



# Environmental and Social Impact Assessment

(Fecal Sludge Management, Subprojects, Debre Berhan City)

[Final]

## Second Urban Water Supply and Sanitation Project

November 2023

Addis Ababa

Financed By



**WORLD BANK**



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MINISTRY OF WATER AND ENERGY  
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## ACRONYMS

ABR	Anaerobic Baffled Reactor
AF	Anaerobic filter
ARCCH	Authority for Research and Conservation of Cultural Heritage
DBWSSS	Debre Berhan Water Supply and Sewerage Service
BAU	Business as Usual
BFP	Belt Filter Press
BH	Borehole
BOD	Biological Oxygen Demand
BP	Bank Procedures
ARSEPA	Amhara Regional State Environmental Protection Authority
CBOs	Community Based Community-Based Organizations
CITES	Convention on International Trade in the Endangered Species of Fauna and Flora
CRGE	Climate Resilient Green Economy
CR-WSP	Climate Change Resilience Water Safety Plan
CSE	Conservation Strategy of Ethiopia
DWTS	Wastewater treatment system
EA	Environmental Assessment
EEPO	Establishment of Environmental Protection Organs
EPA	Environmental Protection Authority
EPC	Environmental Pollution Control
EIA	Environmental Impact Assessment
EPE	Environmental Policy of Ethiopia
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
EHS	Environmental Health and Safety
FDRE	Federal Democratic Republic of Ethiopia
FSM	Fecal Sludge Management
FSTP	Fecal Sludge Treatment Plant
GoE	Government of Ethiopia
GHG	Greenhouse Gas
GTP	Growth and Transformation Plan
GBV	Gender-Based Violence
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HASP	Health and Safety Plan
HNAP	Health National Adaptation Plan to Climate Change



HSDP	Health Sector Development Program
IEC	Information Education and Communication
IFC	International Finance Corporation
ITCZ	Inter Tropical Convergence Zone
IT	Imhoff Tank
MoH	Ministry of Health
MoWE	Ministry of Water and Energy
MoWIE	Ministry of Water, Irrigation and Energy
NAP	National Adaptation Plan
NGO	Non-government Organization
OP	Operational Policy
PAP	Project Affected People
PDB	Planted Drying Bed
PCT	Public and Communal Toilet
PPE	Proper care of Protective Clothing and Equipment
POPs	Persistent Organic Pollutants
PT	Public Toilets
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SA	Sexual Abuse
SEA	Sexual Exploitation and Assault
SEP	Stakeholder Engagement Plan
STD	Sexually Transmitted Disease
S & T	Settling – Thickening Tank
ToR	Terms of Reference
TMP	Traffic Management Plan
UAFB	Up flow anaerobic sludge blanket reactor
UDP	Unplanted Drying Bed
UWSSP-II	2nd Urban Water Supply and Sanitation Program
UWWM	Urban Waste Water Management
WASH	Water, Sanitation, and Hygiene
WB	World Bank
WB's (EHS)	World Bank Environment, Health and Safety
WHO	World Health Organization
WIF	WASH Implementation Framework

## EXECUTIVE SUMMARY

### INTRODUCTION

Debre Berhan Water Supply and Sewerage Service (DBWSSS) is currently implementing the 2<sup>nd</sup> Urban Water Supply and Sanitation Project (UWSSP-II), which the World Bank supports. The primary objectives of the UWSSP-II are to construct 33 communal toilets and 10 public toilets, provide 2 additional emptying trucks with a capacity of 8 cubic meters, and construct a new FSTP in the short-term in the urban center of Debre Berhan town to improve the sanitation problems for the town. This is needed because some of the existing infrastructure facilities were either old or insufficient to meet the desired needs of the communities fully. The PCT will be constructed in different parts of the town to improve the town's sanitation facilities in public and residential slum areas (e.g., sport fields, churches, taxi stations, markets places, and highly populated areas/villages) and low-income communities.

The infrastructure development may bring adverse environmental and social impacts. Hence, this project aims to provide insight into the possible positive as well as negative environmental and social impact analysis that can occur due to the design, construction, and operation of the proposed projects during different phases and the possible mitigation measures that can be adopted. In connection with this, the Ministry of Water and Energy (MoWE) signed a consultancy service contract with Motion Consultancy and Training PLC to undertake the ESIA study for the PCTs and FSTP Construction projects for Debre Berhan town. As ESIA for PCTs will be done this Report is focus only the ESIA of the proposed FSTP project.

The overall objective of the ESIA is to identify, predict, and evaluate the potential impacts of the proposed FSTP project on the biophysical and socio-economic environment in terms of magnitude, spatial extent, duration, and significance. The study also aims to provide recommendations for enhancing the beneficial impacts and mitigation measures for the adverse impacts as well as the environment and social management and monitoring plans that would help implement the recommended enhancement and mitigation measures. The scope of the ESIA study includes:

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

## METHODOLOGY

The ESIA study process followed the environmental and social management framework (ESMF) for UWSSP-II, the Government of Ethiopia (GoE) environmental and social impact assessment proclamation, ESIA guideline and the World Bank's safeguards policies. As such, a scoping exercise was carried out as an initial step of the ESIA study. Qualitative and quantitative data were collected from primary and secondary sources typically through field surveys, literature reviews, stakeholder consultations and key informant interviews on environmental and social aspects of the project area.

This is followed by detail data collection, which includes gathering information on the project site, baseline environmental and socio-economic conditions. Qualitative and qualitative data was collected from primary and secondary sources typically through field surveys, literature reviews, stakeholder consultations and key informant interviews. The ESIA study also considered the legal and regulatory frameworks and international standards to ensure compliance and promote sustainable development.

The next step involves impact prediction, where the potential environmental and social impacts are identified and assessed based on the collected data. The impacts are evaluated in terms of their significance and magnitude, considering both short-term and long-term effects using impact matrices and risk assessments to determine the overall environmental and social impacts. Mitigation measures are proposed to minimize or eliminate any adverse impacts identified. Based on comparison between baseline conditions and projected scenarios, the likely environmental and social impacts (negative and positive) were analyzed. Environmental and Social Management Plan together with Monitoring Plans is prepared.

Finally Based on these findings and expert judgement, the consultant has compiled the projected social and environmental impacts (positive and negative) likely to emanate from proposed project activities and the Environmental and Social Management (ESMP) and Monitoring Plans which details how adverse impacts and risks will be reduced or eliminated and by whom.

## DESCRIPTION OF THE PROPOSED PROJECT

Of twenty-two secondary cities in Ethiopia, five cities: Debre Berhan, Dessie, Gonder, JigJiga, and Degahbur have been selected to participate in this round of the UWSSP-II Project. The project's development objective is to contribute to improving the socio-environmental conditions for the residents of Debre Berhan town by providing effective and efficient sanitation services. To achieve the goals delineated under the immediate horizon urgent works, the following measures have been proposed:

- 1 fecal sludge treatment plant
- 33 communal and 10 public toilets in the selected area of the town.

Along with constructing FSTP and PCT, two vacuum trucks with 8 m<sup>3</sup> capacity are proposed to be purchased. The present ESIA study focuses on sanitation schemes (FSTP) laid down in the short term.

### Proposed Fecal Sludge Treatment Plant

The project area for the proposed faecal treatment plant is found 7 km west of the city center located at GPS coordinates of 9°40'14.60"N, 39°29'8.30"E which rest on 3.8381 ha of land.

**Design capacity**

The FSTP will have a capacity of 54 m<sup>3</sup>/day or 19,710 m<sup>3</sup>/year.

**Treatment process**

The treatment process comprises coarse screening solid liquid separation, solid line treatment, liquid line treatment and tertiary treatment for liquid effluent. In the first unit the liquid and solid part of the fecal sludge will be separated the solid part goes to solid treatment lines (unplanned drying bed) and the. The collected leachate (liquid part) goes to the liquid treatment units called anaerobic Baffle reactor and will be treated in series ponds. The dried sludge will be stored on for reasonable period for further dewatering and stabilization. And the final liquid will enter to constructed wetland for further treatment to ensure for safe reuse or discharge to the nearby natural waterway.

**Project components:****The treatment unit has the following components*****Inlet, Screening and Grit Removal Channels:***

The screening and grift removal comprise two coarse bar Screen channels and grit Removal Channels to remove Coarse as wells as fine objects and to settle the grit particles and scrape grease from the surface of the wastewater.

***Sludge Drying Beds:*** designed to dewater and stabilize partially treated fecal sludge after accumulation in the ABR. Further treatment of sludge is expected in the Drying Beds due to the extensive exposure to UV, resulting in considerable pathogen reduction. Continuous dewatering and drying of the sludge are also expected to stabilize more rapidly.

***Liquid Treatment Units***

ABR in combination of constructed wetland: the liquid part of the sludge and treated in the anaerobic baffle reactors.

***Constructed wetland:***

The faecal sludge treatment plant (FSTP) has been designed to ensure that the effluents released from it are safely discharged into the environment, specifically into water bodies. The proposed effluent quality meets the baseline specifications given in the USWSSP-II ESMF. To the downstream of the ABR, constructed wetlands will be implemented to provide final treatment before the effluent can be reused or disposed of to the environment.

***Dry sludge treatment and management***

Dried sludge from the drying beds will be stored for extended period to further dewater and kill the pathogens before the end use or disposal. A warehouse will be constructed on the FSTP site for this purpose and dried sludge will be stored for at least 6 months.

***Auxillary infrastructures:*** include office, guard house, parking area, internal access roads, laboratory and fencing and gate.

## **POLICIES, LEGISLATIONS, AND INSTITUTIONAL FRAMEWORK**

### **Relevant National Policies and Strategies**

The Constitution of the Federal Democratic Republic of Ethiopia (FDRE), adopted in 1995, provides the overriding principles and legal provisions for all legislative frameworks in the country. The concept of sustainable development and the people's environmental rights are enshrined in the Constitution's Articles 43, 44 and 92. These Articles, among others, state the right to development, the right to live in a clean and healthy environment, and the right to monetary or alternative means of compensation, including relocation with adequate state assistance for persons displaced or whose livelihoods adversely affected by state programs. Article 35 provides a foundation for the recognition and protection of women's rights and guarantees women equal rights with men. The Environmental Policy of Ethiopia, issued in 1997, has the overall policy goal to improve and enhance the health and quality of life of all Ethiopians, to promote sustainable social and economic development through sound management and use of natural, human-made, and cultural resources and their environment as a whole. Environmental policies are included in the cross-sectorial environmental policies, and emphasize the early recognition of environmental issues in project planning, public participation, mitigation and environmental management, and capacity building at all levels of administration.

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

### **Environmental Framework Legislations**

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

The EIA Proclamation makes an EIA mandatory for specified categories of activities undertaken by the public or private sectors and is the legal tool for environmental planning, management, and monitoring. The Environmental Pollution Control (EPC) Proclamation is mainly based on the right of each citizen to have a healthy environment, as well as on the obligation to protect the environment of the Country. Its primary objective is to provide the basis from which the relevant ambient environmental standards applicable to Ethiopia can be developed and to make the violation of these standards a punishable act. Other most relevant laws and regulations include Water Resources Management Proclamation (Proclamation No.

192/2000); Solid Waste Management Proclamation (Proclamation No. 513/2007); Expropriation of Land Holdings, Payment of Compensation and Resettlement Proclamation (Proclamation No. 1161/2019); Public Health Proclamation (Proclamation No. 200/2000); Labor Proclamation (Proclamation No. 1156/2019); Regulation on Prevention of Industrial Pollution (Regulation No. 159/2008); and Regulation on Expropriation and Valuation, Compensation and Resettlement (Regulation No. 472/2020).

### **The World Bank's Safeguard Policies**

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

## **DESCRIPTION OF BASELINE CONDITIONS**

### **Physical Environment**

The town has an elevation of 2618 to 2870 m a s l. Debre Berhan is one of the coolest cities found in the subtropical zone of Ethiopia. The city has a typical subtropical highland climate (Köppen Cwb). The average annual temperature of the city during day and night hours is 20.7 C and 8.2 C, respectively, with the average temperature 15°C. The study area usually gets rain starting from June, which ends in October. The average yearly rainfall is 1,219.2 mm [1] .

### **Biological Environment**

An observation-based biodiversity assessment was made in the proposed project site. The proposed FSTP site has been identified as an area of neither significantly sensitive natural vegetation cover nor an important cultural amenity. There are no sensitive natural habitats and wildlife or any other forms of protected areas at or in the vicinity of the project sites. The selected FSTP site is characterized as a crop-dominant land use type where various crops are cultivated.

### **Socio-economic Environment**

The total population of the study area is 146,918 (CSA, 2022) of these, 73,685 are males and 73,233 are females. However, the actual population size is by far greater than this estimate as there is an influx of peoples to the town. Debre Berhan town has two administration levels, Woreda (town) and Kebele (lower level of administration). Currently, Debre Berhan is transforming into a metropolitan city status. With this status, the city attracts more residents from all over the country, in addition to immigrants.

Different institutions and infrastructures exist in the town, these include schools, pharmacies, residential houses, clinics, market areas, road networks, hospitals, universities & colleges, manufacturing industries, farms, and other institutions and facilities. None of the observed institutions and infrastructures is expected to be directly affected by the construction of the proposed project.

## **PROJECT ALTERNATIVES**

This ESIA study was conducted in joint meetings and discussions with the parties involved in the feasibility study and sub-projects design consultants. During the feasibility and ESIA studies, alternative sites and alternative technologies were assessed, analyzed, compared, and recommended. After analyzing the social, technical, and economic issues, a typical public toilet to be implemented on a plot has been prepared (type I & II following the analysis by the ESIA consultant). The proposed design is well acquainted with the city's development plan.

Different FSTP technologies including Unplanted Drying Bed, Planted Drying Bed, Centrifugation, settling tank, Imhoff Tank and Mechanical methods for solids-liquid separation; and Anaerobic Baffled Reactor (ABR), waste stabilization pond, thickening filter, aerated lagoon, and oxidation ditch for effluent treatment; and Sludge drying bed, composting, Solar drying and thermal drying for solids treatment. These alternative technologies were evaluated and ranked based on technical feasibility (easy operation and maintenance), financial considerations, environmental impacts, and social and economic factors. This resulted in selection of I planted drying beds + ABR for it's a low-cost technology in terms of capital, operation and maintenance as well as skill requirement.

In the alternative 'without project' analysis, it was found that the 'without project' option is not acceptable, and it is recommended that the envisaged project would be implemented to address the shortage of the sanitation facility in the town.

## **PUBLIC AND STAKEHOLDER CONSULTATION**

Consultation meetings were conducted with key stakeholders and project proponents to present the proposed project and get feedback from the stakeholders and local community on the project contents and its possible impacts. Stakeholder consultations were carried out with different actors who have direct or indirect stakes in implementing the proposed project. Accordingly, at the town level, consultations were made with DBWSSS, mayor's office, office of Agriculture, health, education, environmental protection, Water, and Energy (deputy chair of the steering committee). Grassroots consultation was done with the project-affected persons (PAPs) and the local community.

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

- a) Land use rights and proper compensation for their property loss, delay of compensation and appropriate property valuation,
- b) Lack of stakeholder engagement, particularly the local community at the project site,
- c) Odor and Aesthetic effect,

- d) Dust pollution during construction, and
- e) Management of liquid waste (effluent treatment) and its impacts to surrounding villagers and the natural environment,
- f) FSTP design and population projection balance.

## POTENTIAL IMPACTS AND MITIGATION MEASURES

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

### Impacts during Construction Phases

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

Potential adverse impacts include:

- Loss of land and livelihood due to expropriation of land for the construction of - FSTP, 7 (seven) farmers in the project area will lose 3.8381 ha their farmland, and their livelihood will be affected.
- Air pollution due to dust emission caused by vehicle traffic movements on unpaved access roads, land clearing, excavation and earthmoving activities, transport of spoil materials to disposal sites, and gaseous emissions from vehicles and construction equipment.
- Noise pollution resulting from the operation of construction vehicles and equipment.
- Soil compaction and soil erosion caused by project activities including site clearing, excavation in soil, and hauling of spoils to disposal sites, which would involve the operation of heavy-duty equipment and dump trucks.
- Pollution of water bodies downstream due to inadequate handling and spillage of pollutants (like fuel, oils, greases, and paints), release of solid and liquid wastes from construction camps and workshops.
- Increased traffic accident risks to project construction workers, roadside communities, road users, and pedestrians due to increased traffic volume on the roads.
- Impacts on occupational health and safety resulting from construction activities, operation of project vehicles and equipment, storage, and use of hazardous chemicals and explosives, dust and exhaust emissions, etc.



- Alteration of landscape due to construction of treatment plants and exploitation of construction materials from quarry sites and impacts on the aesthetic quality of the sites.
- Conflict on employment opportunities created by the project between local and migrant job seekers.

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

- Implement measures that will reduce dust emission, including regular water spraying on unpaved access roads, exposed earth, and any stockpiles on site.
- Regular inspections and maintenance of vehicles and equipment to reduce excessive exhaust emissions and prevent fuel spills by filling fuel at only designated fuel stations.
- Impose speed limits for project vehicles to 30km/hour on unpaved access roads especially in the vicinity of sensitive areas (residential and business areas, social services, and religious places). Speed limit in camps, nearby towns etc.
- Keep noise levels near sensitive areas such as residential areas and camps below the WHO and Ethiopian maximum allowable noise level standards.
- Prevent environmental pollution by hazardous substances through proper storage and handling.
- Choose hours of less traffic volume on roads for mobilizing materials and construction machinery.
- Implement appropriate traffic management at and in the vicinity of the FSTP sites.
- Provide Personal Protective Equipment (PPEs) for employees and follow up their proper use.
- Create awareness for drivers, equipment operators and other site workers on prevention of health, safety, and traffic accident.
- Post proper and visible signs, barricades, and reflectors at appropriate locations so that road users know the active construction works and take precautions while driving through or at nearby project operational areas.
- Reinstate the damaged sections of roads as soon as the construction works have been completed.
- Plant suitable trees and shrubs on the boundary of the FSTP.
- Provide priority of job opportunities for the local people.
- Provide awareness education about HIV/AIDS, other STIs, and preventive measures for project workers and the local community, and avail protective materials.

### **Impacts during Operation Phase**

Most of the beneficial impacts of the project will be harnessed during the operation phase of the FSTP. Reduce cases of waterborne diseases such as cholera, typhoid, amoeba, and diarrhea through the provision of sanitation facilities due to improved hygiene; Improve quality of health from proper management of fecal matter that would otherwise be dumped haphazardly and drain into rivers where others may become in contact; and increase agricultural products due to availability of manure.

Potential adverse impacts during the operation phase include:

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

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

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

- Adherence to national rules and regulations and appropriate contract specifications and guidelines;
- Maintaining appropriate buffer zones around the treatment plants and planting trees to prevent spread of nuisance odor and improve aesthetic view of the treatment sites;
- Fencing at least the treatment process areas to guard against vandalism and to protect the public from entering to the treatment sites;
- Applying aeration, proper chemical dosing and oxidation or pH adjustment to reduce offensive odor;
- Covering tanks or installation of exhaust hoods;
- Operating equipment at optimum/design conditions;
- Adopting effective and efficient housekeeping procedures;
- Regular facility maintenance and monitoring operational practices including process control and treatment, continuous process of the operation.

## **ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

This section provides an Environmental and Social Management Plan (ESMP) that comprises a specific plan of action for the proposed set of feasible and cost-effective mitigation and institutional measures directed at mitigating, minimizing, or controlling negative impacts arising throughout the different phases of the project.

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

## **ENVIRONMENTAL AND SOCIAL MONITORING PLAN**

The environmental monitoring plan is developed to provide a basis for evaluating the proposed mitigation measures' efficiency and updating the actions and impacts of baseline data. It also gives information for adopting additional mitigation measures if the proposed measures are found insufficient. Thus, it will assist

in identifying where additional mitigation effort or where an alteration to the adopted management approaches may be required. Monitoring should be done during construction, operation and decommissioning phases.

### **Implementation Arrangements and Capacity Building**

DBWSSS has an established position for Environmental and social Safeguard officer (2 positions), which will provide oversight on the implementation of the program's environmental and social impact assessment (ESIA) components. It is further planned that oversight on environmental issues shall be supplemented through the recruitment of additional environmental and social safeguard officer by the supervising consultant as well as by the contractor once the project commences. In the interim, this staffing arrangement is deemed adequate.

The responsibility for implementing the ESMP of the supplement ESIA during construction will be of the contractor, DBWSSS. During the operation and maintenance of the FSTP works, the responsibility will be mainly under the DBWSSS. Similarly, Amhara Regional State EPA and Debre Berhan town environmental agency have the sole responsibility for monitoring and regulating the overall social and environmental performance of the project activities.

The environmental sustainability of the FSTP project is dependent on the capacity of institutions at all levels (i.e., staffing, training, and other necessary support services) to carry out the associated ESMP implementation work. Thus, DBSSS must allocate sufficient resources for training and capacity building. These efforts will benefit the enterprise and build local capacity to undertake other development initiatives.

### **Budget Estimation**

The estimated total budget for the ESMP, mainly for environmental monitoring programs and training required to implement the ESMP, is about **8,668,000.00 Eth Et. Birr**. As it is proposed in the feasibility study, the treatment plant is to be implemented in the Design, Build and operate contract modality. Therefore, they will be taken care of by the specifications bill of quantities, and overall contractor's and consultant's fee.

## **CONCLUSION AND RECOMMENDATIONS**

**Implementation of the proposed project will certainly** be a major solution to minimize the prevailing poor sanitation-related environmental pollution affecting the social dynamics and its consequences in the town and downstream communities and environments. The project will serve as a very important intervention for the protection of the socio-economic and biophysical environment of the town. The identified adverse environmental, social, and health impacts related to the construction and operation of the proposed FSTP as compared to the project benefits, have low to moderate significance and can be easily mitigated to acceptable levels by properly applying the proposed mitigation measures stated in this report.

It is recommended that proper implementation of the proposed mitigation and enhancement measures for each stage of the project will avoid or minimize adverse impacts and enhance beneficial impacts.

## 1. INTRODUCTION

Maintaining safe sanitation is crucial for human health as it helps prevent the spread of infectious diseases and promotes physical, mental, and social well-being. Additionally, it plays a significant role in ensuring environmental well-being. Sanitation is an essential component of development and must be prioritized worldwide (World Health Organization (WHO) 2017). In today's world, the management of wastewater and fecal sludge has become a global concern, especially in low-income countries that rely on on-site sanitation technologies.

Waste management is a big challenge in Addis Ababa and other secondary towns such as Debre Berhan, Dessie Gondar, Jijjiga, and Degahbur especially within the urban areas. Fecal sludge waste from Debre Berhan town is illegally disposed of in open spaces without proper sanitation facilities. Industrial effluent and agricultural activities also contribute to environmental pollution. To address these problems, precautionary measures such as environmental and social impact assessments (ESIA) for waste management projects can be effective. The Government of Ethiopia (GoE), with financial support from the World Bank, plans to implement citywide fecal sludge management and construct public and communal toilets to tackle these social and environmental challenges.

### 1.1. Background

The management of liquid waste/fecal sludge at the household level is very poor. It is estimated that one-third of the world's population is served by onsite sanitation and that in low-income countries less than 10% of urban areas are served by sewers [6]. In low-income countries, the majority of fecal sludge is discharged untreated into the urban environment, and into any accessible public properties, such as streets, drainage lines, and nearby open space, placing a significant burden on public and environmental health. Hence, FSM plays a critical role in safely managed sanitation and the protection of public health.

Ethiopia faces various sanitation problems related to a low level of priority for sanitation, poverty, unavailability of equipped skilled human resources, unclear institutional framework, and responsibilities. As a result, only 4% of rural and 16% of urban households use improved toilet accommodations. About 56% of rural households rely on unimproved toilet facilities and more than 35% of toilet accommodations are shared in urban households, whereas only 2% of rural households share their toilet facilities with other households [3]. One in three Ethiopian households has no toilet facility; defecate in bush/fields (39% in rural areas and 7% in urban areas) [3]. Furthermore, according to the WHO (2014) estimates, diarrhea contributes to more than one in every ten child deaths in Ethiopia. The total population growth rate of Ethiopia is also 2.5% a year, with urban centers growing at a rate of 5.1% [4]. This situation triggers the need for the construction of PCT, fecal sludge management facilities, wastewater treatment plants, sewer lines, and the purchase of vacuum trucks in selected five towns of Ethiopia in three horizons (phases, 2021-2041). Poor sanitation has long been regarded as a constraint to the socioeconomic growth in the city of Debre Berhan like in many parts of the nation or any community.

Fecal sludge management (FSM) includes the storage, collection, transport, treatment, and safe end use or disposal of fecal sludge [5] This constitutes the "value chain" or "service chain" of fecal sludge management. In Debre Berhan, some private operators can empty septic tanks and latrines. However, as there is no appropriate site for disposal of the fecal sludge waste, the waste is dumped in the fields nearby where

there is no proper treatment system. The construction and operation of fecal sludge management system, public and communal toilets will improve the town's sanitary facility problems including its FSM and therefore reduce the spread of communicable diseases and pollution of ground and surface waters. It also increases hygienic conditions which will bring both social and economic advantages to the town and its surrounding environment. Furthermore, the successful implementation of the FSTP will improve the town's socio-economic and environmental conditions.

## **1.2. Project Benefits**

Debre Berhan sanitation facility problems are deep-rooted and accumulated for a long time. These problems were also studied during the feasibility study by ARTELIA and Metaferia Consulting Engineers PLC in October 2022 [7]. The problems are multifaceted, varying from site to site, including a lack of proper sanitation due to shortage of toilets and the unavailability of fecal sludge treatment. The problem is complex and needs an immediate response from all relevant stakeholders with the consultation of the local community.

To address the above-mentioned sanitation problems of Debre Berhan town, a feasibility study was conducted with a detailed design for FSTP. The project under UWSSP-II is addressing these public challenges, to solve the fecal sludge treatment as well as emptying problem through various interventions in the short term.

## **1.3. Rationale of the ESIA**

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

## **1.4. Objectives of the ESIA**

The main objectives of the ESIA study as stated in the Terms of Reference (ToR) is to ensure that the planned sanitation scheme is environmentally sustainable, socially acceptable, and will not cause adverse environmental and social impacts through assessment, identification, and mitigation of potential adverse and localized impacts. The report presents an environmental and social impact assessment of the proposed works, especially during the construction and operation phases of the proposed FSTP and incorporates a corresponding Environmental & Social Management Plan (ESMP). The specific objectives of the ESIA are to:

- Identification and analysis of national and the World Bank environmental safeguard policies and regulations that will be triggered by the project activities at any development phase of the sub project and these shall include but not limited to the project ESMF, GAP, World Bank's Gender strategy and GBV requirements;

- Identify key environmental and social issues related to the proposed project, their impacts, and mitigation for negative impacts.
- Generate baseline information on biophysical, socio-economic, & cultural attributes of the project area.
- Prepare an ESMP comprising environmental and social management measures as well as mechanisms for their implementation and compliance monitoring to minimize the project's negative impacts and enhance the positive aspects.
- Anticipate and avoid, minimize, or offset the adverse significant biophysical, social, and relevant effects of the developmental proposal.
- Enable information exchange, notification, and consultations between stakeholders.
- Propose a practical Grievance Redress Mechanism (GRM) considering the nature of the project.
- Assessment and identification of capacity gap and propose training and capacity building requirements for implementation of environmental mitigation and monitoring;
- Cost estimate for each proposed mitigation measure and monitoring program

### 1.5. Scope of the ESIA

An environmental and social impact assessment (ESIA) was performed for the FSTP component in Debre Berhan, Ethiopia. The assessment followed the guidelines and standards set by the Ethiopian government's ESIA (EIA) regulations, directives, and legislation, as well as the World Bank's safeguard policies and legislation. The ESIA consulting team, in accordance with the provided ToR by MoWE, reviewed relevant policies, legislation, and documents, including a feasibility study on the proposed project activities and technology, and gathered, verified, and compiled environmental and social safeguards and compliance information, as well as grievance redress approaches and protocols in line with the ESIA. The analysis and evaluation of the ESIA used both traditional and modern methods of data collection, coding, and analysis.

This report focuses on providing a description of the ESIA study for the selected project activities and sites in phase I. It outlines the activities, methods, timeline, and personnel involved in conducting the assessment. The report analyzes and presents key aspects of the proposed project, which were thoroughly examined during the ESIA assessment as presented below.

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

- Descriptions of the monitoring plan and developing monitoring strategy were specified. and
- Estimation of cost for proposed mitigation measures formulated.

### 1.6. Team in charge of the ESIA

Our team of ESIA professionals comprises eight senior members with diverse backgrounds and extensive experience in environmental studies. Each member holds a second degree or higher (MSc, MA, or Ph.D.) and has over 15 years of experience in ESIA, ESMP, RAP, and EA studies. They possess specialized knowledge and skills in their respective fields and are well-equipped to plan community and stakeholder consultations, collect qualitative and quantitative data, and analyze both types of data. Please refer to Table 1 for details on the qualifications, experiences, and positions of our staff.

Table 1 Lists of ESIA Team

No	Name	Qualification	Experience	Certification	Position in the project
1	Dr. Mekonnen Maschal	PhD in Environmental Pollution and Sanitation, MSc in Environmental Science and Technology, MSc in Urban Geology/Earth Sciences, BSc in Chemistry	>15 years	Certified Waste Management Expert	Team leader, Environmental pollution analysis
2	Berhanu Rabo	PhD (ongoing) in Environmental law & Development, MSc, Environmental Science, BSc, Plant Science, Diploma in General Agriculture, LLB in Law	>20 years	Certified Environmental ist	environmental specialist
3	Dr. Asebe Amenu	PhD in Sociology, MA in Urban management BA in Sociology and Social Anthropology	>10 years	Certified Sociologist	Social analysis
4	Berhanu Genet	MSc in Environmental Science, B.Sc. in Environmental Health, Diploma in Environmental Health		Certified Environmental Health Specialist	Environmental pollution analysis-WW
5	Ayalew Kibret	PhD (ongoing) in Development, MA in Development Studies, Honors BA degree in Development Studies, BSc in Forestry	>20 Years	Certified Watershed Expert	Evaluate biological environment
6	Asmamaw Mekonnen	MSc. in Development Economics, BA in Business Administration and Information System, Diploma in Veterinary Science, LLB	>20 Years	Certified management Specialist	Socio-economic analysis
7	Abebe Legesse	PhD candidate in Water Resources Management and Engineering, MA in Water Resources and Development, MSc in Hydraulic Engineering, Land and Water Development, Postgraduate Diploma in Water Resource Management, BSc in Forestry	>15 years	Certified Hydraulic and Water resource engineer and Natural resources Expert	Evaluating water resources
8	Dr. Adane Kebele	PhD in Climate and Development, MSc in environmental science, BSc. in biology	>15 Years	Certified Environmental ist	Evaluate the physical environment for the ESIA/ analysis air pollution sources



## 2. METHODOLOGY OF THE ESIA STUDY

### 2.1 Approach

To conduct the ESIA study, we followed the Ethiopian ESIA and World Bank Guidelines. We reviewed relevant studies, policies, and guidelines, and collected primary data through field observations and beneficiary consultations. We conducted a field survey of FSTP project site, identified, assessed, and documented the potential environmental impacts of the expected project activities. We also consulted with key stakeholders, PAPs and local community representatives to address socio-economic and environmental issues. In addition, we obtained expert opinions and learned from previous experiences to ensure a comprehensive study approach.

