ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY FOR THE NEW CHUNGA WASTEWATER TREATMENT PLANT IN LUSAKA

3rd DRAFT ESIA REPORT, INCL. ESMP

Lusaka Sanitation Project

Investment Component A: Construction of the proposed new WWTPs at Chunga and Ngwerere

Zambia

European Investment Bank (EIB)
German Government via KfW Development Bank
Government of the Republic of Zambia

European Union External Actions / ACP-EC Partnership Agreement
Contract No.: LWSC/LSP/EIB/CS-001/2017

November 2023

Lead Company:

GITEC-IGIP GmbH (Germany) / IGIP mbH (Germany)

In association with:

Hydroment Consulting Engineers

Bari Zambia Limited

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Quality Assurance

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Project Key Data

Project Title	New Ngwerere and Chunga wastewater treatment plants in Lusaka, Zambia
Consultancy Services Contract Title	Consultancy services for preparation of functional designs, tendering and construction supervision for the proposed new Ngwerere and Chunga wastewater treatment plants in Lusaka, Zambia
Contract No.	LWSC/LSP/EIB/CS-003/2017
Location	Lusaka, Zambia
Client Contact Person	Lusaka Water Supply and Sanitation Company (LWSC) – Managing Director: Mr Jilly Chiyombwe
Financing (Donor / Volume)	EIB - FI No. 86835: 70 million EUR KfW - BMZ No. 2015 68 674: 32.5 million EUR Component A: WWTP, Collectors and Pumping Stations: 102.5 million EUR
Financier Contact Person	EIB – Mr. Harald Schoelzel KfW Development Bank – Mr. Tom Woyack
Consultant – Contact person	Lead partner: GITEC-IGIP GmbH, Cologne – Mr. Marcel Stüermer In association with: HYDROMENT, Athens BARI Zambia, Lusaka
Report Name	Draft ESIA Report, incl. ESMP - Chunga WWTP
Signing of Consulting Service Contract	3rd June 2020
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Works Contractor	No Works Contract signed

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EXECUTIVE SUMMARY

The purpose of this report is to present the Environmental and Social Impact Assessment (ESIA) for the proposed new Chunga WWTP in Lusaka District, Lusaka Province of Zambia, owned by Lusaka Water Supply and Sanitation Company (LWSC) in accordance with provisions of the Environmental Management Act No. 12 of 2011 under Section 29 (1).

Project Background

It is estimated that 70% of Lusaka's two million residents live in Peri-Urban Areas (PUA), most of whom have poor sanitation, which has resulted in severe health and environmental issues, with regular outbreaks of cholera, typhoid, and dysentery. Approximately 90% of the PUA population uses on-site sanitation facilities, most of which are in poor condition, while 57% of Lusaka's water supply is from groundwater sources within the city, which is prone to sewage contamination.

Based on the 2000 and 2010 census data, Lusaka's population is expected to grow by 4.9% per annum to reach approximately five million by 2035. Sewerage networks in Lusaka cover approximately 30% of the areas with reticulated water supply systems and comprise gravity and pumped sewerage networks flowing to centralized wastewater treatment facilities.

The Lusaka Water Supply and Sanitation Company Limited (LWSC), formerly named the Lusaka Water and Sewerage Company, managed the sewerage network in Lusaka covers approximately 10 to 20% of the population and is divided into five sewer sheds, namely: Chunga, Ngwerere, Manchinchi, Kaunda Square, and Chelston. The existing sewerage system consists of approximately 480 km of pipes, eight sewage pumping stations, two conventional Wastewater Treatment Plants (WWTPs) employing Trickling Filters (TF), and five sets of stabilisation ponds (SPs). Most of the sewerage networks are in poor condition and are inadequate to accommodate future population growth. However, the majority of the population is reliant on onsite facilities (pit latrines), with a small percentage of the population having no access to standard sanitation.

Parallel financing support has been provided by the World Bank (WB), African Development Bank (AfDB), European Investment Bank (EIB), and Kredit für Wiederaufbau (KfW) to implement the Lusaka Sanitation Program (LSP) which consists of Wastewater Collection and Treatment, On-site Sanitation and Institutional Improvements. The LSP, will improve overall sanitation, reduce environmental pollution to water bodies, and thus minimise health and environmental issues associated with water-borne diseases.

The LSP consists of four investment components (A, B1, B2, and B3). Investment Component A, which is funded by the EIB and KfW, covers the provision of a new WWTP at Chunga.

Project Objectives

One of the general objectives of Component A of the LSP is that Lusaka WWTP at Chunga is upgraded, expanded, operated, and maintained by LWSC in a technically, financially, and environmentally sustainable manner, providing compliance with ZEMA effluent discharge standards. The new WWTP will significantly improve the treatment of wastewater originating from the Chunga WWTP catchment areas in Lusaka.

The specific objective of the proposed Consultancy services is the design, procurement supervision of the construction and commissioning of the new Chunga WWTP[1].

Project Location

The project area is located approximately 8km to the north of Lusaka, adjacent to the old Lusaka Cemetery. The site's total area is approximately 14 hectares (Ha) and is currently used by the existing Chunga Wastewater Treatment Plant (WWTP), which was constructed in the 1970s. The site is surrounded by houses to the North and the West which seem like unplanned settlements due to the orientation and layout of the houses. There is also a River known as Chunga River to the north of the treatment plant which runs into the

[1] LSP Component A also comprises the Ngwerere WWTP.

Chongwe River, the Chunga Stream is the recipient of the effluent from the treatment plant. Due to the settlements in the area, there is little to no natural vegetation at the project site under consideration.

Major landmarks around the WWTP are the Chunga Cemetery which is adjacent to the plant on its southern boundary. Further, on the eastern side of the WWTP, is the Lusaka Dumpsite run by the Lusaka City Council, the distance from the dumpsite is about 1.5 km. The great north road is about 2km east of the WWTP. The following figure shows the location of the existing WWTPs intervened in the Project. The entrance to the Chunga WWTP coordinates are (-15°20'51.66", 28°15'15.17").

Figure 1 Location of WWTPs of the Project

Shareholding's Information

LWSC was established in 1988 and commenced operations in 1990 after the water sector reforms. Its mandate is defined in the Water Supply and Sanitation Act No. 28 of 1997 ("to provide water supply and sanitation services to the areas falling under its jurisdiction, except an area where a person provides such services solely for that person's own benefit"). LWSC is the largest provider of water and sanitation services to a population of 2.4 million both in urban and PUA of Lusaka province in Zambia.

LWSC operates using a non-executive Board of Directors which is appointed by the shareholders. LWSC is wholly owned by the Local Authorities (LA) in Lusaka province. All the districts in the province, have shares in LWSC.

The LWSC owns and operates water supply and sewerage assets in Lusaka city proper and outlying communities. In addition to the usual planning, engineering, construction, plant operations, and maintenance functions, the LWSC also maintains a Geographic Information System (GIS), mapping capability, computer networks, Instrumentation and Control (I&C), and administrative functions for governance, management, human resources, service rates, collections, disbursements, and finance.

Project Developer's Contact Details

Table 1 Developer´s contact details

Item	Details
Developer	LWSC
Contact person	Mr. Jilly Chiyombwe
Designation	Managing Director
Physical address	Plot 871/2 Katemo Road, Rhodespark, Lusaka
Phone	0211 257 579

Track Record of LWSC

LWSC has continued to work towards increasing sanitation coverage. Only Lusaka and Kafue have sewerage systems while the rest of the districts of Lusaka Province are serviced by on-site systems. LWSC has three conventional treatment plants, namely Manchinchi and Chunga in Lusaka; and Chawama in Kafue; with seven sets of WSP in Lusaka and one in Kafue. As of December 2019, the total sewer network is about 524 km representing 16% for reticulated sewer.

To scale up on sanitation access, LWSC has integrated OSS services and Faecal Sludge Management (FSM) within its overall business strategy. This implementation of this service has started in areas that will not be serviced in the medium to long term due to technical and socio-economic considerations. These interventions have accounted for 69% of safely managed sanitation.

Having evolved from a small department within Lusaka Urban District Council, the utility had 34,000 water connections in 1990 and as of December 2019, the number of connections stood at 115,567 which include domestic, commercial, and government residing in both the urban and PUA of all the towns in the Province.

The number of employees has equally grown to the current 888 employees across the province in all districts served. This presents a wide range of skills and qualifications among them engineering, management, and business expertise necessary for meeting and improving the services provided. LWSC prides itself on the values of; customer focus, innovation teamwork integrity gender responsiveness, and social inclusion in the quest to meet the stakeholders` needs.

Project Total Investment Cost

The EIB together with KfW agreed on a loan of EUR 102.5 million (one hundred and two million and five hundred thousand Euro). to the Government of the Republic of Zambia (GRZ) in order to implement the LSP. Subsequently, the GRZ agreed on a subsidiary loan agreement with the LWSC. The subsidiary loan agreement dated 04.06.2018 indicates the following:

- The GRZ agreed to on-lend EUR 20.5 million (twenty million and five hundred thousand Euro). to the LWSC for the LSP.
- The GRZ agreed to on-grant EUR 82 million (eighty-two million Euro). to the LWSC for the LSP.

