauling building materials; use spray water to control dust in dusty locations. • Watering often, up to three times a day, particularly in the vicinity of the FSTP; • To prevent an excessive number of trucks and machinery in the region, it is recommende3 to the ditches for trunk lines by dug manually; • All vehicles and construction equipment should be operated per applicable vehicle emission regulations and with regular maintenance to limit air pollution;	• Contractor	• Supervision consultant, • AWSSO & • Regional/Town EPA • (During or subsequent to the construction phase)	200,000	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
6	Noise Pollution (Environmental Impact)	• Making use of noise control tools, such as combustion engine exhaust mufflers and temporary barriers, and diffusers for impact and blasting operations; • Minimize or avoid traveling through congested neighborhood areas; • Workers in construction will be informed about the acceptable noise levels in the surrounding area and at work; • The recommended noise levels for construction sites are 70 dBA at night and 75 dBA during the day, respectively. • Equipment will be turned off during off-work hours wherever feasible; • Use of well-maintained and functioning working equipment; • Personnel will be provided with PPE as needed, such as ear muffs.	• Contractor	• Supervision consultant • AWSSO & • Regional/Town EPA • (During the construction phase)	50,000	
7	Seismic Hazard (Environmental Impact)	• The structural design of FSTP engineering structures must consider the seismic probability account. • Strictly follow up and monitor regularly the construction stage of FSTP by formingwell-equipped engineering technical team; • Buffering a minimum of 50 meters from FSTP; • Proper operation & regular follow-up of the functionality of the plant;	• Contractor	• AWSSO • Supervision consultant • EPA and • Construction Office • (Before and during the construction phase, and during the operation and decomissioning phase)	50,000	
8	Accidents and Jams in the Traffic (Social Impact)	• Create and carry out a traffic management strategy while collaborating closely with the local traffic police; • Educate staff members and the community on the prevention of traffic accidents; • The contractor should outfit workers in protective gear; • Temporary road signs or notices indicating ongoing construction should be provided by the Contractor; • Qualified drivers and designated parking areas should operate vehicles on the site; • Young people should be employed to assist with traffic management activities on both ends of the construction site;	• Contractor	• Supervision consultant, • Adigrat Transport Bureau and • Adigrat WSSU • (During the construction and operation phase)	250,000	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Barriers should be erected around trenches and ditches to prevent children and wild and domestic animals from getting in the way or getting hurt; • Employ a traffic controller to make sure there isn't any traffic buildup along the roadways; • The Contractor should implement traffic controls and cleanliness to prevent congestion and truck accidents on roads; • Plan daily itineraries for site traffic and steer clear of peak traffic periods; • Make sure that vehicles are operated during off-peak hours to steer clear of peak traffic; • Making use of a temporary barrier of the area being trenched to prevent humans and animals from inadvertently slipping into the open trenches; • Select traffic routes that minimize the impact on the community by avoiding any sensitive locations as much as possible;				
9	Impact on Surface and Ground Water Resources (Environmental Impact)	• It is necessary to keep debris and construction materials out of the current drainage system. • Make sure that the ecology of the water body is protected by managing construction materials during civil works properly. • Create and post work instructions for emergency response to accidental chemical and oil spills; • Prepare emergency action plans in case there is an unintentional oil leak; • Keep all construction equipment in uniform operational condition to reduce environmental leaks of fuel, oil, or grease; • Maintain construction equipment and vehicles regularly in a designated workshop or maintenance facility; • Adopt a sound site management strategy that takes pollution avoidance into account; • Never clean machinery and cars outside of the assigned area;	• Contractor	• Supervision consultant • AWSSO • (During construction, operation and decomissioning phases)	50,000	
10	Risk of flooding (Environmental Impact)	• Creation of erosion control barriers • Pause work during rainy times	• Contractor • Adigrat Town Municipality	• Supervision consultant, • Adigrat WSSO	250,000	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Consider implementing a constructed water canal		• Adigrat Town Municipality • (During the construction phase)		
11	Hazardous wastes and exposure to pathogens and vectors (Environmental Impact)	• Sort and separate hazardous waste from non-hazardous garbage, and store the two types of waste in appropriate, authorized storage facilities; • Create a plan for managing hazardous trash; • Bins for storing solid trash must be positioned at key building sites; • Establish a training program for workers who handle ammonia and chlorine; • Offer suitable personal protective equipment; • Develop escape routes from locations where ammonia or chlorine emissions may occur; • Strict control by supervising engineers to ensure acceptable storage practices • The disposal of oils shall be restricted to particular areas like the service bays, and the used oil cans should be disposed of in approved sites (landfills) • Provide worker immunization health monitoring, including routine physical examinations; • Install safety showers and eye wash stations near areas where hazardous chemicals are stored or used; • Prohibit eating, smoking, and drinking outside of designated areas;	• Contractor, • AWSSO • Adigrat Town Municipality	• Supervision consultant, • Adigrat WSSO • Adigrat Town Municipality • (Before/During construction, operation and decomissiong phases)	250,000	
12	Liquid and Solid Waste Management (Environmental Impact)	• Create a plan for managing garbage on the site before work starts; • Utilize earthworks and landscaping materials excavated from the ground and foundation works; • Bins for collecting solid garbage must be positioned in key areas • Set up a temporary, gender-segregated restroom for employees	• Contractor, • Adigrat Town Municipality	• Supervision consultant, • AWSSO, • Adigrat Town Municipality • (During construction, operation and decommissioning phases)	350,000	
13	Effect on public services (road, power, sewage, and water	• To prevent interference, it is advisable to get advice from other important service providers before beginning	• Contractor	• Supervision consultants	• This is to be considered based on the actual and	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
	supply). (Social/Public Impact)	construction to determine the placement of these infrastructures. • To give people time to make arrangements, such as setting up emergency water storage and provisioning facilities, the contractor should notify them of any planned disruption of services. • If it is necessary, advance notice to consumers about the interruption should be prepared and executed during less crucial times and for extremely brief durations. • Infrastructure that sustains damage while a project is being implemented has to be replaced or repaired;	• Adigrat Town Municipality and • AWSSO	• Adigrat Town Municipality • AWSSO • (During construction, operation and decommissioning phases)	desired infrastructure replacement or maintenance valuation report.	
14	Impact on Heritages (Social Impact)	• Follow up on the chance finds procedure, • Any additional excavation should cease right away, and the relevant agency should be notified if any information or indications regarding an archaeological site are discovered; • Site excavation oversight; • Workers in construction camps must get instruction on how to recognize potential archaeological discoveries and notify the contractor about them; • Any archaeological artifacts found must be reported to the Office of Culture and Tourism;	• Contactor in collaboration with • AWSSO	• Supervision consultant and • Adigrat Culture and Tourism Office • (During construction phase)	100,000	
15	Risks related to occupational health and safety (OHS) (Social Impact)	• Before the start of project construction, establish a Health and Safety Plan (HASP); • Inform coworkers and the local community about HIV/AIDS • The town health office and HIV/AIDS Prevention and Control Offices ought to collaborate to generate favorable effects and bring about significant behavioral adjustments. • Appoint a health and safety officer; train project workers in emergency first aid; • Provide them with personal protective equipment (PPE); use signage to alert staff and/or visitors to potentially dangerous areas and activities; • Arrange for the proper handling and disposal of construction waste on a site designated for this purpose; • To reduce the danger of falls, post notices on open trenches; • Fill in open trenches no later than seven days.	• Contractor	• Supervision consultant, • Adigrat Town Health Office • (During construction, operation and decommissioning phases)	250,000	• Before the project starts and during the construction stage

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Put into practice globally acknowledged standards and acknowledged OHS principles; • Create a health and safety management plan tailored to the location • Designate a competent occupational health and safety officer to manage OHS issues daily; • Keep an eye on construction workers' adherence to safe work practices and guidelines (OHS) by monitoring their performance; • First aid kits should be kept in cars, workplaces, and construction sites. • Workers should also be outfitted with the proper personal protective equipment; • Make sure the campsite is walled in, maintained hygienically, and has enough facilities provided. • Thoroughly document and save all instances of accidents and injuries;				
16	Impacts of Gender Empowerment and Gender-Based Violence (Social Impact)	• Assign and utilize a dedicated female-only restroom; • Offer materials and equipment for safety that are suitable for women • Assign women to jobs that don't interfere with their biological makeup; • Create and execute a code of conduct that, among other things, forbids sexual harassment and GBV rigidly and requires all employees to sign it; • Make sure men and women are paid equally for jobs of equivalent value; • Offering GBV-affected staff support services including counselling, healthcare, and legal representation: • Make sure that men and women have equal access to employment opportunities, and affirmative action to empower women will be taken into consideration. • To stop gender-based violence, organize women in the workforce, especially those who work regularly;	• Contractor	• Supervision consultant and • Office of Women, Children and Youth Affairs • (During construction, operation and decommissioning phases)	150,000	• Before the project starts and during the construction stage
17	Violations of social customs (Social Impact)	• Hire both expert and unskilled laborers from the neighborhood, if at all feasible; • Having efficient communication and teamwork to tackle the obstacles and challenges brought forth by a surge of workers;	• Contractor	• Supervision consultant, and • Office of Labor and Social Affairs	50,000	• Before the project starts and during the construction stage

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Every new employee will have to sign a code of conduct. • Inform the workers who are new to the area about the customs of the host society; • It is recommended that the contractor furnish personnel with appropriate identification and uniforms so that individuals with social difficulties may be readily identified.		• (During construction)		
18	Impact on Climate Change and Resilience	• Implementing measures to minimise disturbance, emission and dust control, and consideration of the waste management plan • Integration and use/implementation of plans for adaptation measures, design adjustments, proactive management and climate emergency plans (project-induced or natural climate hazard)	• Contractor	• Supervision consultant, and • AWSSO • Regional EPA and Adigrat City Municipality • (During construction)		• The measures shall be part and parcel of the construction management and operational plan
• B. Operation Stage						
19	Odor and Quality of Ambient Air (Environmental Impact)	• Along the FSTP boundary, trees ought to be planted; • Maintaining a sufficient buffer zone of at least 400 meters between residential and FSTP areas; • Regulating the volumetric BOD loading to stay within the range of 100-400 g/m3 to prevent Odor release; • Applying ferric chloride ($FeCl_3$) to mitigate the potential for hydrogen sulfide (H_2S) Odor generation during the sludge digestion process; • Maintaining the stabilization ponds of the FSTP yearly, clearing away accumulated debris and other solids at the inlets and outlets; • Routinely monitoring the ambient air and measuring the amount of hydrogen sulfide (H_2S) present in the air; • Regulating an aerobic digester parameter (PH, Temperature, O_2 level, etc.) for bacteria/microorganisms that produce hydrogen sulfide (H_2S) • Give employees the proper personal protective equipment (PPE), such as respirators. • To prevent exposure to the public, use leak-free vehicles for the transportation of wastewater and the emptying of septic tanks, and choose a convenient time. • Clearing the inlet system of screens and grit to lessen obstruction	• AWSSO and • FSTP Manager	• AWSSO • PO and • Environmental Protection Office • (During operation and decommissioning phases)	350,000	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Clearing the surface of the pond of floating macrophytes and muck • Ensure that the rendering plant and compost facilities are properly maintained to guard against Odor discharge and keep scavengers, insects, and rodents away • To reduce the unpleasant stench that treatment plants emit, surround them with trees like night queens that emit a nice scent into the surrounding air.				
20	Risks and Impacts to Public Health (Social/Public Impact)	• Provide workers and operators of wastewater treatment plants with appropriate personal protective equipment; • Assure that workers and operators regularly inspect safety equipment; • Teach workers and operators how to use personal protective equipment; • Regularly monitor waste storage and sludge collection facilities to prevent insect attraction and breeding; • Raise the necessary awareness regarding the use and production of FS composts • It is usually necessary to cleanse feces sludge before using it in agriculture • Employ thermophilic composting; • Prevent using untreated sewage for cultivating food crops and livestock feed; • Establish MSEs, offer technical assistance for compost preparation, and establish a market connection for the compost generated;	• AWSSO Office	• Adigrat Town Municipality; • Environmental Protection Office, • AWSSO • (During operation and decommissioning phases)	450,000	
21	Impacts of leakages and spills on water (surface and underground) and soil (Environmental Impact)	• Regularly checking if the treatment plants are operating per the design; • Ensuring that the hydraulic capacity of the gravity mains is sufficient to accommodate peak flows and slopes; • Ensuring a leak detection program; • Cleaning the grit chambers and sewer lines regularly to remove debris, grit, and grease that could cause sewer backups; • Examining past sewer maintenance records to help identify "hot spots" or areas with frequent. • Limit the amount of sludge that enters the treatment plant or storage facility. Modernize the plant or facility to enhance its capability.	• AWSSO Office	• Adigrat Town Municipality; • Environmental Protection Office, • AWSSO • (During operation and decommissioning phases)	550,000	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Establishing a laboratory to assess the quality of water and wastewater • Make sure that the effluent quality from the FSTP facility conforms with the proposed discharge limit criteria outlined within the UWSSP II ESMF. • The septic tank effluent (FSTP) should be checked quarterly for quality against discharge quality standards. • The treated faecal sludge should be used for energy production, agriculture, reclamation, and landscaping instead of being dumped directly into water bodies. • The dried-up sludge cake can also be used as a raw material to make fuel products like briquettes or compost fertilizer.				
22	Impacts of Septage Collection and Faecal Sludge (Environmental Impact)	• Encourage proper septic tank design and enhance septic tank upkeep; • Take into account the provision of a systematic routine collection of septic waste and faecal sludge; • Use suitable collection vehicles; • Allow the discharge of faecal sludge and septage at storage and treatment facilities to prevent untreated septage from being released into the environment.	• AWSSO Office	• Adigrat Town Municipality • Environmental Protection Office • AWSSO • (During construction, operation and phases)	250,000	
23	Impact of Effluent Discharge on Downstream Riverine Water Resources, flora and fauna (Environmental Impact)	• Maintain a 400-meter-wide buffer zone around treatment plant sites to absorb pollutants from the effluent; • Plant trees in the buffer zone, such as reed lilies and other types of plants with the capacity to absorb pollutants; • Give emergency wastewater tank construction consideration if the FSTP malfunctions; • Seal the foundation of FSTP and influence areas with concrete lining to avoid leakage of wastewater through permeable soils and weathered and fractured rocks into the groundwater system • Whenever the quality of effluent fails to meet the standard, stop discharging the effluent into receiving streams and rivers	• AWSSO Office	• Adigrat Town Municipality • Environmental Protection Office • AWSSO • (During operation phase)	350,000	
24	Risks to Occupational Health and Safety (Social Impact)	• Providing workers with appropriate PPE; • Frequent evaluation of the facility's suitability;	• AWSSO and • FSTP Manager	• AWSSO • PO • Health Office, and	400,000	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Plan and oversee the appropriate employees' medical examinations at least once every six months; • Create and work on a plan for environmental health and safety; • Providing FSTP employees with the necessary ergonomics training; • Assist people with first aid needs within the building and provide prompt medical attention in the event of accidents or injuries; • Vaccinate all employees against hepatitis in the workplace, and grant access to routine physicals;		• Environmental Protection Office • (During construction, operation and decommissioning phases)		
25	Impact on Aesthetic Value (Environmental Impact)	• Keep the site green by planting trees around the treatment plant and buffer zone • Keep the buffer zone and open areas within the treatment plant neat all the time	• AWSSO	• Environmental Protection Office • Adigrat Town Municipality • (During construction, operation and decommissioning phases)	150,000	
26	Impact on Climate Change and Resilience	• Reducing storage duration under anaerobic conditions, implementing energy efficiency measures and using renewable energy and resource recovery (compost) plans • Considering resilient design infrastructures and adjustment measures • Implementing measures to minimise emissions and considering desirable operational standards and a waste management plan • Integration and use of adaptation measures, implementing proactive management and climate emergency plans (for the project-induced or natural climate hazard)	• AWSSO	• Adigrat Town Municipality • AWSSO • (During decommissioning phase)		• The suggested measures shall be part and parcel of the construction management and operational plan
C. Decommissioning Stage						
27	Employment Opportunity Risks (Social Impact)	• Vulnerable community groups must be prioritized for related initiatives that align with their skill set, expertise, experience, and areas of interest; • Providing sufficient retirement benefits, such as pensions or provident funds, should also be a priority;	• Adigrat Town Municipality • AWSSO and • Job Creation Office	• Adigrat Town Municipality • AWSSU and • Job Creation Office	250,000	