### 2.2 Methodology

This ESIA study is based on the review of relevant data, studies and reports gathered from various offices at regional, town (Woreda), and Kebele levels in addition to the feasibility and design study reports; We collected primary data through a comprehensive field works and observation. Consultations with project-affected communities/people at Genet Giorgis, relevant experts, as well as city, Woreda, and Kebele administrators were conducted.

The methodology used in this assessment corresponds with the EIA Proclamation of 295/2002, adopting the approach of identifying, collecting, and analyzing information which included:

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

The methodology considered the likely impacts on social, the physical and biological environment (e. g., air, soil, water, and vegetation).

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

- Consult key stakeholders to gather their concerns and opinions about proposed project and in particular, how the project will impact the surrounding communities.
- Carry out additional information or data to supplement ESIA.
- Establish environmental conditions in the proposed site for project activities.
- Assess the status of ecological and social receptors.
- Describe the project' characteristics and affected environment.
- Assess and evaluate the potential environmental impacts resulting from the proposed project, especially within the zones of project influence.
- Identify mitigation measures for adverse social and environmental impacts. And



- Develop an ESMP detailing actions and responsibilities for the mitigation of impacts and for monitoring them.

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

Policies, legislation, and guidelines pertinent to social safeguard and environmental protection were gathered and reviewed for assessing the relevant environmental and social safeguard policies, laws, and regulations related to social and environmental protection matters in general and the expected socio-environmental impacts of the proposed development in particular.

### 2.2.2 Screening

Screening was conducted to characterize the level of environmental and social assessment required and to classify the project into one of the project classes as per the World Bank and Ethiopian environmental guidelines. The project has been assessed based on the criteria set in the ESMF. It falls under category B of the World Bank guideline and Schedule 2 of the Ethiopian guideline, considering its role in improving one of the city's environmental problems (pollution of soil and water bodies by improper discharge of liquid waste); and the overall level of adverse impacts anticipated during the construction and operation phases of the project. All the anticipated adverse impacts are of low to moderate magnitude and reversible by adopting appropriate mitigation measures.

### 2.2.3 Scoping

Environmental scoping was carried out to identify valued environmental components for the project, to identify influential areas where the impacts of the project implementation are felt most, and to identify the significance of the project implementation, both from beneficial and adverse impacts of the project. The scoping was conducted to identify the major environmental issues that should be assessed in the ESIA. The scoping exercise involved studying the proposed design and observation of the site and its surroundings, consultations with the design team, literature review of the site, etc. The Scoping exercise also identified the data required to describe E&S baseline conditions that would be the basis for the impact analysis. Moreover, it showed the availability of the required baseline data and additional surveys that need to be carried out to fill data gaps.

The site for FSTP is farm land owned by farmers. The scoping exercise revealed no environmentally sensitive/ fragile ecosystems like dense forests, parks and wildlife habitats, historical and cultural sites, or sensitive landscapes in the selected sites. There are no social service centers (schools, churches, health institutions, etc.) at the proposed FSTP that can be negatively affected by the construction of the operation of the project.

During the scoping exercise, relevant stakeholders and PAPs were identified. The main stakeholders are the national and regional environmental protection authority, ANRS Urban Development and Construction, Health Bureau, education, culture and tourism, women and children affairs, Municipal Environment Management and beautification, village Committees, and DBWSSS.

The environmental and social impacts likely to be significant were determined in the scoping process and these were analyzed in detail in Section 8. The Scoping exercise also identified the data required to describe

the baseline E&S baseline conditions that would be the basis for the impact analysis. Moreover, it showed the availability of the required baseline data and additional surveys that need to be carried out to fill data gaps.

#### **2.2.4 Baseline Surveys and Data Collection**

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

#### **2.2.5 Stakeholders Consultations**

The main purpose of public and stakeholders' consultation was to disseminate information about the project to the public and affected parties and to obtain their views and concerns. Individuals and groups of the local communities in the project area who are likely to be affected directly or indirectly by the implementation of the proposed project were consulted. Groups of community members focusing on PAP in gender, elders, youths, and vulnerable groups inclusive way; concerned government officials, and professionals (social and environmental experts) at the Regional State, municipal, and its sub-city administrators including Kebeles Administrators were consulted during the ESIA fieldwork.

Information related to the existing waste management system focuses on constraints, existing environmental and social features of the project influence area, potential environmental issues/impacts related to the proposed project components and activities, as well as the attitudes of the officials, local communities, and experts towards the planned scheme were assessed. This information and opinions have been considered in this socio-environmental impact analysis. Formal and informal consultations were also conducted with the design consultant's staff, Client officials, and experts. The outcomes of the consultations are summarized in section- 7.

#### **2.2.6 Identification of Interested Parties**

According to federal laws, regulations, and the WB Sustainability Guideline, public and stakeholder engagement is mandatory. This allows the public, stakeholders, and the surrounding community to express their opinions and gain knowledge about a project. It may also lead to alterations or modifications to the project design or location in order to consider community needs and concerns.

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

As an initial step towards preparing a Stakeholder Engagement Plan (SEP), the consultants have analyzed the relevant stakeholders to the project, who are considered to be affected or affect the project activities

(Table 2). The SEP shall be implemented during the construction and operation phases of the project, where the Contractor and Operator are responsible for ensuring its proper implementation. Moreover, a Grievance Redress Mechanism (GRM) shall be put in place to allow the below-mentioned stakeholders to communicate their concerns regarding any project activity.

**Table 2 List of Concerned Stakeholders**

Stakeholders Groups	Stakeholders	Level of involvement
Local Residents	<ul style="list-style-type: none"> <li>Residents located near the FSTP facility to be constructed</li> </ul>	Directly affected
Property-owner and landowners	<ul style="list-style-type: none"> <li>Individuals, legal entities, local administration holding land title documents</li> <li>Tenants or occupiers without formal rights</li> </ul>	Directly affected
Public facility	<ul style="list-style-type: none"> <li>Educational facilities (none-existence)</li> <li>Religious entities (mosques/churches) none existing around the FSTP</li> <li>Medical facilities (hospitals, clinics, medical centers)-nonexistence</li> <li>Utilities (electricity, water supply, road, telecommunication facility and others)-none existence</li> </ul>	Directly affected
Business and Service Providers	<ul style="list-style-type: none"> <li>Shops, markets, supermarkets</li> <li>Petrol stations, car wash &amp; service, others</li> <li>Restaurants</li> <li>Financial services (banks) (are not at a close distance)</li> </ul>	Indirectly affected
Administrative Bodies and Authorities	<ul style="list-style-type: none"> <li>National and Regional Authorities</li> <li>Ministry of Water and Energy and regional bureaus</li> <li>Environmental Protection Authority and regional authority/bureau</li> <li>Debre Berhan Water Supply and Sewerage Service</li> <li>Regional authorities/bureaus</li> <li>Local authorities (district and Kebele administration)</li> <li>Debre Berhan town municipality</li> </ul>	Indirectly affected, but may have influence over the implementation of the project
International donors	<ul style="list-style-type: none"> <li>World Bank</li> </ul>	Indirectly affected, but may have influence over the implementation of the project
Bodies involved in Project implementation	<ul style="list-style-type: none"> <li>Construction contractor(s) (management, staff)</li> <li>Sub-contractor(s)</li> <li>Supervision contractor (the Engineer)</li> <li>Suppliers</li> </ul>	Directly affected, but may have influence over the implementation of the project
Non-governmental Organizations (NGOs) and Community Based Organizations (CBOs)	<ul style="list-style-type: none"> <li>Specialized environmental and social organizations, NGOs-engaged in WASH activities</li> <li>Experts on a national and international level</li> </ul>	Indirectly affecting/affected
Community-based Organization engaged in waste management	<ul style="list-style-type: none"> <li>Specialized in waste management at the local level</li> <li>Community based organization involved waste collection</li> </ul>	Indirectly affected and/or has impacts on project success

### 2.2.7 Consultation Methods

Consultations were undertaken with community members and government officials at Woreda and Kebele levels to obtain opinions and attitudes towards the proposed FSTP project for Debre Berhan town. One

consultation with relevant stakeholders was conducted at the municipality level, led by the project coordinator of Debre Berhan town.

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

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

### 2.2.8 Use of Relevant Data Generated by Other Disciplines

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

### 2.2.9 Identification and Analysis of Impact

Field investigation, public consultation, literature review, and expert judgment were applied to screen the valued environmental and social components which the impact assessment primarily based upon. Impacts and their depth and significance were outlined with reference to environmental and social settings on a temporal and spatial basis. The following stepwise approach was followed:

- **Identification**- This includes a description of the existing environment, determination of the project components, and definition of the environment that will be modified by the project.
- **Prediction**- Forecasting of the quality and/or spatial dimensions of the changes and estimation of the probability that the impact will occur.
- **Evaluation**- Determination of the incidence or magnitude and significance of the impact before mitigation.

Key, potentially beneficial as well as adverse impacts on the physical, biological, and socio-economic environment associated with the project operation were identified with the help of the checklist and matrices method. The analysis of impacts as relevant to the project and its location in an urban and rural setting includes, among other things

- a) Air, water, noise, solid and liquid waste generation, and pollution with identified permissible limits and management as per the national and international environmental guidelines, procedures and regulations of the country and management plans.
- b) Hazardous wastes (e.g., toxic emissions and their controls)
- c) Loss of land, livelihood, the potential for social disruption/displacement, resettlement, etc.
- d) Drainage, storm drainage, surface water/rivers, and downstream pollution.
- e) Disruption of religious and cultural activities/practices
- f) Traffic and movement of people

- g) Health and safety of project construction workers and neighborhood communities
- h) Impacts anticipated during operation such as sludge disposal, emission of gasses, pollution of surface and groundwater resources, odor nuisances, etc.

The impacts of the proposed project have been analyzed along the following parameters: Probability of occurrence

- Extension in space
- Duration in time
- Magnitude
- Significance

The predicted environmental and social impacts are characterized as follows:

- Nature of Impact: Direct, indirect or cumulative;
- Type of impact: Positive, negative or both
- Duration of impact: Short term, medium term or long term;
- Spatial scale of impact: Local, regional, National, International
- Significance of Impact: Low, Medium, High or Very High

A combination of these parameters were summarized in an all-encompassing measure of significance which is the basis for identifying and prioritizing major significant impacts and recommending mitigating measures. Finally, the magnitude and significance level of the identified impacts were evaluated as minor, medium, or major significant impacts.

### 3. DESCRIPTION OF THE PROPOSED PROJECT

#### 3.1 Overview of UWSSP-II project

The Urban Water Supply and Sanitation Program (UWSSP) is an extension of the World Bank's long-term involvement in Ethiopia's urban water supply and sanitation sector. It aims to support the government's efforts in improving sanitation services in urban areas. The program follows the principles outlined in the One WASH National Program. Key principles of the program include implementing an integrated city-wide approach to sanitation improvement that offers diverse service options to accommodate different settlement types.

The program emphasizes the development of a comprehensive suite of services for the collection, transportation, treatment, and disposal/reuse of liquid waste. It recognizes the importance of public awareness and social engagement in promoting proper waste management practices and encourages the involvement of the private sector to provide services, goods, and construction work, as well as improving the efficiency of utilities in resource utilization and management.

The government has secured finance from the World Bank under the Second Ethiopia Urban Water Supply and Sanitation Project (UWSSP-II) to increase access to improved sanitation facilities and improve efficiency in water supply services in Addis Ababa and 22 secondary cities<sup>1</sup>. The project will support these cities to achieve the targets set under the Growth and Transformation Plan II (GTP II) and the Sustainable Development Goals (SDGs).

Debre Berhan city is among these selected cities for the implementation of UWSSP-II project for the immediate, intermediate and long-term sanitation intervention sub projects. The main goal of the subprojects is to enhance and expand the availability of proper sanitation facilities establish a long-lasting waste management system.

The proposed development interventions in Debre Berhan city for the short term are

- Extension of the current onsite sanitation facilities in the town with improved sanitation technologies.
- Construction of a fecal sludge treatment plant.
- Construction of Public toilet facilities in areas where densely populated and open defecation is noted.
- Construction of communal latrines for residents living in neighborhoods without latrine facilities.
- Provision of vacuum trucks and small vehicles in order to collect and transport fecal sludge.

This report is prepared pursuant to the service contract between MOTION Consultancy and Training PLC, the consultant and Ministry of Water and Energy, the client to undertake Environmental and Social Impact Assessment of envisaged FSTP subproject to be implemented in Debre Berhan.

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<sup>1</sup> Dire Dawa, Mekele, Adama, Bahire Dar, Hawassa, Jimma, Gondar, Sodo, Adigrade, Harar, Jigjiga, Degahbur, Gambella, Assosa, Semera Bishoftu, Dessie, Shashemene, Nekemte, Asela, Arbaminch, and Debre Birhan

### 3.2 Project Description

The proposed Faecal Sludge Treatment Plant (FSTP) project in Debre berhan aimed at addressing the challenges associated with the management of faecal sludge in the city. The project aims to provide a sustainable and environmentally friendly solution for the treatment and disposal of faecal sludge. The FSTP project will involve the construction and operation of a treatment plant specifically designed to effectively manage and treat faecal sludge generated from households and other sources within the town. The plant will be strategically located in an area that minimizes environmental and social impacts, while also ensuring accessibility for the collection and transportation of faecal sludge from various sources within the city. The project site has a gentle slope and is favorable for construction. The project will rest on 3.8381 ha of land.

The FSTP component will have a capacity of 19,710 m<sup>3</sup>/year or 54m<sup>3</sup>/day in the next five years, but after the five-year period, it is recommended by the design consultant that the FSTP will be upgraded / be extended and relevant facilities should be suitably designed accordingly.

The fecal sludge treatment unit has several key components. First, there is a reception area where faecal sludge collection trucks unload the sludge. The fecal sludge is then sent to a pre-treatment unit, where it is coarsely filtered to remove unwanted solids such as plastic waste and debris. After pretreatment, the fecal sludge goes through a series of advanced treatment processes. Liquid and solid part of the fecal sludge will be separated the solid part goes to solid treatment lines (unplanned drying bed) and the collected leachate (liquid part) goes to the liquid treatment units called Anaerobic Baffle reactors (ABR). Where, the main function of these structures is destruction of pathogens, they also carry out polishing of the wastewater to achieve the stands for Biological Oxygen Demand (BOD) and suspended solids. The dried sludge will be stored for an extended time for further dewatering and treatment. And the final effluent will enter to constructed wetland for further treatment to ensure for safe reuse or discharge to the nearby natural waterway.

The components of fecal sludge treatment plant also include Infrastructures and Auxiliary Facilities such as access pathways and roads; an office with a toilet/washroom; a small laboratory; a warehouse of 900 m<sup>2</sup> to receive the dried sludge from the drying beds and to store it for five months; waste deposit and sorting area; waste dumping trenches, hazardous waste pit, area for storing the recyclable waste, leachate collection and aeration areas; and fencing.

#### 3.2.1 Project Location

Debre Berhan is the administrative center of North Shewa Zone of Amhara Regional state. The town is located at 130 km from North East of Addis Ababa on the road which connects Addis Ababa with the North of the country. It is also found at a distance far 695 km south east from Bahir Dar which is the capital city of the Amhara region. Geographically, the town is located between 9°40'46.3"N (9.6795400°) latitude and 39°31'57.4"E (39.5326200°) longitude with an elevation ranging from 2618 to 2870 m a s l. The northern edge and western parts of the town are somewhat stepper consisting small valleys. However, the slope of the FSTP site is gentile with 2.5 -3.5% gradient. The geographic location of FSTP in relation to Debre Berhan town is shown in the figure below.



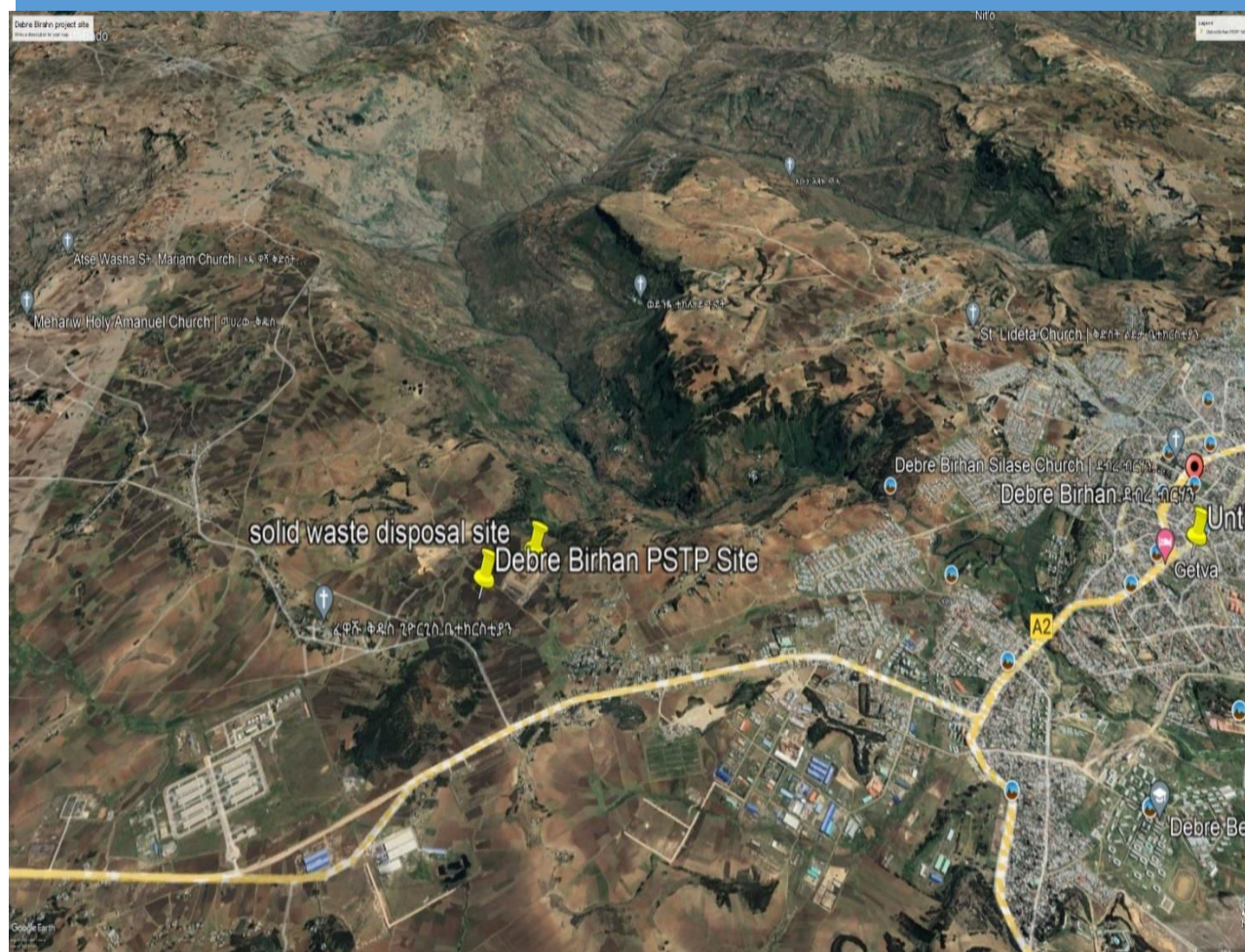


Figure 1 Debre Berhan town, project Intervention Area

Source: Google earth

The project area for the proposed faecal treatment plant is found 7 km west of the city center located at GPS coordinates 9°40'14.60"N, 39°29'8.30"E. The project requires a total of 3.8381 ha of land for Faecal Sludge Treatment site. Coordinated points of the site are as indicated in the following table.

Table 3 coordinate points of FSTP site

No	X coordinate	Y coordinate
1	553149.361	1069064.233
2	553289.12	1068944.98
3	553209.78	1068800.71
4	553149.151	1068833.384
5	553139.445	1068832.97
6	553112.912	1068837.777
7	553093.187	1068843.006
8	553100.127	1068859.662
9	553058.98	1068881.996

Source: Debre Berhan WSSS



### 3.2.2 Components of Fecal Sludge Treatment Plant

The Faecal sludge treatment unit comprises of Receiving unit, Unplanted sludge drying beds, ABR system and constructed wetland.

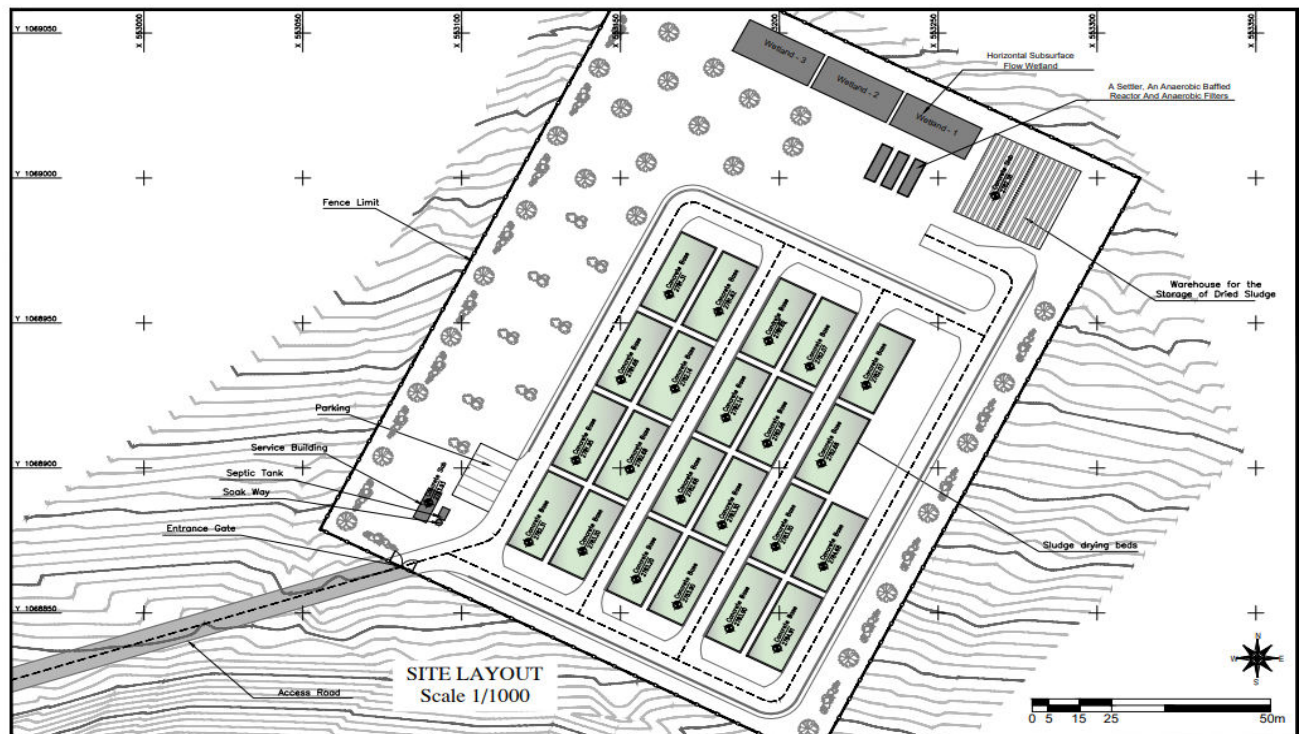


Figure 2 Layout of the FSTP and Facilities

Source: Feasibility study and preliminary design report – Debre Berhan

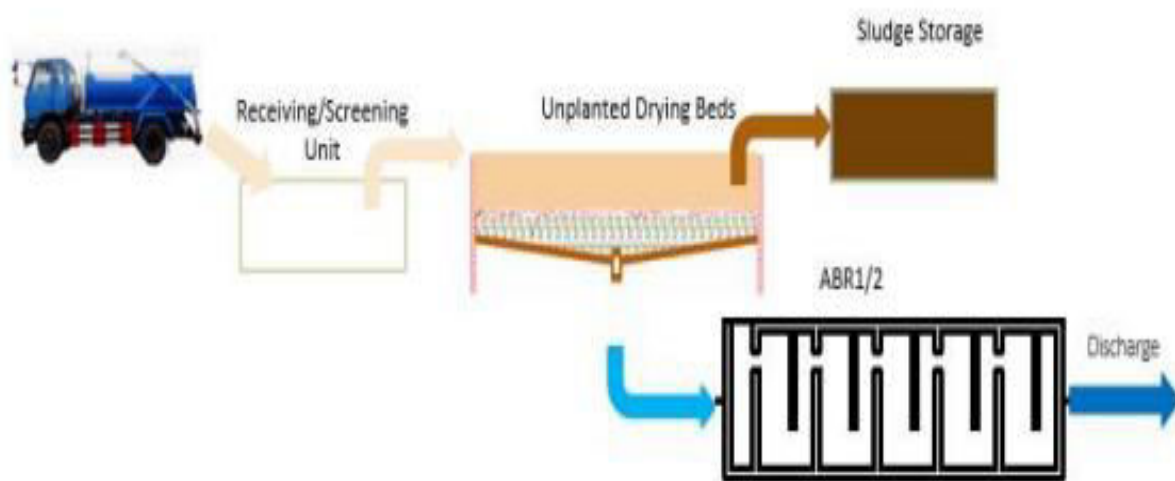


Figure 3 Components of faecal sludge treatment unit

Source: Feasibility study and preliminary design report – Debre Berhan

### Receiving and Screening Units

The FSTP Receiving and Screening units comprise a coarse screen. The vacuum trucks will discharge directly in coarse screens incorporated into each drying bed. The coarse screens are recommended to remove potential hard items, such as those used for anal cleansing. The screenings will be dried and disposed of through burial in excavated trenches within the treatment plant. The proposed screens are manually raked screens due to their simplicity, robustness, and relatively low cost. A splash plate should be used to prevent erosion of the sand layer. Without a splash plate, the sand layer would be destroyed during the first loading operation.

### Unplanted Drying Beds

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 [52]

The sludge, however, is not effectively stabilized or sanitized. The bottom of the drying bed is lined with perforated pipes to drain the leachate that percolates through the bed. On top of the pipes are layers of gravel and sand that support the sludge and allow the liquid to infiltrate and collect in the pipe. According to [52], it should not be applied in layers that are too thick (maximum 20 cm), or the sludge will not dry effectively. The final moisture content after 10 to 15 days of drying should be approximately 60%. When the sludge is dried, it must be separated from the sand layer and transported for further treatment, end-use, or final disposal. The drainage pipes are covered by 3-5 graded layers of gravel and sand. The bottom layer should be coarse gravel, and the top fine sand (0.1 to 0.5 mm effective grain size). The top sand layer should be 250 to 300 mm thick because some sand will be lost each time the sludge is removed. To improve drying and percolation, sludge application can alternate between two or more beds. The inlet should be equipped with a splash plate to prevent erosion of the sand layer and to allow for even distribution of the sludge.

A hard concrete or block work splash pad will be provided below the inlet to each drying bed to ensure that incoming sludge does not scour the sand bed. To achieve this objective, it is suggested that the splash pad should extend at least 0.5 m for each side. In addition, a ramp is provided to each bed to facilitate the sludge removal and ease access to sludge removal equipment into the beds.

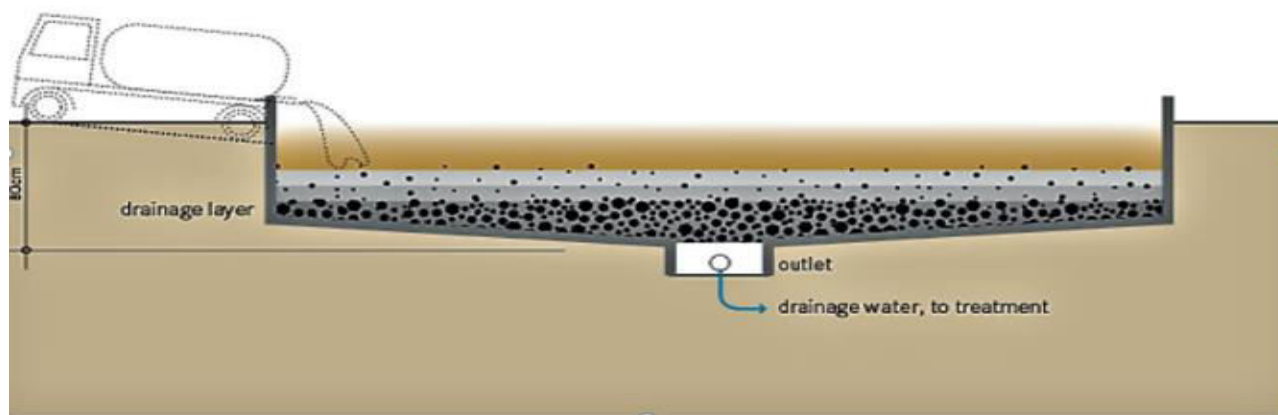


Figure 4 Schematic of an Unplanted Drying Bed

Source: Feasibility study and preliminary design report – Debre Berhan

According to Tilley et al. (2014) 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 composition, which is 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, odors, and flies' reduction.

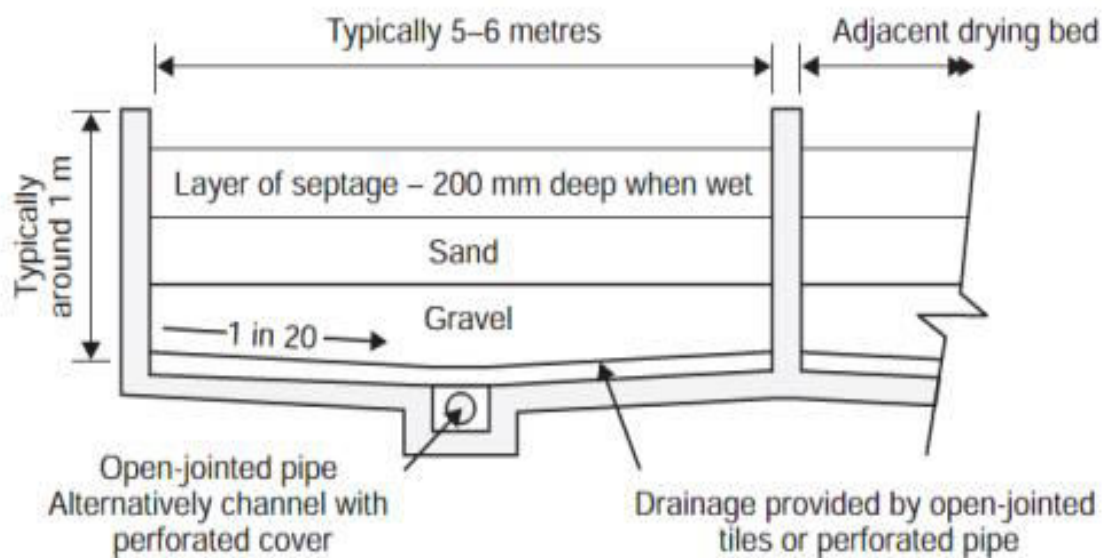


Figure 5 Cross-Section of a Typical Drying Bed

Source: Feasibility study and preliminary design report – Debre Berhan

The FSTP will have a total of 22 unplanted drying beds with a dimension of 28m length and 12m width. The detail of dimensions and area requirements for drying bed is indicated in the following table.