The WWTP investment cost will be covered under Investment Component A, with a total estimated budget for Phase A of EUR 22.9 million (twenty-two million and nine hundred thousand Euro) for Chunga WWTP.[2]

Project Description

In accordance with the Water Supply and Sanitation Master Plan developed under other components of LSP, the Feasibility Study (FS) prepared in December 2015 and updated in May 2016 (COWI, 2016), and the

[2] As mentioned, LSP Component A also comprises the Ngwerere WWTP, with a cost of EUR 50.2 million (fifty million and two hundred thousand Euro). according to the draft FDR (GIC - HYDROMENT- Bari Zambia, 2022) & (GIC - HYDROMENT - Bari Zambia, 2022).

WWTPs draft Functional Design Report (FDR) prepared on March 2022 (GIC - HYDROMENT- Bari Zambia, 2022); it is proposed to construct a new WWTPs at Chunga existing WWTP site applying a Conventional Activated Sludge (CAS) treatment technology. The COWI FS of 2016 was approved considering Option 5, with TF as main treatment technology. However, as a result of the assessment of the Consultant during the inception phase, it was considered to keep the Option 5 as the overall concept, but change the treatment technology to CAS due to several reasons explained in the Inception Report (GIC - Hydroment - Bari Zambia, 2021). The primary reason for the change to CAS was the need for removal of nutrients (nitrogen and phosphorous) in order to meet the Zambian Government effluent standards. Removal of nutrients using TF technology is not possible without the addition of further treatment steps, which would render the 'TF+Nutrient-Removal' treatment process more expensive to build and operate compared to the CAS treatment process.

WWTP capacity

It is proposed to construct new WWTPs at Chunga's existing WWTP site by applying a Conventional Activated Sludge (CAS) treatment technology, with an average dry weather flow capacity of 18,714 m^3/d (146,171 p.e.) to treat the wastewater generated in Phase A 2030, and 44,541 m^3/d (396,606 p.e.) respectively in Phase B for the year 2045.

National Policy, Legal, and Institutional Framework

The key environmental laws of Zambia, which constitute the national legal framework are:

- The Environmental Management Act No.12 of 2011;
- Mines and Minerals Act Cap 213 of 2015;
- The Employment Code Act of 2019;
- Land Surveying Act of 1960;
- Amended Energy Regulation Act No 23 of 2003;
- The National HIV/AIDS/STI/TB Council Act of 2002;
- Forest Act of 2015;
- Urban and Regional Planning Act of 2015;
- The Local Government Act of 1995;
- The Factories Act of 1994;
- The Water Resources Management Act of 2011;
- Water Supply and Sanitation Act of 2005;
- Worker's Compensation Act;
- Public Health Act;
- Occupational Health and Safety Act of 2010;
- Human Rights Commission Act of 1996;
- Fisheries Act of 2011;
- Explosives Act of 1995;
- Disaster Management Act of 2010.

International Regulations and Environmental and Social Standards (ESS)

- The EIB E&S Standards and Principles Sustainability Guideline (European Investment Bank, 2018);
- The KfW Sustainability Guideline (KfW Development Bank, 2022);
- World Bank (WB) Environmental and Social Framework (World Bank Group, 2017) and International Financing Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines (World Bank Group,

2007); including the Industry Specific Guidelines, as applicable, in particular IFC WB Group's Environmental, Health, and Safety Guidelines for Water and Sanitation (World Bank Group, 2007).

WWTP Effluent Discharge Standards

The effluent standards for disposal of treated effluent into water bodies have been specified in the Environmental Management Regulations SI 112 issued by the Zambian government in 2013. The EU effluent standards for WWTPs are set in the Urban Wastewater Treatment Directive (91/271/EEC) (European Union, 1991). Of particular significance is the requirement for nutrient (nitrogen and phosphorous) removal.

Description of the Current Wastewater Infrastructure

The site under consideration is located approximately 8 km to the north of Lusaka, adjacent to the Chunga Cemetery. The total area of the site is approximately 14 hectares. This site is currently used by the existing Chunga WWTP. Unfortunately, the Chunga WWTP has suffered from years of lack of maintenance and as a result, is now barely functioning. No biological treatment of the sewage takes place, and the sludge digesters are out of action. It is noted that the odours from the existing plant are particularly bad in the areas to the west and northwest of the site.

Main Activities During the Project Phase

The pre-construction phase will include the following:

- Topographical survey of the site.
- Geotechnical survey of the site.
- Wastewater quality analysis campaign
- Ad-hoc flora and fauna surveys.
- River water quality analysis.
- The main activities during the construction phase will be:
- construction of access roads;
- demolishing existing structures;
- preparatory works at the WWTP site and grading works;
- construction of WWTP structures and pipeline installation (civil works, use of heavy machinery and vehicles);
- construction of sludge and/or wastewater transfer infrastructure (here interconnecting pipe-lines); and
- installation of the equipment.
- The activities that will characterize the operational phase will include the normal operation of the plant.

Processes and Schedule of Life Span

The WWTP infrastructures have a minimum of 50 years of design life span. The new plant will have the following main units:

- Inlet works – coarse screening – inlet pumping station; screening unit; grit and grease removal unit
- Primary sedimentation, including a mixing chamber for additions of chemicals for Chromium and other heavy metals removal
- Biological treatment consisting of CAS
- Final sedimentation (Clarification)
- Disinfection and post-aeration unit
- Sludge treatment

Project alternatives

The project alternatives were studied in detail at the FS stage. As the alternative was selected in the final FS (2016), in the frame of this Consultancy, the project alternatives were not studied anymore. For details on the project alternatives, please refer to the FS (COWI, 2016).

During the FS stage, the LWSC, EIB, and KfW agreed on **Option 5: Rehabilitation of the smaller Chunga WWTP**[3]; including:

- upgrading (replacement) and expanding the Chunga WWTP based on TF treatment technology, including a possible waste-to-energy option;

As a result of the Project inception phase and preliminary design calculations, Option 5 was maintained, but with the consideration to implement CAS treatment instead of TF. The decision to use CAS as the treatment technology (rather than TF) was ultimately determined by the requirement to meet the Zambian effluent standards; TF technology alone would not be meet the nutrient removal standards. For details on the selection of the treatment technology, please refer to Inception Report (GIC - Hydroment - Bari Zambia, 2021).

Main Product and By-products

The main products from the Chunga WWTP will be treated effluent, dewatered sludge, and biogas. The sewage sludge will be dried and stored for a time until it is completely treated before any application as a soil enhancer or disposed of in the landfill. The biogas will be burned in the WWTP or used for energy recovery.

Environmental Baseline

Geological Conditions: Lusaka comprises a pre-Cambrian basement complex consisting of granites, gneisses, and quartzite which is overlaid by limestones and dolomite rocks. At a greater depth, the underlying rock formation shows a decreasing variation in fracturing intensity. The occurrence and layer stratification of the fractures has significantly dictated the groundwater flow in the Lusaka aquifer.

Topography**:** At a regional level the area is part of the mid-tertiary pen plain of Central Africa, which here stands at 1,280 m above sea level. The topography of the area ranges from 1180m above sea level to 1200m above sea level. The topography at the Chunga WWTP premises is generally flat at the entrance from the Southern direction (gate next to the cemetery) and begins to slope towards the Chunga River, as one approaches the midway point.

Soil Characteristics**:** The soils (and vegetation) show a marked correspondence to the geological formations. Four distinct soil groups are recognized, i.e. plateau soils, upper valley soils, and specialized plateau soils.

Precipitation**:** Lusaka receives an appreciable volume of rainfall, however almost exclusively during the rainy season. On average there is a total of 70 rain days per season (JICA, 2009). In the rainy season from October to April, the monthly average rainfall is 138 mm based on the monthly average rainfall recorded for Lusaka.

Temperature: Mean monthly temperatures for Lusaka District range from 14°C in the cold season to about 28°C in the hot season when humidity is comparatively high. Minimum temperatures which are as low as 11°C have been recorded in the month of July. While the hottest month of the year with temperatures of 30°C and above is October.

Wind: Lusaka District experiences prevailing eastern winds during the dry season with fresh winds in the months of July and August. Mean wind speed ranges from 1.1 m/s (4.0km/h) to 2.5 m/s (9.0 km/h). The wind rose below depicts the wind direction that is predominant in the city of Lusaka.

[3] Jointly with the construction project of one large new Ngwerere WWTP in the framework of the LSP Component A.

***Evaporation and Humidity*:** The average annual evaporation for the City of Lusaka is around 2,070 mm, ranging from 104 mm in January to 315 mm in October. Humidity, on the other hand, averages 64% throughout the year.