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
		• Organize, train, and encourage the establishment of their small-scale businesses by making loans or other financial support available;		• (During decommissioning phase)		
28	Occupational Health and Safety (Social Impact)	• Before the start of decommissioning, staff should get the appropriate training and indoctrination. • Putting in place engineering measures to limit exposure to hazardous materials and physical risks, including barriers and ventilation systems; • Offer suitable personal protective equipment (PPE) to the laborers engaged in decommissioning;	• Contractor • AWSSO	• AWSSO • Health Office and • EPA • (During construction, operation and decommissioning phases)	150,000	
29	Air Pollution Impact (Environmental Impact)	• Equip workers with suitable personal protective equipment (PPE); • Systematically dismantle structures while taking into account the potential for material reuse; • Before demolition, wet the materials to prevent dust release. Steer clear of burning anything. • Minimize dust from sources in open areas, such as storage heaps, by utilizing control methods including installing enclosures and covers and raising the moisture content; • Reduce dust from material handling sources by using covers and/or control equipment (water suppression, cover);	• Contractor • AWSSO	• AWSSO, • Health Office, and • EPA • (During construction, operation and decommissioning phases)	150,000	
30	Noise Impact (Environmental Impact)	• Making use of noise control tools, such as combustion engine exhaust mufflers and temporary barriers, and diffusers for impact and blasting operations; • Minimize or avoid traveling through congested neighborhood areas;	• AWSSO Office	• Adigrat Town Municipality	50,000	
31	Impacts on Soil and Water Bodies (Environmental Impact)	• Create a decommissioning strategy that details the actions and operational protocols;	• Contractor	• AWSSO and • Environmental Protection Office • (During construction, operation and decommissioning phases)	500,000	
		• Evaluating the treated waste and the water body's environmental quality before decommissioning begins;	• AWSSO			
		• Take off all of the contaminated soil from the treatment plant location and dispose of it in a sanitary landfill or another approved waste disposal site; • Level the area so that it may be utilized for other things.	• Contractor			

S/N	Adverse Environmental / Social Impacts	Suggested Mitigation Measures for Consideration	In charge of accountability for:		Estimated Budget in ETB	Remarks
			Implementation	Supervision and Time Frame		
32	Site Reclamation (Environmental Impact)	• Properly reinstate the abandoned fecal sludge treatment plant site • Develop the areas for a recreational park or plant trees to increase the aesthetic value of the area • Integrate with the micro-watershed management system	• AWSSO and • Environmental Protection Office • Adigrat Town Municipality	• Environmental Protection Office • (After Construction and decommissioning phases)	500,000	
33	Impacts on Climate Change and Resilience	• Proper and planned waste disposal and handling of the waste during decommissioning and • Consideration and implementation of site restoration plans to its original condition or to a beneficial use	• Adigrat Municipality • AWSSO	• Environmental Protection Office • Adigrat Municipality • AWSSO		• The measures shall be an integral part of the decommissioning plan
Total Estimated Budget for the ESMP					**6,700,000.00**	**Could vary with time**

10.3. Environmental and Social Monitoring Plan

Establishing and maintaining an environmental and social monitoring system is essential for evaluating the effectiveness of various mitigation strategies, identifying potential environmental concerns, and promptly detecting unforeseen effects. Monitoring social and environmental factors will help identify possible issues early on and enable the quick application of efficient corrective actions.

Environmental and social monitoring shall be carried out during the pre-construction, construction, operation, and maintenance, as well as decommissioning of the project to ensure that the identified mitigation measures are implemented in accordance with the preset schedule, and involving the indicated/proposed responsible body for implementation to ensure environmental and social sustainability of the project under consideration. A framework for keeping an eye on the social and environmental circumstances at the Adigrat FSTP subproject is outlined in this Environmental and Social Monitoring Plan (EMP). The subproject's monitoring program has been established, and it includes information on the parameters, frequency, and accountability for supervision and monitoring in addition to the initial charges. Monthly and quarterly environmental monitoring reports will be generated, and the project implementation office, WDC, and the site operators will all keep thorough records. The regional EPA will receive the environmental monitoring reports every quarter, or more frequently if necessary.

In general, the specific objectives of the environmental monitoring plan 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, and control the risks and ecological/social impacts.
- Ensure best practices management as a commitment to continuous environmental performance improvement.
- Provide environmental information to the community/stakeholders, which include early warning signals on potential environmental degradation for appropriate actions to prevent or minimize environmental consequences. The project's impact on climate change risks and opportunities should also be monitored and evaluated.

The contractors/PIM/PMU, and AWSSO will carry out the environmental monitoring plan that will be adhered to during the construction, operation, and decommissioning stages, possibly with the aid of an external body. Consultants will provide training to employees from various offices so that they can carry out social and environmental monitoring tasks during the construction, operation, and decommissioning phases. During these times, a consultant is being hired to provide training on a few of the topics. To guarantee the effective execution of the suggested ESMP, two primary forms of monitoring will be included in the monitoring activities:

- Compliance monitoring: It is the process of keeping an eye on building and operating sites and activities for general environmental compliance.
- Impact Monitoring: It involves keeping an eye on the quality of produced sludge and wastewater, as well as the air quality, dust, and Odor due to the project implementation.

Table 10. 2: Environmental and Social Monitoring Plan (ESMP)

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
A. Construction Phase							
C 1	Loss of livelihoods and assets due to temporary and permanent land acquisition	○ Using an independent expert to conduct ARAP ○ Priority must be given to vulnerable community groups, such as female-headed HHs, when it comes to compensation, land delivery, and post-livelihood rehabilitation projects; ○ The start date of the PAP census will serve as the cut-off date.	○ ARAP approved by Bank. ○ 100% of eligible PAPs receive full compensation as per the approved ARAP, verified by signed receipts. ○ 100 % of compensated vulnerable HHs (female-headed, etc.) are enrolled in livelihood restoration programs. ○ Number of satisfied personnel by the compensation	○ Review of signed compensation receipts and livelihood program enrollment records.	MoWE Municipality AWSSO PO, and WB	Before and/or during construction	Part of the government ARAP/RAP cost and to be implemented as per the approved procedure and plan
		○ Make PAPs aware of the project's possible effects as well as the compensation obligations. ○ Give PAPs precedence over other candidates for jobs that the initiative creates; ○ Create and carry out a strategy for PAPs to restore their livelihoods;	○ The number of PAPs who were made aware of and encouraged to pursue agriculture. ○ The number of employments that were generated for PAPs who benefited from the livelihood initiative.	○ Documentation and beneficiary witness	AWSSO Women, Youth, and Social Affairs Office Job Creation Office and Land offices	Before and/or during construction	300,000
C 2	Loss of Vegetation Cover	○ Planting suitable native tree and shrub species; ○ At least ten individual seedlings must be planted for each species removed; ○ The Adigrat town EPA should be consulted when choosing suitable tree species.	○ The area coverage and type of native plants and shrubs; ○ The number of tree seedlings planted ○ The number of tree species chosen for planting ○ Survival rate of planted seedlings >80% after one year. Planting completed in designated areas	○ Observation, surface area measurement & recording of trees planted	AWSSO Adigrat Town and the regional EPA and Agricultural office	As required and during the construction period	300,000

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
C 3	Flood risks	○ Creation of erosion control barriers ○ Pausing of work during rainy times ○ Consider implementing a constructed water canal	○ Frequency of flood occurrence and associated risks	○ Observation and records	AWSSO Adigrat Town and the regional EPA Dizaster and Risk Management Office	Monthly	100,000
C 4	Impacts on Soil	○ Create an excavated soil management plan. ○ To prevent the movement of sediment, construction work must be done during the dry season. ○ Prevent soil erosion from sheets and rills by using sandbags, culverts, diversion berms, or other physical techniques. ○ The careful extraction, appropriate storage, and reuse of the topsoil that has been excavated from the site to restore it. ○ Only the workshop area that has been prepared should be used for oil exchange. ○ Washing automobiles and equipment should only be done in the workshop; it should never be done outside; ○ Avoid utilizing outdated (older than ten years) and badly maintained machinery. ○ Drive exclusively on designated routes when feasible; avoid going on unpaved ground.	○ Excavated Soil Management Plan approved before construction commencement. Zero incidents of uncontrolled soil washing into waterways or off-site, as verified by weekly inspections.	○ Observation & documentation ○ Document review about machineries & Maintenance reports	AWSSO Adigrat Town and regional EPA and Agricultural office	Monthly	100,000
C 5	Air Pollution and Dust	○ Offer PPE to all site visitors as well as the construction staff. ○ Set a 30 km/h speed limit for cars on dirt access roads, especially in sensitive locations. ○ Refrain from utilizing outdated (older than ten years) or broken equipment; verify weekly that all machinery on duty is operating properly; ○ Trucks will be covered while transporting building supplies and ○ To reduce dust in dusty locations, use spray water.	○ Availability and use of PPE ○ Measurement of exhaust emission levels generated by construction vehicles & machinery ○ Use of dust collectors or spray water systems during excavation	○ Observation ○ Recording and review of complaints from Workers and local community opinions	AWSSO PO EPA	Monthly	50,000

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
C 6	Noise Pollution	○ Construction sites shall not have noise levels higher than 75 dBA during the day and 70 dBA at night, respectively. ○ Workers will be informed of the acceptable noise levels at their workplace and the surrounding area. ○ Make use of functional and well-maintained working equipment; ○ Give workers the appropriate personal protective equipment (PPE), such as ear muffs, when needed during off-work hours.	○ Noise levels at the construction site ○ Equipment's work plan ○ Maintenance plan of vehicles & machinery ○ Availability and use of PPE like ear muffs	Observation Documentation Records of complaints from Workers and community opinions	AWSSO Supervisory Consultant Contractor EPA	Monthly	50,000
C 7	SeismicHazard	○ When designing FSTP engineering structures, the seismic likelihood has to be taken into account. ○ Closely monitor and follow up on the FSTP construction phase regularly. ○ Enforce proper plant operation and routine plant functionality checks.	○ All structural designs shall be certified by a licensed engineer to comply with national seismic building codes. Construction shall be strictly supervised to ensure adherence to the approved seismic design.	Documentation Physical inspection and observation	AWSSO Supervisory Consultant EPA	Monthly	50,000
C 8	Accidents and Jams in the Traffic	○ Ensure that vehicles are operated by qualified drivers and that they are parked in designated parking areas; ○ Employ youth to facilitate traffic management activities on both ends of the construction site; ○ Develop and implement a traffic management plan and work in coordination with local traffic police; ○ Provide awareness education to employees and the local community; ○ Provide protective wear to workers; ○ Provide temporary road signs or notices to indicate ongoing works.	○ The number of workers who received traffic management and safety awareness training; ○ The presence of road traffic signs or notifications; ○ The driver's code of conduct; ○ The number of construction sites that are fenced off; ○ The availability of designated parking areas	Physical observation and inspection, Documented records of accidents, and Number of complaints	Contractor Supervisory Consultant Traffic management	Daily	10,000