Table 4 Sizing of Sludge Drying Beds

S. No.	Parameter	Unit	Detail
1	Number of beds	No.	22
2	Unit length	m	28
3	Unit width	m	12
4	Single bed drying area	m <sup>2</sup>	336
5	Total drying area	m <sup>2</sup>	7392
6	Effective sludge lodging	KgS/m <sup>2</sup> /year	67.9
	Proposed Daily Drying Bed	m <sup>2</sup>	336
7	The drying beds total surface	m <sup>2</sup>	7392
8	Additional Area for DB related infrastructures	m <sup>2</sup>	1108.8
9	Total DB area requirement	m <sup>2</sup>	8500.8
	Effective sludge loading rate	kgTS/m <sup>2</sup> /year	67.9

Source: Feasibility study and preliminary design report – Debre Berhan

### Effluent Treatment Units

As described previously, Anaerobic Baffled Reactor (ABR) is proposed for the effluent treatment for this project. This maintains passive operation and low construction and operating costs; however, they will need to be dislodged periodically. An anaerobic baffled reactor (ABR) is an improved Septic Tank with a series of baffles under which the wastewater is forced to flow. The increased contact time with the active biomass (sludge) results in improved treatment. Anaerobic baffled reactors (ABRs) are concrete, masonry, or prefabricated fiberglass tanks consisting of several compartments in series.

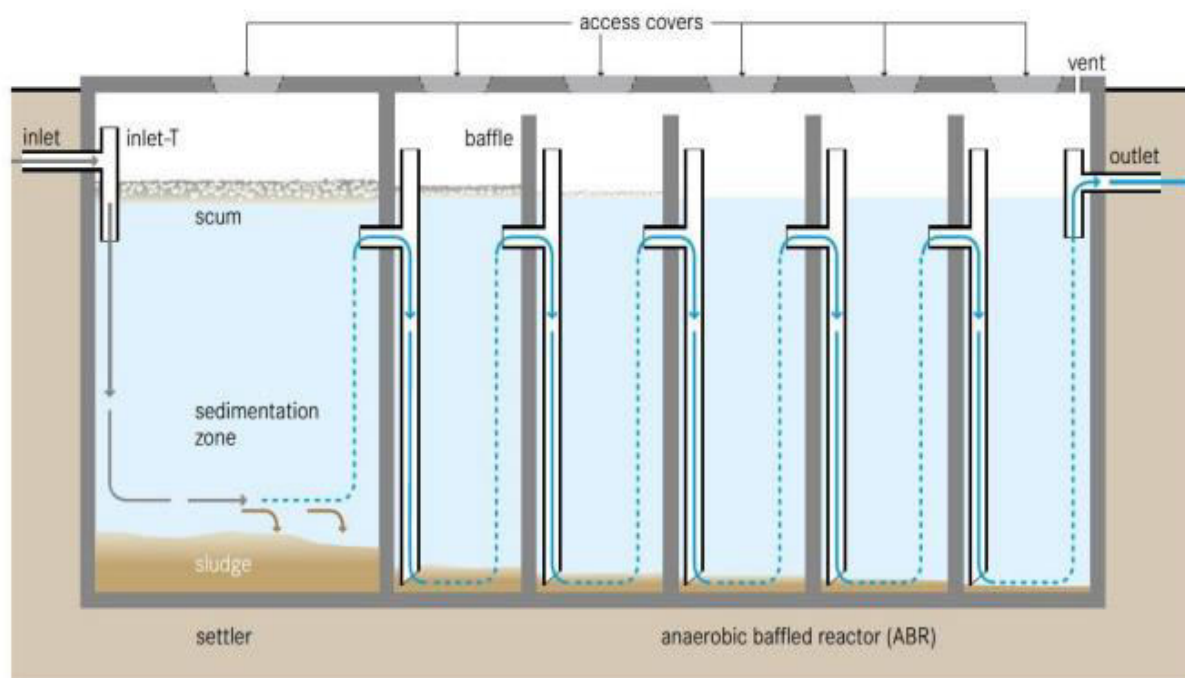


Figure 6 ABR and AF with Typical Down Flow Pipes and Manholes above Baffle

Source: Feasibility study and preliminary design report – Debre Berhan

Depending on the effluent the volume of the ABR and area requirement is indicated in the table below.

Table 5 Sizing and Area Requirement of ABR

Parameter	Value	unit
Average daily inflow	38	m <sup>3</sup> /d
Design hourly flow	2.1	m <sup>3</sup> /h
ABR volume required	95	m <sup>3</sup>
Number of up flow chambers	6	
ABR length	10	m
Depth	2	m
Width	5	m
ABR area requirement	48	m <sup>2</sup>

Source: Feasibility study and preliminary design report – Debre Berhan

As indicated in the above table, the ABR volume and area required are 95 m<sup>3</sup> and 48 m<sup>2</sup> respectively.

### Tertiary Treatment/constructed wetland

FSTP is designed in such way that the effluents released from it need to assure the safe discharge to the environment particularly into the water bodies. As described in design report of the project, the proposed effluents quality fulfills the standard requirement specified within the USWSSP-II ESMF. Constructed wetlands will be provided downstream of the ABR to provide final tertiary treatment before reuse or disposal.

Table 6 Expected Effluent Quality Standards

Parameter	Maximum Value	Unit
PH	6 – 9	
BODD	25	mg/l
COD	125	mg/l
Oil and Grease	10	mg/l
TSS	20	mg/l
Ammoniac nitrogen	25	mg/l
Phosphorus	15	mg/l
Total Nitrogen (as N)	30	mg/l
Coliforms	235	per/100ml
Helminthes egg	< 1	helminthes egg/L

Source: Feasibility study and preliminary design report – Debre Berhan

### Dried Sludge Management

If the proposed design is well implemented and maintained, the sludge can be sufficiently stabilized or digested. Hence it can be reused for energy sources such as biogas and composting. Reusing the dry sludge for biogas may help in providing affordable energy sources and reducing the use of natural resources that contribute to combating climate change. The dried sludge with the proposed design procedure is also suitable for agricultural uses except for fruit and vegetable growing. Animals must be kept off the grazing land for three weeks after applying sludge, which can be used for forage development.

A warehouse of 900 m<sup>2</sup> will be constructed on the FSTP site to receive the dried sludge from the drying beds and to store it for five months. The shed construction will ensure that the drainage of stored sludge is provided at the bottom. In addition, it has to be well covered to avoid rewetting by rain and protected from surface runoff. 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. This can improve the public perception of sludge reuse. To increase awareness of the use of sludge for fertilizer and other uses such as biogas, there should be training and communication campaigns to the local community.

### Infrastructures and Auxiliary Facilities

The main components of the fecal sludge treatment plant include access pathways and roads; an office with a toilet/washroom and a small laboratory and a warehouse of 900 m<sup>2</sup> will be constructed on the FSTP site to receive the dried sludge from the drying beds and to store it for five months; waste deposit and sorting area, waste dumping trenches, hazardous waste pit, area for storing the recyclable waste, leachate collection and aeration areas shall be included.

The auxiliary works include fencing the complete FSTP site with 1.55 m of height and one access gate for security reasons. The fencing might include live fencing with the indigenous trees, which improves the aesthetic value of the site.

#### 3.2.3 Implementation Arrangements

The construction has been proposed to be undertaken in the short term. To pursue the smooth implementation of project activities proposed in the plan, this sub-section presents an organizational arrangement shown below composed of concerned organizations:

DBWSSS is the central unit responsible for implementing the overall project activities together with municipal and regional stakeholders. In this regard, DBWSSS is a project management unit, which will oversee front-line activities and day-to-day management during the implementation. DBWSSS is responsible for the preconstruction (designing), construction, operation, and decommissioning phases. The project management unit is to be headed by the enterprise and supported by the Zone Water, Mine and Energy Office, and Regional Water and Energy Bureau. The management unit is further composed of the divisional officers concerned from relevant sectorial offices. The unit may be assisted by experts or consultants on technical issues. On top of this, MoWE is an overarching institution to facilitate the implementation and sustainability of the proposed project. The other entities include health, education, agriculture, culture and tourism, urban development and construction, women and children affairs, labor affairs, etc. Woreda/town Health Office and other relevant health centers in the city shall play a significant role in creating awareness and promoting health standards, disease prevention, and control during the project implementation. Moreover, the office should inform the community of the proper use of improved sanitation and hygiene facilities.

Implementation Mechanism: Though the implementation mechanism related to the tendering procedure is subject to the rules and regulations of the financing agency, packaged contract tendering is the most recommended implementation mechanism that attracts the most competent local contractors.



The short-term implementation schedule is up to 2026 under the five-year development plan. The brief implementation schedule is discussed below.

### 3.2.4 Construction and Civil Works to FSTP

As per the feasibility study the FSTP is designed to serve the population projection for five years Period. The procurement date for the sub-project activities is indicated April 2023 and the completion time of for the construction of the project is estimated to be within 30 months.

Estimated total cost by the engineering consultant for construction of FSTP and associated facilities is ETB 159,510,500 (USD 3,071,000.00). The estimated cost of the proposed fecal sludge treatment facilities is summarized in the following table.

Table 7 Estimated Cost of the Proposed Fecal Sludge Treatment Facilities

Item	Cost (ETH Birr)	Cost (USD)
Earth works	9,529,800	184,000
Access Road and Pavement	15,473,800	298,000
Sludge drying beds	116,909,800	2,249,000
Anaerobic baffled reactor	312,000	6,000
Warehouse building	10,644,000	205,000
Service Building	2,203,800	43,000
Landscaping	4,437,300	86,000
<b>Sub Total</b>	<b>159,510,500</b>	<b>3,071,000</b>

Source: Feasibility study and preliminary design report – Debre Berhan

## **4. POLICIES, LEGAL, AND ADMINISTRATIVE FRAMEWORK**

The implementation of the FSTP project has the potential to cause environmental and/or social impacts that shall be addressed in accordance with relevant Ethiopian legislation as well as the requirements of the World Bank Environmental and Social safeguards and standards. This section provides a highlighted review of the policy and legislative framework for the ESIA associated with the proposed project considering national and World Bank safeguard policies.

### **4.1 Relevant National Policies and Strategies**

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

#### **4.1.1 Constitution of the Federal Democratic Republic of Ethiopia**

The constitution is the supreme law of the land and it was adopted by Ethiopia in 1995 and provides guiding principles for environmental protection and management thereof in Ethiopia. The concept of sustainable development and environmental rights are enshrined in Articles 43, 44, and 92 of the constitution. Article 43 defines the people's right to improved living standards and sustainable development. Similarly, Article 44 states that all persons in Ethiopia have the right to a clean and healthy environment. Article 92 states that the design and implementation of projects in Ethiopia shall not damage or destroy the environment and that the government and citizens have the duty to protect the environment.

The Constitution also acknowledges the right to private property and ownership (Article 40), stating that laws should be in place to regulate the acquisition, transfer, and use of land. Consequently, individuals affected by development projects should be fairly compensated for any damage or loss to their property.

These provisions will be applicable in the case of Project Affected Persons (PAPs) under this project and will to the extent possible be applied in consideration of the World Bank's requirement for full replacement costs for assets and property lost in the case of Bank-financed operations in line with Operational Safeguard 2 of the Banks Integrated Safeguards System. The constitution also states different treaties ratified by the Government of Ethiopia are parts of the Ethiopian legal system.

#### **4.1.2 Policies**

##### **4.1.2.1 Environmental Policy of Ethiopia [8]**

The EPE emphasizes the importance of integrating environmental considerations into all sectors and levels of decision-making. It promotes the conservation and sustainable use of natural resources, the prevention and control of pollution, and the promotion of environmental education and awareness. Overall, the EPE serves as a comprehensive framework for addressing environmental concerns in Ethiopia. It provides guidelines and principles for sustainable development, resource management, pollution control, community participation, and impact assessments. The requirements included in this policy have been considered in the study.



#### **4.1.2.2 Ethiopian Water Resources Management Policy [9]**

The main objective of the policy is to ensure sustainable and efficient use of water resources in Ethiopia for socioeconomic development. The policy addresses sectoral and cross-sectoral environmental issues, conducting an Environmental and Social Impact Assessment study to identify and mitigate potential negative impacts during project phases. An Environmental and Social Management Plan need to be developed based on this assessment. Overall, the policy guides activities to prevent harm to ecosystems, promote coordination in environmental management, and help achieve sustainable development goals.

#### **4.1.2.3 National Health Policy [10]**

Ethiopia's health policy was issued in 1993, with the aim of giving special attention to women and children, to neglected regions and segments of the population, and to victims of manmade disasters. The policy give emphasis on the control of communicable disease, diseases that are related to malnutrition and poor living condition, promotion of occupational health and safety and the development of environmental health.

#### **4.1.2.4 National Policy on Women [11]**

The primary objective of the policy is to ensure gender equality and equal access to resources and decision-making processes for both men and women in Ethiopia without discrimination. It highlights the importance of women's participation in economic and social programs, emphasizing that they should benefit equally from all activities carried out by government institutions. In line with this policy, the proposed project in Debre Berhan town will prioritize equal economic opportunities for both men and women. This includes ensuring equal access to job opportunities and a fair land acquisition process during various project phases.

#### **4.1.2.5 National Policy on HIV/AIDS [12]**

The 1998 Policy on HIV/AIDS of the Federal Democratic Republic of Ethiopia urges communities at large, including government ministries, local governments and the civil society to feel responsibilities for carrying out HIV/AIDS awareness and prevention campaigns “to provide an enabling environment for the prevention and control of HIV/AIDS in the country”. So that it is expected that sufficient awareness exists with the community. In addition, all the workers and contractors working in the proposed sub projects shall be treated fairly in accordance with the policy.

### **4.1.3 Strategies and Programs**

#### **4.1.3.1 Climate Resilient Green Economy Strategy/2011 [13]**

The objective of the strategy is protecting the country from the adverse effects of climate change and promoting a green economy. By implementing different initiatives, Ethiopia aims to limit its greenhouse gas emissions by 2030 to the levels of 2010. This would result in a reduction of 250 MtCO<sub>2</sub>e per year.

Additionally, the strategy emphasizes the importance of sustainable and clean waste management practices to reduce greenhouse gas emissions in the waste sector.

#### **4.1.3.2 Urban Wastewater Management Strategy [17]**

The Ministry of Water, Irrigation, and Energy (MoWIE) issued a strategy in 2017 with the aim of providing a common understanding and guiding vision for effective wastewater management. The strategy focuses on prioritized interventions, targeted programs, and the sustainable use of resources. Its objectives include

developing robust wastewater management institutions, preparing master plans, implementing methods for wastewater collection, treatment, and reuse treated effluent and sludge, and ensuring protection of the environment from wastewater discharge.

#### **4.1.3.3 Integrated Urban Sanitation and Hygiene Strategy [19]**

The strategy was issued by the Ministry of Health (MoH) in 2016. The goal of the strategy is to mitigate the negative impacts of poor urban sanitation and hygiene on health, environment, society, education and the economy by promoting full sanitation and hygiene systems. The strategy encourages all sanitation related interventions to be based on city and town development plans, taking advantage of economies of scale, sharing of best practices within the country, and involvement of the private sector and Community Based Enterprises.

#### **4.1.3.4 National Hygiene and Sanitation Strategy**

This National Strategy for Improved Hygiene and Sanitation has been developed to complement the existing health policy (developed by the MoH, 2005) and the national water sector strategy (developed by the Ministry of Water Resources) in placing greater emphasis on 'on-site' hygiene and sanitation. The primary focus is on blocking faces from entering the living environment through the safe management of faces, hand washing at critical times and the safe water chain from source to mouth. Thus, the ESIA consultant believes that the current sub projects will contribute to the national hygiene and sanitation strategies.

#### **4.1.3.5 Ministry of Water Irrigation and Electricity, Environmental and Social Management Framework (2017)**

According to this framework Piped sewerage system and wastewater/ fecal sludge management treatment facilities<sup>2</sup> are under schedule 2 that requires partial or limited ESIA study withy preparation of ESMP. Accordingly, the project is clearly schedule 2 with limited ESIA study. Also, ARAP will be required for project affected people and settle compensation issue.

#### **4.1.4 Environmental and Social Legislations/Proclamations**

##### **4.1.4.1 Proclamation on Establishment of Environmental Protection Organs [25]**

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

This Proclamation re-established the EPA as an autonomous public institution of the Federal Government of Ethiopia. Furthermore, the Proclamation states that each regional state should establish an independent

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<sup>2</sup> Categorization of subprojects to be considered under the UWSSP (WoWIE ESMF 2017 final draft p.43)

regional environmental agency or designate an existing agency that shall be responsible for environmental monitoring, protection, and regulation in their respective regional states.

#### **4.1.4.2 Environmental Impact Assessment Proclamation: General EIA Guidelines 299/2002 [26]**

The Environmental Impact Assessment (ESIA) Proclamation makes ESIA a mandatory requirement for the implementation of major development projects, programs, and plans in Ethiopia. The proclamation is a tool for harmonizing and integrating environmental, cultural, and social considerations into decision-making processes in a manner that promotes sustainable development.

The Proclamation states that ESIA studies need to include measures to eliminate, minimize, or mitigate negative impacts, a contingency in cases of incidents, and procedures of self-auditing and monitoring during the implementation. EIA guideline determining the modalities of protection, conservation, and promotion of the environment in Ethiopia regulates the conduct of Environmental Impact Assessments (EIAs). In its article, it states that, every project shall be subjected to EIA before obtaining authorization for its implementation. This applies to programs and policies that may affect the environment and with which ESIA has complied. The Vision further requires that an Environmental and Social Impact Assessment (ESIA) be carried out for development and infrastructure infrastructures activities likely to negatively impact the environment. Hence, this project is assessed based on the legal requirements indicated in the proclamation and associated guidelines.

#### **4.1.4.3 Proclamation on Environmental Pollution Control [27]**

The main objective of Proclamation No. 300/2002 is to protect the environment and ensure the well-being of citizens in Ethiopia. It establishes environmental standards and makes the violation of these standards a punishable offense. The "polluter pays" principle is applied to all individuals, and the Environmental Protection Agency (EPA) is responsible for enforcing these standards through the appointment of Environmental Inspectors. This proclamation also helps ensure occupational health and safety for customers and workers involved in the project.

#### **4.1.4.4 Public Health Proclamation, Proclamation No. 200/2000 [28]**

The proclamation emphasizes the need for occupational health and safety, the development of environmental health, and the provision of safe and adequate water for both urban and rural populations. It also encourages the safe disposal of waste and measures to improve the quality of housing and work premises for better health

#### **4.1.4.5 Solid Waste Management- Proclamation No. 513/2007**

The objective of the solid waste management proclamation is to prevent adverse impacts and create beneficial assets from solid waste. It emphasizes community participation and the management of various types of solid waste. The Proclamation addresses existing waste management problems and aims to prevent environmental pollution. The EPA and regional environmental agencies have responsibilities in implementing the Proclamation. Community participation is promoted, and urban administrations are required to prepare solid waste management plans. Project proponents must adhere to regulation requirements and allocate necessary resources for waste management.

**4.1.4.6 Proclamation on Hazardous Waste Management [29]**

The purpose of this proclamation (Proclamation No.1090/2018) is to prevent and control problems of environmental pollution caused by the mismanagement and disposal of hazardous waste. It deals with creating a system to control the generation, storage, treatment, recycling and reuse, transportation, disposal and movement of hazardous wastes is of paramount importance to prevent harm to human and animal health as well as the environment due to the mismanagement of hazardous waste. The project contractor and proponent must establish clear procedures in terms of handling hazardous wastes such as fuels, chemicals, and others based on the requirements in this proclamation. Subsequent implementation of the procedures needs to be inspected by an environmental expert involved in the project.

**4.1.4.7 Proclamation on Ethiopian Water Resources Management [30]**

The Proclamation (Proc. No. 197/2000) issued in March 2000 regulates water resources management, protection, and utilization in Ethiopia. Its aim is to ensure the proper conservation, utilization, and prevention of harmful effects related to water resources. The Supervising Body, either the Ministry or a delegated organ, is responsible for planning, managing, and protecting water resources. Certain activities such as constructing water works, supplying water, transferring water, and releasing waste into water resources require a permit from the supervising body.

**4.1.4.8 Proclamation on the Development, Conservation, and Utilization of Wildlife [31]**

The Wildlife Proclamation No.541/2007, enacted in August 2007, approves the development, conservation, and utilization of wildlife in Ethiopia. The proclamation emphasizes the importance of protecting and conserving wildlife species and establishing mechanisms for their conservation and protection. Wildlife conservation and protected areas are categorized with four categories as 'National Park', 'Game Reserve' and 'Sanctuary', 'Controlled Hunting Area'. However, the designated FSTP site is not under the category of any of the above wildlife conservation areas and does not have any impact on the wildlife and their habitats.

**4.1.4.9 Proclamation on Forest Development, Conservation, and Utilization [32]**

The proclamation prohibits cutting endangered indigenous naturally grown trees from state forest or those naturally grown in community forest. So, in this regard, the relevant stakeholder shall be involved in the site selection for FSTP Debre Berhan city that does not cause any permanent damages to the forest/natural resources in the surrounding environmental settings.

**4.1.4.10 Proclamation on Research and Conservation of Cultural Heritage [33]**

The Proclamation provides a legal framework for the management, exploration, discovery, and study of Cultural Heritage in Ethiopia. Article 41 specifically addresses the fortuitous discovery of Cultural Heritage during various activities such as mining explorations, building works, road construction, or other similar activities. It states that any person who discovers Cultural Heritage in these circumstances must report it to the Authority and protect it until the Authority takes delivery of it. The Authority is responsible for examining, taking delivery of, and registering the discovered Cultural Heritage. Additionally, the Proclamation states that if Cultural Heritage is discovered during construction activities in a reserved area, the construction must be stopped, and the discovery must be reported to the Authority.

**4.1.4.11 Ethiopian Wildlife Protection Proclamation [35]**

The Wildlife Proclamation No.541/2007, enacted in August 2007, approves the development, conservation, and utilization of wildlife in Ethiopia. This legal enactment aims to enhance the contribution of the wildlife sector towards poverty reduction and maximize the economic and social benefits derived from wildlife resources. The proclamation emphasizes the importance of protecting and conserving wildlife species and establishing mechanisms for their conservation and protection. Wildlife conservation and protected areas are categorized with four categories from the highest protection ranking 'National Park', followed by 'Game Reserve' and 'Sanctuary' to 'Controlled Hunting Area'. Thus, protection and conservation aspects of wildlife species, established mechanisms for conservation and protection of wildlife, etc. shall be assessed to ensure/enhance wildlife management shall be formulated as part of ESMP.

However, the designated FSTP site for Debre Berhan town is not under the category of any of the above wildlife conservation areas and does not have any impact on the wildlife and their habitats.

**4.1.4.12 Ethiopian building code: Proclamation no. 624/2009 [36]**

The building code in Ethiopia determines the minimum national standards for construction or modification of buildings to ensure public health and safety. It applies to urban centers with 10,000 or more dwellers and regulates design, materials used, and other minimum standards for public safety. The code also considers the impact on surrounding economic and public movement, ensuring that buildings do not impair the safety of people, other constructions, or properties. Precautionary measures must be taken during excavation to maintain the safety and stability of neighboring properties or services. The code applies to all classes of buildings and covers health and safety precautions for common construction activities. Special construction methods require associated health and safety measures. These codes should be considered throughout the implementation of the project.

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

This proclamation is the main legislation in Ethiopia regarding land expropriation. It provides guidelines for the expropriation process, compensation, and the purposes for which expropriation can be carried out. The power to expropriate land for public purposes lies with Woredas or urban administrations, and compensation must be paid in advance.

Concerning the compensation, the government has developed a regulation (Regulation 472/2020) which defines in detail how compensation for the expropriated property should be calculated. According to the law, people who are displaced due to expropriation in rural lands (lands used for production) have the right to be compensated for the loss of income from the land if they do not receive replacement land. The compensation is defined as 10 times the yearly income from the land, based on the average income from the last 5 year (article 8(1)).

The Amhara National Regional State Rural Land Administration and Use System Implementation, Council of Regional Government Regulation (Regulation No.51/2007) reassures and complies with the federal compensation processes and procedures.

#### **4.1.4.14 Labor Law/Proclamation 1156/2019**

The Labor Proclamation in Ethiopia, revised in 2019, governs labor conditions based on the political, economic, and social policies of the federal government and international conventions and treaties. It includes provisions on occupational safety, health, working environment, prevention measures, and employer obligations. The proclamation requires employers to take necessary measures to safeguard workers' health and safety. Moreover, the Occupational Health and Safety Directive [39] provides the limits for occupational exposure to working conditions.

According to the proclamation, employers are obligated to pay workers their entire wages, which should be done at the end of a month or based on agreement. The intended Environmental and Social Impact Assessment (ESIA) will assess the availability and level of labor required for the project and considers measures to safeguard the socio-cultural component of the area.

## **4.2 World Bank Environmental and Social Safeguard Policies**

### **4.2.1 The World Bank Operational Policy 4.01 [40]**

In addition to the requirements of the Federal Government of Ethiopia, donor organizations such as the World Bank have requirements for environmental assessment (EA). The WB E&S safeguards policies are applicable as part of the UWSSP II implementation. Five of the ten WB safeguards Policies are triggered as part of implementation of the UWSSP II (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). Besides, the World Bank Group (WBG) Environment, Health and Safety Guideline (EHSG) shall be applicable as deemed necessary. The World Bank Operational Policy 4.01 requires EA of projects proposed for Bank financing to ensure that they are environmentally sound and sustainable, and thus to improve decision-making. The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.

EA considers the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. It also takes into account the variations in project and country conditions; the country's overall policy framework, national legislation and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The Bank does not finance project activities that would contravene such country obligations.

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

- Category A: A full EA is required. I.e., a proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented.
- Category B: Although a full EA is not required, environmental analysis is required. A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas-including wetlands, forests, grasslands, and other natural habitats are less adverse than those of Category A project. These impacts are site-specific; few if any of them are irreversible; and in most cases, mitigation measures can be designed more readily than for Category A projects.

- Category C: No EA or environmental analysis is required. A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.
- A proposed project is classified as Category FI if it involves an investment of Bank funds through a financial intermediary, in project that may result in adverse environmental impacts.

The FSTP have been rated Environmental Risk Assessment Category B and trigger five environmental and social safeguard policies. However, the following safeguards policies are more relevant and applicable as part of implementation of the proposed FSTP project activities; Environmental Assessment (OP/BP 4.01); Involuntary Resettlement (OP/BP 4.12); and Physical Cultural Resources (OP/BP 4.11).

OP/BP 4.01 requires environmental and social impact assessment (ESIA) of projects/to ensure that they are environmentally sound and sustainable. The ESIA process will lead in the preparation of an ESMP for proposed project activities in the town. The ESMP is set out mitigation, monitoring, and institutional measures to be taken during operations of these activities, to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

#### **4.2.2 Physical Cultural Resources (OP/BP 4.11) [41]**

The objective of this policy is to assist countries to avoid or mitigate adverse impacts of development projects on physical cultural resources. For purposes of this policy, ‘physical cultural resources’ are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.

#### **4.2.3 Involuntary Resettlement (OP/BP 4.12) [42]**

WB Involuntary Resettlement Policy OP 4.12 requires that all projects with land acquisition implications are guided by a Resettlement Policy Framework (RPF) [43], which outlines processes and procedures to be followed for the preparation of site-specific RAPs during project implementation. However, in Ethiopia, there are no explicit requirements for an RPF or RAP. As regards compensation, Ethiopia requires only the rightful land or property owner (statutory or customary rights of occupancy) should be compensated, while the WB OP 4.12 requires that any person (whether is the rightful owner or not) who lose or is denied or restricted access to economic resources including tenants, squatters should either be compensated for use of the land or assisted to move. The UWSSP-II project will apply both WB requirements and the Ethiopian government’s guidelines regarding compensation and resettlement of PAP, and where there are gaps between these two, the most stringent policy will prevail. However, the FSTP project in Debre Berhan is not expected to cause any physical displacement.

#### **4.2.4 General Environmental Health and Safety (EHS) Guidelines [44]**

The General EHS Guidelines, developed by the International Finance Corporation (IFC), cover various technical references that can be applied to general and industry-specific actions that resonate with Good international Industry Practices. These Guidelines can apply to this program, along with the mentioned legislation outlined in this section. Specifically, the following EHS guidelines can be considered:

- General EHS Guideline (1): Environmental



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

### 4.3 Comparison between Ethiopian and World Bank Policies

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

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

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

However, the Ethiopian guidelines do not make provisions for the screening of sub-projects of a smaller scale than those listed in Schedules 1 and 2, and which may have negative localized impacts which will require mitigation.

### 4.4 Gaps between the National and the World Bank OP 4.12

There are some gaps between Ethiopian laws and regulations and the requirements for resettlement as laid out in OP 4.12. In some cases, the Ethiopian laws and regulations are incompatible with the Bank’s OP 4.12 provisions. Table 8 below compares Ethiopian Law on land acquisition and the World Bank’s operational policy and recommended measures to address the gaps:

Table 8 Comparison of Ethiopian Legislation and World Bank’s Operational Policy

Theme	World Bank’s Safeguard Policies Applicable	Ethiopian Legislation	Measures to Address the Gaps
<b>Eligibility for Compensation</b>	World Bank OP4.12 gives eligibility to those who have formal legal rights to the land, who do not have formal legal rights to land, but have a claim to such land; and who do not have a recognizable legal right or claim to the land	Proclamation No1161/2019, Article 8(1) allows’ landholders’ to be eligible for compensation. Article 8, landholders or their agents whose landholdings are to be expropriated shall submit landholding certificates or other proofs that show their landholding rights over the	Eligibility criteria for compensation and assistance shall align with the WB eligibility for benefits.

Theme	World Bank's Safeguard Policies Applicable	Ethiopian Legislation	Measures to Address the Gaps
		lands that are decided to be expropriated to the urban or rural land administration office on the schedule of the office.	
<b>Public consultation and disclosure procedures</b>	Consult project-affected persons, host communities, and local NGOs, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan) and for establishing appropriate and accessible grievance mechanisms.	There is a specific Guideline entitled "Guideline on Public Consultations in Environmental and Social Impact Assessments Process," which was entered into force in December 2018 by the FDRE EPA.	Provide project-affected persons and local NGOs/CSOs, local leaders, vulnerable groups, media and women as appropriate the opportunities to participate in the planning, implementation, and monitoring of the resettlement program.
<b>Measures for livelihood restoration and assistance to vulnerable groups</b>	Livelihoods and living standards are to be restored in real terms to pre-displacement levels or better. OP 4.12 further requires attention to the needs of vulnerable groups such as those below the poverty line, landless, elderly, women and children, indigenous groups, ethnic minorities, and other disadvantaged persons.	No specific laws or regulations specify support for livelihood restoration and transition and moving allowances. Ethiopian law makes no specific accommodations for potentially vulnerable groups such as women, children, the elderly, ethnic minorities, indigenous people, the landless, and Those living under the poverty line.	Additional support may be needed for vulnerable groups. Vulnerable groups in the project area will be identified, and the support needs specified in ARAP or LRP.

#### 4.5 Multilateral Environmental Agreements

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

**4.5.1 United Nations Convention on Biological Diversity (UNCBD):**

Ethiopia has ratified this Convention by Proclamation No. 98/94, on May 31, 1994. The Convention has three goals: (i) the conservation of biodiversity; (ii) the sustainable use of the components of biodiversity; and (iii) the fair and equitable sharing of the benefits arising from the use of genetic resources. Under this convention any sanitation facility development shall not be interfered with the biodiversity of the proposed sites.

**4.5.2 United Nations Convention to Combat Desertification (UNCCD)**

This Convention has been ratified by Ethiopia in 1997 through Proclamation No. 80/1997. The objective of the Convention is to combat desertification and mitigate the effects of droughts in countries experiencing serious drought and/or desertification, particularly in Africa. Thus, any activities should not lead or aggravate desertification and do not reduce efforts of combating deforestation process.