***Hydrology and Hydrogeology*:** The proposed Chunga WWTP will be discharging its effluent in the Chunga River, which drains into the Mwambeshi River, and then into the Kafue River, a major tributary of the Zambezi River. The Chunga River shows very different flow patterns due to a large contribution of its waters coming from urban stormwater, springs in its catchment area, and discharge from the WWTP in Chunga. A lot of wastewater from the industries flowing into the River is untreated for heavy metals, and inorganic and organic waste. Farmers and residents downstream use the water from the River for their gardening and other day-to-day activities requiring the usage of water. Annual runoff water from the Chunga River varies due to rainfall variability and human influence on the River. This situation has been evidenced after a measuring station was set up in 2009 at the confluence point with the Mwembeshi River.

The dolomitic limestone underlying most of the city constitutes a karstic aquifer of both local and regional importance. A total of 130,000 m^3/d is abstracted from groundwater in Lusaka. On average, the production boreholes of the LWSC are 50 m deep.

***Flood Areas*:** Flooding does not represent a problem at Chunga WWTP. During community meetings and site visits, no respective information was received.

***Air Quality*:** During the community meetings held between 1st and 9th July 2022, participants claimed that smell is a major problem. The foul smell of varying intensity is experienced by the entire community during the day and at night.

To determine the actual air quality of the area, air samples were collected from four different points, i.e. SP1, SP2, SP3, and SP4. The tests were carried out during the day when anthropogenic activities were expected to be at their maximum, using the SKC Ltd. air sampling pump. The results indicated that there were low levels of SO_2, NO_x, and CO_x, which could be attributed to the low combustion of fossil fuels and less traffic of motor vehicles in the area

***Noise and Vibration*:** The WWTP is surrounded by medium and densely populated settlements characterized by small-scale activities, hence the typical noise in the area is that of daily business activities and traffic. It was concluded that the noise levels in the area are within acceptable limits. The mechanical and electrical installations of the WWTP are not working. Therefore, noise is considered insignificant.

***Climate Change Consideration*:** For the Project, the main-climate induced effects to consider are rising temperatures, heavy rainfall and flooding, drought and water scarcity, and heavy storms.

***Flora*:** The vegetation on site was observed to be mainly concentrated on the western side of the WWTP. The vegetation is a mixture of grass, shrubs, and scattered trees. Some areas have been cleared and are being used as vegetable gardens by the LWSC staff that are working at the WWTP. The far eastern side of the plant still presents some vegetation, the predominant one being grass with a few shrubs in certain areas. The main species of trees on site are *Acacia polyacantha, Dichrostachys cinerea,* and *Tithonia longifolia.,* among others.

***Fauna*:** Animal life within Project AoI is not significant because there has been a human disturbance, hence animals have migrated to other areas. Regardless, some animal activity was noticed, including small animals like rodents, insects, and bugs. Aquatic fauna was also observed in the Chunga River. The fish commonly found in the Chunga River is the barbel fish.

Socio-Economic Baseline

***Population and Gender Distribution*:** The City's population of 1,742,979 comprises of 854,060 males and 888,919 females, representing 49% and 51%, respectively (CSO, 2013c). Lusaka's population accounts for 32% of the total urban population in Zambia and has been growing at an average rate of 3.7% per annum from 1980 to 2010. The population is predominately young, with up to 70% of the population estimated to be below the age of 30.

***Indigenous People in the Area*:** Most people in the Chunga area can speak at least one of the following languages: Nyanja, Bemba, Tonga, Lozi, Soli, and Lenje or more. Due to the growth of Lusaka and general urbanization, many people from different ethnic tribes have migrated to the city surrounding areas to find work.

***Education*:** During the scoping exercise, four schools were noticed to be near the WWTP area. There was no boarding school identified in the area, nor tertiary institutions. Most children in the area are actually admitted to schools outside of Chunga townships such as Matero, and Lilanda townships. This may be attributed to the limited number of schools in Chunga. The closest schools to the Chunga WWTP are Chunga Secondary School, Nelson Mandela Secondary School, New Chunga Primary School, and Twalumba School.

***Gender Mainstreaming and Equity*:** All water supply and sewerage companies in the country are regulated by NWASCO and, as part of its regulatory role, NWASCO directed that all water supply institutions in the country adhere to Gender mainstreaming in all their programs, policies, and operations by institutionalizing gender mainstreaming agenda. Gender equity in LWSC is promoted at various levels which includes, but are not limited to, water committees, ward development committees, and community-based enterprise level. This equity is in terms of roles, responsibilities, opportunities, decision-making, access to, and control over resources.

***Economic Activities*:** The Project is located in a predominantly low-density area which is dominated by small retail shops and the selling of agricultural produce from the nearby farms of the Chunga area. Few, if any, of the households can meet all their needs through one activity, therefore the key characteristic of livelihood strategies is that of a combination of activities. People seek to balance the time, resources, and risk allocated to various activities, so that, in total, the wide range of needs are met; and this is done by prioritizing essential needs first. The strategies employed are dynamic and situational, thus the main strategies used include small-scale business ventures with wage employment existing only in exceptional cases.

***Water Supply Services*:** The majority of the population has access to drinking water. Around 65% of the population is equipped with in-house connections. Houses in Project AoI are all connected to the LWSC system and very few houses still have pit latrines. There is a steady reduction in the use of pit latrines due to sensitization programs around Lusaka.

***Health Facilities*:** The health centre that services Project AoI is Chunga health centre and Matero Level 1 Hospital which offers both out-patient and in-patient facilities. The health centre had its maternity centre recently refurbished by the GRZ with aid from the EU through Millennium Development Goal Initiative (MDGi).

***Land Use and Land Tenure*:** The land use type of Project AoI is mainly that of agricultural practices, but it is slowly becoming a PUA setup with a lot of illegal settlers and irregular housing patterns. Some residents own the land they reside on and others renting the pieces of land, but mainly, the land adjacent to the WWTP, i.e. New Government Farms and Zanimuone East, is owned by individuals under leasehold type of land tenure. During the scoping exercise, there was no property found to be on customary land.

***Culture and Heritage*:** The Consultant is not aware of any archaeological remains present within the Project AoI. Should there be any archaeological site found during the construction period, the teams will notify the National Heritage and Conservation Commission (NHCC). The Chunga cemetery is located near the WWTP and access road. Should there be any tombs found during the construction period, the teams will notify the National Heritage and Conservation Commission (NHCC) and follow the procedure in Annex 17 - Chance Find Procedure.

***Transport, Communication, and Project Site Accessibility*:** The City of Lusaka has a well-developed road network system linking the CBD to various parts of the City as well as to various towns and cities in the country. The main road network in Lusaka forms an urban area pattern along the Great North Road (T2), Great East Road, Kafue Road, Mumba Road (M9), and Cairo Road. The national North-South railway line divides the urban area into the western side and eastern side. The two airports in Lusaka, the City Airport and the Kenneth Kaunda International Airport, are in operation although the City Airport is mainly used by the Zambia Air Force. The road accessing leading to the WWTP is a small, unpaved road that is in poor

condition with a total length of about 3,600 meters. This road is also the access road to the New Government Farms community in Mwembeshi Ward and runs along residential areas.

***Traffic*:** Arising from the high population growth and increased socioeconomic activities, the City of Lusaka has been experiencing a tremendous increase in the volume of traffic, especially during the last one and half decades. This increase is mainly attributed to the increased economic activities within the City and has led to an influx of cheap used vehicles imported mainly from Japan as transport to support these economic activities.

***Telecommunication*:** Project AoI has favourable radio and internet available to people with phones and other facilities that can be used for such communication. For the radio service, the coverage is uniform for most of the general stations, especially the state-run radio and television networks. Mobile service providers Airtel, MTN, and ZAMTEL are present in the project area. The network is along both the rail line and the roads.

***Energy Services*:** Lusaka District is connected to the Zambian Electricity Supply Corporation (ZESCO) National Grid and most of the houses in the project area are connected to the Grid, except for a few vulnerable households in the area. Houses that were not connected to the ZESCO lines either use solar or depend on candlelight at night and charcoal stoves for cooking their food.

***Religious Practices and Rites*:** People in Project AoI are predominantly Christians and several churches including the Catholic, Jehovah's Witness, and Seventh Day were found.

***Sensitive Receptors*:** Considering the baseline study at the Project AoI, the key E&S sensitive receptors are as follows:

- No threatened or endangered species of fauna or flora were registered or known to exist.
- No sensitive or fragile habitats were noted in relation to the extent and magnitude of the works.
- No species of fauna or flora that could be exploited for commercial purposes were noted.
- The extent of the proposed Project AoI does not interfere with any protected area.
- There are no churches, hospitals, or schools.
- The communities of Chunga and Matero.
- Farmers downstream the effluent discharge point that irrigates crops with the water from the receiving water body before the effluent is diluted into the Chunga River.

Environmental and Social Impacts

The ESIA's main objective is to assess E&S impacts caused by the project, which allows defining safeguard measures to be followed during project implementation. Initially, key environmental topics were described, then the impact identification was carried out by separated categories and levels of significance assigned to each impact. Out of the previous process, specific measures for each impact, based on its level of significance, were proposed to be implemented in the project. A summary of the Environmental and Social impacts together with the proposed mitigation measures is provided in Table 2 below; additional details can be found in Section 5 of this report.