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
C 9	Surface and groundwater pollution	○ Arrange for emergency action in the event of an unintentional oil leak. ○ Keep all construction equipment in standardized operating condition by maintaining it. ○ At a designated workshop, conduct routine maintenance on construction equipment and vehicles. ○ Implement sound site management practices that take effective pollution prevention measures into account. ○ Never wash equipment, including cars, outside of the designated location.	○ Existence of an oil leak as a result of building activities; ○ Maintenance records of vehicles and equipment; ○ Accessibility of an emergency response plan;	Physical observation and inspection, Documented records of accidents, and Number of complaints	AWSSO Contractor Supervisory Consultant EPA	Monthly	50,000
C 10	Solid and Liquid Wastes	○ Create a plan for managing garbage on the site before the construction starts. ○ Reuse earthworks and landscaping materials that were excavated during foundation work. ○ Bins for collecting solid garbage must be positioned in key areas. ○ Set up a temporary, gender-segregated restroom for employees.	○ Availability of solid waste containers; ○ Quantity of soils used for landscaping; ○ Presence of restrooms with segregated stalls; ○ Presence of a site waste management plan	Documentation Physical inspection and observation	Contractor Supervisory AWSSO Municipality and EPA	Monthly	50,000
C 11	Hazardous wastes and exposure to pathogens and vectors	○ Create a plan for managing hazardous waste ○ Sort and categorize hazardous waste materials differently from non-hazardous ones, and ensure they are kept in appropriate, approved storage spaces ○ Bins for storing solid waste must to be positioned at key construction locations.	○ Hazardous waste (oils, chemicals, batteries) shall be segregated, stored in labeled, sealed containers, and disposed of at a licensed hazardous waste facility. Records of disposal shall be maintained.	Physical inspection and Documentation and records of contamination exposure	MSSWU Contractor Supervisory Consultant Municipality, and EPA	Monthly	100,000
C 12	Risks related to occupational health and safety (OHS) and increased incidence of diseases	○ Create a site-specific health and safety management plan; ○ Assign a certified health and occupational safety officer to handle OHS concerns daily; ○ Put into practice globally established standards and recognized OHS guidelines; ○ Maintain a close eye on construction workers' adherence to OSHA's safe work practices and guidelines ○ Stock first aid kits in vehicles, workshops, and construction sites. ○ Equip workers with the necessary personal protective equipment (PPE)	○ The availability of a health and safety coordination plan; ○ The provision of OHS training to employees; ○ The assignment of an OHS officer; the existence of an OHS monitoring plan and report; ○ The availability of first aid kits and personal protective equipment;	Occupational site visit Interview of workers and Documentation records of OHS incidents and diseases	MSSWU Contractor Supervisory Consultant Social Affairs Office, Municipality Health Office EPA	Monthly	150,000

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
		○ Make sure the campsite is well-maintained, fenced, and has enough facilities ○ Thoroughly document and preserve any incidents involving injuries and accidents ○ Sensitize workers and the surrounding communities on HIV/AIDS. ○ Town health and HIV/AIDS Prevention and Control Offices should work jointly to create positive impact and bring behavioral changes.	○ The availability of a secured fence and sanitation facilities; ○ The number of recorded fatalities and accidents ○ IEC materials for workers and community ○ Number of workers trained				
C 13	Impacts of Gender Empowerment and Gender-Based Violence	○ Offer and make available a separate restroom just for ladies. ○ Offer materials and safety gear that is gender-neutral ○ Put women in jobs that don't interfere with their biological circumstances. ○ Create and put into effect a code of conduct that, among other things, forbids sexual harassment and GBV and requires all employees to sign. ○ Make sure men and women are paid equally for jobs of equivalent value. ○ Offering GBV-affected personnel support services including counseling, healthcare, and legal representation.	○ The provision of women-friendly safety equipment and materials; ○ The availability of separate sanitary facilities for women; ○ The assignment of women to jobs that do not negatively impact their biological state; ○ The availability of a code of conduct, counseling services, and equal compensation for men and women	Physical observation, Interview of staff/workers, and Review of employment records	AWSSO, Contractor Supervisory consultant Women, Children, and Youth Office	Monthly	100,000
C 14	Violations of social customs	○ Hiring laborers from the neighborhood, both skilled and unskilled. ○ Cooperation and communication that work well to solve issues brought on by the workforce inflow. ○ A code of conduct must be signed by all new hires. ○ It is necessary to inform newcomers about the standards of the project host community. ○ The contractor is responsible for providing workers with uniforms and appropriate identification.	○ The number of local workers employed; ○ The number of grievances filed by the community and workforce; ○ The signed Code of Behavior (COB); ○ Number of newcomers trained	Interview staff and community members, review employment records	AWSSO Contractor Supervisory Consultant and Office of Labor and Social Affairs.	Quarterly	100,000
C15	Climate Change and Resilience	○ Implementing measures to minimise disturbance, emission and dust control, and consideration of the waste management plan ○ Integration and use/implementation of plans for adaptation measures, design adjustments, proactive	○ GHG Emissions ○ Energy consumption ○ Adaptation measures	Air quality measurements, utility bills, number of adaptation measures implemented	AWSSO Contractor Supervisory Consultant	Quarterly	Regular activity of personnel

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
		management and climate emergency plans (project-induced or natural climate hazard)					
Operational Phase							
O 16	Odor and Quality of Ambient Air	○ Along the FSTP boundary, trees ought to be planted; ○ Keep the volumetric BOD loading between 100 and 400 gm3 to limit Odor emission; ○ Provide a sufficient buffer zone between the residential and FSTP site; ○ Ferric chloride (FeCl3) is used to prevent hydrogen sulfide (H2S) Odor from developing during the sludge digestion process. ○ FSTP stabilization ponds are maintained on a yearly basis, and accumulated debris and other solids are removed at the inlets and outlets. ○ The ambient air is regularly monitored, and the presence of H2S in the air is measured. ○ An aerobic digester's parameters (PH, Temperature, O2 level, etc.) are controlled for H2S-producing bacteria and microorganisms. ○ Give employees the proper personal protective equipment (PPE).	○ The FSTP's number of trees planted, ○ The buffer zone that exists at the site, the standard operating procedures that are available, ○ The BOD loading test result, the frequency at which FeCl2 is used to remove Odors, ○ The number of complaints that have been filed, and the FSTP's operation, maintenance, and monitoring plan ○ Odor monitoring conducted quarterly at plant boundary, results within standards. H2S levels ppm at site boundary.	Physical inspection and observation Interview with residents, including workers Review of documented records (training provided, equipment purchased)	AWSSO Adigrat Municipality and EPA	Weekly	50,000
O 17	Impacts of leakages and spills on downstream riverine flora and fauna, water resources(surface and underground), and soil contamination	○ When there is an overflow, less sludge enters the storage facility or treatment plant. ○ Expand the capacity of the storage facility or treatment plant by upgrading it. ○ Setting up a laboratory to analyze the quality of water and wastewater ○ Work to guarantee that the effluent from the FSTP facility conforms with national effluent discharge limit criteria ○ Use the treated faecal sludge for agriculture, industry, energy generation, and landscaping;	○ The amount of FS that is used for soil amendment, agricultural application as fertilizer, and other uses; ○ The quantity of briquettes or compost made from FS by SMEs or organized groups; ○ The availability of laboratory test findings; ○ The amount of inflow sludge control; and	Physical inspection and observation Routine Audits, M & E reports Documented records Laboratory tests	AWSSO Contractor Supervisory Consultant Municipality EPA Agricultural Office	Monthly, and whenever there is an overflowing	100,000

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
		○ Use the dried-up sludge cake for the manufacturing of briquettes or compost fertilizer ○ Quarterly check the quality of wastewater released from the septic tanks & FSTP	○ The availability of facility maintenance reports.				
O 18	Risks of flooding, soil erosion, and landslides	○ Ensure facility design includes adequate drainage capacity for stormwater runoff. Regularly inspect and maintain drainage ditches and embankments.	○ Frequency of flood risk occurrence and associated risks	Observation and records	AWSSO Adigrat Town and the regional EPA Dizaster and Risk Management Office	Monthly	100,000
O 19	Risks to Occupational Health and Safety	○ Giving employees appropriate PPE ○ Consistently assessing the facility's suitability ○ Arrange for the appropriate staff to have medical examinations at least every six months ○ Create and work on a plan for environmental health and safety ○ Giving employees the proper training ○ Offer easily available first aid and prompt medical attention in the event of accidents and injuries ○ Vaccinate all employees against hepatitis at the workplace, and grant access to routine physicals.	○ First aid supplies and PPE are available in the FSTP. ○ Availability of the facility: Regular inspections; ○ Records of occupational health exams; ○ The Environmental Health and Safety Plan document; ○ Number of staff trained; ○ Kind of vaccine and number of immunized staff members	Physical inspection Training attendance lists of workers Occupational & health reports Documented records	AWSSO Contractor Supervisory Consultant EPA Health Offices	Quarterly	250,000
O 20	Risks and Impacts to Public Health	○ It is important to raise knowledge about the proper preparation and use of FS composts. ○ FS should always be treated before use. ○ Thermophilic composting is recommended. ○ Avert using untreated sewage for cultivating food crops or livestock feed; ○ Establish SEMEs and offer technical instruction on the preparation and sale of compost.	○ The quantity of compost preparation training offered ○ Compost made from treated FS that is utilized in agriculture ○ The number of MSEs producing compost	Documented records Physical inspection and observation Awareness creation plans and programs	AWSSO Contractor Municipality SME/MSMEs enterprises EPA Health Offices	Monthly	50,000
O 21	Impact on Aesthetic Value	○ Keep the site green by planting trees around the treatment plant and buffer zone ○ Keep the buffer zone and open areas within the treatment plant neat all the time	○ Changes in appearance and aesthetics	Physical inspection and observation	AWSSO Adigrat Town Municipality	Quarterly	100,000

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
C22	Impact on Climate Change	○ Reducing storage duration under anaerobic conditions, implementing energy efficiency measures and using renewable energy and resource recovery (compost) plans ○ Considering resilient design infrastructures and adjustment measures ○ Implementing measures to minimise emissions and considering desirable operational standards and a waste management plan ○ Integration and use of adaptation measures, implementing proactive management and climate emergency plans (for the project-induced or natural climate hazard)	○ GHG Emissions ○ Energy consumption ○ Adaptation measures ○ Infrastructure vulnerability ○ Operational stability ○ Community engagement and awareness	Air quality measurements, utility bills, number of adaptation measures implemented, assessment of infrastructure resilience, number of comments, operation downtime records	AWSSO Adigrat Municipality Environmental Protection Office	Quarterly	Regular activity of personnel
Decommissioning Phase							
D 23	Employment Opportunity Risks	○ Provide a sufficient provident fund or pension for those who choose to retire ○ Assist vulnerable community groups in establishing their small businesses by organizing training programs and providing loans or other forms of financial support	○ Number of Workers Supported ○ The number and frequency of the provided training ○ Number of MSEs established, jobs produced, and funding provided	Physical observation, job creation records & reports, and documentation	AWSSO Municipality SME/MSMEs enterprises and Job Creation Office	During the decommissioning period	250,000
D 24	Occupational Health and Safety	○ Adequate worker training about work-related incidents before decommissioning ○ Putting engineering measures in place to reduce exposure to dangerous substances and potential bodily harm ○ When transporting goods, trucks shall be covered to minimize dust emissions ○ Provide the workers participating in decommissioning activities with the proper PPE.	○ Reduced truck emissions; ○ Availability and use of suitable personal protective equipment; ○ Number of trainings provided; ○ Availability of engineering controls implemented;	Physical inspection observation Review of documentation records	AWSSO Municipality SME/MSMEs enterprises (Job Creation Office) EPA Health Offices	During the decommissioning period	300,000
D 25	Air Pollution Impact	○ Give workers proper, sufficient personal protective equipment (PPE). ○ Dismantle structures methodically while taking into account the possibility of reusing the materials. ○ To reduce the emission of dust, moisten the materials before demolition ○ Steer clear of burning anything	○ The volume of water sprayed ○ Employee provision and usage of PPE ○ Amount of reusable demolition materials	Physical inspection and observation Review of documentation records	AWSSO Municipality EPA	During the decommissioning period	100,000

S/N	Adverse Impacts	Mitigation Measures	Indicators	Method of Monitoring	Responsible Institution/s	Monitoring Schedule	Estimated Budget inETB
D 26	Impacts on Soiland Water Bodies	○ Create a decommissioning strategy that details the actions and operational protocols ○ Assessing the water body's environmental quality and the processed waste; ○ Eliminating all contaminated soil from the treatment facility and disposing of it at a specified disposal location ○ Level out the terrain so that it may be utilized for future projects.	○ The available decommissioning plan, ○ The laboratory test results, ○ The quantity of contaminated soil that has been appropriately disposed of, and ○ The restored area	Physical inspection, measuring rehabilitated area, water quality report, and documentation	AWSSO Contractor and EPA	During the decommissioning period	200,000
D27	Impact on Climate Change and Resilience	○ Proper and planned waste disposal and handling of the waste during decommissioning and ○ Consideration and implementation of site restoration plans to its original condition or to a beneficial use	○ Tracking Implementation of planned measures ○ Site visits and status reports	Physical inspection, measuring the rehabilitated area	AWSSO Contractor and EPA	During the decommissioning period	Regular activity during stage
Total Estimated Budget for the ESMP as per the estimated frequency/duration without aggregates							**3,010,000**

10.4. Training and Capacity Building

The immediate need of capacity building of the project operation is summarized below in Table 10.3. As conditions permit or depending on the prevailing circumstances, the budget could be modified. For the effective and efficient implementation of this ESMP, providing appropriate training and capacity building on environmental and social safeguards for the project implementers and stakeholders is indispensable. Accordingly, it is recommended that capacity building interventions including hhands on exposure should be provided on the management of environmental and social issues at all levels i.e., CBOs, relevant regional and town level government officials (health, education, water and energy bureau, job creation, labor and social affairs, women and youth and Environment), community leaders, Adigrat Town WSSO management team, E&S safeguard experts. The training program for various role players will include an orientation program on the ESMP, Environmental and Social Assessment Processes and safeguards, OHS, and Project Management and monitoring. The training on ESMP may be integrated with the ESMF and RPF, and other related training programs for cost-effectiveness.