**4.5.3 United Nations Framework Convention on Climate Change (UNFCCC)**

Ethiopia has ratified the Convention through Proclamation No. 97/1994 on May 2/1994. This Convention takes into account the fact that climate change has trans-boundary impacts. Its basic objective is to provide for agreed limits regarding the release of greenhouse gases into the atmosphere and to prevent the occurrence or minimize the impact of climate change. Any activities related to sanitation facility development shall not contribute to global warming through the greenhouse gas emissions.

**4.5.4 Convention on the Protection of World Cultural and Natural Heritage**

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

**4.5.5 The Vienna Convention on the Protection of the Ozone Layer**

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

The basic objective of the Convention is to combat the negative impact on the environment and human beings resulting from ozone depleting substances by reducing the amounts released and eventually banning their commercial use through internationally agreed measures.

**4.5.6 The Basel and Bamako Conventions:**

Both of these Conventions have been acceded by Ethiopia. The agreements regulate the Trans boundary movement of hazardous waste for reclamation or final disposal. In preparing this proposed project, these international agreements that Ethiopia signed shall be considered when it deems necessary at various phases of the project intervention in Debre Berhan town.

#### **4.6 Administrative and Institutional Framework**

The FDRE Environmental Protection Authority (EPA) was established under Proclamation No. 295/2002 as an autonomous public institution of the Federal Government of Ethiopia entrusted with the protection and conservation of natural resources in Ethiopia. The general role of the EPA is to provide for the protection and conservation of the broad environment through the formulation of policies, strategies, laws, and standards, which foster social and economic development in a manner that enhances the welfare of humans and the safety of the environment.

The Debre Berhan Environmental Protection Agency (EPA) is in charge of handling environmental protection matters within the town. The Bureau oversees the assessment and approval of Environmental and Social Impact Assessments (ESIAs) for development proposals, as mandated by the Regional Government. Additionally, they monitor the implementation of ESIA recommendations for such proposals. Therefore, project proponents in the Region should cooperate closely with the Bureau to ensure that the adverse environmental effects of development proposals are properly identified and their mitigation or management actions incorporated in the project design or planning and implemented at the right time. Similar to the federal level, an Environmental Impact Study Report should be prepared by the project proponents and examined, commented and approved by the AEPA.

## 5. DESCRIPTION OF BASELINE CONDITIONS

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

### 5.1 Physical Environment

#### 5.1.1 Climate

Debre Berhan is one of the coolest towns which are found in the sub-tropical zone of Ethiopia. The town is characterized by high humidity and heavy rainfall from May to October. The average annual rainfall at Debre Berhan is 1,219.2 mm [1], while the mean temperature of the town and its surrounding area ranges from 20°C to 30°C. The monthly rainfall pattern shows a unimodal rainfall pattern with a longer rainy season from May to October, with the highest rainfall occurring in July & August. Generally, the town is characterized by Dega (cool) climate conditions.

#### 5.1.2 Topography

The topology of the town is characterized by ups and down topography mainly covered by hills, with a small part of the plain surface. The hilly area is in the form of undulating terrain. The town's elevation is between 2618 and 2870 m a. s. l [45].

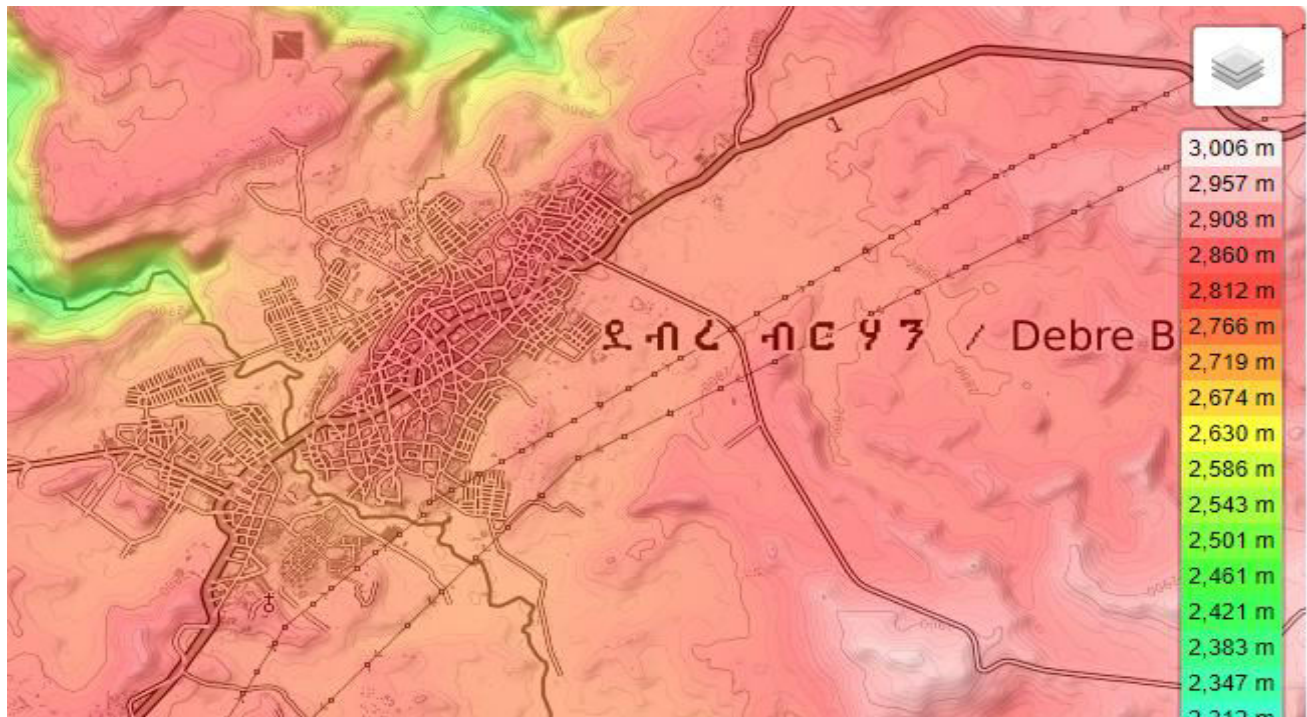


Figure 7 Debre Berhan topographic map, elevation, and terrain

Source: Topographic-map.com

In the neighborhood of the town, there are oriented northwest and southeast. These valleys become deep steep-sided river gorges to the northwest and north of the town eventually joining the Blue Nile gorge. The town itself lies on a low-laying ridge-oriented northeast to southwest situated between two broad valleys. The slope of Debre Berhan is characterized into four types. These include gentle, moderate, steep, and very



steep slopes. The majority of the parts of the town mainly have a gentle and moderate slope and the fecal sludge treatment plant (FSTP) lies within a slope (the slope range of 2.5-3.5% gradient).

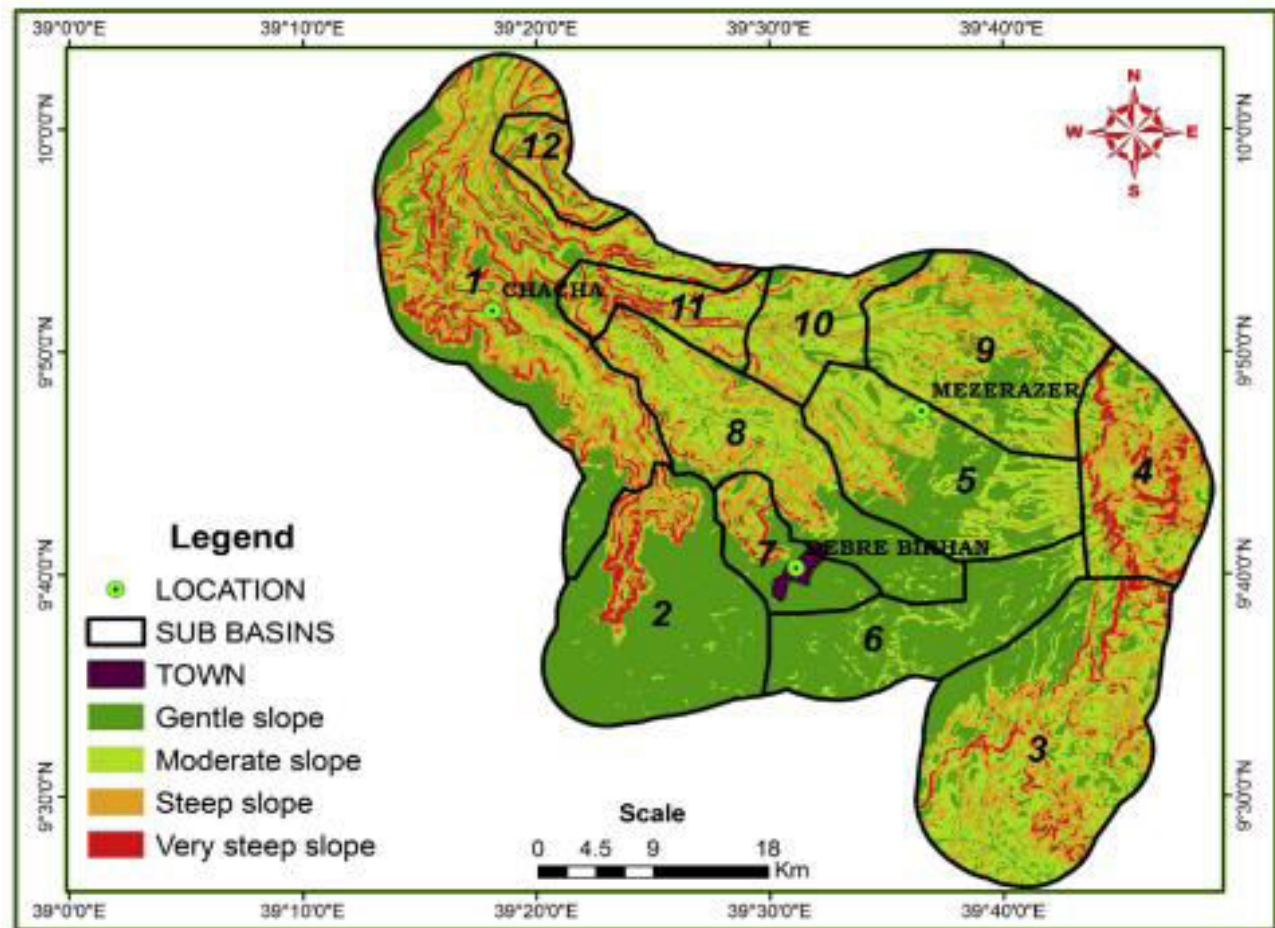


Figure 8 Slope map of the Debre Berhan

Source: [ Bagyaraj et al (2019)<sup>3</sup>46]

### 5.1.3 Wind Speed and Direction

The average hourly wind speed in Debre Berhan is characterized by a significant seasonal variation over the year. As per the data from whether sprk.com the windier part of the year lasts for 8.4 months (from September 25 to June 8), with average wind speeds of more than 9.2 kilometers per hour. October is the windiest month of the year in the town, with an average hourly wind speed of 11.5 kilometers per hour. August is the calmest month with an average hourly wind speed of 6.6 kilometers per hour. The calmer time of year lasts for 3.6 months, from June 8 to September 25.

The major average hourly wind direction in Debre Berhan varies throughout the year. Easterly winds are the most prevailing wind in the town. The wind is most frequently from the east for 11 months, from August 8 to July 12, with the highest percentage of 91% in the first week of January. The wind most frequently blows from the west for 3.9 weeks between July 12 and August 8 [47].

<sup>3</sup> Data of remote sensing and GIS - to demarcate the potential sector of groundwater in Debre Berhan, Amhara region, Ethiopia

#### 5.1.4 Geology and Soils

According to the design and feasibility study of the project the geology around Debre Berhan town and its vicinity has the Cenozoic volcanic mainly of ignimbrite with patches of trachyte and rhyolite at few places overlain by thin layer of Tarmaber Megezez basalt at few spots and Tertiary basalt north of the town. The Tertiary sediments are also reported in mega structures in some drilling reports. In general, the project area is covered with basaltic rocks, ignimbrite, rhyolitic glass, and occasional loosely welded tuff.

The FSTP site is covered by black cotton soil at the top overlying weathered tuff, ignimbrite and basalt. The black cotton soil overlies brownish soil or weathered rock. The thickness of the black cotton soil cover ranges from 0.5m to 1.2m (Artelia 2022). As per the design study permeability values of soils are less than 10.6 m/sec, which is considered impermeable. Moreover, the study showed that no seismic hazard or any important impact of landslides at any of the sites identified.

#### 5.1.5 Water Resource

The project area is located in one of the highlands areas of Ethiopia and hence there are rivers and streams that originate and transverse the town. Both perennial and/or intermittent streams, rivers, and an artificial pond/dam also exist in the area. Beressa River is the only perennial river draining through the town of Debre Berhan. The river flows from southeast to North West and this is the main source of agricultural irrigation around the area. The Barossa River is found in the Jema sub-catchment of the Abbay River Basin. The FSTP project site has no rivers or wetland areas within a 1 km radius.

According to the study conducted by the design consultant, the average static water level (SWL) is at about 11.55 m below ground level with the maximum depth being recorded to be 18 m. However, one shallow groundwater spring was also observed downstream of the FSTP site with a water level of about 3 m.

#### 5.1.6 Noise and Vibrations

Most of the urban areas experience 'typical' noise and vibration levels that are generated from normal human activities and vehicles (e. g. 'Bajaj'). Road traffic noise levels are considered below 55 Decibels during the day and 45 Decibels during the night, and the range of densely traveled roads as established by WHO (1997) is representative of urban city areas.

#### 5.1.7 Air Quality

In general air quality is influenced by anthropogenic activities distinguishing two main sources, namely mobile and stationary sources associated with the project activities. The local stationary sources are not a serious challenge to the local air quality. Excavation and vehicle activities are major sources of ambient air pollution arising from the project activities during construction. In addition, the exhaust from the vehicles during the construction is a short-term source of ambient air pollution with insignificant levels. Furthermore, during operation, there will be no potential permanent sources of ambient air pollution except evaporation of liquid wastes with some toxic materials.

Emissions to the ambient air from vehicles may include pollutants particulate matter (PM), Benzopyrene, Carbon dioxide (CO<sub>2</sub>), Nitrous oxide (NO<sub>x</sub>) Phosphorus, Sulphur oxide (SO<sub>x</sub>). Prolonged exposure to these activities poses the risk of acute respiratory infections. However, these toxic substances will not be released



in a significant amount since the construction phase takes only a few months and the emission amount will be small.

Exhaust emissions are highest in urban centers and along major highways and vary according to periods of peak traffic flow. However, the FSTP site is not subjected to such congestion during construction and operation phases, since it is located in the outskirts of the town. The operation of FSTP might generate greenhouse gases such as CO<sub>2</sub>, CH<sub>4</sub>, Sox, etc. which have the potential to affect the ambient air of the project's surroundings.

## 5.2 Biological Environment

The proposed FSTP site is located in an area where farming is practiced. The upstream of the FSTP site is covered by the eucalyptus trees (small in coverage) and the downstream is gorges and quarry site for the production of selects. There are no natural streams or water sources close to the proposed FSTP site.

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

- No threatened, rare, or endangered species of fauna or flora were registered or known to exist around the site.
- No sensitive or fragile habitats were noted in relation to the extent and magnitude of the envisaged works.
- The current degree and extent of the proposed works do not interfere with any protected area.

### 5.2.1 Local Flora and Fauna

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

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

### 5.2.2 Land Use

The land use in the town can be classified as residential, buildings, water bodies, and open spaces. The land use category under the building includes governmental and non-governmental institutions, service institutions such as education institutions (KG up-to-University level) health institutions (including health

post health center and hospitals); civic and cultural service giving places (ceremonial places, youth centers, public library) and worship places & cemetery places; as well as industrial areas.

There are many open spaces in different parts of the town and farm lands which are used as a source of livelihood for the residents in and around the town are among these spaces. The site proposed for the construction of FSTP is categorized in these land use patterns. As per the site survey and observations made on the proposed FSTP site (also solid waste site), crops such as pea, bean, and wheat are growing in the allocated plots and it constitutes a major source of income for about 7 households..



Figure 9 partial view of FSTP Site

### 5.2.3 Conservation Areas

The specific project site (FSTP) has no forest reserves, no National Parks, or any form of conservation area as defined in the National Wildlife Policy. Similarly, there are no culturally, historically, or archaeologically sensitive areas close to the FSTP site.

## 5.3 The human environment (socio-economic settings)

### 5.3.1 Population and Settlement Areas:

Debre Berhan is the administrative center of the North Shewa Zone in the Amhara regional state. According to the National Population and Housing Census of 2007 conducted by the Central Statistical Agency of Ethiopia (CSA), the population of Debre Berhan was registered to be 65,231, of which 48.6% (31,668) were male and 51.4% (33,563) were female. According to this census, the majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 94.12%, while 3.32% of the population was Muslim and 2.15% were Protestants [48]. Currently, the town has a 146,918 total population of which 73,685 are Male and 73,233 are Female (Figure 10). The town has 31 Kebele administrative (lowest administrative structures) a total area coverage of 146.27 km<sup>2</sup> (14,627 hectares) with a population density of 1,004.4/km<sup>2</sup> [49].

Between 2007 and 2022 the population has increased by 125% during the phase of the project. This increase in population is expected to continue producing larger quantities of excreta.

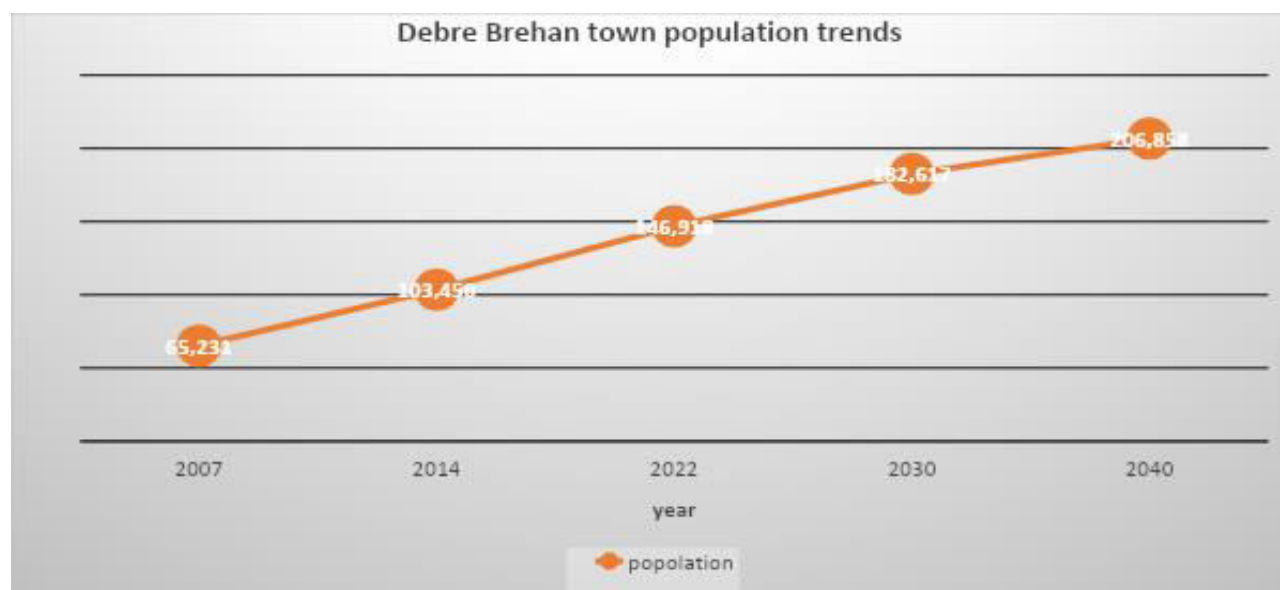


Figure 10 Population trends of Debre Berhan Town

Source: CSA

### 5.3.2 Economic Conditions

A large portion of the urban population earns income through various means, including businesses, farming, and government or private employment. Formal jobs are increasing, and economic activities in the town focus on agricultural product sales and retail trade of consumable goods. Other important economic activities include government and private sector services such as petty trading, hotels and tourism, restaurants, cafeterias, and transportation services. Agricultural production on the outskirts of the town is also a significant source of livelihood. Debre Berhan is attracting investments and a significant labor force.

### 5.3.3 Health

The major health institutions in the town include one hospital, health post, and one health center and clinic owned by both public and private. Based on data from the Debre Berhan town Woreda health office respiratory and gastrointestinal diseases such as diarrhea are among the top ten prevalent diseases that occur in the town. The lists of the top ten diseases and the number of cases registered in 2021/22 are indicated in the table below.

Table 9 Top Ten Diseases and Number of Cases in Debre Berhan Town 2021/22(2014 EC)

Disease	Number of cases
Respiratory Infection	7,453
Typhus fever	5,359
Dyspepsia	5,329
Tonsillitis (Acute pharyngitis unspecified)	4,854
Urinary Tract Infection	4,808
Typhoid Fever	4,710

Fecal Sludge Management, Debre Berhan City-ESIA		October 2023
Disease	Number of cases	
Pneumonia		3,891
Amoebiasis		3,520
Severe febrile disease		3,144
Diarrhea (Functional diarrhea)		2,338

Source: Debre Berhan Town health Office

### 5.3.4 Education

There are government and privately owned-educational facilities in the town. Such facilities include nursery schools, several primaries, and secondary schools. Debre Berhan University is one of the government-owned higher educational institutes in the town.

Accordingly, 152 private and governmental schools operated in the Town in 2022/23. The total number of students registered in such schools in the same year was 48,783, of which 53% are females and 47% male (Table 10).

Table 10 Education Facilities and Number of Schools and Students

Sr.no	Schools	Ownership				No of students		
		Private	Public	NGO	Total	F	M	Total
1	Secondary	3	8	-	11	7779	4841	12611
2	Primary	19	47	-	66	12936	12889	25825
3	KG	29		-	29	3007	2964	5971
4	O-Class	-	46	-	46	2156	2290	4376
5	University	-	1	-	-			

Source: Debre Berhan Town Woreda education Office

### 5.3.5 Utilities and Services

Major transportation facilities comprise roads connecting different parts of the north Shewa zone, neighboring zones of the Amhara regional state, neighboring Oromia towns, and Addis Ababa. The North Shewa zone has many tourist attraction sites, as well as industrial park. Hence, the influx of visitors and travelers in and out of the town is increasing from time to time which is expected to contribute and increase waste generation in return. The road which connects Addis Ababa to the northern parts of the country provides good economic opportunities to the town but also contributes to the generation of waste.

Regarding electricity power supply, the town is being serviced on a 24-hour basis with power supply from the national grid. Although there is occasional interruption of power supply, the town has almost 100% power supply coverage. In the town, there are also communication facilities (for mobile phones, line phones, internet, fax, and postal services).

### 5.3.6 Water Supply

The main source of water supply for the town is groundwater. The town water supply is from 14 boreholes. However, residents in the periphery of the town also use spring water.

## **5.4 Existing Waste Management Practice**

### **5.4.1 Solid waste Management [50]**

The sanitary condition of the town is poor, like many similar towns in Ethiopia. Most of the households use pit latrines that are in poor condition, and domestic solid waste disposal in any available open field is common.

The major sources of solid waste in Debre Berhan town could be categorized into domestic, commercial, institutional, industrial, and construction and demolition. The predominant quantities of waste generated in the town are from domestic and commercial, followed by others. The other major solid waste contribution comes from the streets and open markets of the town where different inorganic and organic materials such as vegetables, fruits, chat (khat), etc., are generated daily in huge quantities.

In Debre Berhan, waste collection systems are not properly planned to effectively utilize available resources. Less than half of the generated waste is collected, and almost all of the collected waste is dumped haphazardly in a crude manner, and no evidence that the collected wastes are used as inputs for various productions such as fertilizers and biogas, etc. The current solid waste collection practice in Debre Berhan town includes communal containers, curbside truck collection, and in some areas of the town door-to-door collection is used.

### **5.4.2 Wastewater and Faecal sludge Management**

One of the major concerns for Debre Berhan town, poor liquid waste management, is threatening public health and menacing the natural environment. Gray water and black water are the two main types of wastewaters, which are being generated in Debre Berhan from households, commercial entities, health facilities, hotels, public and non-public institutions, industries, and community gathering places. Both on-site and off-site management of wastewater requires improvement.

There is a problem with the proper disposal of wastewater generated through household activities. Soil infiltration is poor, so even households with seepage struggle to remove their daily effluent [51]. Households discharge their grey water into the storm water drain. Most of the households collected and disposed of wastewater to drainage canal ditches and to the nearby Barossa River. Fecal Sludge is usually collected using vacuum trucks and disposed of in some low-lying areas. This creates severe air and water pollution, leading to major health issues for the people in and around the area.

To alleviate this sanitation problem, efforts to plan and implement wastewater management, including rehabilitation and construction of communal latrines and effective fecal sludge management, have been put in place by different organizations. Despite all efforts made to alleviate the sanitation problem, wastewater management is still posing threats to the local communities and the environment.

Most of the residents in the town use pit latrines that are in poor condition, and domestic solid waste disposal in any available open field is common. This has been observed during fieldwork and community discussions (Key informant interview and FGD).

According to the feasibility study report, the town relies fully on onsite sanitation technologies, with a majority of the population utilizing different types of pit latrines. According to the Ethiopian Demographic and Health Survey (EDHS) 2016, only 16% of Ethiopian households in urban areas use improved toilet facilities, and more than one-third (35%) of toilet facilities are shared in urban households. Moreover, one in three households in Ethiopia has no toilet facility (39% in rural areas and 7% in urban areas).

According to the household survey conducted by the Sustainable WASH Systems Learning Partnership, 51.14% of respondents use a private latrine and 48.21 % use a communal or shared toilet with other households in the town. As per this study, a higher proportion of house owners, 62.30 percent, have private facilities compared to 48.39 percent of renters in public housing with private sanitation facilities. The majority of renters of privately owned houses use communal and shared facilities. This poor sanitation coverage suggests that is a critical area for improving sanitation service levels.

Based on the information from the feasibility study, there are private and public service providers currently officially operating for liquid waste/sludge collection, emptying, and transportation in Debre Berhan. In the town, emptying and transportation services of fecal sludge/wastewater for large hotels are provided by private service providers based in Addis Ababa (located 130 Km from Debre Berhan).

## 6. PROJECT ALTERNATIVE ANALYSIS

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

### 6.1 'No Sub-Project' Option

One of the many choices provided and examined in the comprehensive ESIA in order to meet the program objectives is the "no action" option. Technical, economic, environmental, social, and climate risk comparisons were made amongst the alternatives, taking into account the different issues. Doing nothing will jeopardize or delay the long-term city development plan since a good sanitation system is essential for maximizing the effects of other development measures and elevating the city's status.

Under the Do-Nothing Alternative, FSTP will not be built and operated, and the unsanitary conditions associated with the dispersal fecal sludge to the environment surrounding the town will continue. The do-nothing alternative would mean that land and water and ultimately the surrounding environment will continue to be polluted and loaded with untreated fecal matter and potential disease vectors. The existing system released the untreated micro-nutrients (mainly nitrogen and phosphorus) into the natural environment.

The FSTP project in Debre Berhan town is expected to: improve sanitation and public health in the urban setting. The municipal population is growing fast amid the absence of adequate and quality sanitation services and facilities. From the economic perspective as well as health and social considerations, the following benefits will be realized: i) improved sanitation; ii) enhance modern FSM; and iii) low incidence of pollution, diseases, and accidents.

For this project, the alternative of "no-project" will increase the risks of poor public health and environmental degradation. Hence, the 'no sub-project' option is not a viable alternative.

### 6.2 Alternative FSTP

#### 6.2.1 FSTP location alternatives

Initially four sites were proposed by the town administration in collaboration with DBWSSS and other relevant stakeholders during the design and feasibility period, but an additional site was also proposed, and a total of five separate FSTP sites were considered in the ESIA study. The proposed sites are:

1. Kebele 07 (old/existing disposal site)
2. Genet Georgis (new)



3. Habitat/college (new) /Dibicho Gure.
4. Misir Duqate (new)
5. Tiqur Gedel (existing site)

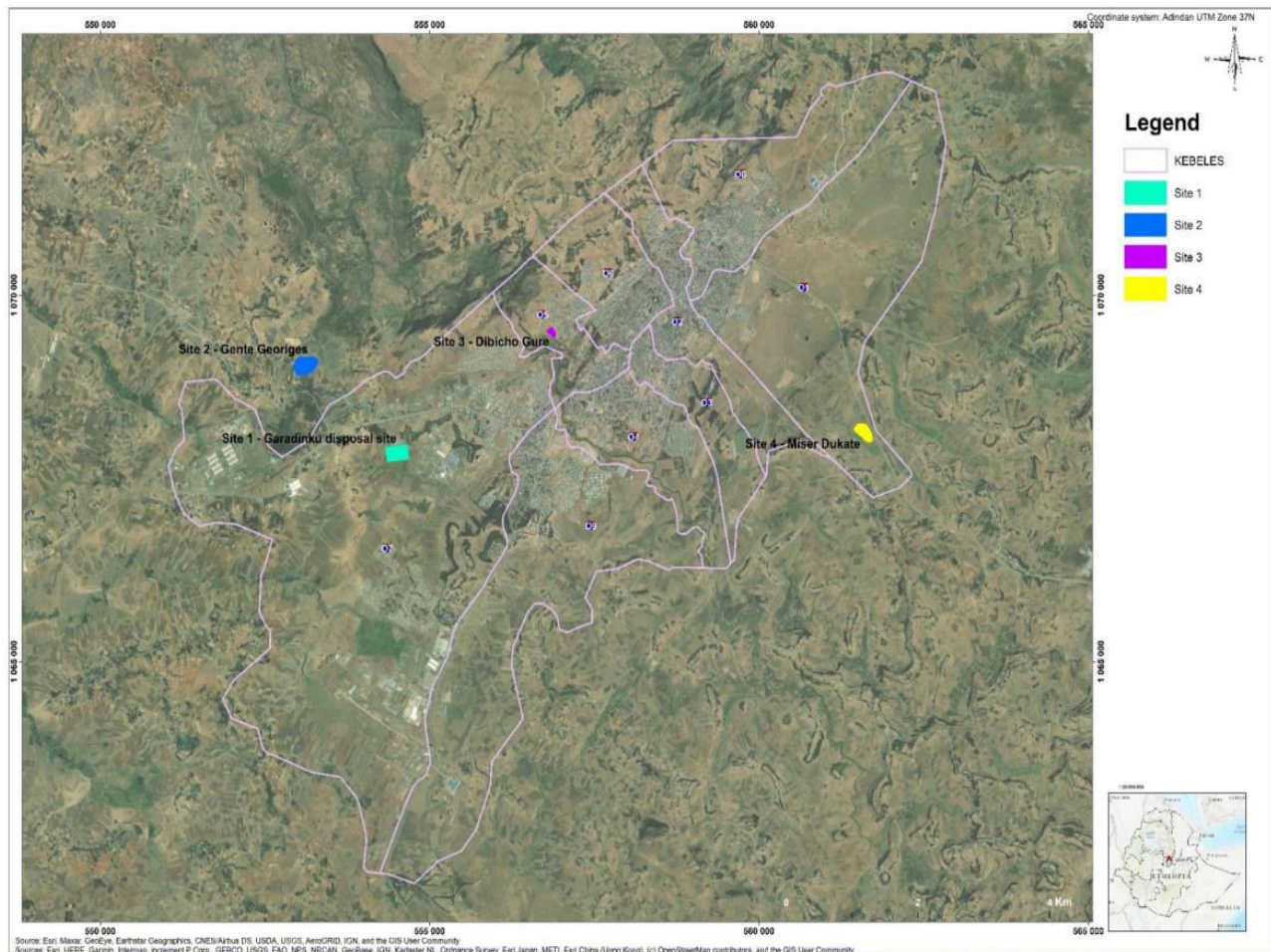


Figure 11 Proposed FSTP Locations

Source: Feasibility study and preliminary design report – Debre Berhan

**Option 1: Kebele 07 site/ Garadinku disposal site**, this is also an existing fecal sludge dumping site and solid waste dumping site. It is about 5.5 km from the center of the town to north south of the town along the Jiru Road. The site is close to the Tiqur Gedele site. The landfill at this site is the only active landfill used by the town and is planned to close soon.