Table 2 Summary of E&S impacts of the project

Domain	Potential impact	Significance	Mitigation measure
Pre-construction			
Physical	Soil erosion and compaction	Moderate	• Establish sound construction principles for contractors on soil stabilization requirements in the bidding documents (Employer's Requirements).
	Water Resources (receiving water body) pollution	Major	• Design the WWTP to meet the effluent discharge standards. • Establish performance guarantees on effluent discharge values for contractors in the bidding documents.
			• Enforce the pre-treatment of the major industries' discharges into the sewerage prior to the commissioning of the new WWTP. In this regard, it is envisaged that Zamleather Industries Ltd. is the main contributor to Chromium in the Chunga sewer shed, and therefore, the efforts from LWSC to enforce the trade effluents standards should be put in this industry.
	Soil & Water Resources (receiving water body) pollution / Waste generation	Moderate	• Design of the WWTP in order to reduce heavy metals expected in the influent, e.g. Chromium. • Establish sound construction principles for contractors on pollution prevention in the bidding documents (ESHS specifications). • Engage a water bowser to be watering the premises at least five times a day. • Work within acceptable noise levels of 40 dB(A) during the night and 50 dB(A) during the day. • Undertake noisy activities only between 6 – 18 hrs. Such activities could be undertaken at night only under exceptional cases such as emergencies or similar. • Make sure all construction vehicles are maintained regularly so to minimize their emissions. • Provide covers to equipment and containers that are likely to cause odour nuisances (sludge, waste, grit material). • Adopt ZEMA and international regulations and standards on air quality. • Implement vegetation in perimetral areas of the WWTP site.
	Air / Noise pollution	Minor	
Biodiversity	Landscape deterioration	Moderate	• Establish environmental clauses for contractors on landscape impact mitigation in the Works Contract (ESHS specifications).
	Deterioration of Flora & Fauna / Habitats & Ecosystems	Minor	• Establish performance guarantees on effluent discharge values for contractors in the bidding documents.
Social	Risk of exclusion of vulnerable people	Moderate	• Develop SEP in line with EIB/KfW and Zambian requirements. • Raise awareness towards vulnerable people.

Domain	Potential impact	Significance	Mitigation measure
			• Include systematically women in all stakeholder consultations also at the beneficiary level. • Invite the Gender Council to participate in stakeholder engagement meetings at the community level. • Establish and implement a functional GRM.
	The influx of Outsiders (Construction Workers)	Minor	• Ensure that the Contractor is capable to plan and implement H&S measures by putting such requirements (qualifications, experience) in the Prequalification documents. • Establish H&S clauses for contractors on construction workers in the Works Contract (ESHS specifications).
Health & Safety	Community H&S	Minor	• Ensure that contractors are capable to plan and implement H&S measures. • Establish clauses for contractors on community and construction workers H&S.
	Workers H&S	Moderate	
Climate Change	Climate mitigation/adaptation	Minor	• WWTP is designed to save energy and resources, minimizing pumping needs and use energy-efficientent equipment and including biogas generation and energy recovery. • WWTP is designed to be resilient against increasing magnitude of flash floods due to CC.
Construction			
Physical	Soil erosion and compaction	Moderate	• Control contamination by isolating storage areas, and placing protective coatings in areas where oil and other contaminants are handled. • Perform ongoing machine monitoring and maintenance to prevent leaks. • Provide spill kits in all operative areas, especially where oil and other contaminants are handled. • Consult the local authority and community before any imminent exploitation of water sources during construction works. Water abstraction permits should be obtained from the Water Resources Management Authority (WARMA). • Construct water pans/dams to tap stormwater during the rainy season before the commencement of construction works. • Implement good hygienic standards and proper management of sewage. • Store materials in protected areas to reduce incidences of leakage. • Protect and store adequately leftover construction materials, e.g. by bunding and covering the storage areas. • Store on impermeable surfaces all chemicals, hydrocarbons, and other potentially polluting materials. • Install proper siting of pit latrines away from water-logged areas.

Domain	Potential impact	Significance	Mitigation measure
			• Maximize material reuse by temporarily storing and sorting onsite under proper conditions. The not reused material shall be transported offsite to a site agreed upon by LWSC. Stored material shall be handled safely in designated areas, not dumped into the river or deposited at river slopes. Erosion prevention measures need to be implemented at all earthwork sites. • Avoid the use of heavy machinery in areas not designated for construction. • Loose the soils after completion of construction and plant vegetation around the campsites. • Avoid digging in areas where construction is not intended. • Protect / separate non-construction areas. • Vegetate areas where there is no construction planned. • Restore and re-vegetate construction sites immediately after the completion of construction activities to enhance slope stabilization. • Avoid damages to private properties and minimize environmental negative effects (e.g. non-planned tree removal, etc.) during construction works. • Compensate all non-expected damages to private properties and the environment. • Design drainage and other disposal facilities to ensure soil stability and appropriate treatment.
	Soil & Water Resources (receiving water body) pollution / Waste generation	Moderate	• Require works contractors to develop and implement a detailed Waste Management Plan (WMP) including specification of disposal sites for excavated materials and generated construction wastes. • Set up waste disposal bins in strategic areas on site. • Put fines for any employees found discarding waste in undesignated areas. • Engage an authorized and licensed garbage disposal unit. • Avoid under any circumstance the reuse of sludge and soil when is contaminated. These should be disposed of safely. • Collect in a temporary hazardous waste storage area the hazardous wastes; This area should be surrounded by wire fences, bottom-sealed, and protected from precipitation. Materials from demolition could be hazardous and need to be disposed of safely. • Collect and remove regularly non-hazardous wastes generated at the plant. Dispose of these materials in the city's solid waste landfill. • Discharge the domestic wastewater generated in the running WSP. • Forbid to conduct activities close to the river such as re-fuelling or lubrication of vehicles, and material deposit, among other potentially risky activities for this water body.

Domain	Potential impact	Significance	Mitigation measure
			• Design a drainage system (wastewater) to avoid run-off and spillage.
	Air / Noise pollution	Minor	• Enforce works' contractors to the maintenance of machines and transportation vehicles (minimization of air pollution). • Avoid oil and fuel spills, by implementing proper storage of oil and fuel barrels. • Require the use of H&S personal protection equipment (incl. noise protection equipment). • Limit noise generation close to habitation zones only to working hours. Ambient noise monitoring is not required. • Engage a water bowser to be watering the premises and suppress the dust at least five times a day during dry seasons. • Enclosed equipment used for processes that are likely to generate dust. This includes equipment such as gravel crushers and gravel screeners. • Adopt ZEMA regulations and applicable international standards on air quality. • Work within acceptable noise levels of 40 dB (A) during the night and 50 dB (A) during the day. • Require contractors to use Best Management Practices (BMPs) for blasting, such as the chemical method to shatter the rocks and weaken rock formation, design and use of specific blasting plans, blasting mats, correct charging, and micro delay detonations to minimize noise and vibrations. • Require all workers to wear appropriate PPE every time, including hearing protection. • Undertake noisy activities only between 07-22hrs. • Use well-serviced machinery to minimize noise generation. • Implement vegetation in perimetral areas of the WWTP site. • Pave and widen the access road to Silvia Masebo Compound. • Restrict the project's vehicle speed in/along residential areas.
Biodiversity	Landscape deterioration	Moderate	• Train workers in good environmental practices.
	Deterioration of Flora & Fauna / Habitats & Ecosystems	Minor	• Avoid noise-generating activities and construction site lighting at night time to limit wildlife disturbance. • Stockpile removed topsoil for further use of it in reinstating flora. • Replant trees/plants harvested during construction activities. • Avoid cutting trees and clearing vegetation in areas that shall not be developed.

Domain	Potential impact	Significance	Mitigation measure
Social	Risk of exclusion of vulnerable people	Moderate	• Implement SEP in line with EIB/KfW and Zambian requirements. • Reinstate damages and/or provide compensations for all construction damages with replacement value to be satisfactory for PAPs.
	The influx of Outsiders (Construction Workers)	Minor	• Give priority to local residents for jobs positions that require unskilled labour (if available and applicable). • Implement good practices in the signalization of work sites and respect for normal working hours. • Prepare an influx management plan to mitigate the influx of migrant workers. • Maximise employment of the local labour force to reduce labour influx.
Health & Safety	Community H&S	Minor	• Pave the access road. • Implement and update (if necessary) the Traffic Management Plan, considering information on peak and off-peak hours on the access road to the Project site. • Instruct drivers for responsible driving and compliance with traffic regulations. • Implement traffic signs in all construction sites and fencing for construction sites. • Place safe access bridges across trenches for pedestrians, especially at house entrances. • Keep all barriers and signs at sites during night-time, with lighting and /or fluorescent signs placed as required to warn both vehicular and pedestrian traffic. • Enforce public health and safety regulations. • Conduct a comprehensive health awareness campaign among the local community and project workers on the dangers of the Malaria and HIV/AIDS pandemic, in consultation with local health centres. • Provide workers with information on the existence of anonymous VCT centres (Testing, pre-test, post counseling) through referrals. • Promote H&S by supporting programs that aim to reduce the spread of diseases. • Sensitize schools and churches about the dangers of construction sites. • Engage the victim support unit to have talks with the workers and community members on the negatives of GBV and Sexual and other forms of harassment at a place of work. • Promote programs that will encourage the protection of women and children from sexual abuse.
	Workers H&S	Moderate Minor	• Develop site-specific Construction and Operation H&S Management Plans.