Table 10.3. Budget for Training and Capacity-building Requirement

S/N	Training Topic	Participants	Time	Responsible Body	Cost Estimation (ETB)
1	Environmental and Social Impact Mitigation, Monitoring, and Reporting (High Priority) ▪ Public health and safety of FSTP Management. ▪ Social mitigations for the environmental project ▪ Community participation in environmental supervision monitoring ▪ Supervision of contractors, Subcontractors, and community representatives ▪ Risk assessment, response, and control	✓ Environmental and social safeguards staff of the regional and Town WSSO and other stakeholders who are going to be engaged in the management and monitoring (total 20 participants)	○ Soon after project commencement and during project implementation ○ Refreshment training during operations	MoWE AWSSO WB Municipality	500,000
2	Implementation of Mitigation Measures (Moderte Priority) ▪ Overview and requirements of environmental and social monitoring ▪ Role and responsibilities of contractors ▪ Scope and methods of environmentaland social monitoring ▪ Response and risk control ▪ Preparation and submission of reports ▪ Risk of hazards ▪ OHS and community health ▪ Grievance handling and reporting ▪ GBV reporting	✓ Local communities, AWSSU, Health Officers, municipality, urban infrastructure technicians, Engineers, E&S experts ✓ On-site construction management staff; safeguard Staffs, Kebele & community leaders	○ During construction & Operation ○ Refreshment training during operations (quarterly)	AWSSO together with MoWE and EPA	1,500,000
3	Environmental and Social Safeguards (High Priority) ▪ Safety and health issues ▪ Environmental Pollution risks and management ▪ Management of environmental safetyand sanitation on work sites	✓Community representatives ✓Workers on transporting FS and FSTP	○ During operation (every six months)	AWSSO and other relevant stakeholders	500,000

S/N	Training Topic	Participants	Time	Responsible Body	Cost Estimation (ETB)
	▪ Mitigation measures at construction sites ▪ Procedures to deal with emergencies				
4p78u	▪ Environmental Sampling and Water&Wastewater Quality Monitoring (Moderate Priority)	✓AWSSO and FSTP Operating staff	○ During operation (biannually)	MoWE and AWSSO	400,000
5	▪ Safety Measures for Proper Emptying of FS (High Priority)	✓FSTP workers ✓Truck drivers for emptying sludge	○ Every six months during operation	AWSSO and other stakeholders	300,000
6	Operation and Maintenance of FS Treatment Plant (High Priority)	✓ AWSSO and FSTP Operating staff	○ Every quarter during operation	AWSSO and other stakeholders	250,000
7	Experience sharing and hands-on training (Moderate Priority)	✓ AWSSO and FSTP ✓ Operating staff	○ Prior operation and after two years of operations	Municipality, AWSSO	1,500,000
Total Estimated Cost					**3,600,000.00**

11. CONCLUSIONS AND RECOMMENDATIONS

11.1. Conclusions

The construction of the Faecal Sludge Treatment Plant (FSTP) in Adigrat Town marks a significant advancement in addressing critical public health and environmental issues linked to inadequate sanitation infrastructure. The comprehensive Environmental and Social Impact Assessment (ESIA) has demonstrated that the project offers substantial socioeconomic benefits that far exceed any minor adverse effects. Through meticulous engineering design, adherence to best construction practices, and the implementation of effective mitigation measures, the project is well-positioned to minimize or eliminate negative environmental and social impacts.

The selected treatment technology, which includes non-planted drying beds, waste stabilization ponds, and constructed wetlands, is specifically tailored to the local context. This approach not only addresses sanitation challenges but also provides opportunities to enhance public health and improve livelihoods. Successful implementation is expected to yield numerous positive outcomes, including improved health and well-being for residents and neighboring communities through the reduction of waterborne diseases and sanitation-related issues. Additionally, the project is anticipated to create both short- and long-term employment opportunities and promote the agricultural reuse of treated faecal sludge as organic fertilizer.

The ESIA has identified only minimal negative environmental impacts associated with the project while highlighting its substantial socioeconomic advantages. By following a carefully designed engineering framework and adhering to the mitigation measures outlined in the Environmental and Social Management and Monitoring Plan (ESMP), the project can effectively address concerns such as loss of productive farmland, air quality deterioration, soil erosion, improper solid waste disposal, and vegetation clearance. Conversely, expected positive outcomes include job creation, increased agricultural productivity through fertilizer production, improved public health conditions, and the establishment of well-designed wetlands.

To maximize positive effects and effectively address identified adverse impacts, a detailed ESMP has been developed with allocated budgets for various project phases—construction, operation, and decommissioning. The responsibilities of stakeholders involved in implementing these plans have been clearly defined. Adhering to the ESMP is crucial to prevent major adverse impacts, making strict compliance essential for the project's success.

In summary, the effective implementation of this project is expected to mitigate anticipated impacts to non-harmful levels. Timely and adequate execution is vital, with the overall positive impacts anticipated to significantly outweigh any negative consequences. The project is poised to enhance the health and livelihoods of residents and downstream users of contaminated river waters, thereby contributing to the reduction of waterborne and sanitation-related diseases. Furthermore, it is expected to create job opportunities, foster agricultural reuse of treated faecal sludge, and potentially produce organic fertilizer. Ultimately, the project aims to promote a more ecologically, socio-culturally, and economically sustainable environment in intervention areas. Therefore, it is strongly recommended that the project proceeds in accordance with the proposed ESMP.

11.2. Recommendations

To ensure the successful implementation of the project, strict adherence to the Environmental and Social Management and Monitoring Plans (ESMP) is essential. The project supervision consultant should develop a Construction Supervision Plan before construction begins, integrating this plan into the contract. Additionally, the contractor's documents must include the environmental management plans to

ensure compliance with ESMP. All responsible parties should adhere to best monitoring practices throughout the construction, implementation, and decommissioning phases.

In light of the identified adverse impacts and findings from the baseline survey, the following recommendations are proposed:

- Ensure the project is executed accurately and promptly by strictly following the design documents provided by the design consultant, maintaining high-quality standards during construction and operation of the FSTP.
- Rigorously apply the mitigation and management measures outlined in the ESMP to address potential negative impacts, preserve job opportunities, and promote local employment while managing workplace health and safety, noise, dust, and traffic concerns.
- Conduct ongoing environmental audits and monitoring to ensure compliance with health, safety, and environmental standards.
- Explore opportunities to amplify the project's benefits and encourage community engagement to address concerns and promote participation at all project stages.
- Address community requests regarding compensation and livelihood restoration promptly, while adhering to the proposed design to manage contamination issues and produce environmentally friendly effluent for agricultural use.

Operation and Decommissioning Considerations

Operation:

- Efficient Waste Management: A well-operated FSTP effectively treats faecal sludge, reducing the risk of waterborne diseases and contamination, thereby improving public health.
- Resource Recovery: FSTPs can recover valuable resources, such as organic fertilizer, contributing to sustainable practices and minimizing environmental impact.
- Job Creation: The operation creates various job opportunities, boosting local employment and economic development.
- Community Engagement: Engage the community through awareness programs and training sessions, fostering a sense of ownership and responsibility towards sanitation and environmental conservation.

Decommissioning:

- Environmental Restoration: Restore the site to its original state or repurpose it for beneficial uses, minimizing environmental impact.
- Community Involvement: Engage the community in the decommissioning process to provide skill development, employment, and education on sustainable waste management practices.
- Legacy Planning: Develop strategies for the plant's legacy, including maintaining infrastructure for continued beneficial use or repurposing assets for community development.
- Monitoring and Evaluation: Implement post-decommissioning monitoring to promptly address any potential environmental or social impacts, applying lessons learned to future projects.

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ANNEXES

Annex 1: Minutes of Meetings

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* መምህር ግርማይ - project coordinator Adigrat city.
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16. [illegible] [signature]
[illegible] [signature]
18 [illegible] [signature]
19. [illegible] [signature]

2

- ብቲ FSTP ዝፀሎ ንብረት / asset እንተዝሓልፍ መመሓየሺና::
- ብቲ ፕሮጀክት መፅንዓት ዝለዓለ ሓዘል እንተዘሓልፍም ዘተ መማለር::
- physical & biological baseline data መሰነዳእ::
- ምስ ናይ ልምዓት ፀሓይ ኣለ መደፋት ቀሊ ውሕዳት መማለር::

ኣሉታዊ ጽልዋ

* ናይ ፍርሒ መዕረፊት ኣሉታ ምትሕብባር ኣጸጋሚ::
* ብንግዲ ምትሕብባር ንኣለመን እቲ ፕሮጀክት ወሳኒ ምዃኑ::

ጀ/ር ተሳትፎ

- ደቂ ኣንስትዮ ዝበለ መሪጽነት ኣማኻሪ ተሳትፎ የድሊ

ኣዎ+ ወልዒ

- ካልኦት ፕሮጀክት ሕድሪ ምዕባለ ኣብኡ ኣለዎ ንምትሕብባር ይሰራ ኣሎ::
- እቲ ተመሃሮ ዝሰለ ብዓቢ ዝፈጥር መንገዲ ደጊም ዝፈጥር ካብ 5-8 ሄክታር ኣጠቓላሊ ዝለዋ::
- ንሕዝብ ናይ ሓድሽ ተገዲሱ::

Tigray Regional State Interim Administration Bureau Of Water & Energy Office Of Adigrat Town Water Supply & Sewerage Service

3.

- ዋጋ ንብረት ሓሊፉ ኣብ ኣጠቓቕማኡ ዘለዎ ፍልጠት ምርዳእ ተገዲ'ዩ::
- ናይ መንገዲ ስራሕ ተበሪዑ ኣብ ቀልጢፉ ግዜ (መዕለቢ) ተፈፀመ ክንርእዮ'ዩ::
- ቅድሚ ሕጂ ካብ 30 ዓመት ዝተሰርሐ ስራሕ መወዳእታ ክሰርሕ'ዩ::
- ESIA ቀሊል መስርሕ ክውዳእ ኣ ~~[illegible]~~ ኣለዎ:: ምኽንያቱ ካብ ዘለና 5-6 ወርሒ መጀመርታ ንዝገብር ተጸበጸብና

ኣቶ ገዛኢ

- ናይ physical design ለውጢ ሓገዝ'ዩ:: ሓዚ ድሮ ብተመሳሳሊ ንምርካብ ይቐልል'ዩ::
- ምስ ምሕዋይ ዘሎ መሰረት ብተዛማዲ ምስ ሰብ ኣገዳሲ'ዩ::

ኣቶ ዮሓንስ

- ካብ ሰዲዶ ዘይምሕዳሩ ቅድሚ ምልማዕ ኣሎ'ዩ::
- ARAP ንምውዳእ ዶ ክንመሓየሽ?
- ESIA ምስ ናይ ስራሕ ክፍቲ ንምድላው ቀሪቡ'ዶ?

4.

ሳይት ወለዶይ

- FSTP ቅድሚ ምስራሕ ትካል ዝሓዞ ዝሓለፈ ዓዉድ ዕዳጋ ድሩን ኣይኮነን:: ንተጠቃምነት ዝምርኮሰ ዓቢ መሰረት ኣለዎ ንኽሳለጥ ትኽተትል ኢዩ::

ሳይት ገዝሁ

- ማለት ንምንጻር alternative project assessment ተሪፉ ኣይተገብረን ንጠቃምነት ምትእኽኻብ የድሊ::
- What is the unit of analysis?

ናይ ከባቢ ውሕስና

- ቅድሚ ምጅማር ስራሕ ዕቓፍ ኣገልግሎት ዝምልከት ኩሉ ነገር ኣብ ግምት ክኣቱ ይግባእ::
- ስራሕ ክንጅምር ንሕብረተሰብ ክንሕብር ኣለና::
- ቅድሚ ምጅማር ዝተፈላለየ ኣካላት ሓበሬታ ክረኽቡ ይግባእ::
- ESIA ቅድሚ ምጅማር ዝተዳለወ ክኸውን ኣለዎ ብዝርዝር ተሰኒዱ ክቐርብ ይግባእ::

- ሓፈሻዊ ተጠቃምነት ንምርግጋጽ ዝተኣከቡ ሓበሬታታት ብዝርዝር (ንብረት) ኣብ ዘይኖም ሰባት ካሕሳ ክወሃቦም ይግባእ ኢልና ኣለና::

1

ዕለት 23/11/2017

አጀንዳ: የከ[illegible] ውሃ አገልግሎት ዘርፍ FSTP ግንባታ [illegible] ማህበራዊ ምክክር::
ቦታ: በጎንደር ከተማ

ቀን: 23/11/2017 ሰዓት: 8:35

ተሳታፊዎች:

1. ፕሮፌሰር መሰረት [illegible]	ሀላፊነት: [illegible]	
2. አቶ [illegible] Kanat	Beles Eng plc (TTL)	0911348277
3. ኢንጅ [illegible] (R/c)	"	0913499472
4 ገዘሀኝ መንግስቱ	social safeguard (specialist)	0920871879
5. መሰረት ገ/መድህን	Finance Head	0904868284
6. ወሰኑ [illegible]	[illegible]	0910285549
7. ብርሃኑ [illegible]	Branch manager	0902557712
8. ሃይሌ [illegible]	Utility Technical head	0914264154
9. ገዛኸ [illegible]	Utility manager	0914732413
10. ተወልደ [illegible]	" " " V. manager	0914091665
11 የኮሮሬስ መለሰ	" HRM	0914065052
12. [illegible]	UWSSP-II E. safeguard	0920872106
13. [illegible]	UWSSP- branch manager	0904869613
14 [illegible]	UWSSP coordinator / Socio Economic	0901999314 / 0914019280

የስብሰባው ዓላማ: በጎንደር ከተማ ውሃ አገልግሎት FSTP አስመልክቶ የሚ [illegible] ተሳታፊዎች መወያየት ተቀምጧል::
- ዝርዝር [illegible]
- [illegible]

1

ዕለት 24/11/2017.