The site is surrounded by a farm, close to the settlement, close to a milk processing factory (agro-industry), close to the streams and low groundwater. It has no sufficient land for the expansion of future works. Moreover, settlement is a key issue due to the expansion of urban centers.



Figure 12 Partial View of Tiquir Kebele 07 Waste Disposal Site

**Option 2: Genet Georgis site,** this site is found in Genet Kebele in the north-western part of Debre Berhan town which consists of about 3.8381 ha of farmlands. It is seven kilometers away from the center of the town. It is also adjacent to the newly demarcated landfill site. The site will have an eleven-meter-wide access road. The slope of the area is estimated to be gentle slope (2.5-3.5 degrees). This allows the liquid treatment part of the plant to work largely by gravity. It has a black soil (vertisol).

The upstream is covered by the eucalyptus trees, and the downstream is quarry site and a natural water way which drains to Beressa River. The land is currently used for agricultural cultivation by seven (7) households. The city land administration has under taken Composition plan and in the process of compensation payment. However, the ESIA consultant recommends ARAP to be conducted to update the previous compensation plan before commencing the project construction works.





Figure 13 Partial View of Genet Georgis Site

**Option 3:** Dibicho Gure **/Habitat/ site**, this site is located in Kebele 06 or Midre Genet and about 2km from the center. It is about 2.9 ha. The closest site is located in the middle of the settlement. The site is also within 100 m of the Barossa River and is located near the roadside. The land use of the site is an irrigated vegetable farm. It is the most socially and environmentally sensitive site among the other sites.



Figure 14 Habitat/College Site Partial View

**Option 4: Miser Duqet**, It is located at atkilt Kebele, on the way to Ankober, about 7.5-8 km from the center of the town. Its surface area is about 5 hectares. The land belongs to the local government/ town administration. The site is currently a quarry site used by cooperatives. It is covered by few natural vegetation/shrubs such as Eja, Koshole, qetatena ('donkey ear'/yeahya joro), Amararo, etc. The site is well

accessible from the main road and there is no settlement in the near distance. The site is already formed into a gorge, and the earthwork is very difficult and expensive, making it not economically feasible. This proposed site has no proper outlet and may contaminate the Dalucha well field (town water sources).



Figure 15 Partial View of Miser Duqet Site

**Option 5: Tiquir Gedel (existing site)**, the site was used by the utility service as a dumping site for fecal sludge and some toxic chemicals from the industries. It is found about 10 km away from the center and 3.5 km from Genet Georgis site. This site is good in terms of land location and rock basement, which is suitable to manage leachates. Currently, the site is closed due to mismanagement, which leads to social conflict. These chemicals destroyed crops at the farms due to flooding and killed two cattle. Since then, it has been closed and no longer active.



Figure 16 Partial View of Tibur Gödel Waste Disposal Site

Each of the sites was evaluated against certain criteria taking into consideration the nature of the work and socio-environmental condition of the sites. The criteria include: Resettlement or Land acquisition and displacement, Disturbance to the community (noise, odour), Threat to water sources (surface or

groundwater Impact on vegetation, Vehicular accessibility Suitability for future upgrade Ease of expansion, cost of construction, conflict on the site with the community.

The alternatives sites were evaluated using multi-criteria analysis, based on this method each of the selected criterion was scored on a negative scoring basis, with a score of between 0 and 4 assigned per the following approach:

- ✓ 0 – Excellent
- ✓ 1 – Very Good
- ✓ 2 – Good
- ✓ 3 – Poor
- ✓ 4 – Very Poor

A weighting factor in percentage was assigned to each criterion as per Table 11 below. The site with the lowest total weighted score was deemed the most favorable site for the construction of FSTP.

Accordingly, the site at Genet Georgis which was also proposed by the design consultant is also found suitable by the ESIA consultant for the construction of FSTP compared to other sites based on the above characteristics. The following points were taken into account for the selection of this site for FSTP:

- It is far from the residential development
- no potentially exposed populations nearby
- can be acquired immediately especially compared to other newly proposed sites since compensation for the land is in the process to be paid for the land owners (farmers) by the municipality
- challenges to accept the FSTP by the community will be reduced due to the location of the FSTP adjacent to newly proposed solid waste landfill site
- there is already constructed access road to the site but needs upgrading
- topography: the proposed site has sufficient gentle slope to allow the liquid treatment part of the plant to work largely by gravity

The site selection for the FST looks appropriate in terms of socio-environmental feasibility and acceptance by the local community. However, it requires addressing the issue of compensating the farmers who will lose their farmland before commencing the construction work. Even though, the City administration has already prepared the compensation plan, the plan should be updated through ARAP to handle the concerns of the affected farmers which is connected to the delayed application of the compensation.



Table 11 FSTP Site Evaluation

		Genet Georgis	Tiqur Gedel/existing	Kebele 07 (old/existing)	Habitat/college (new)	Miser Duqet (new)
<b>Resettlement or Land acquisition</b>		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
	10%	1	0	0	1	1
		farm land and require compensation	Owned by municipality	Owned by municipality	farm land & require compensation	Quarry & require compensation
	Normalised score	0.333	0.000	0.000	0.333	0.333
	weighted Score	3%	0%	0%	3%	3%
<b>Disturbance to the community (noise, odour)</b>		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
	20%	1	0	2	3	0
		Relatively Far/300m from residential settlement rural area - Disturbance to existing settlements around site during operation period	Far from residential settlement more than 1 km, No disturbance to existing settlements around site during construction and operation period	Close to the urban settlement and to milk processing factory/less than 200m disturbance to existing settlements around site during construction & operation period.	Close to urban settlement less than 100m /in the middle of settlement high compared to site in kebele 07.	Far from residential settlement more than 600m
	Normalised score	0.17	0.00	0.333	0.5	0
	weighted Score	3%	0%	7%	10%	0%
<b>Vehicular accessibility</b>		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
	10%	0	0	0	1	1
		Need upgrading of access road	Has Access Road from the	Accessible from the main road	Need access road	Need access road
	Normalised score	0	0	0	0.5	0.5
	weighted Score	0%	0%	0%	5%	5%
<b>Impact on vegetation</b>		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
	10%	1	0	0	1	1
		1 - Vegetation observed	0 - Minimal vegetation	0 - Minimal vegetation	Some vegetation	Some vegetation
	Normalised score	0.333	0.000	0.000	0.333	0.333
	weighted Score	3.33%	0.00%	0.00%	3.33%	3.33%
		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
<b>Impact on</b>	20%	0	0	2	3	1

		Genet Georgis	Tiqur Gedel/existing	Kebele 07 (old/existing)	Habitat/college (new)	Miser Duquet (new)
<b>watercourses</b>		At a distance of around 3km from Barossa River	Not nearby to water bodies /well	close to the streams and low groundwater	100 m from the Barossa River	not near surface water but the site has no proper outlet and may contaminate the Dalucha well field
	Normalised score	0.00	0.00	0.33	0.50	0.17
	weighted Score	0.0%	0.0%	6.7%	10.0%	3.3%
<b>Suitability for future upgrade</b>		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
	10%	0	2	2	2	1
		0 - Site with most land availability for future expansion	2 - Site with limited land availability for future expansion	2 - Site with limited land availability for future expansion	has no enough area even for current plan (only 2.8 ha)	the site not favourable for expansion
	Normalised score	0	0.286	0.286	0.286	0.143
	weighted Score	0%	3%	3%	3%	1%
<b>cost of construction</b>		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
	10.00%	0.00	0.00	0.00	0.00	2.00
		appropriate for the construction of a FSTP	appropriate for the construction of a FSTP	the slope of the site is suitable for the construction of a FSTP	the slope of the site is suitable for the construction of a FSTP	the earthwork is very difficult and expensive
		0	0	0	0	1
		0%	0%	0%	0%	10%
<b>conflict on the site with the community</b>		<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>	<b>score</b>
	10.00%	0.00	2.00	0.00	0.00	0.00
		no conflict	has serious conflict with local community	no conflict	no conflict	no conflict
	Normalised score	0	1	0	0	0
	weighted Score	0%	10%	0%	0%	0%
<b>Total score</b>	100%	10%	13%	16%	35%	26%



### 6.2.2 Technology Alternatives for FSTP

This involves looking at various possible technology alternatives, project designs, and layouts based on design study, literature, and document reviews. The main technological aspect considered by the ESIA team was the gradient factor; the objective was to ensure that it was cost-effective (low maintenance and operation costs), easy to manage, and had less social and environmental impacts. As outlined in the feasibility study, the concept design was guided by the requirement to select a low-cost option for fecal sludge treatment.

Fecal sludge can be treated in various ways, and there is no single best option considering the widely varying conditions of urban areas. Primary sludge treatment technologies that are best suited for developing countries were identified through a literature review and document analysis. Various options for the treatment of sludge are available. FS treatment technology usually involves the separation of the solid and liquid parts (primary treatment) and sludge treatment, which is the final stage of treatment that is generated from the primary treatment using different alternative combination of technologies that are indicated in the diagram below (Figure 17).

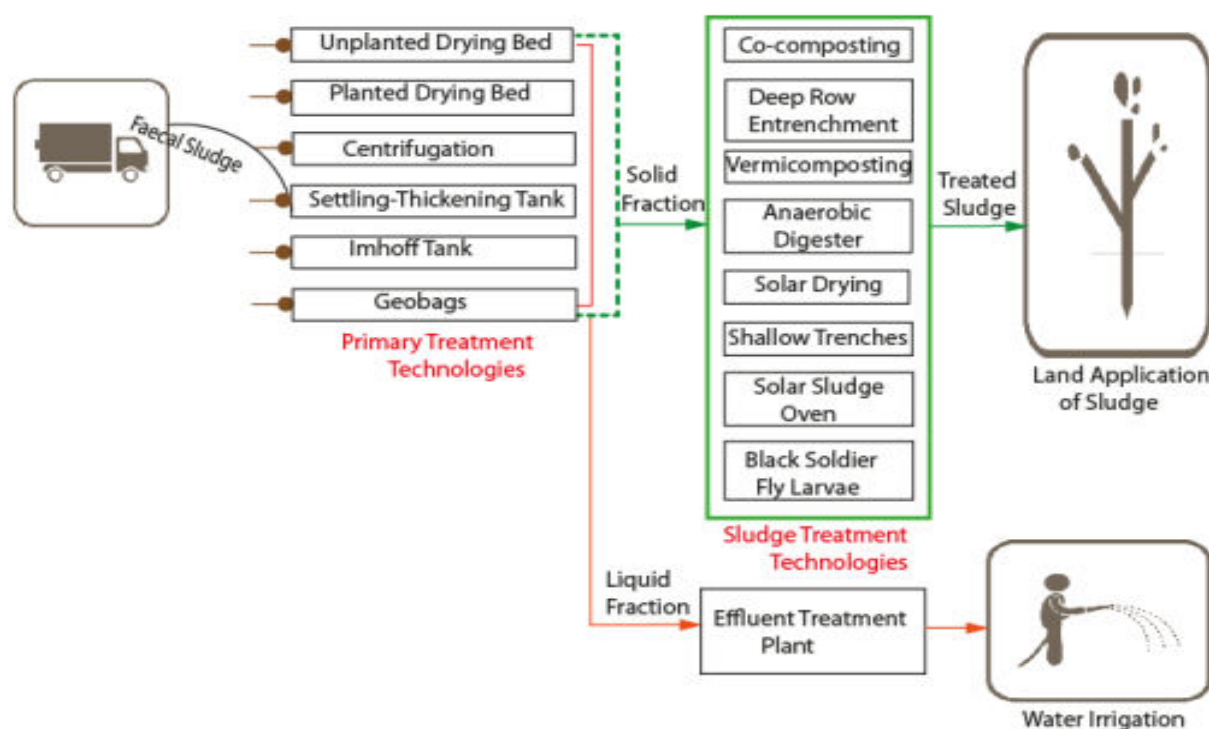


Figure 17 Overview of Technology Options for Fecal Sludge Treatment.

Source: Feasibility study and preliminary design report – Debre Berhan

Because sludge comprises complex organic minerals, most of the treatment options involve some form of anaerobic digestion to complete the process of mineralization. Subsequent treatment processes may include solid-liquid separation, liquid treatment, solid treatment, and pathogen removal in liquid stream.

Screened Fecal Sludge Treatment Options for Debre Berhan town comprise different options for Solid Liquid Separation, Primary liquid treatment Secondary effluent treatment, and Solid treatment. The

combination of primary treatment technologies with unplanted drying bed with Settling– thickening Tank and ABR emerged to be the most viable options for FS treatment in the town. The table below presents Screened Fecal sludge Treatment options for Debre Berhan town

Table 12 Screened Fecal Sludge Treatment Options for the Town

Solid-liquid Separation/	Liquid treatment	Solids Treatment
<ul style="list-style-type: none"> <li>Unplanted Drying Bed</li> <li>Settling– thickening Tank</li> </ul>	<ul style="list-style-type: none"> <li>Anaerobic Baffle reactor (ABR)</li> <li>Anaerobic pond</li> <li>Maturation pond</li> <li>Facultative ponds</li> </ul>	Sludge Drying bed

Source: Feasibility study and preliminary design report – Debre Berhan

Considering the local operation and maintenance capabilities and local socio-economic conditions, three alternative combinations of the above screened fecal sludge treatment technologies are considered by the design consultant. These are

Alternative 1: Settling-Thickening Tanks + Unplanted Drying Beds + ABR

Alternative 2: Unplanted Drying Beds + ABR

Alternative 3: Unplanted Drying Beds + Waste stabilization ponds (Anaerobic Pond, Maturation Pond and Facultative ponds).

#### 6.2.2.1 Alternative 1: Settling-Thickening Tanks + Unplanted Drying Beds + ABR

Alternative 1 used a combination of Settling-Thickening Tanks, Unplanted Drying Beds and ABR as indicated in the following figure.

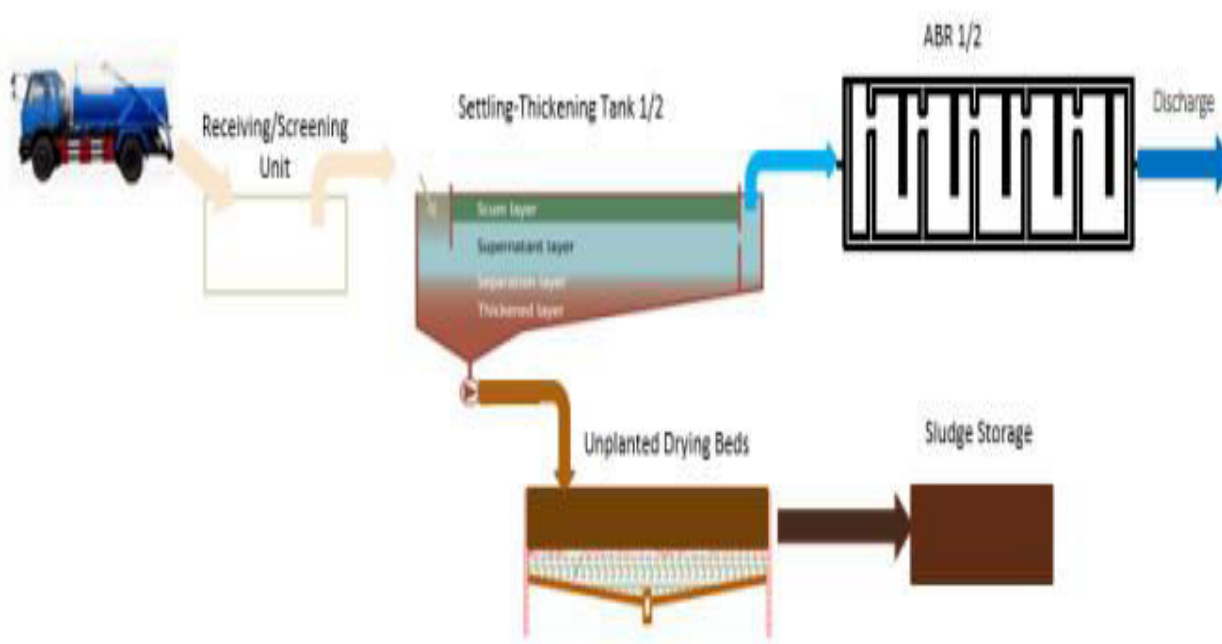


Figure 18 Logical arrangement of Settling-thickening tank, unplanted drying bed, and ABR

Source: Feasibility study and preliminary design report – Debre Berhan

### **Settling-Thickening Tanks**

Settling-thickening tanks are rectangular concrete units, typically 2–3 m in depth with sloppy floor. They are used to separate the liquid and solid parts of fecal sludge (FS). Solids settle along the length of the tank. Unlike sedimentation tanks, Settling-thickening tanks operate in batch mode, with each tank loaded for several days and then allowed to rest before sludge is removed. During this period, discharge continues to a second tank. The typical settling-thickening tank is shown in the diagram below.

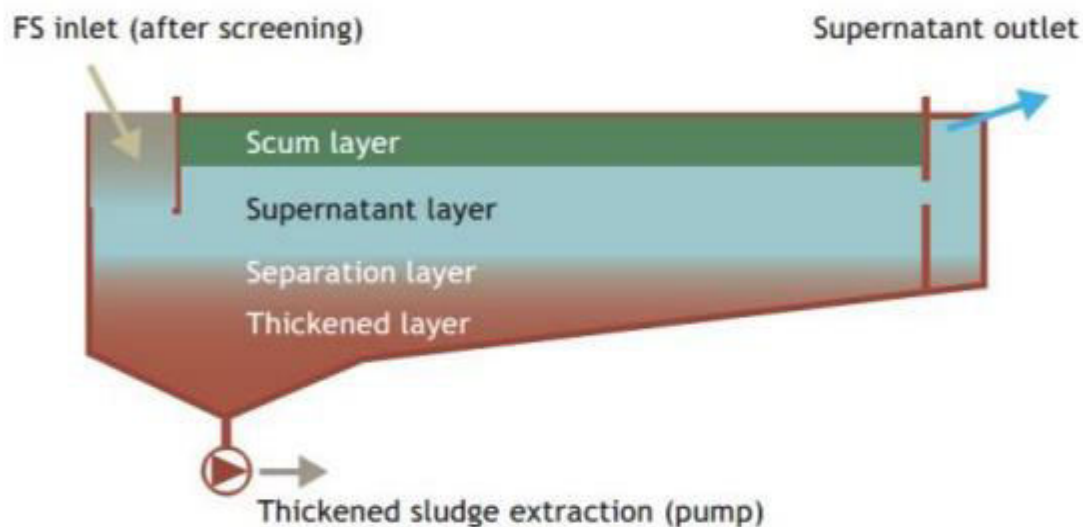


Figure 19 Settling-Thickening Tank

Source: Feasibility study and preliminary design report – Debre Berhan

### **Unplanted Drying Beds**

An unplanted drying bed is a simple, permeable bed filled with several drainage layers that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by percolation and evaporation. According to TILLEY et al. (2014) [52], around 50% to 80% of the sludge volume drains off as liquid or evaporates. Wet sludge is discharged onto a bed to a depth of 200–300 mm. It is then left on the bed to allow water to percolate through the bed and evaporate from the surface until the material on the bed has dried sufficiently to allow its removal using spades or other suitable equipment. Unplanted drying beds must be desludged before fresh sludge is applied (figure 4 in Section 3 show a Schematic and cross-section of a typical drying bed). It is proposed that this technology is the most suitable and cost-effective option due to its simplified construction, operation, and maintenance.

### **Anaerobic Baffled Reactor**

As indicated above an anaerobic baffled reactor (ABR) is an improved septic tank with a series of baffles or vertical pipes and chambers which increase the contact time of the untreated effluent and the active biomass. These results in an improved treatment where the removal of 65% to 90% COD and 70% to 95% of BOD can be achieved. This treatment performance is better compared to the conventional septic tank. The

ABR is simple to build and operate. In addition, they are more resistant to organic and hydraulic shock loads, have low operating costs, and have long service life.

In order to control the release of odorous and potentially harmful gases, at least the last chamber needs to be vented. Similarly, the outlets of each tank, as well as the final outlet, should be placed slightly below the liquid surface to allow the retention of any possible scum formed in the up-flow chamber. ABR tanks should be checked from time to time to ensure that they are watertight.

#### 6.2.2.2 Alternative 2: Unplanted Drying Beds + ABR

The second alternative uses unplanted sludge drying bed and Anaerobic Baffle reactor. In this alternative, a vacuum truck discharges directly into the drying beds. Due to the absence of solids/liquid separation at their upward, this would avoid bed clogging and allow effective infiltration of the liquid fraction as the sludge still has high water content. As indicated in the following figure, drained liquid from the sludge drying beds is directed into ABR for further treatment, and the dry sludge will be stored for further dewatering.

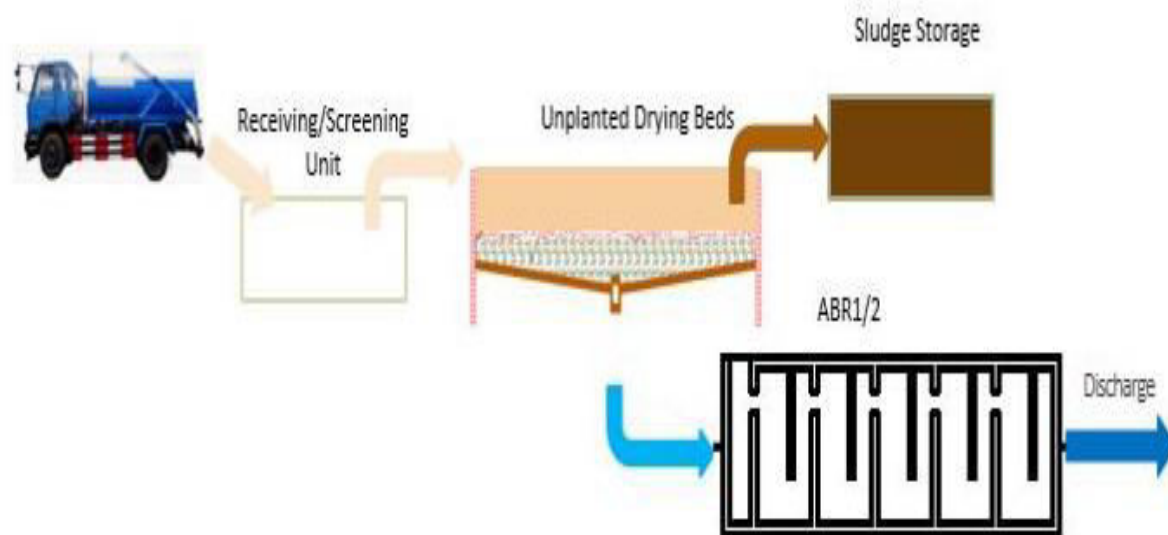


Figure 20 Arrangement of Unplanted Drying Bed and ABR

Source: Feasibility study and preliminary design report – Debre Berhan

#### **Unplanted Drying Beds**

As indicated in the previous alternative sludge drying beds provide a simple dewatering option

#### **Anaerobic Baffled Reactor**

The inflow will be the leachate drained from the unplanted drying beds where it will be the supernatant from the settling-thickening tanks for the alternative 1. Apart from the design process, the other part is the same as the ones of alternative 1.

### 6.2.2.3 Alternative 3: Unplanted Drying Beds + Waste Stabilization Ponds

This alternative uses unplanted sludge drying bed with a combination of anaerobic pond, maturation pond, and facultative ponds. The design of the unplanted beds is the same as the one presented under alternative 2. In this alternative, the drained liquid from the beds is directed into the waste stabilization ponds for further treatment, as indicated in the following diagram.

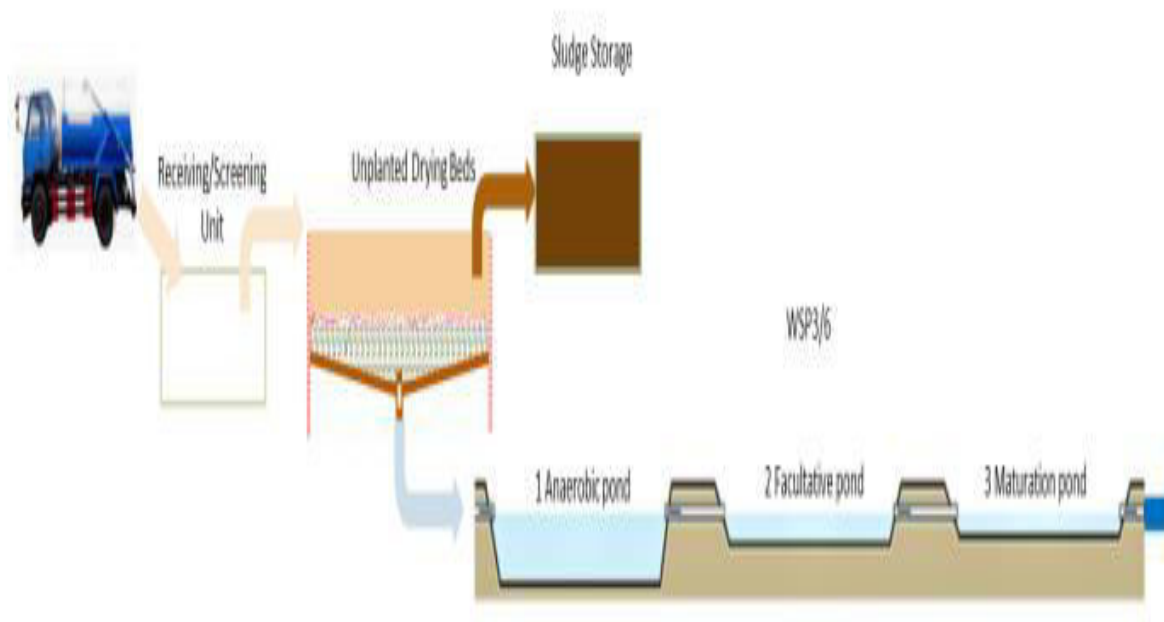


Figure 21 Arrangement of Unplanted Drying Bed and Waste Stabilization Ponds

Source: Feasibility study and preliminary design report – Debre Berhan

Supernatant from the unplanted drying bed will resemble very high strength wastewater. The BOD and TSS in the liquid stream are expected to be reduced high degree; this is almost an order of magnitude higher than domestic sewage. The higher strength of seepage/fecal sludge creates a need for more than one treatment stage; if an acceptable effluent standard is to be achieved accordingly, it will be treated in seriously connected waste stabilization ponds.

#### **Waste stabilization ponds**

Waste stabilization ponds are sizable, shallow basins surrounded by earthen embankments where raw sewage is naturally cleaned by bacteria and algae. Long hydraulic retention times are used because the oxidation rate is slow due to the usage of natural processes; these times typically range from 30 to 50.

The effluent is effectively treated by connecting the three ponds. Pre-treatment is strongly advised at the ponds' inlets to prevent scum formation and prevent extra sediments and trash from getting in. If they are properly constructed and run, they are suitable for high solids, BOD, and pathogen reduction; nonetheless, they have some minor issues with insects or odors.

#### **Treatment principles**

**Anaerobic pond:**

The pond is intended to lessen the organic load by anaerobic bacteria and serves as a primary pretreatment of the effluent. The pond is 2 to 5 m deep with a retention time varying between 1 and 7 days.

**Facultative ponds:** The type of pond sewage from the preliminary treatment (anaerobic pond) it reduce the pathogen using both anaerobic and aerobic treatment, which occur respectively towards the bottom and in the upper layers of this pond.

**Maturation ponds:** maturation pond receives the effluent from the facultative pond and effectively reduces the remaining pathogens. It represents an inhospitable environment for fecal bacteria and viruses and results in their elimination.

**6.2.2.4 Comparison of the three alternatives**

The selection of technology for FSTP is governed by a number of factors that include land availability, treatment efficiency, ease of design and construction, adaptability to the local climate, ease of operation and maintenance, etc. For Debre Berhan town, land is relatively available, but there is low funding for both capital investments and operation and maintenance (O&M) and relatively low staff skills. Consequently, the situation favors low-cost technologies with little or no energy requirement that can be constructed and operated with minimum skills. Comparison of the three alternatives using selected criteria is indicated in the following table.

The alternatives technologies were evaluated using multi-criteria analysis, based on this method each of the selected criterion was scored on a negative scoring basis, with a score of between 0 and 4 assigned per the following approach:

- ✓ 0 – Excellent
- ✓ 1 – Very Good
- ✓ 2– Good
- ✓ 3– Poor
- ✓ 4 – Very Poor

A weighting factor in percentage was assigned to each criterion as per Table 13 below. The technology with the lowest total weighted score was deemed the most favorable treatment technology for the town.

Table 13 Summary and Comparison of Alternative Technologies

Criteria	Weight	Settling-Thickening Tanks + Unplanted Drying Beds + ABR 9(option 1)	Unplanted Drying Beds + ABR (option 2)	Unplanted Drying Beds + Waste stabilization ponds (option 3)
Cost (OPEX & CAPEX)		score	score	Score
		2	1	0
	25%	High cost due to thickening tank than option 2	Moderately high compared to option 3,	Lower cost
	Normalised score	0.67	0.33	0.00
	weighted Score	16.7%	8.3%	0.0%
operation&		Score	Score	Score

Fecal Sludge Management, Debre Berhan City-ESIA				October 2023
Criteria	Weight	Settling-Thickening Tanks + Unplanted Drying Beds + ABR 9(option 1)	Unplanted Drying Beds + ABR (option 2)	Unplanted Drying Beds + Waste stabilization ponds (option 3)
maintenance		2	1	0
	15%	Complex	moderate	Simple
	Normalised score	0.67	0.33	0.00
	weighted Score	10.0%	5.0%	0.0%
Treatment effectiveness and efficiency		Score	Score	Score
		0	1	1
	25%	High treatment efficiency	Moderate treatment efficiency	Moderate treatment efficiency
	Normalised score	0.00	0.50	0.50
	weighted Score	0.0%	12.5%	12.5%
Land Requirement		Score	Score	Score
		0	0	1
	10%	require small area of land	require small area of land	require larger area of land compared to option 1 & 2
	Normalised score	0.00	0.00	1.00
	weighted Score	0.0%	0.0%	10.0%
ease of design and construction /complexity		Score	Score	Score
		2	1	0
	10%	Complex	Moderate	Simple
	Normalised score	0.67	0.33	0.00
	weighted Score	6.7%	3.3%	0.0%
Adaptability to area/cold climate		Score	Score	Score
		0	0	1
	15%	good for cold climate	good for cold climate	mostly used for hot climate
	Normalised score	0.00	0.00	1.00
	weighted Score	0.0%	0.0%	15.0%
Total score	100%	33.3%	29.2%	37.5%

Based on the above evaluation of selection criteria, the second alternatives deemed suitable to be adopted for Debre Berhan town the option was also adopted by the client.