Domain	Potential impact	Significance	Mitigation measure
			• Ensure and monitor the appropriate hygienic and sanitary situation for workers at work camps and work sites. • Develop site-specific Waste Management Plans (WMP). • Educate workers and sub-contractors. • Enforce appropriate waste separation and management measures for inert materials, recyclable materials including packaging, hazardous materials (if applicable), and other construction waste. • Prohibit the burning of waste. • Ensure appropriate traffic signage, construction site signalization, and barriers. • Ensure adequate handling of machines and hazardous substances within operational and construction sites. • Make firefighting equipment available on construction sites and conduct its regular maintenance. • Develop an emergency preparedness and response plan for the Project component. • Train all employees and contractors' workers on actions in case of emergency. • Develop safety instruction guidelines for drivers, which will outline requirements for drivers and the technical conditions of the vehicles; and instruct them accordingly. • Prohibit drunk driving, use of mobile phones while driving, mandatory use of safety belts, and further provisions, as necessary, to be included. • Provide 24-hours security of all project sites and enhance surrounding communities. • Promote the respect of human rights through an employer's code of conduct.
Climate Change	Climate mitigation	Minor	• Minimize emissions from construction vehicles • Encourage environmentally friendly behaviour among workers.
Operation			
Physical	Soil pollution	Moderate	• Monitor the quality of treated sludge. • Implement a treatment unit for heavy metals if required. • Establish environmental clauses for the operator on pollution prevention.
	Water Resources (receiving water body) pollution	Major	• Establish environmental clauses for the operator on pollution prevention. • Comply with effluent standards. • Define ad monitor key performance parameters of the WWTP. • Monitor the treated effluent at WWTPs. • Monitor the water quality of the receiving water body.

Domain	Potential impact	Significance	Mitigation measure
Social	Risk of exclusion of vulnerable people	Moderate	• Develop adequate tariffs for all groups of customers within the planned improved sanitation services (e.g. social tariffs). • Perform periodical consultations with communities within the AoI. • Implement gender equality provisions and strategies such as equality in salaries among women and men, preference for women with equal qualifications, and inclusion in decision-making.
Health & Safety	Community H&S	Moderate	• Implementation of a functional GRM. • Develop early warning procedures for unwanted events such as river water pollution and train accordingly the respective stakeholders.
	Worker H&S	Moderate	• Implement periodical cleaning and maintenance procedures for the facilities. • Implement a Hazardous Materials Management Plan and training plan for workers • Develop and implement inspection programs for equipment. • Provide specific PPE and training needed to respond to emergency situations.

Environmental and Social Management Plan (ESMP)

The ESMP defines management measures for all identified impacts, these measures were formulated as a function of impacts' assessed risks. Each measure specifies the activities to be developed, responsibilities, periodicity, and phase of implementation. The general ESMP includes OHS and labour conditions management plan to manage and mitigate any potential negative impacts in compliance with national and international standards.

Decommissioning and Rehabilitation Plan

This phase will involve planning for the way to decommission the existing infrastructure, once the new WWTP is commissioned and operational. Permanent termination implies the removal of the entire infrastructure and disposal of such decommissioned materials at the designated sites approved by ZEMA. This will be followed by revegetating and landscaping the affected sites.

To ensure this is achieved, progressive rehabilitation of the area will start on the commencement of the proposed operations of the new WWTP at the site. As an integral part of the activities of the plant. All disturbed areas will be progressively rehabilitated once operations cease in that particular area.

Conclusion and Recommendations

Key social and environmental parameters were identified during the scoping exercise. The various issues raised by the stakeholders and community members in the meetings and interviews were considered in the ESIA and included when structuring the ESMP of the proposed project. The following are some of the recommendations to the developer:

- The decision-making process should adhere to including the vulnerable in society, so as to make this an all-inclusive development for both the local community and Zambia;
- Pre-treatment by the industries should be encouraged to avoid putting the WWTP under strain trying to treat high contents of heavy metals, and other industrial waste;

- Waste from the WWTP should be considered for alternative energy, i.e. biogas;
- Treated sludge should be sold at very affordable prices to the farmers in the area.

EXECUTIVE SUMMARY IN CHINYANJA

CHIDULE CHA AKULUAKULU

Cholinga cha lipoti ili ndi kupereka ciuunikilo pa chilengedwe ndi chikhalidwe cha anthu a bungwe latsopano la Chunga WWTP m'boma la Lusaka, m'chigawo cha Lusaka ya Zambia, eni ake a kampani yopereka madzi ndi ukhondo kudziwika ngati Lusaka Water Supply and Sanitation Company (LWSC) m'Chingerezi mogwilizana ndi lamulo la Environmental Management Act No. 12 ya 2011 pansi pa Gawo 29 (1).

Maziko a Polojekiti

Akuti makumi asanu ndi awiri pa zana (70%) ya anthu miliyoni ziwiri a mu Lusaka amakhala mu ma komboni, ndipo ambiri a iwo ali ndi ukhondo wosauka, zomwe zachititsa kuti pakhale mavuto aakulu a thanzi ndi chilengedwe, zatulusa matenda monga kolera, taifodi, ndi kamwazi. Pafupifupi makumi asanu ndi anayi pa zana (90%) ya anthu a mu ma komboni amagwiritsa ntchito zimbudzi zapamalo, zomwe zambiri sizili bwino, pamene makumi asanu ndi asanu ndi awiri pa zana (57%) ya madzi a Lusaka amachokera ku madzi apansi mkati mwa mzindawo, omwe amatha kuipitsidwa ndi zimbudzi.

Kutengera ndi kalembera wa mu chaka cha zikwi ziwiri (2000) ndi chaka cha zikwi ziwiri ndi khumi (2010), chiŵerengero cha anthu ku Lusaka chikuyembekezeka kukula ndi anayi ndi theka pa zana (4.9%) pachaka mpaka kufika pafupifupi miliyoni asanu (5 million) pozafika mu caka zikwi ziwiri ndi makumi atatu ndi zisanu (2035). Njira zoyendetsera madzi ndi zimbudzi mu Lusaka zimatenga pafupifupi makumi atatu pa zana (30%) ya madela omwe ali ndi makina operekera madzi osinthidwa ndipo amakhala ndi mphamvu yokoka ndi zimbudzi zopopera ma netiweki omwe amapita kumalo opangira madzi onyansa apakati.

Lusaka Water Supply and Sanitation Company Limited (LWSC), yomwe kale inkadziwika kuti Lusaka Water and Sewerage Company, idayang'anira mayendedwe a madzi ndi zonyansa ku Lusaka imagwira pafupifupi khumi (10) mpaka makumi awiri pa zana (20%) ya anthu ndipo yagawidwa m'ma shedi asanu, omwe ndi: Chunga, Ngwerere, Manchinchi, Kaunda Square, ndi Chelston. Dongosolo lomwe liripoli lili ndi mapaipi okwana ma kilomita mazana anai mphambu makumi asanu ndi atatu (480km), malo opopera zimbudzi asanu ndi atatu, malo awiri opangira madzi a Malo Ochizira Madzi Otayira (Wasterwater Treatment Plants, muchingelezi) omwe amagwiritsa ntchito Zosefera zochedwa Trickling Filters muchingelezi, ndi ma seti asanu a ma damu okhazikika. Malo ambiri a ngalande zotayirako zimbudzi ali mumkhalidwe woipa ndipo ndiwosakwanira kutengera kukwera kwa chiwerengero cha anthu mtsogolo. Komabe, anthu ambiri amadalira zimbudzi zomwe zili pamalowo (zimbudzi za m'dzenje), pomwe anthu ochepa alibe mwayi wopeza zimbudzi. Thandizo la ndalama zofananira zaperekedwa ndi World Bank (WB), African Development Bank (AfDB), European Investment Bank (EIB), ndi Kredit für Wiederaufbau (KfW) kuti akhazikitse dongosolo la Lusaka Sanitation Programme (LSP) lomwe lili ndi kutoleredwa kwa Madzi oipa ndi chithandizo, ukhondo pamalo ndi kuwongolera masukulu. LSP, ikonza ukhondo wonse, kuchepetsa kuipitsidwa kwa chilengedwe kumadzi, motero kuchepetsa thanzi ndi chilengedwe chokhudzana ndi matenda obwera ndi madzi.