ጉዳዩ: FGD with relevent Sectoral Office.

ቦታ: ሰንዳፋ (የበኬ)- በደጋማት ከተማ- ንግድ.

ተሳታፊዎች: መምሪያዎች እና FSTP (key stakeholders).

ሃላፊ ~~Health manager.~~ Project coordinator

- የከተማው በደጋማት ዓይነ ህዝብ ቁንጣሮች የሚሰበሰበው ይሆናል:: ለመንደሮች FSTP ግንባታ እንዲሰራ የአ መሬት ይሆናል:: ዝርዝሩ ቦታ 5-7 ሄክታር ተቀባይ መሆን የሚገባው ይሆናል::

- ለዚህ ዝግጅት ማዕከል ቀበሌ ትር:: ዝርዝሩን ከቤት የሚሰጠው ESIA ሰነድ ተመርምሮ ይሰራል:: ከተማ መንገድ መዳረሻ ይሰጣል ከተማ እና ፍሳሽ ዝግጅት ከማጠቃለያ መንገድ 2.8km ይገኛል::

ፍሳሽ አወጋገድ

- በአሁኑ ወቅት የከተማው ፍሳሽ አወጋገድ ችግር ይታያል:: ይህ መሰረተ ልማት FSTP በፍጥነት ሊሰራ ይገባል::
- FGD & KII ተደራጅቶ መረጃ መሰጠት ያስፈልጋል::
- Waste water treatment project ተገንብቶ ዝግጅት እና FSTP ተሰርቶ ሥራ ላይ መዋል ይገባል::
- የከተማ ነዋሪዎች ፍሳሽ ማስወገጃ መሰረተ ልማት ያስፈልጋል::

2

- Physical environment ዝግባዩ መሬዳት እንደሚያደርጉ ነው።
- Biological መሬዳት ዝግባዩ ይዐዋ ትይጎዱ መሬዳ እና ከንወሰዱ ነው።
- ዐበና፡ ባለበን ብክለትን እስ ጎጎበን ለቦበን ዝህበ ቀ ተፀዐፉ ክፀሬዐ ፑ።

ስጋቶች

- Down stream dam ያዘ አስገዘ ወሬ ሰው ተፀዐፉ ትሬጌሬዎችዎ?

መልደሪ - ቀበሌ ... ሰተዐ ዐደመሬፉ

- ቦታው ገለዐ መሬት ስተዐጵን ተዐዐዐን ካስ ለንተፍል።
- አመሬት ተደጋጋሚ ተወዳይ ለ FSTP project እንዲሳካ እናገዕምፋለ።
- FSTP Site እና አዉጪዎች ... ዘመንዱ ለለ ሌሎች ለአስገዳጅ ለስተዐዐ ሂደቱ እዲህ ለዉጭ project ነው።
- ለዚህ ... ለማንኛ ... አል እንደምንፍል።

ፀጋዬ፡ ካለ ሁለዐባሬቀ ዩሬፕርት

- ...ESIA ... ... መሬት ተሟይዱ?
- ለቀጣይ FSTP ዝሁለት እንደገና ... ... እንተዝባዐር።

* ፀጉ - ካሳ ለተሰጣ በደረሰባት ማስረጃ

- ጽዳት ፍሳሾች ንለማስወገድ አገዳ ከሚቀርብ ነው:: ለአካባቢ ጤንነትም እንዲሁ ንጽህና ፍሳሾች ነው::

* ሞላጌን - survey ካሳ ጋንት አፈጻጸም ወረዳ

- ጽቴ ነደጀ ከተመረጠው በሬቮ ቤት ለአካባቢ ካሳ ተሰጥቶ ዝም ብለው እንጂ ይቀበላሉ::

-* አሞልኛሁ

- ቀድሞ ሰፈሩ ከተመሰረተ በኋላ ጽዳት ፍሳሾች ካሳ የገባን ዕለባን ካሳ ተከፍሎ ከሞ ዘይለላት ነው::

* ሃይለዩ: በደረሰባት ምደን ፊንፊን

- ~~ብዙ~~ ካሳ ለተሰጣ ለለንዱ FSTP ከሚመሰረተው ካሳ ንሯሯ ካሳ ዕቦታ እንዲሰራ ነው::
- ለነዚህ ለተሰጣ በደረሰባቸው ወረዳ ግንባታ አፈጻጸም ለስለፍ ተፈጻሚ ካሳ ምስረታ ነፍሳ::
- ከተዘለለ ቁጥራዊ እንዲታለም ሰፈሩ ካሳ ESIA ተሰራራ ይሟላ ነው::

መሰለናን መለፈሂርዪን

ወለደ ይ::

- ጽዳት ፍሳሾች ንፅህናማ ለለጋዳ ለለበገዞች ESIA በአካባቢ ወይ ጽዳት ፍሳሾች ቀደሞ ሰመሰጽ ተገደዶ:: ለለዚያንም ጽዳት የንፅህና ከተመረጠ ማን
- ካሳ ከተመረጠ ለለሳት site ለካን ለለፈንች ከተመረጠ ማን ጽዳት ሰለዚ ካሳ ከለ ዝርዝል ነው::
- ጽዳት ሰለዚ ዝለሁን FSTP ንግተማ ንማገዝ ንዳይ ነው::
- FSTP ሊሰራ ለተገለው ሰጋጠ ንጽሕ የለውም

* ዓ/ር መሰረተ ልማት - አባላት ኢንጂነሪንግ
  - አቶ ዓ/ ሰራተኞች ዝንቅፋት ይሆናሉ ብለው ነገሮች ተቀርፈዋል
    ትብብር ወሳኝ ነው።
  - Contructor የESIA ተግባራዊ ለማድረግ አሰራር ሊኖረው ይገባል።
    ስለዚህ አቶ ዓ/ ራሳቸው ዝግጅት ተደርጎላቸዋል።
  - ለሁሉ ተቋማት መመሪያዎች ገንዘብ ተደራሽ guideline
    ስለሚኖር ዕንቅፋት አይኖርም።

* ጉዳዩ - ሳሳሌ ኢንጂነሪንግ
  = ESIA ተግባራዊ ካልሆነ ፕሮጀክቱ ዘላቂነት አይኖረውም compliance ነው።
  - ፍሳሽ ESIA ተግባራዊ እና Contructor ዝግጅት ሊኖራቸው ይገባል
    ነው።
  - ተጠናቅቋል ሳይንሳዊ መረጃዎች እንዲሁም ስራዎች ይከናወናሉ።

ዓይነት የፍላጎት ምላሽ

- የፍሳሽ - ማስወገጃ
- የፍሳሽ sheet flow diagram/SFD ተግባራዊ መደረግ አለበት።

ችግሮች
- ፍሳሽ በተገቢው መንገድ አለመወገድ በአካባቢ ላይ ጉዳት ያደርሳል።
- ዓ/ ሰራተኞች ስለ ተግባሩ ለማወቅ ሥልጠና መሰጠት
  አለበት።
- ለተቋሙ ጥሩ ትኩረት ተሰጥቶ የፍሳሽ አገልግሎት ለመስጠት
  የሚያስችል መሳሪያ ማሟላት ይገባል።

ጉዳዮችም

- ፕሮጀክቱ Open-dump ንያዘርጋ ሊሆን ·ይ::
- ESIA ጥናት የሚያካሄዱት ተግባራት ሊካሄድ ይገባል::

* ዜ.ጥን - env-talist

- የፕሮጀክቱ የአካባቢ ንምፋሪያ mitigation strategy ሊካሄድ ይገባል::

* ገ/ወ ርደም - በደምሆት ስተወ ጥ/ለቶ

* ፕሮጀክቱ ቁጠጠባ የሚሰራ ነው ተመለሰ ሲኖር ይገባ::

ወ/ሮ - project coordinator (መልሰን መቀሆስርን)

- ASFD-ቀጠሮ 73% የይስተዋፅ [illegible] ሊከናወን ይችላል::

ወ/ሮ - ም/ አገሪተ

- ለለአ አገልግሎት ሰጭን ምንጭ ለአዳ ፕሮጀክቱ ተመለከቶ ያገሌሀን ለቁርጠኝነት ያገራ ለህብረ ተሰባ ወገሉ ደራለገዋል::
- አዚ ይገኙ ተሳተፋሪዎች ይጠቅም ለ አገሌለሰቶች ያበረ ይወ ለሰጣ ያለገኙ::

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Website:www.belesengineering.com

LIST OF MEETING PARTICIPANTS

Aim: FGD with relevant sect oral offices

No.	Name	Position	Organization	Woreda	Kebele	Signature
1	Teweldebrhan Haile	V.manager	AWS	Adigrat	05	
2	H/silasie Tharmana	M. Board	AWS	"	04	
3	Hailay Kidanu	Technical head	AWS	"	06	
4	Yohannes Seyoum	S. Env. tel eng	UWSSP-II	Adigrat	05	
5	Mebrahtu G/Cherkos	Finance Head	A.WS	Adigrat	03	
6	Hailay Aregawi	branch Manager	A.W.S	Adigrat	05	
7	Ermias Melkesa	HRM	A.W.S	Adigrat	05	
8	Msgo? Girgesos	Environment		G/Afesom	05	
9	Seyoum Teka	NREM-Coord	Agr.	G/Afeshum	02	
10	Tsegay Kahsay	Environment	ADU	Adigrat	06	
1	G/mariam G/her	"	"	"	"	
2	Welday G/Kiros	V/Mayor	Administration	Adigrat	04	
3	Atakilti Hislass	Foodlab	Admin	Adigrat	06	
4	Kahsay G/meskel	water sup coor	econo	G/Afesh		
5	Tesfay Hagos	heads	Econom	G/Afeshum		
6	Tekle Tesfay	Head	Admin land	Adigrat	04	
7	Gezae Asgedom	Head	AWS	"	03	
8	Tewelde Beyene	Coordinator sanitation Municipal	MU.	Adigrat	01	
9	Gergis Abadi	Head	women affair	Adigrat	06	
20						

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Website:www.belesengineering.com

LIST OF MEETING PARTICIPANTS

Aim: FGD with relevant sect oral offices

No.	Name	Position	Organization	Woreda	Kebele	Signature
1	Musgun Gebeya	Survey	Land Admin	Glafeshum	Adigrat	[signature]
2	GHSadkanbeyene	Co-ordin	land Admin	99	02	[signature]
3	Gezahegn Mengiste	Specialist	SUWSSP	Adigrat	01	[signature]
4	Tsegu Segred	Expert	H.Spea	Adigrad	05	[signature]
5	Awraneh Amare	Head	Education	Adigrat	01	[signature]
6	Gmariam Bisrat	Expert	H Speka	Adigrat	04	[signature]
7	Azeb Elmariam	Head	finance	adigrat	04	[signature]
8	MERYEM ADEM	Head	Health	Adigrat	01	[signature]
9	Yosef haile	Environmental	municipal	Adigrat	03	[signature]
10	Mehret Hindeya	Head	Lows		03	[signature]
11	Ghirwot Tadesse	Depty council	city council	Adigrat	04	[signature]
12	Welday Kansay	pro.coor	UWSSP	Adigrat	04	[signature]
13	Brhane Fisseha	B/Manager	AWS	Adigrat	04	[signature]
14	Abiha Mulu (Dr.)	Expert	Belese	A.A		[signature]
15	Hailay Tsigab	11	A 11	Adigrat	02	[signature] 0914010192 80
16	Aysheshum Abesaw	Beles TL	Beles fty	AA	Akk	[signature]
17	Tenalem Ayenew	6/m	11	AA	Bole	[signature]
18						
19						
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Annex 2: List of PAPs

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY OF THE FAECAL SLUDGE TREATMENT PLANT IN ADIGRAT TOWN

1. List of Project Affected Persons (PAPs) by FSTP

S.N	Name	Fathers' Name	Sex	Age	Family Size (Number)			Woreda	Kebele
					Male	Female	Total		
1	Megalsti	Teka	M	57	4	3	7	Ganta-afeshum	Gola-Genahti
2	Desta	Abrha	M	62	6	6	12	Ganta-afeshum	Gola-Genahti
3	Desta	Atsbha	F	45	3	2	5	Ganta-afeshum	Gola-Genahti
4	Tsadkan	Gebremedhin	F	50	2	1	3	Ganta-afeshum	Gola-Genahti
5	Elsa	Heshe	F	50	1	2	3	Ganta-afeshum	Gola-Genahti
6	Berihu	Abdela	M	82	1	0	1	Ganta-afeshum	Gola-Genahti
7	Trhas	Lemlem	F	60	0	1	1	Ganta-afeshum	Gola-Genahti
8	Nurya	Umer	F	40	4	4	8	Ganta-afeshum	Gola-Genahti
9	Lemalmo	Tesfay	F	35	0	1	1	Ganta-afeshum	Gola-Genahti
10	Ali	Dawd	M	70	1	0	1	Ganta-afeshum	Gola-Genahti
11	Brhane	Syum	M	57	3	3	6	Ganta-afeshum	Gola-Genahti
12	Hailay	Hadish	M	54	2	3	5	Ganta-afeshum	Gola-Genahti
13	Hadish	Hagos	M	54	2	3	5	Ganta-afeshum	Gola-Genahti
14	Medhin	Lemlem	F	55	1	3	4	Ganta-afeshum	Gola-Genahti
15	Alem	Embay	M	59	1	1	2	Ganta-afeshum	Gola-Genahti
16	Ataklti	Gebremedhin	F	60	0	1	1	Ganta-afeshum	Gola-Genahti
17	Hiwot	Gebremariam	F	48	3	5	8	Ganta-afeshum	Gola-Genahti
18	Seada	Husen	F	38	3	6	9	Ganta-afeshum	Gola-Genahti
19	Berhe	Kinfe	M	48	1	0	1	Ganta-afeshum	Gola-Genahti
20	Tros	Kahhisay	F	70	0	1	1	Ganta-afeshum	Gola-Genahti
21	Desta	Syum	M	52	3	2	5	Ganta-afeshum	Gola-Genahti
22	Almaz	Embay	F	40	5	3	8	Ganta-afeshum	Gola-Genahti
23	Kiros	Gebreyesus	F	70	0	1	1	Ganta-afeshum	Gola-Genahti
24	Berhe	Syum	M	60	4	3	7	Ganta-afeshum	Gola-Genahti