The main advantages of the recommended treatment technologies are the low cost in terms of construction, operation, and maintenance, simplicity of operation and maintenance, good treatment efficiency. Moreover, the cold climate of the town favors for use of ABR over Waste stabilization bonds.



## 7. CONSULTATION PROCESS

During the preparation of the ESIA, extensive consultations were conducted at various levels. The public consultation process was conducted in accordance with the Ethiopian Environmental Impact Assessment Regulation of 99/2002 to provide clear and accurate information about the proposed project to stakeholders, communities living in the project area and PAPs to promote understanding through the active engagement of individuals, groups, stakeholders, and organizations who have a stake in the subproject and its outcomes.

Information related to the existing waste management system focusing on constraints, existing environmental and social features of the project influence area, potential environmental issues/impacts related to the proposed project component and activities, as well as the attitudes of the officials, local communities, design consultant's staff, Client's officials and experts, PAPs towards the planned scheme were assessed. This information and opinions have been considered in this socio-environmental impact analysis.

The project ESIA process also involved the development of a separate Stakeholder Engagement Plan (SEP) report which provides guidance for the engagement and disclosure activities for the future project stages, starting from the project preparation to the actual operation of the wastewater project.

### 7.1 Consultation with Genet Georgis /Project Intervention Site/ Community

Local community and PAPS whose assets/properties will be affected by the proposed project activities were consulted on a meeting held on 14 2022. The discussion took place in the compound of St George church. All members of the consultation meetings were very interested in participating in the discussions, and they shared their views and opinions on the discussion points. The participants in the meeting discussed and forwarded their opinions on the issues of implementing the proposed FSTP project. The participants' attitudes towards the realization of the proposed FSTP projects are positive and they would fully support and participate in the project.

However, during the discussion, the PAPs raised loss of their land and livelihood used to support the households and require fair and adequate compensation. As well as they also expected benefits from the project such as job creation.

During the preparation of the copnasation plan process, the PAPs were promised to be provided with alternative land, but currently, the PAPs complain the town administration does not keep its promise, and they are pessimistic that they do not believe they will be compensated fairly.

The following are PAPs major concern

- The measurement was not fair
- The valuation didn't consider the productivity of the land
- They were promised alternative land, but now the Woreda is not keeping the promise.
- We learned that from experience, the government promise many things, including employment opportunity, but most of the time they employee from other places

Moreover, as waste disposal sites are adjusted to the FSTP, they are also concerned the cumulative impact of these two projects will be high, specifically on their health.

In general, the meeting participants raised the issue of safe disposal of fecal sludge and proper treatment in order to ensure the health of the local community and the environment. The project client needs to properly compensate for the loss of livelihood (crops they are growing)/lands and has to respond to ensure proper management of the site in a way not to pollute the environment and cause an additional socio-economic problem to the people living in close proximity.

Mitigation:

- Provide livelihood alternatives and sufficient compensation for the property loss;
- Conduct regular monitoring for effluent quality and needs to fulfill the national and international standards before it is released to nearby water bodies;
- The constructed facilities need to be managed by properly trained workers;
- Implement the FSTP as indicated in the design and technologies so that reduce/avoid bad smells from the treatment plan; and
- Create an employment opportunity for the local people.



Figure 22 Community Consultation Meeting at Kebele Level

## 7.2 Consultation with Governmental Stakeholders at Debre Berhan Town

The consultative meeting was conducted on 16-17 March 2023. More than 8 institutions (city administration, which consists of environment and land, Culture and tourism, Women and children affairs, Zone water energy, and Environment protection office, Agriculture, Health, and Education) participated in the consultation process. We had a fruitful discussion about the project, project importance, stakeholder and their roles, impacts of the proposed project, and mitigation measures. During the discussion, stakeholders shared their concern and information about the project and key recommendations were forwarded by the participants.

During the discussions, we learned that there was a different level of knowledge and understanding about the proposed project among the local people. As a result, they were curious to know the details of the project and its benefits to them. Moreover, we feel that further discussions and consultations between DBWSSS and stakeholders would be important to disclose the project and incorporate their needs in its implementation.



*Figure 23 Consultative/Stakeholder Meeting at Debre Berhan Water and Sewerage Service Hall*

The outcomes of the discussions during the consultative meeting are briefly presented below:

- The project is critical and needs to urgently start the construction and operation in such a way as to ensure the health and wealth of the public. The implementation of this project is crucial for promoting sustainable development and ensuring equitable share considering the interests of all stakeholders to address the increasing population sanitary demand.
- The FSM are long-standing problem of the city of Debre Berhan, that needs to engage all stakeholders in the design, implementation, and operation;
- Lack of stakeholder engagement was raised, key stakeholders' engagement from the design of the project is critical for sustainability of the proposed project but some of the stakeholders complain that they were not consulted at the initial stage as they are key stakeholders.
- Other major concern was the size of the land, technological design which did not put into consideration high population growth (including immigrants). The design was prepared based on the old population data (120,000), which now increases to 400,000 as per their estimation. That they have a doubt the intervention will not sufficiently solve the problem. Urbanization is a key challenge for the treatment plant capacity.
- Compensation was also among the issues and concerns of the participants. They indicate that though they were told that compensation will be effective immediately, they are not paid yet.
- Moreover, they also recommend proper mitigation methods to control bad odor, buffering and landscaping of the site as well as reusing of FSTP effluent and sludge for fertilizer.

### 7.3 Consultation Findings

The following table summarizes the findings of consultation at various levels.

Table 14 Issues and Concerns as Raised During Stakeholder Meeting for Proposed Work

Stakeholder	project impacts/concern raised	Mitigation suggested
Institutional stakeholders	Project delay, appropriate compensation issues Lack of coordination, the complexity of land acquisition	Improve project communication and capacity of the client and its stakeholder's coordination system
Woreda/Town stakeholders	Impacts on the existing land use, livelihood, and response to the challenges Appropriateness of property compensation	Promote appropriate rehabilitation for degraded lands due to the project and provide appropriate compensation timely as the law demands Continuous awareness raising activities at all level
Community	Impacts on their livelihood, nuisance odor, aesthetic value deterioration	The project ensure the proper compensation of PAP livelihoods lost due to the project, fencing and proper operation of the facility Promote importance of the project through awareness raising activities, engage the local community in any relevant site works at various level
PAP	Impacts on their livelihood and issue of appropriate compensation. Need appropriate attention from the client	Timely, fair, and appropriate compensation according to the national and regional law. Preparing ARAP is recommended to facilitate the compensation process.

### 7.4 Public Disclosure

The Start of the project study has been disclosed to relevant stakeholders through a series of consultations made at the town administration and Kebele levels. Through these consultations, project information (including purpose, project type, and project location) and the ESIA requirements were disseminated to the stakeholders and PAPs. This helped to gain feedback and concerns that must be addressed during the project planning, construction, and implementation processes. This ESIA report has been prepared taking into account all the feedback from stakeholder and PAPs consultations. In accordance with the World Bank policy on access to information, disclosure of relevant project information needs to be posted on MoWE website (executive summary translated in Amharic and full ESIA document) and the World Bank external website to receive the opinions and suggestions of civil societies, academics, and other professionals as well.

### 7.5 Stakeholders Engagement Plan (SEP)

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

The project proponent has to conduct public and stakeholder consultation starting from the project inception to the completion of the project. So far, a number of public consultations have been conducted during the project identification, scoping, and ESIA assessment phases and more consultations should be continued during the construction phase of the project to settle any emerging issues related to construction activities and interaction of the construction workforce with the local community. Hiring a



community liaison officer from the local community/project Woreda or Kebele would facilitate consultation and grievance redressing processes during the construction phase. Public consultation sessions should involve Town (Woreda) and Kebele officials, community elders, women representatives, and representatives of youth and NGOs if available. All the consultations should be minuted and properly filed.

Consultation conducted during the scoping and ESIA phases revealed that the consulted stakeholders are positive towards the proposed project. However, further consultation may be needed, particularly to resolve any pending land-related issues at the FSTP site. Consultation is expected to continue in the subsequent phases of the project (construction and implementation). The essential objectives of the Stakeholders Engagement Plan can be defined as:

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

SEP will encourage keeping a record of all the complaints, concerns, and feedback received regarding the Project and ensure resolution of any reaction, disagreement, or disputes related to the Project impacts via an open communication method. It will contribute to caring for life and property safety during construction works & ensure continuous smooth relations with the local community. Therefore, during the construction phase, the contractor must prepare the SEP that will be implemented in this phase. The plan to be prepared should consider the above objectives of SEP and should be updated regularly based on the actual condition of the project activities and interaction with stakeholders.

Whenever stakeholder consultation is required, stakeholders can be approached through existing administrative structures such as through Town/Woreda Administration and Kebele Administration. Future consultation can be initiated by the community or project proponents or other stakeholders depending on the issue to be discussed.

## 8. IMPACT IDENTIFICATION, ANALYSIS, AND POSSIBLE MITIGATION MEASURES

### 8.1 General Considerations

This part of the report addresses potential impacts associated with the proposed FSTP project and measures for avoidance, reduction, or restoration of the negative impacts and enhancement (improvements) of positive effects of the project. The following issues were considered for the assessment of the socio-environmental impacts of the project:

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

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

**Proposed Topics to be Scoped Out:** Concerning the analysis of the legal and institutional framework and collected information in the baseline, there are certain topics considered irrelevant or with less importance to the project and, therefore proposed to be scoped out.

Topics of less importance and therefore proposed to be scoped out

- Surface and groundwater resources as there are no such resources in the vicinity of the project site.
- Biodiversity conservation and sustainable management of living natural resources. Not relevant, given that there are no threatened, rare, or endangered species of fauna or flora registered or known to exist around the site.
- Climate change assessment (climate check) since the project intervention is very local and does not have significance on climate change adaptation and mitigation efforts.

### 8.2 Impact Identification

, In this section, the possible impacts that are expected under each stage of the project activities were identified and analyzed for the proposed project in relation to the various stages of their implementations.

For the purpose of this assessment, the impacts identified were those which are considered to be 'significant impacts. This is not to say that minor impacts were disregarded, but that their impact, whilst detectable, is not considered significant. The overall levels of predicted impacts (positive and negative) are

evaluated. Realistic assumptions have been made and qualified. The impacts may be positive as well as negative and, may be short or long-term, temporary, and reversible or permanent. The impact assessment for the proposed project works has considered the level of the potential impacts, this being based on both the value of the environment and the nature and magnitude of the potential impact.

Identifying the project boundaries within which the ESIA was undertaken is an important component of the study. The identification process focused and delineated the FSTP within an area where impacts both positive and negative, will be felt on the environment, economy, and the local community. The types of boundaries considered were institutional, temporal, and spatial in nature.

### 8.2.1 Institutional Boundaries

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

The institutional framework for environmental management and handling ESIA requirements in the town/region exists at the regional, sector, Municipality/ DBWSSS/ Woreda Council / local government, and Kebeles (Village). The relevant institutions for handling ESIA requirements for the construction sector include the following: National and regional Environmental Protection Authority, Amhara Regional State Urban Development and Construction, Health Bureau, education, Culture and Tourism, women and children affairs, and Municipal Environment Management units, village Committees, and DBWSSS.

### 8.2.2 Temporal Boundaries

Temporal boundaries refer to project life span and the reversibility of impacts. For example, the impact of construction works on natural vegetation may be short-lived if measures are taken to restore vegetation and the land after material extraction. However, the resettlement of the community to give way for proposed works, if applicable, may have a long-lasting impact, stretching far into the future in terms of loss of income, land, and disruption in cultural life and livelihood of the people. However, the proposed sanitation project will have some permanent impacts on the local community in terms of loss of land and properties at FSTP sites.

Table 15 Estimated Temporal Boundaries of the Project

Project phase	Duration
Construction	Up to 2 years
Operation	20 years
Decommissioning	After 20 years depending on the conditions

### 8.2.3 Spatial Boundaries

Spatial boundaries refer to the area affected by the project. The area of direct impact for the proposed FSTP will be within the legal framework of the project, where most of the activities will take place. The immediate impact area of the proposed projects is adjacent to the farm site and the village residence where some of the impacts, such as loss of land, resettlement, damage to people's properties, interference



with business, traffic accidents; spread of communicable diseases such as HIV/AIDS public health; and dust and sound pollution will be felt directly.

The influential impact area is defined as the one comprising areas where decisions are made. For this project, decisions are made mainly at the regional, Woreda/ Municipality, and Kebele administration levels. In addition, environmental protection and DBWSSS, together with town administration, may all have input regarding land ownership and construction permits and issues.

### 8.3 Impact Characterization and Significance

Impact significance of each identified impact was decided by an expert's judgment based on past experience, field observation, the outcome of consultation with stakeholders, and project-related legal frameworks, regulations, and standards. Key experts involved in the impact assessment were assigned on impact significance for each impact separately, and finally, each rating of experts was combined into significance rating (low, medium, and high) for each impact.

The overall significance of the possible impacts has been determined by combining the perceived 'Likelihood of Occurrence' of the source of the impact in combination with the corresponding impact 'Consequence' describing the severity of the impact, 'Significance' describing the level of required mitigation measures, the 'Spatial Influence', describes the proximity of the impact, 'Temporal Influence' describes the duration of the impact, and finally, 'Reversibility' describes the ability to return to original conditions after implementing mitigation measures.

The table 16 below provides a detailed classification of impacts and the potential impacts matrix for each project categorized by their classification and significance.

Table 16 Detailed Impacts Classification Approach

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

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

Table 17 Prediction and Significance of Potential Impacts of FSTP project Activities

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

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

## 8.4 Positive Impacts and Enhancement Measures

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

The fecal sludge management will contribute to alleviating the impacts of the existing uncontrolled fecal waste disposal into the environment, which include nuisance odors, poor aesthetics, and risk of groundwater pollution/contamination, among others.

The impact analysis presented in Table 17 identified positive and negative impacts of the proposed project activities. The positive impacts have been ranked depending on their anticipated impacts during the construction, operation, and decommissioning phases. The identified impacts and their enhancement measures are briefly described in the sections below.

### 8.4.1 Job creation

The construction, operation, and decommissioning of the project activities will create both short- and long-term employment opportunities. Most of it will be during the construction phase, where the possibility of engaging skilled and unskilled labor from the project-affected communities can be created. Skill transfer from experienced and skilled workers to others will also be one of the beneficiary impacts of the project. This beneficiary impact is rated as low to high based on different phases of the project (duration and extent of the project).

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

### 8.4.2 Health

The implementation of the proposed project will prevent any health-related problems, particularly from outbreaks of waste-related diseases (such as cholera dysenteric disease caused by poor sanitation). The proposed project will improve environmental sanitation and community health in Debre Berhan town.

**Enhancement measures:** The health advantage of treating the wastewater would be enhanced by creating awareness among the users on clean and polluted water as well as its advantages and disadvantages. It is also advisable to provide sufficient information and raise awareness of local communities at project site

### 8.4.3 Air Quality in the Catchment

Though the localized odor at treatment sites and their boundaries is expected to be adverse, the overall air quality of the catchment will be improved. The project itself is designed to mitigate environmental pollution. Hence, the project's impact on air quality will be highly positive.

**Enhancement measures:** To improve the air quality in the Genet Georgis (FSTP project intervention site) in particular and in the city in general, promoting establishment and implementation of appropriate management strategies such as regular monitoring.

#### 8.4.4 Improvement of Water Quality

Fecal sludge treatment is essential to protect water resources. The quality of water flowing from the FSTP to the nearby rivers can be improved by way of changing positively water quality parameters such as the BOD, COD, turbidity, color, pH, temperature, total dissolved and suspended solids, conductivity, coliforms, nutrients, and trace metals, if there are any discharges released to the natural water courses.

Concerning surface water, including the bottom sediment, the major positive impact of the operation of the FSTPs is the improved water quality within the project area and downstream. Therefore, properly managing FS will play a key positive role in protecting against water pollution.

**Enhancement measures:** In order to enhance the positive impacts on downstream water quality, it would be important to regularly monitor the quality of the effluent, if any, to be released to downstream rivers and check whether the effluent quality complies with the Ethiopian effluent discharge standards. Furthermore, it is advisable to plan and implement integrated watershed management in the micro-catchment that helps to enhance the quality of water resources and reduce the negative impacts of FSTP residues. This can be implemented in collaboration with the Amhara Regional State Water and energy and agriculture and natural resource bureaus.

#### 8.4.5 Production of Compost/Fertilizers

One of the advantages of unplanted drying bed is that the sludge can be used for the preparation of compost. Dewatering sludge removed from the FSTP process can be utilized for fertilization and conditioning of the soils. This could be an additional benefit for PAP. In addition, the Debre Berhan town water and energy office can mobilize resources to take advantage of FS wastes to generate biogas for households and institutions. The good learning and collaboration point will be Debre Berhan's University. In this regard, the related office will collaborate with the institutions in the Debre Berhan town to convert the waste into biogas. Motion Consultancy and Training is ready to advice on the design and development of both household and institutional biogas development projects.

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

#### 8.4.6 Supplementary measures

The following proposed measures would scale up the expected benefits obtained due to the implementation of the project activities (Table 18). These include:

- **Capacity Building:** The other broad area of intervention required to enhance the identified positive impacts is conducting capacity-building programs within DBWSSS, municipality, and other relevant

stakeholders, including environmental protection, health, and agriculture. The implementation of training and capacity-building programs would serve the sustainability of the project.

- **Strengthening the legal framework:** Another recommended enhancement measure is to work on and strengthen the legal aspect. Laws relevant to solid and liquid waste management (including disposal methods) should be reinforced, and their application must be monitored to minimize the ongoing gap.
- **Awareness creation on construction, proper utilization, and maintenance of sanitation and hygiene facilities:** Integrating hygiene promotion and awareness creation activities will enhance the positive impacts or results of the proposed project. In this regard a national WaSH approach can be followed.
- **Give priority to job opportunities for the local people in general and for the women and disabled community groups in particular.**

Table 18 ESMP for Enhancing Beneficial Impacts

Socio-Environmental Component	Proposed Enhancement measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		Implementation	Supervision		
<b>Job opportunities</b>	Benefits from job opportunity can be enhanced by providing priority for the project affected people and for women. By providing on-the-job training and capacity building, it is possible to enhance job opportunities for the project-affected people. Recruit local labor in consultation with the project administration office	Construction Contractor	DBWSSS/ Supervisory Consultant	construction phase	Not required
	Give priority to skilled and unskilled jobs for project-affected people. Provide on-the-job training to build the capacity of workers.	DBWSSS/FSTPs Management	Labor and social affairs office	Operation Phase	550,000
<b>Improvements on public health</b>	Creating awareness among the users on clean and polluted water as well as its advantages and disadvantages. Promote proper solid waste collection, treatment, and disposal systems to supplement the benefit obtained from the treatment.	Debre Berhan Town Woreda Health Office	Community Health Promotion Office	Operation Phase	Cost part of the Government budget.
<b>Production of compost/fertilizers from the Sludge</b>	Creating a demonstration field and training farmers on how to use the compost on their farm plots would enhance the benefit. Producing marketable compost will enhance the benefit and generate income for DBWSSS.	DBWSSS/FSTPs Management in cooperation with Agriculture Offices	AREPA, Agriculture and natural resource department		Part of the FSTPs operation budget

## 8.5 Negative Impacts and Recommended Mitigation Measures

An impact evaluation matrix has been used for the identification and assessment of potential negative impacts of the proposed project activities in terms of spatial extent, duration, level of significance,



probability of occurrence, and reversibility of the issue for the stages of construction, operation, and decommissioning.

The assessment is made against each issue or medium of impact on physical elements that include water bodies (surface and ground), soils, ambient air and flora, as well as the human or socio-economic elements that include the socio-economy, health, and safety, noise and vibration, traffic accidents referring to the impacts on the overall wellbeing. These impact areas that are of concern for the implementation of the project and their proposed mitigation measures are presented below:

### 8.5.1 Construction Phase

**Loss of land and Land Use change:** The proposed project activities would lead to the land-use change (land clearance). The FSTP is planned to be implemented in agricultural lands and hence change it into other land-use types such as removing vegetation covers (trees used fuel & construction and cereals). About 80 young eucalyptus trees will be affected and removed. The new land-use type will be semi-built. This change is permanent, and needs to be compensated with the planting of trees in the vicinity to maintain the cleared tree species.

The number of households affected due to land acquisition for FSTP is 7. Total area of farm land required for construction of the proposed treatment plant is about 3.8381 ha. The significance of impact on land resources is rated to be high as it affects the livelihood of the 7 farmers. Therefore, all the affected households at treatment plant sites need to be compensated ahead of mobilization and commencement of construction works. In fact compensation plan was prepared by city administration but the compensation has not been effected so far. This has created grievance among the affected farmers, therefore the plan need to be revised based on current markets values through ARP process.

#### Mitigation measures

- Prepare an appropriate compensation plan for the affected households and implement it before the start of mobilization and construction works.
- Create awareness among the landholders and the project.
- Provide alternative land in the nearby area if applicable to support the livelihood of the affected persons or pay adequate compensation for the loss of farmlands (provide support to those households who lose their livelihood according to the federal land expropriation and compensation laws).
- Give priority to the project-affected people for job opportunities created by the project.
- Give on-the-job training to build the capacity of PAPs so that they would fit for the available job rather than filtering out using education or training level requirements.
- Prepare and implement a livelihood restoration program.
- DBWSSS has to redress grievances raised by former landowners amicably.

**Soil Compaction and Erosion:** Potential impacts on soils during the project construction phase include soil compaction, soil erosion and contamination by hazardous substances. Among the activities that would affect the soil resources include site clearing, stripping of topsoil, excavation in soil, loading of spoils, and hauling of the same to disposal sites; This will increase the risk of soil erosion and silt transport to rivers, streams, and other watercourses.

In addition, there will be a risk of soil contamination from leakages of hazardous substances such as fuel and oils from equipment and vehicles; and poor handling of the substances especially during maintenance of machinery and vehicles.

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

**Mitigation measures**

- Limit land clearing and excavation works only to what is absolutely necessary and carry out the works in the dry season only to reduce soil exposure to runoff water erosion.
- Careful removal and proper stockpiling of the topsoil removed from the sites and re-using it for site restoration when construction works are finished.
- Reduce the time exposed surfaces or excavated soils remain bare following completion of works and implement restoration measures such as re-vegetating exposed areas as quickly as possible.
- Prevent environmental pollution by hazardous substances such as fuel, oil, cement sludge, and detergents through proper storage and handling of the substances. Oil exchange should take place only in the pre-prepared workshop area. Washing of vehicles and machinery should only be conducted in the workshop area and never done in rivers and open soils.
- Use only existing roads to the extent possible and do not drive through farmlands or unpaved soil.
- Park all the vehicles and types of machinery at only designated parking areas.
- Construction sequencing, locating stockpiles away from watercourses, and disposing of grit, screenings, and sludge from existing lagoons in a landfill.

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

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

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

**Mitigation measures**

- Implement measures that will reduce dust emission including regular spraying of water on unpaved access roads, exposed earth, and any stockpiles on site, and where feasible, covering stockpiles on site with plastic materials.
- Regular vehicle inspections and maintenance of equipment and vehicles to reduce excessive exhaust emissions.

- Minimize excavation and earth moving to only what is required for the specific nature and type of construction.
- Backfill of borrow pits and exposed excavation sites as soon as possible.
- Limit stockpiling of excavated topsoil to a maximum of 2m height.
- As much as possible use paved roads. and

**Noise and Vibration Impact:** noise pollution is one of the adverse impacts of construction activities that involve the operation of vehicles and heavy equipment. The Ethiopian noise standard for daytime in residential areas is 55 dB and for night times it is 45 dB. Long-term exposure to noise levels above this standard in residential areas is expected to cause health impacts.

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

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

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

#### Mitigation Measures

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

**Pollution of Water Bodies:** The release of solid and liquid wastes from construction camps has the potential to affect the surface and groundwater quality. In addition, spillages of hazardous substances such as fuel and oils from workshops may affect the water quality of nearby streams and Beressa River.

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

#### Mitigation Measures

- Perform excavation works and earth-moving activities during the dry season only thereby minimizing erosion or transport of excavated materials by runoff water to water bodies.
- Prevent environmental pollution by hazardous substances such as oil, fuel, cement sludge, and detergents through proper storage and handling of these substances.
- locate storage areas and compounds away from watercourses

- Properly collect used oil and other chemicals and safely dispose of them properly

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

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

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

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

#### **Mitigation measures**

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

**Impacts on Fauna and Flora:** The construction of the proposed project is not expected to cause significant adverse impacts on fauna and flora. There are limited types of trees (Eucalyptus) that would be affected by the project development. In general, the impact on flora during the construction phase is considered as minor, localized, and temporary.

#### **Mitigation measures**

- Pay appropriate cash compensation for project-affected trees and/or crops.
- Planting of appropriate trees (10 seedlings per removal of a single tree), which are friendly to the environment, including watering and protection of seedlings until it reaches to 1.5 meters height.
- The selection of appropriate tree species and locations of planting shall only be done in consultation with the concerned Environmental Protection Office.

**Impact on Cultural, religious, and Archaeological Sites:** According to site observations, the proposed project site is not located in any historical or cultural and archaeological sites, and is unlikely to be affected.

However, the Project Contractor must take appropriate measures not to prevent any chance to find or discover cultural or archaeological assets during the project construction and immediately report to the relevant Culture and Tourism Office if archaeological, cultural, and religious resources are discovered.

**Occupational Health and Safety Impact:** There could be safety risks related to the storage and use of hazardous chemicals and explosives. Moreover, there might be accidents of various natures to project workers. Furthermore, dust and exhaust emissions may affect the respiratory tract of project workers and local people exposed to such emissions. The impact on the health and safety of project workers, local people, and users of the existing roads or paths affected during the construction of FSTPs is anticipated to be a moderate to high, short-term to long term and direct adverse impact.

#### **Mitigation measures**

- The contractor to take maximum care and minimize accident risks by applying internationally accepted standards and recognized occupational health and safety guidelines.
- Health and Safety induction for new arrivals.
- Health and Safety Officer facilitates toolbox meeting on daily basis before the start of a work.
- Health and Safety officer prepares and shares an emergency response plan (ERP) to all project staffs.
- The contractor takes appropriate care in storing and using hazardous chemicals and explosives and provides training to workers in handling hazardous chemicals.
- Provide awareness creation among the local community on the hazardous nature of chemicals, and explosives if it is used during the construction works.
- Provide first aid kits at workshops, construction worksites, and inside vehicles.
- Provide first aid training to workers.
- Provided workers with appropriate PPE such as hand gloves, eye goggles, safety shoes, reflective vests, helmets, etc., based on their work condition as much as possible and strictly inspect proper use throughout the construction phase.
- Hung-up fire extinguisher bearing detailed information about its status at appropriate places.
- All personnel, vehicles, and machinery should be covered under an appropriate Insurance System.
- Carefully record and keep all incidences of injuries and accidents including date, time, and place of occurrence, level of injuries, resources damaged, people injured/dead, major causes for the accident, measures taken, etc.
- Regularly spray water on dusty roads and work areas. and

#### **Exposure to HIV/AIDS and Other Sexually Transmitted Infections (STIs)**

Construction project workers are considered to have a high potential for the spread of HIV/AIDS and other sexually transmitted infections partly because construction workers are mostly young, sexually active groups of the population, mobile and partly because they are forced to live in hotel rooms or in construction camps.

Hence, this makes the project area highly vulnerable and easily exposed to the spread of STIs and HIV/AIDS transmitting diseases.

**Mitigation Measures**

- Launch awareness and education campaigns about HIV/AIDS and STIs among the construction workers and community to make them informed.
- Condoms shall be provided at a subsidized rate or for free to construction workers and health facilities must be supported with a supply of condoms.
- Town administrations and health offices, HIV/AIDS Prevention and Control Office, Elders, and NGOs operating in the area need to work jointly to create a positive impact and bring major attitudinal and behavioral changes.

**Gender and Gender Based Violence/SH Risks:** female construction workers could face difficulties in their workplaces, such as GBV and sexual harassment. Hence, there is a potential that gender abuse might occur during the construction of the proposed fecal sludge treatment plant through unequal distribution of work, sexual harassment, discrimination against women, and unequal pay for women, among others. This impact is rated to be low for the reason that contractors are expected to include gender specialists among the workforce to create awareness to prevent GBV/SH and SEA.

**Mitigation measures**

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

**8.5.2 Operation Phase**

**Odor (Foul smell):** The frequent dumping of truckloads for fecal sludge may cause bad smell in and around the FSTP. However, as the FSTP is located outside the town amidst farm land, an obnoxious smell from the treatment plant area is expected to be of minor significance. But there are some settlements which may be affected more by the odor or foul smell compared to the very distant habitants. As the impact is long term but medium in its significance and although they live beyond 500m from the treatment site, attention should be given to these farmers.

**Mitigation measures**

- Regular facility maintenance and monitoring operational practices including avoidance of pools of dirty stagnant waters, spills, process control and chemical treatment, continuous process of the operation
- Covering swampy parts of the settlement and drying beds with a layer of earth or sand.
- Aerate, adjust chemical dosing and oxidation or pH to reduce odor from plant influents.
- Cover tanks or installation of exhaust hoods.
- Operate equipment at optimum/design conditions.



- Adopt effective and efficient housekeeping procedures (regular cleaning of the grit and screenings).
- Operate especially the secondary treatment processes at optimum condition.
- Plant layers of shrubs and trees along the periphery and provide adequate stack height to exhaust emissions.
- Provide adequate buffer zone, particularly along the major windward.
- Give more attention to the farmers that reside in closer proximity to the project site and target them with the project beneficial impacts

**Impact on ambient air quality:** multiple contaminants gases (CH<sub>4</sub>, CO<sub>2</sub>, and H<sub>2</sub>S) will be generated from fecal sludge treatment plants and there will be a release of these gases into the atmosphere, and impact on the environment through generation of bad odors. The impact is adverse, possible, reversible, of moderate significance, and long-term.

#### **Mitigation Measures:**

- Regular monitoring of the ambient air including measuring H<sub>2</sub>S presence in air,
- Control an aerobic digester parameter (pH, Temperature, oxygen level etc.) for H<sub>2</sub>S producing bacteria/microorganism (creating unfavorable environment),
- Changing redox potential, which helps in reducing or oxidizing capacity of anaerobic digestion system?

#### **Health impact and risks**

- i. Health impact on people contact with sludge:

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

#### **Mitigation measures**

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

- ii. Health impact from use of untreated fecal sludge in agriculture

If the sludge is not adequately treated, pathogenic organisms contained in the sludge are dispersed on the fields. Here they can infect the farmers working on the fields as they permanently enter in contact with the

contaminated soil and usually do not use protection measures. Bacteria and worm eggs may also attach to the plants and infect consumers if the crops are eaten raw and are not thoroughly washed. In adequately treated sludge can also affect the quality of grazing lands as well as the health of cattle grazing around.