LSP ili ndi magawo anayi a ndalama (A, B1, B2, ndi B3). Zigawo za ndalama A, zomwe zimathandizidwa ndi EIB ndi KfW, ikukhudzana ndi kuperekedwa kwa Malo Ochizira Madzi Otayira yatsopano ku Chunga.

Cholinga Cha Polojekiti

Chimodzi mwa zolinga za Chigawo choyambirira (Component A) cha LSP ndikuti Lusaka WWTP ku Chunga ikwezedwa, kukulitsidwa, kuyendetsedwa, ndi kusamalidwa ndi LWSC munjira yaukadaulo, yandalama, komanso yosamalira za chilengedwe, ndikupereka kutsata miyezo ya ZEMA yotayira madzi. Ma WWTP atsopanoyi akonza bwino kagwiritsidwe ntchito ka madzi oipa ochokera kumadera a Chunga WWTP malo opezeka ku Lusaka.

Cholinga chenicheni cha ma ntchito zaulangizi omwe akufunsidwa ndi kupanga, kuyang'anira kagulitsidwe ka ntchito yomanga ndi kutumiza ntchito yatsopano ya Chunga WWTP[4].

Malo a Polojekiti

[4] LSP chigawo A chilinso ndi Ngwerere WWTP.

Dela la polojekitiyi lili pafupifupi ma kilomita asanu ndi atatu (8km) kumpoto kwa Lusaka, moyandikana ndi manda akale a Lusaka. Malo onse a malowa ndi pafupifupi mahekitala khumi ndi anayi (14 Ha) ndipo pano akugwiritsidwa ntchito ndi Chunga Wastewater Treatment Plant (WWTP), yomwe inamangidwa m'ma khumi ndi zisanu ndi zinayi (1970s). Malowa akuzunguliridwa ndi nyumba za Kumpoto ndi Kumadzulo zomwe zimawoneka ngati malo osakonzekera chifukwa cha momwe nyumbazo zikuyendera. Palinso mtsinje womwe umadziwika kuti mtsinje wa Chunga kumpoto kwa malo otsuka zimbudzi omwe umadutsa mumtsinje wa Chongwe, mtsinje wa Chunga ndi womwe umalandira madzi otayira kuchokera kumalo lotsuka zimbudzi. Chifukwa cha midzi yomwe ili m'derali, pali zomera zochepa kapena palibe zachilengedwe pamalo ya projekiti.

Malo akulu akulu ozungulira Malo Ochizira Madzi Otayira ndi manda a Chunga omwe ali moyandikana ndi malo otsuka zimbudzi kumalire ake akumwera. Komanso, kum'mawa kwa aya Malo Ochizira Madzi Otayira, ndi malo yotaila zinyala za Lusaka (Lusaka Dumpsite) yomwe imayendetsedwa ndi Khonsolo ya Mzinda wa Lusaka, mtunda wochoka pamalowo ndi pafupifupi kilomita imodzi ndi theka (1.5 km). Msewu waukulu wakumpoto uli pafupi makilomita awiri (2km) kum'mawa kwa Malo Ochizira Madzi Otayira a Chunga. Chithunzi chotsatirachi chikuwonetsa malo omwe Malo Ochizira Madzi Otayira a Chunga zili mu polojekitiyi. Polowera ku makonzedwe Malo Ochizira Madzi Otayira a Chunga ndi pa malo a -15°20'51.66", 28°15'15.17".

Figure 2 Malo a WWTPs polojekiti

Zambiri za eni ake

LWSC inakhazikitsidwa mu chaka cha 1988 ndipo inayamba kugwira ntchito mu chaka cha 1990 pambuyo pa kusintha kwa gawo la madzi. Ulamuliro wake wafotokozedwa mu lamulo la Water Supply and Sanitation Act No. 28 ya 1997 ("kupereka madzi ndi ntchito zaukhondo kumadera omwe ali pansi pa ulamuliro wake, kupatula malo omwe munthu amapereka chithandizochi kuti apindule yekha"). LWSC ndiyomwe imapereka chithandizo chachikulu cha madzi ndi ukhondo kwa anthu okwana ma miliyoni awiri ndi mazana anayi mu mtawuni ndi makomboni m'chigawo cha Lusaka ku Zambia.

LWSC imagwira ntchito pogwiritsa ntchito bungwe lo yang'anira lomwe silili wamkulu lomwe limasankhidwa ndi omwe ali ndi magawo mu LWSC. Ma boma onse a m'chigawo cha Lusaka ndi eni ake a LWSC. Maboma onse m'chigawochi ali ndi magawo mu LWSC.

LWSC ndi eni ake komanso amayendetsa katundu wa madzi ndi zimbudzi mu mzinda wa Lusaka ndi midzi yakunja. kuonjezera pa makonzedwe okhazikitsadwa kale, uinjiniya, zomangamanga, ntchito zamafakitale,

ndi ntchito zosamalira, LWSC ilinso ndi Geographic Information System (GIS), luso lopanga mapu, makina apakompyuta, Zida ndi Kuwongolera (I&C), ndi ntchito zoyang'anira utsogoleri, kasamalidwe, zothandizira anthu, mitengo ya ntchito, zosonkhanitsira, zobweza, ndi ndalama.

Zambiri Zokhudza Wopanga projekiti

Table 1 Zambiri zolumikizirana ndi Wopanga Projekiti

Kanthu	Zambiri
Wopanga Polojekiti	LWSC
Munthu Wolumikizana naye	Mr. Jilly Chiyombwe
Udindo	Woyang'anira wamkulu
Adilesi ya ofesi	Plot 871/2 Katemo Road, Rhodespark, Lusaka
Foni Nambala	0211 257 579

Mbiri yakale ya LWSC

LWSC ikupitilizabe kuyesetsa kusebenzela pali ukhondo. Lusaka ndi Kafue okha ndi omwe ali ndi zotayira zotayira pamene maboma ena onse a mu chigawo cha Lusaka amathandizidwa ndi makina apanyumba. LWSC ili ndi malo atatu ochiritsira ochiritsira, omwe ndi Manchinchi ndi Chunga ku Lusaka; ndi Chawama ku Kafue; ndi ma seti asanu ndi awiri a WSP ku Lusaka ndi imodzi ku Kafue. Kuchokera mwezi wo siliza wa 2019, maukonde onse onyansa ndi pafupifupi 524 km kuyimira 16% ya ngalande yolumikizidwa.

Pofuna kukulitsa mwayi wopeza ukhondo, LWSC yaphatikiza ntchito za OSS ndi Faecal Sludge Management (FSM) mkati mwa njira zake zonse zamabizinesi. Kukhazikitsidwa kwa ntchitoyi kwayamba m'madera omwe sadzakhalapo pakanthawi kochepa chifukwa cha malingaliro aukadaulo ndi chikhalidwe cha anthu. Njira izi zachititsa 69% ya ukhondo woyendetsedwa bwino.

Popeza idachokera ku dipatimenti yaying'ono mkati mwa Lusaka Urban District Council, bungweli lidalumikizidwa ndi madzi 34,000 mu 1990 ndipo pofikala mu mwezi wo siliza wa 2019, kuchuluka kwa kulumikizana kudayima pa 115,567 zomwe zikuphatikiza zapakhomo, zamalonda, ndi zaboma zomwe zikukhala m'matauni ndi PUA onse matauni a m'chigawochi.

Chiwerengero cha ogwira ntchito chakwera chimodzimodzi mpaka ogwira ntchito pano 888 m'chigawo chonse, m'maboma onse omwe akutumikiridwa. Izi zimapereka maluso ndi ziyeneretso zosiyanasiyana pakati pawo uinjiniya, kasamalidwe, ndi ukatswiri wamabizinesi wofunikira pakukwaniritsa ndikuwongolera ntchito zoperekedwa. LWSC imadzikuza pazikhalidwe za; luso, kugwira ntchito limodzi, kukhulupirika, kuyankha pakati pa amuna ndi akazi komanso kuphatikizana ndi anthu pofuna kukwaniritsa zosowa za omwe akukhudzidwawo.

Ndalama Zonse Za Polojekitiyi

EIB pamodzi ndi KfW adagwirizana pa ngongole ya EUR 102.5 million. ku Boma la Zambia (GRZ) kuti akwaniritse LSP. Pambuyo pake, a GRZ adagwirizana za mgwirizano wangongole wocheperako ndi LWSC. Mgwirizano wangongole wapa 04.06.2018 ukuwonetsa izi:

- GRZ idavomera kubwereketsa EUR 20.5 million. ku LWSC kwa LSP.
- A GRZ adavomera kupereka EUR 82 million. ku LWSC kwa LSP.