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Total PAPs By the FSTP	**50**	**55**	**105**		

2. List of Project Affected Persons (PAPs) by Access Road

S.N	Name	Fathers' Name	Sex	Age	Family Size (Number)			Woreda	Kebele
					Male	Female	Total		
1	Bahlibi	Syum	M	65	4	1	5	Ganta-afeshum	Gola-Genahti
2	Tewldemedhin	Asefa	M	84	4	0	4	Ganta-afeshum	Gola-Genahti
3	Heshe	Tsegay	M	62	2	2	4	Ganta-afeshum	Gola-Genahti
4	Teame	Embaye	M	52	3	8	11	Ganta-afeshum	Gola-Genahti
5	Kibatu	G/slasse	M	28	1	0	1	Ganta-afeshum	Gola-Genahti
6	Abeba	Nayzgi	F	46	4	2	6	Ganta-afeshum	Gola-Genahti
7	Dehab	Amare	F	60	0	1	1	Ganta-afeshum	Gola-Genahti
8	Maero	Mohamed	F	78	0	1	1	Ganta-afeshum	Gola-Genahti
9	Medhin	Gebre	F	62	0	1	1	Ganta-afeshum	Gola-Genahti
10	Abrhet	Teka	F	75	0	1	1	Ganta-afeshum	Gola-Genahti
11	Abrha	Aregawi	M	54	4	4	8	Ganta-afeshum	Gola-Genahti
12	Hagos	Desta	M	60	1	0	1	Ganta-afeshum	Gola-Genahti
13	Desta	Hadera	M	90	0	1	1	Ganta-afeshum	Gola-Genahti
14	Gebremikael	Kahisay	M	70	1	0	1	Ganta-afeshum	Gola-Genahti
Total PAPs By the access road					**24**	**22**	**46**		

List Approved By: Mebrahtu Mezgebe

Position: VA Administrator

Signature:

Date:

Annex 3: List of Consulted Key Experts from Different Stockholder Offices

S.No.	name	position	Mobile
1	Mr. Welday Kahisay	Project Office Coordinator	0914784301
2	Mr. Yohaness Seyoum	Project Office Environmentalist	0920872106
3	Mr. Gezae Asgedom	Utility Manager	
4	Mr. Yosef Hailu	Adigrat Sanitation and Beautification Office Environmentalist	0923300592
5	Mr. Tewelde Beyene	Adigrat Sanitation and Beautification Office Environmentalist	0914030543
6	Mr. Hailay Kidane	Adigrat Water Supply and Sewerage Office	0912264154
7	Mr. Biruh Desta	Adigrat Town Planning	0914765330
8	Mr. Aregawi Mekonen	Adigrat Town Land Process Owner	0914126145
9	Mr. Awiraneh Amare	Adigrat Education Bureau	0914724018

Annex 4: General Table of Content Outline of the ARAP for the Proposed FSTP

TABLE OF CONTENTS

Annex 5: Chance Find Procedure

Purpose of the Chance Find Procedure:

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation. A Chance Find Procedure, as described in IFC Performance Standard 8 and relevant law on Cultural Heritage of Ethiopia, is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

Scope of the Chance Find Procedure:

This procedure is applicable to all activities conducted by the personnel, including contractors that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

Induction/Training:

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

Chance Finds Procedure:

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

- Stop all works in the vicinity of the find, until a solution is found for the preservation of these artifacts, or advice from the relevant authorities is obtained;
- Immediately notify a foreman. The foreman will then notify the Construction Manager and the Environment Officer (EO)/Environmental Manager (EM);
- Record details in Incident Report and take photos of the find;
- Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
- Preliminary evaluation of the findings by archaeologists. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;
- Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the Ministry/Agency, once completed.
- In case of significant find the Agency/Ministry (Agency for Protection of National Heritage or Archaeological Research Centre, hereinafter referred to as Heritage team should be informed immediately and in writing within 7 days from the find.
- The onsite archaeologist provides the Heritage team with photos, other information as relevant for identification and assessment of the significance of heritage items.

- The Ministry must investigate the fact within 2 weeks from the date of notification and provide response in writing.
- Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
- Construction works could resume only after permission is granted from the responsible authorities.
- In case no response received within the 2 weeks period mentioned above, this is considered as authorization to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photolog, copies of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports – kept.

Additional Information:

Management Options for Archaeological Site:

- ***Site Avoidance.*** If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option)
- ***Mitigation.*** If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option.)
- ***Site Protection.*** It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site- specific.

Management Of Replicable and Non-Replicable Heritage:

Different approaches for the finds apply to replicable and non-replicable heritage.

Replicable Heritage:

Where tangible cultural heritage that is replicable and not critical is encountered, mitigation measures will be applied.

The mitigation hierarchy is as follows:

- Avoidance;
- Minimization of adverse impacts and implementation of restoration measures, in situ;
- Restoration of the functionality of the cultural heritage, in a different location;
- Permanent removal of historical and archaeological artifacts and structures; and

Compensation of loss - were minimization of adverse impacts and restoration not feasible.

Non-Replicable Heritage:

Most cultural heritage is best protected by in situ preservation, since removal is likely to result in irreparable damage or even destruction of the cultural heritage.

Nonreplicable cultural heritage must not be removed unless all of the following conditions are met:

- There are no technically or financially feasible alternatives to removal;
- The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and

Any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

Human Remains Management Options:

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above.

There are two possible courses of action:

- ***Avoid.*** The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.
- ***Exhumate.*** Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can recommence in the area of the discovery.

Annex 6: Contractor's E & S Guidelines (Environmental and Social Requirements for Contractors)

The contractor shall implement all activities under this contract in compliance with the requirements of the World Bank Environmental & Social Framework and the applicable laws of Ethiopia. All contractors engaged on the project operate in a manner consistent with the requirements of the environmental and social standards (ESSs), To achieve this, the contractor shall:

- Incorporate the requirements of ESMF and all other relevant E&S instruments in the bid document.
- Adopt the sub-project ESMPs and where necessary develop Construction Environmental and Social Management Plans (C-ESMPs) to help manage construction risks.
- Make sure that the C-ESMP should get approval from World Band and relevant regulatory bodies prior to commencing the project.
- Implement, and review site specific contractor- Environmental and Social Management Plans (C- ESMPs) as required by the ESMF and specifically the Labor Management Procedures (LMP) including, OHS plans, labor recruitment plan, code of conducts for employees, waste management plan, emergency plan, protection of biodiversity, land clearing and erosion control, traffic management, noise and dust control, and labor influx, communicable diseases and others.
- Submit a recruitment plan containing number of staff required, intended working condition, Intended locations of staff and Job specifications in terms of qualification and experience to the Project Management Unit (PMU) or any other assigned responsible body for review and approval.
- Publishes the job invitation in the appropriate media (local press or direct invitation for contracted worker, or word of mouth through local leaders for community workers) to ensure all potential candidates have access to the information, including women and persons with disabilities,
- Employ qualified E&S personnel to oversee E&S performance, and that contractor staffing, and resources are commensurate with the magnitude and timing of work and potential E&S risks.
- Ensure all workers have signed a Code of Conduct (see annex 3 of ESMF.
- Prepare E&S training programs for workers and for communities if necessary.
- Ensure the employee are aware of E&S commitments and their responsibilities, which including key Job Specifications, terms and Conditions of Employment, special Codes of Conduct, disciplinary Procedures, workers' Grievance Mechanism, freedom to join and participate fully

in workers association activities, key E&S aspects of the ESMF and other E&S instruments, and emergency Preparedness before work commencement.

- Adopt and implement the national, regional, and international best practices on Safety, Health, Environment and Social risk management.
- Ensure the provision of Safety, Health, Environment and Social risk information to employees, communities, and all relevant stakeholders.
- Focus on compliance with all applicable safety, health, environmental and Social Multilateral Agreements, policies, national laws, regulations, and Codes of practice applicable to the activities being implemented.
- Ensure that substantial resources are allocated for the prevention of accidents, injuries, and fatalities in all areas of operation including the provision of a safe working environment for all.
- Promote of sustainable consumption and utilization of natural resources focusing on the prevention of environmental pollution, and environmental degradation. Export E&S performance timely (on at least a monthly basis throughout the construction phase, including mobilization, construction, and demobilization), including investigate and resolve all complaints, issues, incidents, accidents, and non-conformities. o) Participate regular weekly meeting to evaluate E&S performance-monitoring results and to improve its performance.
- Establish, maintain, and update relevant environmental and social risk management registers as required.
- Conform to the requirements and provisions of the World Bank Environmental and Social Framework (ESF) as read with the applicable Environmental, Health and Safety Guidelines (EHSG).
- Monitor and keep records on E&S performance in accordance with the E&S management plans. This may include monitoring of E&S matters, scheduled and unscheduled inspections to work locations, observations made during routine activities, desk reviews, drills, and any other monitoring protocols implemented by the contractor to ensure E&S compliance.

Failure to comply with the Environmental and Social Safeguarding requirements shall constitute a violation of contractual provisions and may lead to the cancelation of the contract. The responsible body may recover any unanticipated costs from any funds withheld in terms of the contract to remedy any environmental and social residual risks that shall be attributed to the contractor's activities. Generally, the contractors shall take corrective action(s) for major noncompliance. The following are some of the major noncompliance that contractors need to take note of:

- Failure to submit mandatory quarterly progress report.
- Failure to avail for inspection specified documentation pertaining to the implementation of the ESMP.
- Failure to timely notify and submit incident and accident investigation report.
- Failure to appoint or replace a competent and experienced EHS officer.
- Failing to enforce C-ESMPs including provision of adequate appropriate PPE.
- Recruitment of nontechnical staff from outside the local community.

Annex 6. Rationale and Source for Budget Estimation for the ESMP

An overview of the sources and budget estimation methodologies for environmental and social management, as well as the monitoring of World Bank-funded Environmental and Social Impact Assessments (ESIAs) linked with faecal sludge management includes (but not limited to) the following:

- Cost-Benefit Analysis: Determine the economic viability of social and environmental initiatives by weighing their costs and expected benefits.
- Estimating Unit Cost: For specific tasks (such as infrastructure development, monitoring, and training), established unit costs based on completed projects are referenced.
- Activity-Based Costing: After breaking down the project into smaller components, assigning expenses to each of the separate activities (such as evaluations, consultations, and training) has been considered.
- Contingency Funds: Set aside a percentage of the entire budget (typically 10-20%) to cover unforeseen expenses or overruns in social and environmental management.
- Framework for Monitoring and Evaluation: Provide a comprehensive M&E framework that enables periodic evaluations of the cost-effectiveness and efficiency of environmental and social management activities.
- Costs related to stakeholder engagement: To ensure active participation in the ESIA process, the costs of community consultations, workshops, and stakeholder meetings are considered based on the local or national usual practices and reports.

Funding Sources

- World Bank finances: Direct funding for social and environmental management is typically included in project budgets.
- Government funding: National and local governments' budgets may include funds for social and environmental management projects. Availability of federal, regional, or municipal funds explicitly designated for activities that increase environmental sustainability.
- Other non-governmental organizations (NGOs) or international organizations may give additional funding or technical support for ESIAs and related activities.

Guidance taken from:

- World Bank (2020): Environmental and social framework.
- World Bank (2017): Guidelines for Preparing Environmental and Social Impact Assessments. Ethiopian Environment Protection Authority (2016): Environmental Impact Assessment Proclamation No. 299/2002.
- Ethiopia's Ministry of Water, Irrigation, and Energy (MoWIE) (2018): National Fecal Sludge Management Strategy.
- UN Development Programme (UNDP) (2019): Guidelines for Ethiopian Environmental and Social Management Systems
- Ethiopian Water and Sanitation Services Project (2015): Environmental and Social Management Framework (ESMF).