### Mitigation Measures

- Create appropriate awareness on preparation and utilization composts from such sources.
  - Fecal sludge should always be treated prior to its use in agriculture.
  - Use thermophilic composting. If composting is well done (the substrate has the right composition, moisture content and aeration are optimized) the temperature in the heaps usually rises above 55°C for several days and all pathogens are destroyed.
  - Storage of sludge over a period long enough to allow natural pathogens to die off (minimum 6 months) is the other possibility to disinfect sludge without using expensive technologies.
  - Sun drying of sludge can enhance the pathogen destruction during storage and therefore increase the security of this method.
  - Avoid Use of untreated sludge for growing food crops: Agricultural use of fecal sludge for non-food crops can be possible without prior disinfecting treatment. Particularly, abstain from irrigating edible vegetables & crops with untreated sludge water or percolated water from the drying bed.
  - Avoid Use of untreated sludge for growing cattle feed: Cattle grazing on pasture irrigated or contaminated fields with raw sludge could be heavily infected with the larval stage of the tapeworm *Taenia saginata* (*Cysticercus bovis*).
- iii. Hygienic Education and Treatment: Good personal hygiene breaks the direct contact routes by which pathogens are transmitted and the full impact of the measures described above will only be achieved if they are accompanied by efforts to improve hygiene. Non-Pathogenic Health Risks

Contamination of soil and water can be easily possible by chemical constituents embodied in the fecal sludge, particularly heavy metals. Eventually, these chemicals accumulate in soils and water and directly or indirectly affect human health through various routes or through the food chain. Further non-pathogen risks result from impurities of non-biodegradable origin such as Glass splinters or other sharp objects contained in the sludge. Also, health risks due to the attraction and proliferation of rodents and other disease carrying vectors are common features of improperly managed sludge treatment and dumping sites.

### Mitigation Measures

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

### Impact on water and soil bodies

If there is leakage or overflow, the contamination risk will be high. The heavy metals in the treated wastewater may have potential human and environmental health impacts. The impacts associated with heavy metals in sludge are adverse, irreversible, of high significance and long term.

**Mitigation Measures**

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

**Impact on downstream and riverine flora:** If the treatment plant releases for some unforeseen reasons any untreated or practically treated waste effluent into downstream rivers, it would adversely affect the riverine and aquatic plants. This impact is less probable and rated to be medium significance.

**Mitigation measures**

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

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

**Mitigation measure**

- Ensure proper quality control of "treated" wastewater and sludge before releasing.
- Control any accidental spill of untreated or partially treated wastewater into the environment.
- Install a regular monitoring system on the quality of water discharged.

**Occupational Safety:**

Workers may be affected from handling of partially treated dry sludge as indicated in the previous section and the gas emission from the treatment plant. Hydrogen sulfide is toxic gas with a characteristic rotten egg odor can poison several different systems in the body. Breathing very high levels of hydrogen sulfide can cause death within just a few breaths. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness.

The OSHA permissible exposure limits for hydrogen sulfide are 10 ppm (time-weighted average) and 15 ppm (short-term exposure limit). Other potential health and safety impacts include accidents and plant malfunctions. The probability and impact of the following events were categorized; Spills, Process Upset,

Natural Hazards, Power Failures, Fires, Injury/Death. The impact is adverse, possible, reversible, of moderate significance, and long-term.

#### **Mitigation measures**

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

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

#### **Mitigation measures**

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

### **8.5.3 Decommissioning phase**

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

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

#### **Mitigation measures**

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

#### **Impacts on Soil and Water Bodies:**

During the decommissioning phase, there will be large amount of spoil from demolishing of structures and scraped contaminated soil that would pollute the soil and water resources including ground water. The impact is of medium significance. However, decommissioning of the sites without availing a better

substitute for the treatment of ever-increasing waste water would adversely affect the soil and water resources of the area and its downstream.

**Mitigation measures**

- Properly collect all the debris generated while demolishing the structures and transport to the designated disposal site
- Remove all the contaminated soil from the treatment plant site and dispose of it at a designated waste disposal site or at sanitary landfill.
- Level the ground in such a way that it will be used for other purposes.
- Reclaim polluted soil with appropriate technologies such as phytoremediation.
- Avail advanced FSTP that technology of the time offers before decommissioning the one at hand.
- Properly reinstate the abandoned fecal sludge treatment plant site.
- After reinstatement, DBWSSA could use the area for other purposes.
- Develop the areas for recreational park or plant trees to increase the aesthetic value of the area or handover to the nearby community in consultation with their respective Woreda/Kebele administrations so that they can develop what they think important for the community.

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

**Mitigation measures**

- Give job priority in other related projects.
- Secure pension benefit if the age of the job loser is in the set range of pension.
- Organize, train and promote to establish their own small-scale enterprises through the facilitation of loan or financial support. Create links with appropriate government agencies and financial sources.

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

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

**Mitigation measures**

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

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

#### **Mitigation measures**

- Properly reinstate the abandoned fecal sludge treatment plant site.
- After reinstatement, DBWSSS could use the area for other purposes.
- Develop the areas for recreational park or plant trees to increase the aesthetic value of the area or handover to the nearby community in consultation with their respective Woreda/Kebele administrations so that they can develop what they think important for the community.
- Integrate with the micro-watershed management system.

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

#### **Mitigation measures**

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

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

#### **Mitigation measures**

- Provide appropriate awareness training to the staff and local communities.
- Provide and avail a separate sanitation facility for women and men.
- Provide women friendly occupational health and safety equipment and materials.
- Assign women in works that do not affect their biological condition.
- Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all employees.
- Ensure equal pay for women and men for equal jobs.



## 9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The ESMP for the proposed project consists of a set of mitigation and institutional measures to be taken during the implementation and operation phases to eliminate the adverse environmental and social impacts identified and predicted in the previous sections, offset them, or reduce them to acceptable levels. The plan will also include the actions needed to implement these measures. The ESMP identifies and describes in detail feasible and cost-effective measures that will reduce potentially significant adverse environmental impacts to acceptable levels. The plan includes compensatory measures if mitigation measures are not feasible, cost-effective, or sufficient. A mitigation plan is a key to ensure that the environmental qualities of the area will not deteriorate due to the implementation of the project. The mitigation plan covers all aspects of implementation of the project in its various phases related to environment and social health.

This ESMP provides a schedule for the implementation of recommended mitigation activities. Table 19 presents identified impact mitigation measures proposed in the ESIA, for the implementation arrangements, including responsibilities for implementation, the time frame, and the budgetary implications. The ESMP identifies measures to address any potential environmental and socio-economic impacts that might occur during the implementation of the FSTP.

The objective of this ESMP is to ensure the integration of environmental and social requirements and proposed mitigation and monitoring measures into the construction contractor's obligations. The ESMP shall be fully integrated into the construction activities, hereby addressing the responsibilities of the construction contractor (the contractor), the Engineer, and the Employer. Furthermore, an ESMP has been developed for impacts resulting from the operational phase, which shall be fully integrated in operational activities. Responding adequately to the nature of the envisaged FSTP construction, the ESMP is referring to the following issues:

- Environmental and Social Mitigation Measures during Construction.
- Environmental and Social Mitigation Measures during Operation.
- Environmental and Social Quality Monitoring during Construction.
- Environmental and Social Quality Monitoring during Operation. and
- Obligations, roles, and responsibilities amongst concerned parties.

Due to the long-term life of the intervention facilities and related components, a decommissioning assessment will be undertaken at least 1 year before the process for any of the components commences, following a notice to decommission. The decommissioning process will be guided by a comprehensive decommissioning plan developed through the decommissioning audit process. However, the following features will need to be decommissioned upon completion of the works.

- i. The contractor's camp and installations that will need to be removed without compromising on the safety and general welfare of the immediate residents. Special care is to be given to associated wastes and dust emitted in the process.
- ii. Materials stores that will comprise fresh materials and used items. Each category will be moved safely out of the site ensuring minimal or no impacts to the related environment and social setting.
- iii. Wastes and debris holding sites will be cleared with maximum re-use of the debris either on surfacing the passageways or other grounds such as schools and church compounds.

- iv. Under normal circumstances, the project will be maintained and sometimes rehabilitated. During rehabilitation, a new ESIA can be instituted or an environmental management plan can be prepared depending on the degree of rehabilitation.

The following table (Table 19) shows environmental and social management plans for proposed works for FSTP.

Table 19 Environmental and Social Management Plan

Issue/ Main impacts			Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
				Implementation	Supervision		
	CONSTRUCTION PHASE						
1.	Loss of land under various uses	The permanent acquisition of land for onsite works shall be carried out in accordance with the ARAP and entitled Framework for the project. It shall be ensured that all ARAP activities are reasonably completed before the construction activity starts. All grievances of the PAPs will be reasonably redressed, in accordance with the ARAP implementation mechanism suggested for the project.	DBWSSS & land use and administration office	Grievance Handling Committee, regional land administration	Before the start of construction	the cost is based on ARAP and part of the municipality	
2.	Impacts on soils (soil erosion, compaction & contamination)	<ul style="list-style-type: none"><li>• Execution of earthworks during the dry season and refilling the excavated soil soon.</li><li>• Restricting land clearing to what is absolutely necessary.</li><li>• Refilling the trenches and other excavated/exposed places soon, covering with topsoil, leveling to surrounding landscape and replanting with appropriate grass, shrub and/or tree species as soon as possible.</li><li>• Ploughing the compacted areas to restore and improve infiltration into the soil and reduce water runoff.</li><li>• Provision of well-designed and constructed culverts and side ditches for the access roads to minimize potential erosion.</li></ul>	Construction Contractor	DBWSSS/ Supervisory Consultant SC, regional and Debre Berhan land administration and bureau of agriculture	Throughout Construction phase	Part of the construction and supervision cost to be covered by the contractor and consultant	
3.	Air & noise pollution due to dust, exhaust emissions, and noise generated by the construction activities	<ul style="list-style-type: none"><li>• Follow good site practices incorporating appropriate mitigation measures to reduce dust, nuisance noise, and vehicle emissions.</li><li>• Limit traffic speeds to minimize dust and spray water regularly on the dusty roads.</li><li>• Use dust collectors or water spray systems as appropriate to prevent high dust emissions from stone crushing or batch plant operations.</li><li>• Service the exhaust systems of all vehicles and equipment on a regular basis to ensure that noise</li></ul>	Construction Contractor	Supervisory Consultant (SC), Woreda/town Environmental protection Office (Debre Berhan), health office	Throughout the Construction phase	Included in the contract for the Contractor & SC	

Issue/ Main impacts			Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
				Implementation	Supervision		
		and exhaust emissions are kept to appropriate levels. <ul style="list-style-type: none"><li>All machinery and plants should conform to the applicable noise standards, and plants should be provided with effective noise mufflers.</li><li>Construction workers should adhere to health and safety standards pertaining to noise, such as wearing ear protection when operating plant or heavy machinery.</li></ul>					
4.	Impact on water bodies	<ul style="list-style-type: none"><li>Minimize land clearance and earthworks to the imperative area necessary for the project works.</li><li>Minimize soil erosion by refilling the trenches and other excavated/exposed places soon, and establishing protective cover such as appropriate grasses and other vegetation</li><li>Locating storage areas and compounds away from watercourses.</li><li>Appropriate storage of fuel and materials</li><li>Providing suitable facilities for workers,</li><li>Avoid disposal of used oils in the field, by strictly controlling &amp; documenting waste disposal process</li></ul>	Construction Contractor	Supervisory Consultant Woreda Water and energy office, Environmental protection Office	Throughout construction phase	Part of Contractor’s Contract	
5.	Impact on archaeological & cultural heritage sites	<ul style="list-style-type: none"><li>No known archaeological sites are expected on-site, however, if encountered the Contractor/ Supervising Consultant is to inform the local authority for further action.</li><li>Apply the chance finds procedure.</li></ul>	Construction Contractor	Supervisory Consultant, culture and tourism bureau	During construction	-Part of the construction and supervision cost to be covered by the contractor and consultant	
6.	Impact on agricultural lands, and other uses	<ul style="list-style-type: none"><li>Implement the construction works during the dry season.</li><li>Reinstate the affected areas to a productive state.</li><li>Plough the compacted areas to prepare the surface for growing crops or pasture grasses/to avoid potential erosion.</li><li>Plant appropriate trees at the boundaries of the FSTP site to improve the aesthetic value of the areas, to absorb air pollutants from the air, and to serve as a windbreak.</li></ul>	<ul style="list-style-type: none"><li>DBWSSS</li><li>Construction Contractor</li></ul>	<ul style="list-style-type: none"><li>Supervisory consultant</li><li>Woreda Bureau of Agriculture</li><li>Region and Woreda/town /municipality land officers</li></ul>	Prior to and during construction works	-Part of the ARAP cost -Part of the construction and supervision cost to be covered by the contractor and consultant	

Issue/ Main impacts	Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		Implementation	Supervision		
7. Impact on flora and fauna	<ul style="list-style-type: none"> <li>Demarcation and fencing off the construction areas.</li> <li>Prohibit poaching and killing of wildlife by the workers.</li> <li>Backfilling of trenches and other excavated areas and grading to the natural topography.</li> <li>Awareness creation for the project personnel.</li> <li>Compensatory plantation program of at least saplings of 10 seedlings for each tree felled (staggered to follow Civil Works) including three years of maintenance.</li> </ul>	Construction Contractor	<ul style="list-style-type: none"> <li>Supervisory</li> <li>Consultant</li> <li>Woreda wildlife protection office /agency</li> </ul>	During construction	-Part of the construction and supervision cost to be covered by the contractor and consultant & birr 300,000.00 for plantation
8. Occupational Health and Safety	<ul style="list-style-type: none"> <li>Provision of protective wearing (gloves, gum boots, overalls, and helmets).</li> <li>Provide temporary toilets and bathrooms for the construction workers at the work sites.</li> <li>Provide onsite first aid kit accessible by the workers on need.</li> <li>Contractor to provide a Healthy and Safety Plan prior to the commencement of works to be approved by the resident engineer.</li> <li>There should be a safety policy clearly displayed on the site.</li> <li>Appropriate signs must be erected on the site to warn workers and visitors.</li> <li>Ensuring that the drivers and machine operators hired to work on the site are qualified.</li> </ul>	Construction Contractor	<ul style="list-style-type: none"> <li>Supervisory</li> <li>Consultant</li> <li>DBWSSS</li> <li>Health office</li> </ul>	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant
9. Traffic	<ul style="list-style-type: none"> <li>Only essential traffic will be allowed to the project area during traffic peak hours when traffic is a problem.</li> <li>Sensitization of the nearby communities about the increased traffic.</li> <li>Materials hauling to the tipping site and vice versa will be carried out during off-peak periods during the day.</li> <li>Alternatively finished materials as such ready-made concrete, precast elements or pre-</li> </ul>	Construction Contractor	Supervisory Consultant, traffic management office of the town	During construction	Part of the construction and supervision cost is to be covered by the contractor and consultant

Issue/ Main impacts			Proposed Mitigation measures		Responsibility	Timing of Execution	Cost Estimate (Eth. Birr)
					Implementation	Supervision	
			assembled materials can be delivered at the site when the need arises.				
10.	Health impact (HIV/AIDS/STDs)	<ul style="list-style-type: none"> <li>Awareness raising and education programs about HIV/AIDS and other STIs</li> <li>Ensure the availability of first-aid services for all site personnel, including the staff of the Engineer and visitors</li> <li>Provide clinics with all necessary medication in camp.</li> <li>Support nearby health facilities and work in cooperation with nearby health offices.</li> </ul>		Contractor & Health Office	Supervisory Consultant & Health office	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant and Birr 30,000.00 for HIV awareness
11.	Gender Equity, GBV/SEA, and Sexual Harassment	<ul style="list-style-type: none"> <li>Create awareness among workers on gender and sexual harassment issues.</li> <li>Issue a strong Workers Code of Conduct (CoC) that sufficiently addresses gender and sexual harassment issues;</li> <li>Take appropriate actions on workers violating the CoC.</li> <li>Provide women workers with appropriate types of safety equipment and protective materials.</li> <li>Include in the employment contract for the construction workers that any GBV and sexual harassment against women workers will lead to administrative measures and legal actions.</li> <li>The Contractor is required to design gender core labor standards and employment and contract procedures, and also design gender-responsive workers manuals.</li> <li>The Contractor should ensure that women are paid equal pay for equal work with their male counterparts.</li> <li>Provision of gender-disaggregated bathing, cloth changing areas &amp; sanitation facilities.</li> <li>Include gender expert among the consultant's team to follow up Gender mainstreaming activities.</li> </ul>		Contractor	<ul style="list-style-type: none"> <li>Supervisory Consultant</li> <li>Office of Women, children and youth affairs</li> <li>GRC</li> </ul>	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant Birr 30,000.00 for GVB /SEA awareness training



Issue/ Main impacts			Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)	
				Implementation	Supervision			
Operation phase								
1.	Ambient air quality (Odor/obnoxious smell from the TP and from open manholes)	<ul style="list-style-type: none"><li>• Proper maintenance of the facility, including avoidance of pools of dirty stagnant waters and spills.</li><li>• Covering swampy parts of the settlement and drying beds with a layer of earth or sand.</li><li>• Aerate, and adjust chemical dosing and oxidation or pH to reduce odor from plant influents.</li><li>• Cover tanks or installation of exhaust hoods.</li><li>• Operate equipment at optimum/design conditions.</li><li>• Adopt effective and efficient housekeeping procedures (regular cleaning of the grit and screenings).</li><li>• Regular facility maintenance and monitoring operational practices including process control and chemical treatment, continuous process of the operation</li><li>• Operate especially the secondary treatment processes at optimum condition.</li><li>• Plant layers of shrubs and trees along the periphery and provide adequate stack height to exhaust emissions.</li><li>• Provide adequate buffer zone, particularly along the major windward.</li></ul>	<ul style="list-style-type: none"><li>• Facility manager</li></ul>	<ul style="list-style-type: none"><li>• DBWSSS</li><li>• Environmental protection office /EPA</li></ul>	Throughout the operation phase	Part of the FSTP operation budget		
2.	Soil	<ul style="list-style-type: none"><li>• Dispose of sludge with dangerous substances only in a designated sanitary landfill</li></ul>	DBWSSS Facility manager	DBWSSS, Woreda EPA and agriculture & natural resource offices	Throughout the entire operation phase	Part of the FSTP operation budget		
3.	Water Bodies	<ul style="list-style-type: none"><li>• Seal the foundation of treatment plants and influence areas with concrete lining to avoid leakage of</li><li>• Wastewater through permeable soils and weathered and fractured rocks into the groundwater system.</li><li>• All pipework and fittings should be a class a rating</li></ul>	DBWSSS Facility manager	DBWSSS Woreda/regional environmental protection and water & energy bureau	During design, construction, and operation of TPs	Part of the FSTP operation budget		

Issue/ Main impacts			Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
				Implementation	Supervision		
		<p>more than the maximum pressure attained in service including any surge pressure.</p> <ul style="list-style-type: none"><li>• Dispose of the sludge with dangerous substances in a designated landfill.</li><li>• Close monitoring of the facility to ensure it functions as planned, this involves monitoring of ground and surface waters in the surroundings of the TP, and ensuring that the facility’s effluent complies with the national effluent standards.</li></ul>					
4.	Fauna & Flora	<ul style="list-style-type: none"><li>• Proper quality control of ‘treated’ sludge before releasing into the natural environment.</li><li>• Develop a green belt around the treatment plant site to compensate for trees removed during the construction phase and to increase the aesthetic view of the treatment plant sites as well as to sequestrate GHG gasses and to absorb bad odor and noise pollution.</li></ul>	<ul style="list-style-type: none"><li>• FSTP Quality Control</li></ul>	<ul style="list-style-type: none"><li>• DBWSSS,</li><li>• Environment Prot. Office (both city administratio n and region)</li></ul>	Throughout the operation phase	Part of the FSTP operation budget	
5.	Safety	<ul style="list-style-type: none"><li>• Adherence to national rules and regulations.</li><li>• Appropriate warning signs shall be placed in areas where accidents are expected to occur.</li><li>• Provision and use of protective wear.</li><li>• Strict prohibition of the operation of equipment by unauthorized personnel.</li><li>• Operators shall be provided with regular medical check-ups and safety training.</li></ul>	<ul style="list-style-type: none"><li>• DBWSSS</li><li>• Facility manager</li></ul>	<ul style="list-style-type: none"><li>• DBWSSS</li><li>• Health bureau and office</li></ul>	Throughout the entire operation phase	Part of the FSTP operation budget	
6.	Impact on Aesthetic value	<ul style="list-style-type: none"><li>• Plant trees around the treatment plant and buffer zone.</li><li>• Keep the buffer zone and open areas within the treatment plant neat all the time.</li></ul>	DBWSSS Facility manager	DBWSSS	Throughout the entire operation phase	Part of the FSTP operation budget	
7.	Health Impact on people handling the sludge	<ul style="list-style-type: none"><li>• Careful handling of fecal sludge:</li><li>• Use of protective clothes such as gloves and masks, and good hygiene (washing hands after work, etc.).</li><li>• Most important is that workers be aware of the nature of the health risks to which they are exposed and that they know how to protect</li></ul>	<ul style="list-style-type: none"><li>• DBWSSS</li><li>• Facility manager</li></ul>	<ul style="list-style-type: none"><li>• DBWSSS</li><li>• Health</li></ul>	Throughout the entire operation phase	Part of the FSTP operation budget	

Issue/ Main impacts		Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
		<p>themselves.</p> <ul style="list-style-type: none"> <li>• Training of staff and targeted information may therefore be the most successful measures.</li> <li>• DBWSSS dealing with sludge should introduce rules for use of protection by their staff and care should be taken to enforce those rules.</li> </ul>				
8.	Health impact from the use of untreated fecal sludge in agriculture	<ul style="list-style-type: none"> <li>• Fecal sludge should always be treated prior to its use in agriculture.</li> <li>• Use thermophilic composting. If composting is well done (the substrate has the right composition, moisture content, and aeration are optimized) the temperature in the heaps usually rises above 55°C for several days and all pathogens are destroyed.</li> <li>• Storage of sludge over a period long enough to allow natural pathogens die off (minimum six months)</li> <li>• Sun drying of sludge can enhance the pathogen destruction during storage and therefore increase the security of this method.</li> <li>• Avoid the use of untreated sludge for growing food crops.</li> <li>• Hygienic Education and Treatment.</li> <li>• Avoid the use of percolated liquid from the sludge dry bed for irrigation or any use before adequately treating and Disinfecting.</li> <li>• Create awareness among these people who are potentially exposed to the direct and indirect health impacts of the sludge.</li> <li>• Fence the area to prevent the entrance of dogs and other nocturnal animals. and</li> <li>• Keep the area neat and attractive so that flies and rodents cannot be attracted.</li> </ul>	DBWSSS Facility manager	<ul style="list-style-type: none"> <li>• DBWSSS</li> <li>• Environment Prot. office</li> <li>• Health office</li> </ul>	Throughout the entire operation phase	Part of the FSTP operation budget
9.	Gender and Gender-Based	<ul style="list-style-type: none"> <li>• Provide and avail a separate sanitation facility for women and men at the treatment plants.</li> <li>• Provide women-friendly safety equipment and</li> </ul>	DBWSSS Facility manager	<ul style="list-style-type: none"> <li>• DBWSSS</li> <li>• Women and children</li> </ul>	Throughout the entire operation	Part of the FSTP operation budget

Issue/ Main impacts			Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
				Implementation	Supervision		
	Violence/SH/SEA Risks	<div>materials.</div> <ul style="list-style-type: none"><li>Assign women to works that do not affect their biological condition.</li><li>Ensure that women workers do not face GBV and sexual harassment.</li><li>Incorporate measures to be taken against those workers who commit GBV and sexual harassment.</li><li>Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all employees.</li><li>Ensure equal pay for women and men for equal jobs.</li></ul>		affairs, office of Opossum	phase		

## 10. ENVIRONMENTAL AND SOCIAL MONITORING PLAN

Issues that will be monitored during the development of the FSTP include:

- Waste water quality, occupational health and safety issues, leakage monitoring, energy, and chemical management.
- The development of a Gender Policy for the sector which will be based on gender assessment and intensive consultations with relevant stakeholders.
- Strengthening of the environmental and social safeguards of the JWSSA and other relevant stakeholders.
- Capacity building of the existing environmental and social safeguards of the JWSSA through increased the capacity of the Environmental Health and Safety Safeguards expert, social mobilization initiatives and effective communication.
- Inclusive hygiene promotion.

The environmental and social impact assessment requires the developer to prepare and undertake a monitoring plan and regular auditing. The objectives of environmental monitoring upon executing activities are to:

- Monitor the effective implementation during the construction and operation, decommissioning phases of proposed mitigation measures.
- Confirm compliance with environmental, public health, and safety legislation/regulations during construction.
- Control the risks and ecological/social impacts.
- Ensure best practices management as a commitment for continuous improvement in environmental performance.
- Provide environmental information to community/stakeholders.
- Provide early warning signals on potential environmental degradation for appropriate actions to be taken to prevent or minimize environmental consequences.

Recommendations for monitoring responsibilities and estimated costs have been included in the implementation of the ESMP.

Table 20 below provides the monitoring indicators and monitoring activities at various phases. Monitoring plan: As the Executing Agency, DBWSSS will bear overall responsibility for monitoring the implementation of the ESMP. In addition, the relevant Debre Berhan town stakeholders shall be engaged as deemed necessary.

However, for day-to-day monitoring, it is expected that the supervising Consultant will hold the Contractor(s) accountable for all ESMP implementation requirements, including implementation of all approval conditions as stated in the approval. It is expected that the regional and Federal EPA (or appropriate regulatory body), as the agency responsible for the environment, will also conduct oversight monitoring on ESMP implementation as appropriate. The WB, on the other hand, will conduct routine bi-annual supervision missions to ensure all activities, including ESMP implementation, are on track. The individual ESIAs and ESMPs have identified areas for monitoring by the enterprise, the contractor(s), the Supervising Consultant(s), and other relevant stakeholders. Key aspects of the monitoring program will

include, among others; water quality monitoring, especially with respect to effluent discharged FSTP and receiving waters, sound operation of fecal sludge treatment plants, reinstatement of areas disturbed by earthworks, occupational health and safety aspects, and related construction-related accidents and protection of workers as well as the status of PAPs livelihood programs after compensation.

The key verifiable indicators that will be used to monitor the impacts will mainly include pollution (noise, soil, air-dust, waste), erosion and loss of resources, occupational and health safety, land use change, the spread and occurrence of diseases (Pathogenic and nonpathogenic-HIVE/AIDS, COVID-19, etc.) and accidents as well as job creation.



Table 20 Environmental and Social Monitoring Plan

S/N	Issue/ project main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitoring	Budget Estimate (in Birr) for monitoring
<b>CONSTRUCTION PHASE</b>						
1.	Land acquisition and impacts on land use	<ul style="list-style-type: none"> <li>Area of land under various uses expropriated for the project activities categorized as temporary or permanent land acquisition.</li> <li>Number of households affected due to land expropriation or damages of properties and no. of HHs paid commensurate compensation.</li> <li>Area of land reinstated to the productive state after completion of works, i.e., land area affected due to temporary activities</li> </ul>	Supervisory Consultant (SC) & Debre Berhan Woreda Environmental Protection Office, Agriculture & Natural resource office, and land administration representatives of the community	As required	Cadastral survey/ measurement, registration of HHs during inventory of properties affected collaborative field visit and reporting	300,000
2.	Impacts on soils and landscape quality	<ul style="list-style-type: none"> <li>Evolution of erosion signs (sheet erosion, gully formation, siltation in nearby watercourses or drains).</li> <li>Length/ area of trenches and other exposed surfaces properly refilled, leveled to the surrounding landscape, and replanted with appropriate plant species following completion of works to minimize soil erosion, and slope failures or to improve the quality of the affected landscape.</li> <li>Area of land affected due to exploitation of quarries and borrows sites and area reinstated after exploitation has ceased.</li> <li>Incidence of soil pollution by spillage of hazardous substances</li> </ul>	As above	Minimum twice per month during the construction contract period	Visual observation, area measurement, Collaborative field visits and reporting the result	150,000
3.	Impacts on water quality; sedimentation,	<ul style="list-style-type: none"> <li>Location/distance of the contractor's site facilities (camps, storage site, workshop/garage) from water bodies</li> </ul>	Supervisory Consultant DBWSSS, Woreda Environment Protection, Water and	As required	Visual observations, water quality analysis in laboratory or using field kits Collaborative field	200,000

S/ N	Issue/ project main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitor ing	Budget Estimate (in Birr) for monitoring
	pollution by hazardous substances and wastes generated by the project	(min. of 1km is recommended). <ul style="list-style-type: none"> <li>Provision of a secondary containment system for fuel storage facilities.</li> <li>Proper handling of hazardous substances (oil, fuel) and disposal system used oils.</li> <li>Incidence of water pollution by spillage of hazardous substances.</li> <li>Sediment load/turbidity of nearby streams &amp; rivers.</li> </ul>	Energy office		visit and reporting the result	
4.	Impacts on air and noise quality	<ul style="list-style-type: none"> <li>Dust levels or incidence of dust pollution in the construction areas &amp; rate of application of dust suppressants (spraying water) on dusty areas.</li> <li>Use of dust collectors or water spray systems in stone crushing or batch plant operations.</li> <li>Noise and exhaust emission levels generated by construction vehicles and equipment.</li> <li>No. of complaints due to nuisance noise or dust pollution.</li> </ul>	Supervisory Consultant (SC) Environment Protection office, DBWSSS	As required	Visual observations & Recording of case	350,000
5.	Impacts on flora and fauna	<ul style="list-style-type: none"> <li>Area of vegetation cleared for the project within the boundary of the project site</li> <li>Number of trees/land area replanted a survived to replace the trees removed and the plantation affected.</li> <li>Number of wild animals killed during the construction works.</li> </ul>	Supervisory Consultant, Wildlife Life Protection Authority, Environmental Protection, Culture and Tourism Office	As required during the contract period	Visual observations, surface area measurement & Recording of trees affected & Animal fatalities Collaborative field visit and reporting the result	250,000
6.	Impact on agricultural lands	<ul style="list-style-type: none"> <li>Area of agricultural land affected.</li> <li>Area of affected agricultural land reinstated after completion of works.</li> <li>Number of households paid</li> </ul>	Supervisory Consultant Woreda Agriculture & natural resources office	As required	Surface area measurement & recordings of compensation	250,000

S/ N	Issue/ project main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitor ing	Budget Estimate (in Birr) for monitoring
		compensation for loss of their farmlands.	Representatives of the community		committee Collaborative field visit and reporting the result	
7.	Impacts on infrastructures	<ul style="list-style-type: none"> <li>Length or area of infrastructures (roads, drainage facilities &amp; pedestrian walkways) damaged due to the project activities,</li> <li>Length or area of damaged infrastructures reinstated to an original state after completion of the works</li> </ul>	Supervisory Consultant,  Municipality (DBWSSS, Ethio-telecom, electricity, etc.)	As required	Visual observations & measurement Collaborative field visit and reporting the result	120,000
8.	Impacts on traffic mobility and safety issues	<ul style="list-style-type: none"> <li>Number of construction sites provided with appropriate signals to minimize obstruction to traffic mobility &amp; safety hazards.</li> <li>Number of risky construction sites prohibited for people and animals or fenced to minimize safety risks.</li> <li>Timely collection and disposal of excess spoil materials availability of an adequate number of protective kits and whether workers are using protective kits</li> </ul>	Supervisory Consultant, Municipality (traffic management office of Debre Berhan town)	Once per day or as required construction works are ongoing at road crossings or pedestrian access	Visual Observations Collaborative field visit and reporting the result	130,000
9.	Impacts on public health	Number of awareness raises and education campaigns about HIV/AIDS given for project workers and vulnerable local population.	SC, Health Office, DBWSSS Representatives of the community	As required	Communication with the implementers & Interviewing the vulnerable groups Collaborative field visit and reporting the result	150,000
<b>OPERATION PHASE</b>						
1.	Odor	<ul style="list-style-type: none"> <li>Intensity of odor and spatial coverage around the treatment plant and nearby surrounding areas</li> </ul>	DBWSSS, Woreda Environment Protection and Health Offices Representatives of the community	Whenever there is complaint from the affected people	Visual observations & Recording of cases Collaborative field visit and reporting the result	Part of the regular budget of regulatory body

S/ N	Issue/ project main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitor ing	Budget Estimate (in Birr) for monitoring
2.	Sludge water treatment & disposal of the cake	<ul style="list-style-type: none"> <li>Proper functioning of the installed drying lagoons as thickeners for sludge water.</li> <li>Proper disposal &amp; control of the dewatered sludge at the properly located dumping/landfill site</li> </ul>	DBWSSS Woreda Health office, Water & Energy offices, Representatives of the community	As required	Visual Observation Collaborative field visit and reporting the result	Part of DBWSSS operation cost and cost of regulatory body and 250,000 monitoring cost
3.	Water quality monitoring	<ul style="list-style-type: none"> <li>Physical-chemical indicators such as PH, turbidity, total dissolved solids, electrical conductivity, nutrients (nitrate, phosphate), residual chlorine, etc.</li> <li>Bacteriological indicators such as Escherichia coli (E. coli) – an indicator of fecal contamination</li> </ul>	DBWSSS Woreda/town Water and Energy and Environment Prot. office	Twice/year for nearby source water intake), once per month for treated water at WTP	Sampling & testing in the laboratory or using field kits with portable incubators for microbiological testing	Part of DBWSSS operation cost and cost of regulatory body and 300,000 monitoring cost
4.	Public Health & Environmental sanitation issues	<ul style="list-style-type: none"> <li>Number or availability of adequate drainage facilities for disposal of wastewater.</li> <li>Wastewater disposal situation by the local people using available facilities</li> </ul>	DBWSSS Woreda Health office Representatives of the community	As required	Visual observations, review of drainage plans & documents	Part of the regular budget of regulatory Body and 250,000 monitoring cost
5.	Operation and Maintenance of the TP System	<ul style="list-style-type: none"> <li>Adequacy of implementation of preventive and all unscheduled/emergency maintenance work</li> <li>Periodic housekeeping of the system,</li> <li>Allocation of human and financial resources for the preventive and unscheduled maintenance</li> </ul>	DBWSSS Woreda Environment Prot. and Health Offices	Monthly	Performance reports Collaborative field visit and reporting the result	Part of DBWSSS regular maintenance cost and 250,000 monitoring cost
	<b>Monitoring</b>	<b>Total monitoring costs for the planned activities</b>				<b>2,750,000.00</b>

## **11. INSTITUTIONAL/IMPLEMENTATION ARRANGEMENTS AND CAPACITY BUILDING**

The program will use the existing institutional arrangements and a dedicated Program Implementation Team, who are employees of the executing agency, Debre Berhan Water Supply and Sewerage Service. DBWSSS has an established position for an Environmental and social safeguard which will provide oversight on the implementation of the environment (ESIA) and social (ARAP) components of the program. It is further recommended that oversight on environmental issues shall further be supplemented through the recruitment of additional environmental expertise by the contractor and supervising consultant once the project commences. In the interim, this staffing arrangement is deemed adequate (Table 21).