Ndalama za WWTP zogulira zidzaperekedwa pansi pa Investment Component A, ndi bajeti yoyerekeza ya Gawo A la EUR 22.9 Million. kwa Chunga WWTP.[5]

Kufotokozera Polojekiti

Mogwirizana ndi Dongosolo Lamapulani Lopereka Madzi ndi Ukhondo yopangidwa pansi pa zigawo zina za LSP, Kuphunzira zotheka yokonzedwa mu mwezi wo siliza wa 2015 ndi kusinthidwa mu May 2016 (COWI, 2016), ndi WWTPs lipoti la Draft Functional Design yokonzedwa pa Marichi 2022 (GIC-HYDROMENT-Bari Zambia, 2022); akukonzekera kumanga malo opangira madzi oyipa yatsopano pamalo a malo opangira madzi oyipa omwe alipo a Chunga pogwiritsa ntchitoukadaulo wamankhwala wa Kasamalidwe ka Matope Okhazikika ukadaulo wamankhwala[6].

Kuchuluka kwa Malo Opangira Madzi Oyipa ya Chunga

Akufuna kumanga malo opangira madzi oyipa atsopano pamalo omwe alipo ya Chunga pogwiritsa ntchito ukadaulo lotsuka zimbudzi wa Kasamalidwe ka Matope Okhazikika wokhala ndi mpweya wokwanira wa 18,714 m3/d (146,171 p.e.) kuyeretsa madzi onyansa opangidwa mu Phase A 2030, ndi 44,541 m3/d (396,606 p.e.) motsatana mu Gawo B la chaka cha 2045.

Ndondomeko Yadziko Lonse, Zalamulo ndi chimango cha Bungwe

Malamulo akuluakulu a zachilengedwe ku Zambia, omwe amapanga malamulo a dziko lonse ndi awa:

- The Environmental Management Act No.12 ya 2011;
- Malamulo a Migodi ndi Mchere Kapu 213 ya 2015;
- The Employment Code Act ya 2019;
- Land Surveying Act ya 1960;
- Kusinthidwa kwa Energy Regulation Act No 23 ya 2003;
- Lamulo la National HIV/AIDS/STI/TB Council Act ya 2002;
- Forest Act ya 2015;
- Urban and Regional Planning Act ya 2015;
- Lamulo la maboma ang'ono la 1995;
- The Factories Act ya 1994;
- The Water Resources Management Act ya 2011;
- Water Supply and Sanitation Act ya 2005;
- Lamulo la Malipiro a Ogwira Ntchito;
- Public Health Act;
- Occupational Health and Safety Act ya 2010;
- Human Rights Commission Act ya 1996;
- Fisheries Act ya 2011;
- Explosives Act ya 1995;
- Disaster Management Act ya 2010.

[5] Monga tanenera, LSP Component A ilinso ndi Ngwerere WWTP, ndi mtengo wa EUR 50.2 million. malinga ndi ndondomeko ya FDR (GIC - HYDROMENT- Bari Zambia, 2022) & (GIC - HYDROMENT - Bari Zambia, 2022).

[6] COWI FS ya 2016 idavomerezedwa poganizira Njira 5, ndi TF ngati ukadaulo waukulu lotsuka zimbudzi. Komabe, chifukwa cha kuwunika kwa Consultant panthawi yoyambira, idaganiziridwa kuti isunge Njira 5 ngati lingaliro lonse, koma kusintha ukadaulo wamankhwala kukhala CAS chifukwa chazifukwa zingapo zomwe zafotokozedwa mu Inception Report (GIC - Hydroment -) Bari Zambia, 2021).

Malamulo a Padziko Lonse ndi Miyezo ya Zachilengedwe ndi Zachikhalidwe

- Ndondomeko ya EIB E&S Miyezo ndi Mfundo Zokhazikika (European Investment Bank, 2018);
- The KfW Sustainability Guideline (KfW Development Bank, 2022);
- Banki Yadziko Lonse (WB) Environmental and Social Framework (World Bank Group, 2017) ndi International Financing Corporation (IFC) Malangizo a Environmental, Health and Safety (EHS) (World Bank Group, 2007); kuphatikiza Maupangiri Otsimikizika a Makampani, monga momwe akuyenera kukhalira, makamaka IFC WB Group's Environmental, Health, and Safety Guidelines for Water and Sanitation (World Bank Group, 2007).

Miyezo ya Malo Opangira Madzi Oyipa yotaya madzi osefukira

Miyezo yotayira madzi otayira otayira m'madzi a akatswiri mu Malamulo Oyang'anira Zachilengedwe SI 112 yokhazikika ndi boma la Zambia mchaka cha 2013. Miyezo ya EU ya WWTPs yotayira madzi amadzimadzi ya Urban Wastewater Treatment Directive (91/271/EEC) (European Union, 1991).

Kufotokozera za Zomangamanga Zamadzi Onyansa Panopa

Malo omwe akuganiziridwa ali pafupifupi 8 km kumpoto kwa Lusaka, moyandikana ndi manda a Chunga. Malo onse a malowa ndi pafupifupi mahekitala 14. Tsambali pano likugwiritsidwa ntchito ndi Chunga WWTP yomwe ilipo. Tsoka ilo, bungwe la Chunga WWTP lakhala likuvutika ndi kusamalidwa kwazaka zambiri ndipo chifukwa chake, tsopano silikugwira ntchito. Palibe mankhwala achilengedwe a zimbudzi zomwe zimachitika, ndipo ma sludge digesters sagwira ntchito. Zikudziwika kuti fungo lochokera ku malo otsuka zimbudzi chomwe chilipo ndi choipa kwambiri m'madera akumadzulo ndi kumpoto chakumadzulo kwa malowa.

Zochita Zazikulu Pagawo la Ntchitoyi

Ntchito yomanga isanakwane izikhala ndi izi:

- Kufufuza mozama za malowa.
- Kafukufuku wa Geotechnical wa malowa.
- Kampeni yowunikira ubwino wa madzi onyansa
- Kafukufuku wa Ad-hoc wa zomera ndi zinyama.
- Kusanthula ubwino wa madzi a mumtsinje.
- Zochita zazikulu panthawi yomanga ndi:
- Kumanga misewu yolowera;
- Kugwetsa nyumba zomwe zilipo;
- Kukonzekera pa malo a WWTP ndi ntchito zokopera;
- Kumanga nyumba za WWTP ndi kukhazikitsa mapaipi (ntchito za boma, kugwiritsa ntchito makina olema ndi magalimoto);
- Kumanga zinyalala ndi/kapena zipangizo zopititsira madzi oipa (pano polumikiza mapaipi); ndi
- kukhazikitsa zida.
- Ntchito zomwe zidzakhale gawo la kagwiritsidwe ntchito kafakitale ndi kagwiritsidwe ntchito ka nthawi zonse kwa mbewu.

Njira ndi Ndandanda ya Moyo

Zomangamanga za WWTP zimakhala ndi zaka zosachepera 50 zopanga moyo. malo otsuka zimbudzi chatsopanocho chikhala ndi mayunitsi akulu awa:

- Ntchito zolowera m'njira - kuyang'ana kukhwima kwa mapangidwe - popopera polowera; chigawo chowonetsera; unit kuchotsa grit ndi mafuta
- Sedimentation ya pulayimale, kuphatikiza chipinda chosanganikirana chamankhwala owonjezera a Chromium ndi kuchotsa zitsulo zina zolemera.

- Chithandizo chachilengedwe chokhala ndi CAS
- Final sedimentation (Kufotokozera)
- Chigawo chopha tizilombo toyambitsa matenda ndi pambuyo pa mpweya
- Chithandizo cha matope

Njira zina za polojekiti

Njira zina za polojekitiyi zidaphunziridwa mwatsatanetsatane pagawo la Kuphunzira zotheka. Monga njira ina idasankhidwa ndime la Kuphunzira zotheka zomaliza, mu dongosolo la upangiri uwu, njira zina za polojekiti sizinaphunzirenso. Kuti mudziwe zambiri za njira zina zogwirira ntchito, chonde onani Kuphunzira zotheka (COWI, 2016).

Panthawi ya Kuphunzira zotheka, LWSC, EIB, ndi KfW adagwirizana pa Njira 5: Kukonzanso kwa Chunga WWTP[7] yaying'ono; kuphatikizapo:

- Kukweza (kusintha) ndi kukulitsa Chunga WWTP potengera ukadaulo wo tsuka zimbuzi a TF, kuphatikiza njira yotaya mphamvu yotaya mphamvu;
- Chifukwa cha gawo loyambitsira Polojekiti komanso kuwerengera koyambira, Njira 5 idasungidwa, koma poganizira kukhazikitsa chithandizo cha CAS m'malo mwa TF. Kuti mumve zambiri pamasankhidwe aukadaulo wo tsuka zimbuzi, chonde onani (GIC - Hydroment - Bari Zambia, 2021).

Zinthu Zazikuluzikulu Ndi Zopangira

Zinthu zazikuluzikulu zochokera ku Chunga WWTP zidzakhala zothira madzi otayira, zinyalala zothetsedwa, ndi mpweya wa biogas. Dongosolo la zimbudzi lidzawumitsidwa ndikusungidwa kwakanthawi mpaka litayeretsedwa kwathunthu musanagwiritse ntchito ngati chowonjezera kapena kutaya mu dothi. Biogas imene iyi idzawotchedwa mu WWTP kapena kugwiritsidwa ntchito yobwezeretsa mphamvu.