Annex 7. Legal documents of the consultant

በኢትዮጵያ ፌደራላዊ ዲሞክራሲያዊ ሪፐብሊክ ገቢዎች ሚኒስቴር

የመካከለኛ ግብር ከፋዮች ቁጥር 2 ቅ/ጽ/ቤት

The Federal Democratic Republic of Ethiopian Ministry of Revenues

ቁጥር: መ/ቁ.ሃ2-ሀ 9119083

ቀን: ግንቦት 20 2017

ለሚመለከተው ሁሉ

ጉዳዩ:- በጨረታ ለመካፈል/ለመሳተፍ የሚሰጥ የምስክር ወረቀት/ክሊራንስ/ ይመለከታል፤

የግብር ከፋይ ስም በለስ ኢንጂነሪንግ ኃላ/የተ/የግ/ማህበር

የግብር ከፋይ መለያ ቁጥር 0011730824

የድርጅቱ አድራሻ

ክልል አ.አ ክ/ከተማ ቦሌ ወረዳ 06 ቀበሌ --

የቤት ቁጥር አዲስ ስልክ ቁጥር 0911230110 ፖ.ሣ.ቁ ---

የመኖሪያ አድራሻ /ባለቤት/ሥራ አስኪያጅ/

ክልል አ.አ ክ/ከተማ ቦሌ ወረዳ 14 ቀበሌ --

የቤት ቁጥር 6211 ስልክ ቁጥር 0911230110 ፖ.ሣ.ቁ ---

ከላይ ስሙ እና መለያ ቁጥሩ የተጠቀሰው ግብር ከፋይ በጨረታ ለመሳተፍ እንዲችል የግብር ግዴታውን ስለመወጣቱ የሚያረጋግጥ ደብዳቤ እንዲፃፍለት 19/09/2017 ዓ.ም በተፃፈ ማመልከቻ ጠይቋል።

ግብር ከፋዩ ግብር/ታክስ ግዴታውን እየተወጣ በመሆኑ ይህ ደብዳቤ ከተፃፈበት ጊዜ ጀምሮ 4 (አራት) ወር ድረስ በጨረታ መሳተፍ እንዲቻል ይህ የምስክር ወረቀት/ክሊራንስ/ የተሰጠው መሆኑን እንገልፃለን።

ከሠላምታ ጋር

ማርዬ ተገኝ ደቦ

የታክስ ከፋዮች ምዝገባና

አገልግሎት ቡድን አስተባባሪ

ማሳሰቢያ:- በጨረታ ተሳታፊ ሆነው ያሸነፉ ድርጅቶች መረጃ በገቢ ግብር አዋጅ ቁጥር 979/2008 መሠረት ለባለሥልጣኑ የመረጃና የስጋት ሥራ አመራር ዳይሬክቶሬት መተባበር ይኖርበታል

በአዲስ አበባ ከተማ አስተዳደር ንግድ ቢሮ
Addis Ababa City Administration Trade Bureau

ሴሪ ቁ. № 2125293

የግብር ከፋይ መለያ ቁጥር/TIN 0011730824
የንግድ ምዝገባ ቁጥር BL/AA/2/0002745/2005
Principal Registration No
የቀድሞው የምዝገባ ቁጥር 06/2/30203/02
Previous Registration No
የቀድሞው የምዝገባ ቀን 10/10/2002
First Registration Date 9/1/2005
መጀመሪያ የተመዘገበበት ቀን
የተሻሻለበት ቀን : 7/5/2010
Modification Date

የንግድ ምዝገባ ምስክር ወረቀት
በንግድ ምዝገባ የፈቃድ አዋጅ ቁጥር 980/2008 መሰረት የተሰጠ

Commercial Registration Certificate
Issued under Commercial Registration and Business license proc No. 980/2016

1.የግለሰቡ/ድርጅቱ ስም	በለስ ኢንጂነሪንግ ኃላፊነቱ የተወሰነ የግል ማህበር	1.Owner/ Company Name	BELES ENGINEERING PRIVATE LIMITED COMPANY
2. ዜግነት	በኢትዮጲያ የተመዘገበ	2. Nationality	Registered in Ethiopia
4. የሥራ አስኪያጅ ስም	አቶ ጤናዓለም አየነው ጉግያ	4. General Manager Name	Mr. TENALEM AYENEW TGYA
5. የንግድ ድርጅቱ አድራሻ		5. Business Address	
ክልል: አዲስ አበባ	ዞን/ክፍለ ከተማ: ቦሌ	Region: Addis Ababa	Zone/Sub City: Bole
ከተማ: አዲስ አበባ	ወረዳ: 06	City: Addis Ababa	Woreda: 06
ቀበሌ: -----	የቤት ቁጥር: አዲስየቢ.ቁ417	Kebele: -----	House No.: .417
ፖ.ሳ.ቁ	ስልክ ቁጥር: 0116634843	P.O.Box	Tel. No: 0116634843
ፋክስ: ---	ኢ-ሜይል: ----	Fax: ----	E-mail: ----
6. ካፒታል በኢት. ብር	1,873,000.00	6. Capital in ETB	1,873,000.00
7. የተሰማራባቸው የንግድ ሥራዎች	በጀርባው ገፅ ይመልከቱ	7. Type of activities engaged	See Back Page

በግብር ከፋይ መለያ ቁጥር 0011730824 የተመዘገበ መሆኑን እናረጋግጣለን ።
ይህ የምዝገባ የምስክር ወረቀት ዛሬ 7/5/2010 ዓ.ም
በ አዲስ አበባ ተሰጠ ።

has duly been registered under TIN 0011730824
This Registration Certification is issued in 1/15/2018
on Addis Ababa

የኃላፊ ስም
Official's Name

ፊርማ
Signature

ማህተም
Seal

ማሳሰቢያ፦ 1. ይህ የንግድ ምዝገባ በአቅጅ ቁጥር 980/2008 መሠረት በየዓመቱ ሃምሌ 1 ቀን እስከ ጥቅምት 30 ቀን ድረስ የሚታደስ ሲሆን በጊዜ ገደቡ ያልታደሰ ንግድ ምዝገባ ይሰረዛል።

N.B. 1. This License Shall be renewed annually in accordance with Regulation no 980/2016 from July 1 to October 30 E.C with out penalty otherwise Commercial Registration Certificate would be Cancelled

2. ይህ የንግድ ምዝገባ የምስክር ወረቀት በዋስትና ወይም በሌላ ሊያዝ አይችልም።
The holder of this License is forbidden for surety ship or debt

የቅርጫፍ አድራሻ :

Branch Address :

8. የፋይናንስ ኢንሹራንስ የሪል እስቴት እና የንግድ ስራዎች
6. የጅምላ እና ችርቻሮ ንግድ፣የመኪና እና የሞተር ብስክሌት ጥገና፣የቤት ውስጥ እቃዎች የሆቴል እና ሬስቶራንት የአስመጪና ላኪነት ንግድ ስራዎች
5. ኮንስትሪክሽን
1. ግብርና ፣አደን፣የደን ልማት እና የአሳ ማስገር
3. ማኑፋክቸሪንግ

8. FINANCIAL INTERMEDIATION, INSURANCE, REAL ESTATE AND BUSINESS SERVICES
6. WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES, MOTOR CYCLES AND PERSONAL AND HOUSEHOLD GOODS; HOTELS AND RESTAURANTS; IMPORT & EXPORT
5. CONSTRUCTION
1. Agriculture, Hunting, Forestry, And Fishing
3. MANUFACTURING

የኢትዮጵያ ፌዴራላዊ ዴሞክራሲያዊ ሪፐብሊክ
የኢትዮጵያ ገቢዎችና ጉምሩክ ባለሥልጣን
Federal Democratic Republic of Ethiopia.
ETHIOPIAN REVENUES AND CUSTOMS AUTHORITY

የግብር ከፋይ ምዝገባ ሰርተፊኬት
TAXPAYER REGISTRATION CERTIFICATE

የግብ ከፋይ መለያ ቁጥር: Taxpayer Identification Number:	0011730824
የድርጅት/የግለሰብ ስም: Name of Business/Individual:	በለስ ኢንጂነሪንግ ኃላ/የተ/የግ/ማህበር BELES ENGINEERING PLC
የተመዘገበ አድራሻ/Registered Address:	
ክልል: Region:	አዲስ አበባ ADDIS ABABA
ዞን/ክ.ከተማ: Zone/Sub City:	ቦሌ BOLE
ወረዳ: Woreda:	
ቀበሌ /ገበሬ ማህበር/: Kebele/Farmer's Assoc.:	WOREDA 06 WOREDA 06
የቤት ቁጥር: House No.:	NEW/O.417
ESIC Sub-group: ESIC Sub-group:	50230 - GENERAL CONTRACTOR EXCEPT WATER WORK CONTRACTOR 88222 - CONSULTANCY SERVICE FOR ENVIRONMENTAL AUDITING AND ENVIRON 88730 - WATER WORKS CONSULTANCY
የሰጠው ተቋም: Issuing Authority:	የኢትዮጵያ ገቢዎችና ጉምሩክ ባለሥልጣን ETHIOPIAN REVENUES AND CUSTOMS AUTHORITY
የተሰጠበት ቀን: Date of Issuance:	08 TIRR 2010 16-JAN-18

ይህ የምስክር ወረቀት የግብር ከፋዩን ብቸኛ የግብር ከፋይነት ምዝገባ ሲሆን ከዚህ ቀደም የነበሩ የግብር ከፋይነት ምዝገባ ሰነዶች ካሉ በዚህ ሰነድ የተተኩ መሆናቸውን ነው።
ከላይ በተጠቀሰው መረጃ ላይ ማንኛውም አይነት ለውጥ ቢደረግ ግብር ከፋዩ ለሚመለከተው የግብር ሰብሳቢ ጽ/ቤት የማሳወቅ ግዴታ አለበት።

This certificate represents the sole and only registration as a taxpayer and supersedes all prior registration documentation.
The taxpayer is responsible for notifying the appropriate Tax Office of any changes to the above information.

Registration & Deregistration Officer

የሰርተፊኬት ቁ.:
Certificate No.: 1321218610010

የባለሥልጣኑ መ/ቤት ማህተም
Seal of Issuing Authority

በኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፐብሊክ
የኢትዮጵያ ገቢዎችና ጉምሩክ ባለሥልጣን
የተጨማሪ እሴት ታክስ
የምዝገባ የምስክር ወረቀት

The Federal Democratic Republic of Ethiopia
Ethiopian Revenues and Customs Authority

Value Added Tax Registration Certificate

አቶ/ወ/ሮ ወይም የድርጅት ስም በለስ ኢንጂነሪንግ ኃ/የተ/የግ/ማህበር
የንግድ ስም (ካለ) በለስ ኢንጂነሪንግ ኃ/የተ/የግ/ማህበር
አድራሻ/ክልል/ አ.አ ዞን/ ክፍለከተማ ቦሌ ወረዳ 06
ቀበሌ/ገ/ማህበር ______ የቤት ቁጥር NEW/ቤ.ቁ417 ስልክ ቁጥር 116634843 ፖ.ሣ.ቁ ______
የግብር ከፋይ መለያ ቁጥር 0011730824 የሚታወቀት በተጨማሪ እሴት ታክስ አዋጅ ቁጥር 285/ 1994
አንቀጽ 16 ወይም አንቀጽ 18 መሰረት በተጨማሪ እሴት ታክስ ቁጥር 3037400010 ከ መስከረም 01 ቀን 2003 ዓ.ም ጀምሮ ስለተመዘገበ ይህ የምዝገባ ሰርተፊኬት ተሰጥቷቸዋል::

Mr./s or Company Name BELES ENGINEERING PLC
Trade name /If any/ BELES ENGINEERING PLC
Address (Region) ADDIS ABABA Zone / Sub city BOLE Woreda NO WOREDA-144
Kebele/Farmers Ass. WOREDA 06 House No. NEW/O.417 Telephone No. 116634843 P.O. Box
Whose Taxpayer Identification Number (TIN) is 0011730824 has been registered in accordance with VAT Proclamation No. 285/2002
Article 16 or Article 18 and hence, this VAT registration Number 3037400010 has been issued starting from 11-SEP-2010.

16-JAN-2018/ 4324930010

የደንበኞች አገልግሎት ዳይሬክቶሬት ዳይሬክተር
Customers' Service Directorate Director

የኢትዮጵያ ኮንስትራክሽን ባለሥልጣን
ETHIOPIAN CONSTRUCTION AUTHORITY

ሴሪያል ቁጥር
Serial No. 00325

የምዝገባ ቁጥር፡ ውሃአድ/5/35
መጀመሪያ የተሰጠበት ቀን 14/11/2007

የአማካሪ ድርጅት የብቃት ማረጋገጫ ምስክር ወረቀት

የኢትዮጵያ ኮንስትራክሽን ባለሥልጣን በሚኒስቴሮች ምክር ቤት የባለሥልጣኑን ሥልጣን፡ ተግባር እና አደረጃጀት ለመወሰን በወጣው ደንብ ቁጥር 524/2015 አንቀፅ 5/12 በተሰጠው ስልጣን መሰረት፡-

የድርጅት ስም ፡በለስ ኢንጂነሪንግ ኃ/የተ/የግ/ማህበር ዜግነት ኢትዮጲያዊ

የቴክኒካል ስራ አስኪያጅ ስም፡ ፡ጤናአለም አየነው ትግያ

አድራሻ፡ ከተማ፤ አዲስ አበባ ክ/ከተማ፡ ቦሌ

ወረዳ/ቀበሌ፡ 14 ፖ.ሣ.ቁ. ስልክ.ቁ. 0911230110

የተመዘገቡበት መስክ፡ ጠቅላላ የውሃ ሃብት አማካሪ

ደረጃ፡ 05/አምስት

ለደረጃው የሚያስፈልገውን መስፈርት ያሟላ መሆኑን በማረጋገጥ ይህንን የብቃት ማረጋገጫ ምስክር ወረቀት ሰጥቷል፡፡

ከሠላምታ ጋር

Registration No. WRCF/5/35

Date of Issue 21/07/2015

1st

CERTIFICATE OF COMPETENCE FOR CONSULTANT

ETHIOPIAN CONSTRUCTION AUTHORITY BY VIRTUE OF THE AUTHORITY GIVEN TO IT BY SUB ARTICLE (12) OF ARTICLE 5 OF THE REGULATION No. 524/2022 PROVIDED FOR THE DEFINITION OF THE ORGANIZATION, POWERS AND DUTIES OF THE AUTHORITY BY COUNCIL OF MINISTERS, HAS ISSUED THIS CERTIFICATE OF COMPETENCE TO

NAME - OF- FIRM BELES ENGINEERING P.L.C

NATIONALITY ETHIOPIAN

NAME - OF - TECHNICAL - MANAGER : TENALEM AYENEW TEGAYE

BUSINESS ADDRESS - CITY ADDIS ABABA SUB - CITY BOLE

WEREDA/KEBELE 14 P.O. BOX TELE 0911230110

REGISTERED - AS GENERAL WATER RESOURCE CONSULTANT CATEGORY 05/FIVE

THIS CERTIFICATE OF COMPETENCE IS ISSUED IN COMPLIANCE WITH THE PROVISIONS OF THE GUIDELINES FOR THE GRADE

እስከ ሰኔ. 30.201[illegible]

VALID UPTO JU[illegible]07[illegible]

Amanuel Mijana

WITH REGARDS.

B.S.S.P.E

የኢትዮጵያ ኮንስትራክሽን ባለሥልጣን

ETHIOPIAN CONSTRUCTION AUTHORITY

ሴሪያል ቁጥር
Serial No.