The responsibility for implementing the ESMP of the supplement ESIA during construction will be of the contractor, DBWSSS, and the Woreda Health office. The regional environmental authority is also mandated for the follow-up and compliance monitoring of the E&S related aspects. During the operation and maintenance of the FSTP works, the responsibility will be mainly under the DBWSSS.

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

The institutional capacity to implement enforces, and monitor the project environment and health was assessed based on the technical, financial, and physical capability of the Community leaders and DBWSSS. The findings indicated that these different groups have different capacity-building and training needs in terms of raised awareness, sensitization to the issues, and detailed technical training. The DBWSSS is found to have a limited institutional capacity to implement the provisions of the ESMP, especially regarding the FSTP management sub-project. Although general awareness of environmental issues exists within the steering committee stakeholders and DBWSSS professional staff, focused training and capacity building would enhance the ESMP implementation capacity substantially on their part.

It is recommended that capacity-building interventions including training should take place at all levels i.e., community-based organizations relevant to waste management, relevant government officials (E&S, environmental protection, health, women and labor), community leaders, DBWSSS management team. The DBWSSS environmental and social experts should be exposed to short-term training in the management of environmental and social issues. The training program for various role-players will include an orientation program on the ESMP, Environmental Assessment Processes, Participatory Methodologies, and Project Management and Monitoring. The training on ESMP may be integrated with the social framework and another related training program for cost-effectiveness.

Table 21 Institutions Responsible for the Implementation of ESMP

Stakeholders	Roles and Responsibilities
<b>Debre Berhan town Administration</b>	Allocate Budget to the Client project office and monitor its utilization; Monitor the implementation and operation of the proposed project; Coordinate the activities of the Woreda and town Administrations for the successful implementation of the project including the resettlement process. Make sure the ARAP is appropriately estimated and payment/replacement has been done accordingly. Also involved in the GRM
<b>DBWSSS</b>	Responsible for the implementation of the proposed project as proponent; Coordinate the efforts of the other organizations responsible for the management and monitoring plan; Follow-up the rehabilitation of the affected part. Coordination of stakeholders during monitoring of project activities at various phases.
<b>Town Environmental Protection office</b>	Provide technical advice about environmental protection during the project implementation; Audit the project from an environmental protection point of view; monitor the implementation of environmental and social mitigation actions.
<b>Debre Berhan town health office</b>	Provides technical advice about social health issues such as HIV/AIDS, COVID-19, STD, and others.
<b>Debre Berhan town Women and Children office</b>	Provide technical advice about the social issues on GBV, child labor etc. and monitoring at various phases.
<b>Amhara Regional State Water &amp; Energy Bureau</b>	Provide technical advice (2 <sup>nd</sup> UWSSP) and capacity building and monitoring. The bureau will participate in monitoring during water quality measurement.
<b>MoWE</b>	Technical advice and capacity building (2 <sup>nd</sup> UWSSP).
<b>The World Bank</b>	Finance the project as per the agreement. Monitor and evaluate the progress of the work and check the correct use of the allocated funds. Demand work progress reports on the implementation of the project.
<b>Contractor</b>	The Contractor has to prepare the Construction's ESMP and implement it. To this end, the contractor should mobilize environmentalists, sociologists, health and safety expert, and gender specialists at the construction sites.
<b>Supervision Consultant</b>	The Consultant's EHS team in cooperation with AWSSA social and environmental impact assessment & monitoring and evaluation sub process will conduct regular monitoring of the project activities and give advice and instruction to the Contractor to perform environmental, social and health, and safety issues as per the ESIA, ESMP, and financiers environmental, social and health safeguard guidelines.
<b>PAP and the general community</b>	Engaged in monitoring the E&S through their representative

### 11.1 Training Programs

Training programs are developed and shall be delivered to the project developer for the implementation of environmental safeguards of the proposed project (Table 22). Following training needs assessment; specific and tailored training will be developed and agreed upon by the developer and key stakeholders for implementation of safeguards in the course of project implementation.

- Target groups for the training: DBWSSS Civil and Sanitary Engineers, Environmental, Community development Officers, Contractors, and community representatives in the project area.
- Training schedule: at least one month before construction starts.
- In-service and refresher Training: The training programs proposed below will take place every six months on a yearly basis and their content updated and adapted to implementation issues. Training frequency and the content will be reviewed in the course of the sub-project's operation lifespan depending on needs or technical requirements.

Table 22 Training Programs for Capacity Building and Associated Costs

Target Group	DBWSSS Staff, MoWE (regional water and energy bureau), Health officers, Regional EPA, and other relevant stakeholders	Estimated Cost in birr
<b>Training title</b>	Environmental supervision, monitoring and reporting	500,000
<b>Participants</b>	Environmental staff and social workers of DBWSSS and other stakeholders who are going to engage in the management and monitoring (total 15 participants)	
<b>Training frequency</b>	Soon after project effectiveness but at least two weeks -1 month before the start of project work. In-service /refresher training during operation.	
<b>Time</b>	Training twice a year, and then to be repeated on a yearly basis until year three of implementation.	
<b>Training content</b>	<ul style="list-style-type: none"> <li>Public health and safety of FSTP management.</li> <li>Social mitigations for environmental projects</li> <li>Community participation in environmental supervision monitoring</li> <li>Supervision of contractors, Subcontractors, and community representatives in the implementation of environmental supervision</li> <li>Risk assessment, response, and control</li> <li>Awareness creation</li> <li>Public and communal toilet management approaches</li> </ul>	
<b>Responsibilities</b>	DBWSSS with the facilitation from the MoWE environmental and social safeguard specialists	500,000
<b>Training title</b>	Implementation of mitigation measures	
<b>Participants</b>	On-site construction management staff; environmental and social safeguard staffs; village/group authorities.	
<b>Duration</b>	After bidding, and determining based on needs	
<b>Time</b>	3 days of training for contractors and 2 days of training for others, to be repeated twice a year on an annual basis depending on needs	
<b>Training Content</b>	<ul style="list-style-type: none"> <li>Overview of environmental monitoring</li> <li>Requirements of environmental monitoring</li> <li>Role and responsibilities of contractors</li> <li>Scope and methods of environmental monitoring</li> <li>Response and risk control</li> <li>Propagate monitoring forms and guide how to fill in the forms and risk report</li> <li>Preparation and submission of reports</li> <li>Other areas to be determined</li> <li>Grievance handling and reporting</li> <li>GBV reporting</li> </ul>	
<b>Responsibilities</b>	DBWSSS with facilitation from the MoWE	750,000
<b>Target groups</b>	Local communities/ stakeholders, DBWSSS, Health Officers and, municipality, urban infrastructure technicians/ Engineers/EPA	
<b>Training title</b>	Environmental sanitation and safety	
<b>Participants</b>	Representatives of community and/or worker leaders (as appropriate) (up to 30 participants)	
<b>Training frequency</b>	Bi-yearly or every 6 months for the first two years	
<b>Time</b>	One-day presentation and one-day on-the job training twice a year, to be repeated on as needed basis	750,000
<b>Training content</b>	<ul style="list-style-type: none"> <li>Environmental and Social safeguards</li> <li>Safety and health issues</li> <li>Environmental Pollution risks and management</li> <li>Management of environmental safety and sanitation on work sites</li> </ul>	



Fecal Sludge Management, Debre Berhan City-ESIA		October 2023
Target Group	DBWSSS Staff, MoWE (regional water and energy bureau), Health officers, Regional EPA, and other relevant stakeholders	Estimated Cost in birr
	<ul style="list-style-type: none"> <li>Mitigation measures at construction sites</li> <li>Procedures to deal with emergency situations</li> <li>Other areas to be determined</li> </ul>	
Responsibilities	DBWSSS and another relevant stakeholder	
Subtotal 1		1,750,000
Training title	Customer service management:	500,000
Course content	Marketing (promotion), customer handling, record keeping and reporting, financial management	
Target group	Head of Core Process, Fecal Sludge (FS) Emptying Customer Service Team Leader, Head of Finance Accountant (up to 20 participants)	
Responsibilities	DBWSSS and another relevant stakeholder	
Training title	Safety measures for proper FS emptying	500,000
Course content	Training on risks, safety measures and good practices for FS sludge collection and conveyance	
Target group	Head of Core Process, FS Emptying Customer Service Team Leader Sludge Truck Drivers Sludge Emptying Crew	
Responsibilities	DBWSSS and another relevant stakeholder	
Training title	Operation and maintenance of treatment plant	700,000
Course content	Treatment plant operation principles, operation and maintenance procedures, and treatment processes	
Target group	Head of Core Process FSTP Team Leader FSTP operators	
Responsibilities	DBWSSS and another relevant stakeholder	
Training title	Leadership and communication	570,000
Course content	Training on group coordination, team leading and communication	
Target group	Utility Director General Head of Core Process, FS Emptying Customer Service Team Leader FSTP Team Leader Finance Team Leader	
Responsibilities	DBWSSS and another relevant stakeholder	
Subtotal 2		2,270,000
Total estimated cost		4,020,000

## 11.2 ESMP Implementation Costs

The maintenance of specified impacts within permissible levels, early mitigation of unanticipated consequences (before they become a problem), and realization of projected project benefits are all dependent on environmental and social management and monitoring. So, the goal of an ESMP is to aid in the systematic and quick identification of issues as well as the successful implementation of corrective measures, leading to the achievement of good environmental performance.

To support this, the ESIA's have provided a budget estimate for ESMP implementation, and this will be included in the overall project implementation budget. Thus, the overall cost, i.e., including mitigation, monitoring and capacity building as detailed in Table 23 is ETB **8,668,000.00**

Table 23 Summary of Budget Estimate for ESMP

No.	Component	Project phase	Unit/Reference	Estimated cost in ETB
1.	ESMP			
	Implementation of replanting program to compensate for trees or buffer zone plantation	construction phases and implementation	Lump sum	300,000.00
	HIV/AIDS & GBV awareness and	construction	Lump sum	60,000.00

Fecal Sludge Management, Debre Berhan City-ESIA				October 2023
No.	Component	Project phase	Unit/ Reference	Estimated cost in ETB
	prevention	phases		
	ESMP enhancing beneficial impacts	All phases		550,000.00
	<b>Subtotal 1</b>			<b>910,000.00</b>
<b>2.</b>	<b>Environmental and Social Monitoring Costs</b>			
	Land acquisition and land use monitoring	Construction	Lump sum	300,000.00
	Soils and landscape quality monitoring	Construction	Lump sum	150,000.00
	water quality monitoring	All phases	Lump sum	500,000.00
	Air and Noise quality monitoring	Construction	Lump sum	350,000.00
	Monitoring of flora and fauna	Construction	Lump sum	250,000.00
	Monitoring of Impact on agricultural lands	Construction	Lump sum	250,000.00
	Monitoring of Impacts on infrastructures	Construction	Lump sum	120,000.00
	Traffic mobility and safety issues monitoring	Construction	Lump sum	130,000.00
	Public health and Environmental sanitation monitoring	All phases		400,000.00
	Sludge water treatment & disposal of the cake monitoring	Operation		250,000
	Operation and Maintenance of the TP System monitoring			250,000.00
	<b>Subtotal 2</b>			<b>2,950,000.00</b>
<b>3.</b>	Training cost including skill development	All phases		4,020,000.00
	<b>Subtotal 3</b>			<b>4,020,000.00</b>
	<b>Subtotal 1+2+3</b>			<b>7,880,000.00</b>
	Contingency 10%			<b>788,000.00</b>
	<b>TOTAL</b>			<b>8,668,000.00</b>

### 11.3 Grievance Redressing Mechanisms

An efficient and effective process for handling project-related complaints is intended to be outlined by a grievance redressing mechanism (GRM). As per OP 4.12 of the WB, GRM should be accessible and appropriate to bring about remedial measures for complaints. Appropriateness and accessibility basically signify the need to have a workable GRM arrangement tailored to the local context. Without these essential components of GRM, complaint procedures won't produce the desired results in terms of resolving complaints. In case of complaints by PAPs on project-related activities, the preferred way of settlement is through amicable means so as to save time and resources as opposed to taking the matter to formal courts.

Procedures for the redress of grievances should be established for the project to ensure that the PAPs have access to channels for resolving complaints related to any aspect of environmental and social impacts, compensation, construction management negligence, and any other pertinent project-related matters.

The objective is to respond to the complaints of the PAPs efficiently, i.e., the mechanism to be easily accessible, transparent, and fair and to avoid the need to resort to complicated formal channels to redress grievances. Accessible and appropriate GRM not only helps to have more effective and efficient procedures but also has a strong bearing on the project implementation progress, as PAPs grievances tend to thwart timely accomplishments of project activities. For the project at hand, a grievance redress committee needs to be established that consists of members from the project administration office, PAPs, elders/religious

leaders, and local NGOs. Capacity building and awareness creation interventions for local-level GRC are essential. The project owner/client is expected to facilitate such training for better performance of the project at large.

The following steps will be followed in order to achieve consensus for any grievance related to any aspect of the project.

**Procedure**

- Complainants can log/file their complaint(s) in written form, verbally, through a telephone call, text message, or any means of channels convenient to them.
- The filed complaint(s) need to be itemized, clear, and concise with remedial suggestions
- Present the form for the relevant designated officer (first contact point, in this case, secretary of the Grievance Redress Committee-GRC)
- All types of complaints presented by the above means should be registered in a standard format prepared for the same purpose by the secretary of GRC. (Address of the PAP or PAPs (Telephone number, Kebele, etc.)

**The obligation of the GRC**

- Check the complaint is project-induced
- Registering all complaints and organize them properly (Secretary of the GRC)
- Forwarding the case to the committee
- Feedback /or GRC committees' decisions should be communicated to the PAP(s) at a maximum of two weeks.
- If it is not settled by the GRC, inform/forward the same to the project owner/client
- Feedback from the project owner to be communicated to the PAP
- Amicable dispute settlement continues to be explored
- In case amicable arbitration not working, PAP (PAPs) can use their own right in formal court procedures
- As it has been repeatedly mentioned, the GRM should be based on the core principles of fairness, objectiveness, simplicity (localized and contextual), accessibility to PAPs, responsiveness and efficiency. In addition, GRM should not only deal with compensation issues, rather it also takes into account all other project-induced complaints partly listed above.

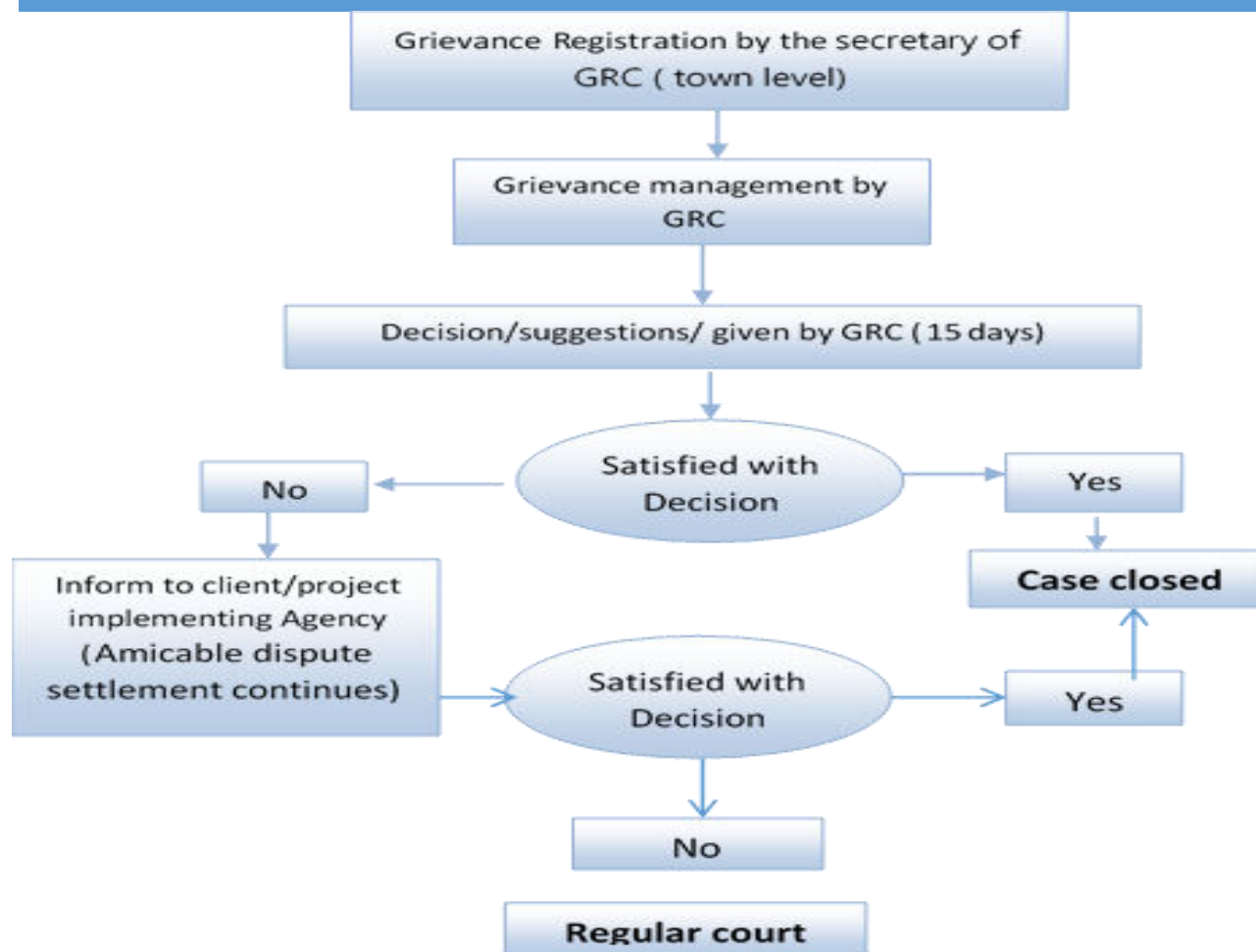


Figure 24 Grievance Redress Mechanism Procedure

## 11.4 Code of Conduct

The project implementing Agency shall develop and implement a Code of Conduct to deal with the environmental and social risks related to construction. The aim of the code of conduct is to foster an environment in which dangerous, offensive, abusive, or aggressive behavior is not permitted and in which everyone can voice concerns without fear of punishment or retaliation.

The Code of Conduct shall be applied to all staff, laborers, and other employees at the construction site or any other places where construction-related activities are being carried out. It also applies to the personnel of each contractor, subcontractor, consultant, and any other personnel assisting the contractor in the execution of the Works.

More specifically, the Code of Conduct should include the following core requirements applicable to the project workers. Every person involved in the project activities should:

- Carry out his/her duties competently and diligently;
- Comply with this Code of Conduct and all applicable laws, regulations, and other requirements, including requirements to protect the environment, health, safety, and well-being of other contractor's personnel and any other person;

- Maintain a safe working environment including by
  - ensuring that workplaces, machinery, equipment, and processes under each person's control is safe and without risk to health; wearing required personal protective equipment;
  - using appropriate measures relating to chemical, physical and biological substances, and agents; and
  - Following applicable emergency operating procedures.
- Report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation that he/she reasonably believes presents an imminent and serious danger to his/her life or health;
- Treat other people with respect, and not discriminate against specific groups such as women,
- people with disabilities or migrant workers;
- Not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other unwanted verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
- Not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust for sexual purposes, including but not limited to profiting monetarily, socially or politically from the sexual exploitation of another.
- Not engage in Sexual Assault, which means sexual activity with another person who does not consent.
- Not engage in any form of sexual activity with individuals under the age of 18, except in case of a pre-existing marriage.
- Complete relevant training courses that shall be provided related to the environmental and social aspects of the Contract, including health and safety matters, and Sexual Exploitation and Assault (SEA).
- Report violations of this Code of Conduct. Any violation of this Code of Conduct by contractor's personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.
- The contractor shall require all employees and the employees of sub-contractor to individually sign the Code of Conduct, and shall proactively address any breach of the Code of Conduct.
- A copy of the Code of Conduct in Amharic shall be displayed in a location easily accessible to workers.

## 12. LIMITATION OF THE ASSESSMENT

Even though some progress has been made regarding ESIA on the various projects in the country, there are lots of issues to be addressed to realize the objectives of ESIA in developing countries like Ethiopia. The lack of similar studies like UWSSPII sub-projects in the country is another limit that might affect the quality of the ESIA study. The following limitations have been identified during the assessment process and in the compilation of this ESIA Report:

- Getting sufficient primary and secondary data of the baseline for the existing socio-economic activities.
- Lack of systemic interaction among concerned government organizations so as to accomplish the study as per the time frame and guidelines of ESIA.

The limitations listed above can be taken as the drawback for systematic, complete, and scientific analysis of the environmental and social impacts of the sub-project.

The implication of these identified gaps is that the limitations should be considered in decision making though the impact assessment could only indicate the most likely cause of the project activities on the social and environmental aspects.

## 13. CONCLUSION AND RECOMMENDATIONS

### 13.1 Conclusions

Lack of sanitation is a serious health problem that affects billions of people around the world, specifically in developing countries. When human beings do not have access to sanitation facilities, they suffer in the overall socio-economic and environmental existence. This is true for Debre Berhan town, the lack of sufficient sanitation facilities such as FSTP in Debre Berhan town are among the bottlenecks for the development of the town. This poor sanitary situation is affecting the socio-economic and environment of the town. Hence, efforts to increase access to improved sanitation will have a great contribution to the overall sanitation improvement of the town. Considering all these conditions of the town, the need for an improved fecal sludge management system (fecal sludge treatment plants and collection system) is indisputable.

The new treatment plant will be installed in newly designated land FSTP (at Genet Georgis Kebele near the new demarcated landfill site). In order to maintain current treatment as well as future goals, unplanted Drying Beds with settler, ARB, and anaerobic filters are recommended for the proposed fecal sludge treatment plant (FSTP).

The selected technology for the fecal sludge treatment plants allows the proper waste management and creates new capacity and opportunity for the municipality. The selection of the treatment technology was carried out based on capital and operation cost, space requirement, ease of operation, treatment efficiency, etc. The appropriateness of the sanitation facilities and technologies has been critically evaluated against available alternatives. Accordingly, the selected treatment technology is appropriate to the local context.

The ESIA study results show some limited negative environmental implications of the project activities, the proposed works will have high socio-economic benefits to the residents of Debre Berhan town and project intervention Kebeles. The associated negative impacts will be significantly reduced or eliminated through careful engineering design, best construction practices, and effective implementation of mitigation measures. Specific mitigation measures have been suggested in this report to offset some of the inherent adverse impacts, especially those linked to the natural, human, and social environment. Effects in the construction phase include effects on ambient air quality due to dust, noise pollution, soil erosion, poor solid waste disposal, and storm water. In addition, interference with business and residential access, occupational health, and the spread of social diseases e.g., HIV/AIDS risk may result from project activities.

Many of the adverse environmental and socio-economic impacts in the FSTP site are minor and can be easily mitigated. The identified 'major impacts' are all subjective and may happen under rare conditions, such as in the case of negligence, accident, etc. These also have appropriate mitigation measures and are indicated in the ESMP.

It is, therefore, concluded that effective implementation of the proposed project works will mitigate the predicted impacts to non-harmful or near non-harmful levels. Their implementation should be adequate and timely. Overall, the anticipated positive impacts will outweigh the negative ones by far. In particular,



sanitary facility improvement decreased the socio-environmental impacts of the poor sanitary facility hence increasing social development and welfare for the community of the municipality.

Predicted impacts shall be managed through the proposed mitigation measures and implementation regime laid down in this ESIA. Debre Berhan Water Supply and Sewerage Service is committed to implementing all the proposed recommendations and further carrying out environmental auditing and monitoring schedules as well as enhancing the anticipated positive impacts, especially the creation of a healthy environment (social and natural environment).

The summary of recommended mitigation and management measures to minimize the potential impacts are:

- Proper design to accommodate measures for storm water effects soil erosion, and slope destabilization during FSTP construction.
- Measures to safeguard job opportunities and gender balance during both construction and operation of project.
- Measures to encourage local employment.
- Mitigation measures against workplace health and safety.
- Measures against noise and dust effects.
- Management of traffic accidents.
- Measures against the possible increase of social disease prevalence.
- Monitor compliance with environmental, health, and safety measures.

In general, the ESIA study indicates that the implementation of the project is expected to have enormous significance. The positive impacts by far outweigh the negative impacts. The implementation of the project will improve the health and livelihood of the town residents and downstream users of polluted river waters as it reduces the prevalence of waterborne diseases and other diseases born due to poor sanitation. The project will also create short and long-term employment opportunities potentially enable the reuse of the treated fecal sludge waste for agriculture and allow the production of biogas for energy and organic fertilizer (compost) from the by-products of the fecal sludge treatment process in the future.

The project is important and timely to reduce the problems associated with the disposal of fecal sludge in Debre Berhan town. The project will certainly play an important role in bringing about a more ecologically, socio-culturally, and economically sustainable and equitable environment in the project intervention sites.

## 13.2 Recommendations

It is recommended to implement the project with strict observation to the environmental and social management and monitoring plans. However, the project supervision consultant once mobilized should prepare 'Construction Supervision Plan' before the beginning of construction works and this plan should be part of the contract. In addition, the environmental management plans should be made part of the contract documents of the contractor so that ESMP compliance is ensured. The ESMP recommends environmental monitoring at the different phases of the project. The monitoring should be conducted to check the efficacy of mitigation measures. An environmental checklist should be developed by the Environment and Safety

Division for the daily environmental audit of the project activities. This should be filled up by the environmental expert of the contractor and should be verified by the city environmental protection office.

Moreover, during the stakeholder consultation one of the main issues is the capacity of the FSTP during the design horizon (short term) as the population is increasing at alarming rate due to migration the capacity may not accommodate the associated increase in volume of sludge produces in the town and hence, to accommodate this the city administration can construct additional treatment structures within the FSTP compound. It is also highly recommended that livelihood restoration programs should be implanted for the PAPS

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**APPENDICES**

Appendixes	Appendix title	Appendix Attachment
1	Minutes of community consultation	 CC FSTP minutes Debere brehan.pdf
2	Lists of participants	 stakeholder meeting participant:
3	Primary data collection checklist	 Checklist.docx
4	Secondary data collection Checklists	 Secondary data collection Checklists
5	Checklist and Formats	 Other checklist and Formats.docx
6	Ambient Factors	 Environment.docx
7	GRM form	 GRM Form.docx
8	GAP	 Gender Action Plan.docx
9	Environmental and Social Clause	 Environmental and Social Clause for Co
10	Chance find procedure	 Chance Find Procedure.docx
11	Brief summary of Scoping report	 D Bireahn scoping.docx
12	Reponses to Comments	 Reponse to Commnetts.docx
13	List of Affected households	 List of HH and size of land affected by tt

## DEFINITION OF TERMS

**Aerobic digestion:** This is a **sewage treatment process** designed to reduce the volume of sewage sludge and make it suitable for subsequent use. Aerobic digestion is typically used in an activated sludge treatment plant. Waste-activated sludge and primary sludge are combined, where appropriate, and passed to a thickener where the solids content is increased

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

**Containment/storage:** Ways of collecting and storing (and sometimes treating in situ) fecal sludge generated from a latrine/lavatory.

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

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

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

**Drying beds:** Method of treating fecal sludge off-site whereby sludge is spread out as a thin layer over a porous bed made up of layers of sand and gravel pace to dry

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

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

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

**Environment and Social Impact Assessment (ESIA):** A systematic examination conducted to determine whether or not a project will have any adverse environmental impacts.

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

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

**Fair compensation:** is defined as 'an indemnity equivalent to the value the activities performed thereon given to the person to be expropriated and calculated in consideration of market prices as well as compensation for disturbance due to expropriation

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

**Fecal sludge management (FSM):** Methods and processes to manage fecal sludge.



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

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

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

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

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

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

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

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

**Replacement Cost:** Compensation for acquired housing, land, and other assets that are calculated at total replacement costs based on the following elements: (i) fair market value; (ii) transaction costs; (iii) interest accrued, (iv) transitional and restoration costs; and (v) other applicable payment if any.

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

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

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

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

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

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

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

**Squatters:** People who unlawfully occupy land or a structure. Suppose the occupation is well established before the dissemination of project details and the cut-off date and, the occupying people are found vulnerable. In that case, they are eligible for compensation for the loss of any structure, trees, crops, and other assets they will lose access to because of project implementation.

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

**Vulnerable Groups:** Households below the poverty line, women, children, elderly, and people without legal title to assets

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



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