የምዝገባ ቁጥር ወ-ሃ-ኢ/5/35
Registration No. WPCF/5/35

ታድሷል

RENEWED

እስከ 30/10/2017 ዓ.ም

VALID UNTIL 07/07/2025 G.C

ስምና ፊርማ/Name & Signature

ቀን/Date 10/07/2017

እስከ ______ ዓ.ም

VALID UNTIL ______ G.C

ስምና ፊርማ/Name & Signature

ቀን/Date ______

እስከ ______ ዓ.ም

VALID UNTIL ______ G.C

ስምና ፊርማ/Name & Signature

ቀን/Date ______

እስከ ______ ዓ.ም

VALID UNTIL ______ G.C

ስምና ፊርማ/Name & Signature

ቀን/Date ______

ቁጥር/Ref.No 11/1·1/9333/17

ቀን/Date 15/8/2017

Trucking #: EPA/1720/250407/1

በኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፑብሊክ
የአካባቢ ጥበቃ ባለስልጣን
FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
ENVIRONMENTAL PROTECTION AUTHORITY

የብቃት ማረጋገጫ ምስክር ወረቀት
CERTIFICATE OF COMPETENCE

የሚያበቃበት ቀን

የታደሰበት ቀን፡ 15/08/2017 ዓ.ም

የሚያበቃበት ቀን፡ 14/08/2019 ዓ.ም

Valid until

Renewal date: 23/04/2025 G.C

Expire date: 22/04/2027 G.C

የአካባቢ ጥበቃ ባለስልጣን በአዋጅ ቁጥር 299/1995 እና መመሪያ ቁጥር 1005/2016 መሠረት የአካባቢ እና ማህበረሰብ ተፅእኖ ግምገማ ጥናት የማማከር አገልግሎት ብቃት ማረጋገጫ

ለ፡ **በለስ ኢንጅነሪንግ ኃ/የተ/የግ/ማህበር**[CO-0012]

የብቃት ደረጃ፡ 1 ተሰጥቷል።

ENVIRONMENTAL PROTECTION AUTHORITY, BY PROCLAMINATION NO. 299/2002 AND DIRECTIVE NO. **1005/2024**, HAS ISSUED THIS ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDIES CONSULTANCY CERTIFICATE OF COMPETENCE.

TO: **BELES ENGINEERING PLC [CO-0012]**

COMPETENCE LEVEL: **1**

ክሠላምታ ጋር

WITH REGARDS

Kassahun Wakoya
Environmental licensing service desk head

Shiferaw Negash Bira
Lead Executive, Environment and Social Impact Assessment and Licensing

ያዘጋጀው
Prepared by

ያረጋገጠው
Checked by

ያፀደቀው
Approved by

www.epa.gov.et info@epa.gov.et +25111170 4138 /4064 /4065

በአዲስ አበባ ከተማ አስተዳደር ንግድ ቢሮ
Addis Ababa City Administration Trade Bureau

የግብር ከፋይ መለያ ቁ. /TIN 0011730824
የንግድ ምዝገባ ቁ. BL/AA/2/0002746/2005
Principal Registration No.
የቀድሞው ንግድ ፈቃድ ቁጥር 06/2/24703/03
Previous License No.
የንግድ ሥራ ፈቃድ ቁጥር 14/673/9911/2005
Business License No.
ቀድሞ ተሰጠበት ቀን 1/10/2003
Previous Date of issuance
የተሰጠበት ቀን 9/1/2005
Date of issuance
የታደሰበት ቀን : 23/3/2017
Renewal Date

የንግድ ሥራ ፈቃድ

በንግድ ምዝገባና ፈቃድ አዋጅ ቁጥር 980/2008 መሰረት ተሰጠ

1. **የግለሰቡ/ድርጅቱ ስም** በለስ ኢንጅነሪንግ ኃላፊነቱ የተወሰነ የግል ማህበር
2. **ዜግነት** በኢትዮጲያ የተመዘገበ
3. **የንግድ ስም**
4. **ሥራ አስኪያጅ ስም** አቶ ጤናዓለም አየነው ትግያ
5. **የንግድ ድርጅቱ አድራሻ**

ክልል አዲስ አበባ ዞን/ክፍለ ከተማ ቦሌ
ወረዳ 06 ቀበሌ ---
የቤት ቁጥር አዲስየቢ.ቁ417 ስልክ ቁጥር 0116634843
ፋክስ ኢ-ሜይል

6. **የንግድ ሥራ መስክ**
(86515)በዉሃ ስራዎች የማማከር አገልግሎት
7. **ካፒታል በኢት ብር** 1,873,000.00

ይህ የንግድ ፈቃድ ዛሬ 23/3/2017 በ አዲስ አበባ ተሰጠ

የሃላፊ ስም/Name of Official
ፊርማ/Signature

ማህተም Seal

Business License

Issued Under Commercial Registration and Business license proc.No 980/2016

1. **Owner/Company Name** BELES ENGINEERING PRIVATE LIMITED COMPANY
2. **Nationality** Registered in Ethiopia
3. **Trade Name**
4. **General Manager Name** Mr. TENALEM AYENEW TGYA
5. **Business Address**

Region Addis Ababa Zone/Sub City Bole
Woreda 06 Kebele ---
House No. አዲስየቢ.ቁ417 Tel.No 0116634843
Fax E-mail

6. **Field of Business**
(86515)Consultancy service on water Works
7. **Capital in ETB** 1,873,000.00

This Business License is issued in Addis Ababa
this day 12/2/2024

ለ 2017 ዓ.ም

ማሳሰቢያ- 1. ይህ የንግድ ፍቃድ በዓዋጅ ፈቃድ ቁጥር 980/2008 መሠረት እንደ የበጀት ዓመቱ በእዋጅ በተቀመጠው መሰረት መታደስ አለበት።
N.B. This License Shall be renewed in accordance with Proclamation No. 980/2008 as per the fiscal year.

2. ይህ የንግድ ፈቃድ የምስክር ወረቀት በዋስትና ወይም በእዳ ሊያዝ አይችልም።
The holder of this License is forbidden for surety ship or debt

በአዲስ አበባ ከተማ አስተዳደር ንግድ ቢሮ
Addis Ababa City Administration Trade Bureau

የማብር ከፋይ መለያ ቁ./TIN 0011730824
የንግድ ምዝገባ ቁ. BL/AA/2/0002746/2005
Principal Registration No.
የቀድሞው ንግድ ፈቃድ ቁጥር
Previous License No.
የንግድ ሥራ ፈቃድ ቁጥር 14/673/988424/2007
Business License No.
ቀድሞ ተሰጠበት ቀን
Previous Date of issuance
የተሰጠበት ቀን 15/2/2007
Date of issuance
የታደሰበት ቀን : 23/3/2017
Renewal Date

የንግድ ሥራ ፈቃድ

በንግድ ምዝገባና ፈቃድ አዋጅ ቁጥር 980/2008 መሰረት ተሰጠ

1. **የግለሰቡ/ድርጅቱ ስም** በለስ ኢንጅነሪንግ ኃላፊነቱ የተወሰነ የግል ማህበር
2. **ዜግነት** በኢትዮጵያ የተመዘገበ
3. **የንግድ ስም**
4. **ሥራ አስኪያጅ ስም** አቶ ጤናዓለም አየነው ትግያ
5. **የንግድ ድርጅቱ አድራሻ**
   ክልል አዲስ አበባ ዞን/ክፍለ ከተማ ቦሌ
   ወረዳ 06 ቀበሌ ---
   የቤት ቁጥር አዲስየቢ.ቁ417 ስልክ ቁጥር 0911230110
   ፋክስ ኢ-ሜይል
6. **የንግድ ሥራ መስክ**
   (51114)ጠቅላላ ስራ ተቋራጭ ከውሀ ስራዎች በስተቀር
7. **ካፒታል በኢት ብር** 1,873,000.00

ይህ የንግድ ፈቃድ ዛሬ 23/3/2017 በ አዲስ አበባ ተሰጠ።

የሃላፊ ስም/Name of Official
ፊርማ/Signature

ማህተም Seal

Business License

Issued Under Commercial Registration and Business license proc.No 980/2016

1. **Owner/Company Name** BELES ENGINEERING PRIVATE LIMITED COMPANY
2. **Nationality** Registered in Ethiopia
3. **Trade Name**
4. **General Manager Name** Mr. TENALEM AYENEW TGYA
5. **Business Address**
   Region Addis Ababa Zone/Sub City Bole
   Woreda 06 Kebele ---
   House No. አዲስየቢ.ቁ417 Tel.No 0911230110
   Fax E-mail
6. **Field of Business**
   (51114)General Contractor Except water work
7. **Capital in ETB** 1,873,000.00

This Business License is issued in Addis Ababa this day 12/2/2024

ለ 2017 ታድሷል

ማሳሰቢያ- 1. ይህ የንግድ ፍቃድ በዓዋጅ ፈቃድ ቁጥር 980/2008 መሠረት እንደ የበጀት ዓመቱ በእዋጅ በተቀመጠው መሰረት መታደስ አለበት።
N.B. This License Shall be renewed in accordance with Proclamation No. 980/2008 as per the fiscal year.

2. ይህ የንግድ ፈቃድ የምስክር ወረቀት በዋስትና ወይም በእዳ ሊያዝ አይችልም።
The holder of this License is forbidden for surety ship or debt

በአዲስ አበባ ከተማ አስተዳደር ንግድ ቢሮ
Addis Ababa City Administration Trade Bureau

የማብር ከፋይ መለያ ቁ. /TIN 0011730824
የንግድ ምዝገባ ቁ. BL/AA/2/0002746/2005
Principal Registration No.
የቀድሞው ንግድ ፈቃድ ቁጥር
Previous License No.
የንግድ ሥራ ፈቃድ ቁጥር BL/AA/14/673/493684/2007
Business License No.
ቀድሞ ተሰጠበት ቀን
Previous Date of issuance
የተሰጠበት ቀን 22/11/2007
Date of issuance
የታደሰበት ቀን : 23/3/2017
Renewal Date

የንግድ ሥራ ፈቃድ

በንግድ ምዝገባና ፈቃድ አዋጅ ቁጥር 980/2008 መሰረት ተሰጠ

1. የግለሰቡ/ድርጅቱ ስም በለስ ኢንጅነሪንግ ኃላፊነቱ የተወሰነ የግል ማህበር
2. ዜግነት በኢትዮጵያ የተመዘገበ
3. የንግድ ስም
4. ሥራ አስኪያጅ ስም አቶ ጤናዓለም አየነው ትግያ
5. የንግድ ድርጅቱ አድራሻ

ክልል አዲስ አበባ ዞን/ክፍለ ከተማ ቦሌ
ወረዳ 06 ቀበሌ ---
የቤት ቁጥር አዲስየቢ.ቁ417 ስልክ ቁጥር 0116634843
ፋክስ ኢ-ሜይል

6. የንግድ ሥራ መስክ
(86312)በአካባቢ ኦዲትና አካባቢ አጠባበቅ የማማከር አገልግሎት

7. ካፒታል በኢት ብር 1,873,000.00

ይህ የንግድ ፈቃድ ዛሬ 23/3/2017 በ አዲስ አበባ ተሰጠ

የሃላፊ ስም/Name of Official
ፊርማ/Signature

ማህተም Seal

Business License

Issued Under Commercial Registration and Business license proc.No 980/2016

1. Owner/Company Name BELES ENGINEERING PRIVATE LIMITED COMPANY
2. Nationality Registered in Ethiopia
3. Trade Name
4. General Manager Name Mr. TENALEM AYENEW TGYA
5. Business Address

Region Addis Ababa Zone/Sub City Bole
Woreda 06 Kebele ---
House No. አዲስየቢ.ቁ417 Tel.No 0116634843
Fax E-mail

6. Field of Business
(86312)Environmental auditing and environmental protection consultancy service

7. Capital in ETB 1,873,000.00

This Business License is issued in Addis Ababa
this day 12/2/2024

ለ 2017 ዓ.ም

ማሳሰቢያ- 1. ይህ የንግድ ፍቃድ በዓዋጅ ፈቃድ ቁጥር 980/2008 መሠረት እንደ የበጀት ዓመቱ በአዋጅ በተቀመጠው መሰረት መታደስ አለበት።
N.B. This License Shall be renewed in accordance with Proclamation No. 980/2008 as per the fiscal year.

2. ይህ የንግድ ፈቃድ የምስክር ወረቀት በዋስትና ወይም በእዳ ሊያዝ አይችልም።
The holder of this License is forbidden for surety ship or debt

Annex 8. Key Experts Involved in the Project

No.	Name	Qualification	Assignment in the Project
1	Aysheshum Abebaw	MSc in Environmental Science (PhD Candidate, Environmental Pollution and Sanitation Stream at AAU)	Environmental Pollution Analyst, Waste Management and Social Safeguards Specialist (Team Leader)
2	Tenalem Ayenew (Prof.)	PhD in Environmental Hydrology and Hydrogeology	Project Manager, water quality, hydrology, and hydrogeology specialist (Water Resource Utilization Analyst) (Coordinator)
3	Abreha Mulu	PhD in Environmental Science	Environmental Health Analyst, Public Health Expert
4	Fitsum Tarekegn	MBA in Sociology/Social Anthropology	Social Issues Analyst, Socioeconomic expert
5	Markos Temesgen	MSc. in economics	Economic Issues Analyst Expert
6	Girma Gizachew	MSc in Environmental Science	Biodiversity and Ecosystem Analyst Expert
7	Almaz Shitie	MSc. Environmental Science and BSc. In chemistry	Climate Change Analyst and Pollution Expert
8	Teshome Soressa*	M.Sc in Livlihood and Plan Science (Biodiversity Analyist)	Livlihood and biodiversity

Remark: As appropriate licensed additional experts under Beles Engineering PLC have been involved.*