Zachilengedwe Zoyambira

Zinthu zachilengedwe (Geological Conditions): Lusaka ili ndi chipinda chapansi cha pre-Cambrian chopangidwa ndi granite, gneisses, ndi quartzite chomwe chimakutidwa ndi miyala ya limestone ndi miyala ya dolomite. Pakuzama kwakukulu, mapangidwe a miyala yapansi panthaka akuwonetsa kuchepa kwamphamvu kwa maflakicha. Kuchitika ndi kusanjika kwa maflakichas kwachititsa kuti madzi apansi ayende mumchenga wa Lusaka.

Maonekedwe a Dziko: Pachigawo chachigawo derali ndi gawo la chigwa chapakati pa chigawo chapakati cha Central Africa, chomwe pano chili pa 1,280 m pamwamba pa nyanja. Maonekedwe a malowa amachokera ku 1180m pamwamba pa nyanja mpaka 1200m pamwamba pa nyanja. Maonekedwe a malo a Chunga WWTP nthawi zambiri amakhala athyathyathya pakhomo lolowera Kumwera (chipata choyandikana ndi manda) ndipo amayamba kutsetsereka kulowera kumtsinje wa Chunga, pamene munthu akuyandikira pakati.

Maonekedwe a Dothi ndi nthaka: Dothi (ndi zomera) zimasonyeza kugwirizana kodziwika ndi mapangidwe a nthaka. Magulu anayi odziwika a nthaka akudziwika, mwachitsanzo, dothi lamapiri, dothi lapamwamba la zigwa, ndi dothi lapadera lamapiri.

Kalokedwe ka Mvula: Lusaka imalandira mvula yambiri, koma imagwa nthawi yamvula yokha. Pa avareji pali masiku 70 amvula pa nyengo (JICA, 2009). M'nyengo yamvula kuyambira Okutobala mpaka Epulo, mvula yambiri pamwezi ndi 138 mm kutengera mvula yamwezi yolembedwa ku Lusaka.

Nyengo yotentha ndi yozizira: Kutentha kwa mwezi uliwonse m'boma la Lusaka kumachokera pa 14°C m'nyengo yozizira kufika pafupifupi 28°C m'nyengo yotentha pamene chinyezi chimakhala chokwera kwambiri. Kutentha kocheperako komwe kumatsika mpaka 11°C kwalembedwa mwezi wa Julayi. Pamene mwezi wotentha kwambiri pachaka ndi kutentha kwa 30 ° C ndi pamwamba ndi mu October.

[7] Mogwirizana ndi ntchito yomanga ya WWTP imodzi yayikulu ya Ngwerere mu gawo la LSP Component A.

Mphepo: Chigawo cha Lusaka chimakumana ndi mphepo yamkuntho ya kum'maŵa m'nyengo yachilimwe yokhala ndi mphepo yatsopano m'miyezi ya July ndi August. Kuthamanga kwa mphepo kumachokera ku 1.1 m/s (4.0km/h) mpaka 2.5 m/s (9.0 km/h). Mphepo yokwera m'munsiyi ikusonyeza mmene mphepo ikuyendera mumzinda wa Lusaka.

Kachija kwamadzi mu mpweya ndi Chinyezi: Avereji ya nthunzi ya pachaka ya City of Lusaka ndi pafupifupi 2,070 mm, kuyambira 104 mm mu Januwale mpaka 315 mm mu October. Chinyezi, kumbali ina, pafupifupi 64% chaka chonse.

Hydrology ndi Hydrogeology: Chunga WWTP yomwe akufuna kuti iperekedwe ikhala ikutayira mumtsinje wa Chunga, womwe umatsikira mumtsinje wa Mwambeshi, kenako mumtsinje wa Kafue, womwe umadutsa mtsinje waukulu wa Zambezi. Mtsinje wa Chunga umasonyeza njira zosiyana kwambiri zoyendetsera madzi chifukwa cha thandizo lalikulu la madzi ake omwe amachokera ku mvula yamkuntho, akasupe m'dera lake, ndi kutuluka kuchokera ku WWTP ku Chunga. Madzi otayira ambiri ochokera m'mafakitale omwe amapita ku Mtsinje sagwiritsidwa ntchito ndi zitsulo zolemera, komanso zinyalala. Alimi ndi anthu okhala kumunsi kwa mtsinjewo amagwiritsa ntchito madzi a mumtsinjewo polima dimba ndi ntchito zina zatsiku ndi tsiku zomwe zimafuna kugwiritsa ntchito madzi. Madzi osefukira chaka ndi chaka kuchokera ku Mtsinje wa Chunga amasiyana chifukwa cha kusiyana kwa mvula komanso mphamvu ya anthu pa Mtsinjewo. Izi zadziwika pambuyo pokhazikitsa siteshoni yoyezera m'chaka cha 2009 pamalo olumikizirana ndi mtsinje wa Mwembeshi.

Mwala wa miyala ya dolomitic womwe uli pansi pa mzindawu ndi malo osungira madzi a karstic ofunika m'deralo komanso m'madera. Okwana 130,000 m3/d amatengedwa kuchokera pansi pa nthaka ku Lusaka. Pa avareji, zibowo zopangira za LWSC ndi zakuya mamita 50.

Madera a Chigumula cha madzi: Kusefukira sikuyimira vuto ku Chunga WWTP. Pamisonkhano ya anthu komanso kuyendera malo, palibe chidziwitso chomwe chidalandiridwa.

Ubwino wa Mpweya: Pamisonkhano yapamudzi yomwe idachitika pakati pa 1st ndi 9th Julayi 2022, otenga nawo gawo adanena kuti kununkhiza ndi vuto lalikulu. Fungo loipa la kusiyanasiyana kosiyanasiyana limamva anthu onse ammudzi masana ndi usiku.

Kuti mudziwe mkhalidwe weniweni wa mpweya wa derali, zitsanzo za mpweya zinasonkhanitsidwa kuchokera kumalo anayi osiyana, mwachitsanzo SP1, SP2, SP3, ndi SP4. Mayeserowa adachitika masana pamene ntchito za anthropogenic zikuyembekezeka kukhala pamlingo wawo wonse, pogwiritsa ntchito pampu ya SKC Ltd. Zotsatirazi zikuwonetsa kuti panali milingo yotsika ya SO2, NOx, ndi COx, yomwe ingakhale chifukwa cha kuyaka kochepa kwamafuta amafuta komanso kuchuluka kwa magalimoto m'derali.

Phokoso ndi Kugwedezeka: WWTP yazunguliridwa ndi midzi yokhala ndi anthu apakati komanso anthu ambiri omwe amadziwika ndi zochitika zazing'ono, chifukwa chake phokoso lomwe lili m'derali ndi lazantchito za tsiku ndi tsiku komanso magalimoto. Zinanenedwa kuti mafunde a phokoso m'derali ali m'malire ovomerezeka. Kuyika makina ndi magetsi a WWTP sikugwira ntchito. Choncho, phokoso limaonedwa kuti ndi lochepa.

Kuganizira za Kusintha kwa Nyengo: Kwa Polojekitiyi, zomwe ziyenera kuganiziridwa chifukwa cha nyengo ndizo kukwera kwa kutentha, mvula yambiri ndi kusefukira kwa madzi, chilala ndi kusowa kwa madzi, ndi mvula yamkuntho.

Zomera: Zomera zomwe zili pamalowa zidawonedwa kuti zimakhazikika kumadzulo kwa WWTP. Zomera ndi zosakaniza za udzu, zitsamba, ndi mitengo yamwazikana. Madera ena akonzedwa ndipo akugwiritsidwa ntchito ngati minda ya masamba ndi ogwira ntchito ku LWSC omwe akugwira ntchito ku WWTP. Kum'maŵa kwakutali kwa chomeracho kudakali zomera, udzu waukulu wokhala ndi zitsamba zoŵerengeka m'madera ena. Mitundu ikuluikulu ya mitengo yomwe ili pamalopo ndi Acacia polyacantha, Dichrostachys cinerea, ndi Tithonia longifolia., pakati pa ena.

Nyama: Moyo wa zinyama mkati mwa Polojekiti AoI siwofunika chifukwa pakhala chisokonezo cha anthu, choncho zinyama zasamukira kumadera ena. Mosasamala kanthu, zochitika zina zanyama zinawonedwa,

kuphatikizapo nyama zazing'ono monga makoswe, tizilombo, ndi zinazache. Mumtsinje wa Chunga munalinso nyama za m'madzi. Nsomba zomwe zimapezeka mumtsinje wa Chunga ndi mulamba.

Chiyambi cha chikhalidwe - Zachuma

Chiwerengero cha Anthu ndi Kugawa kwa Jenda: Chiwerengero cha anthu mu mzinda 1,742,979 chili ndi amuna 854,060 ndi akazi 888,919, omwe akuyimira makumi anayi nayini pa zana (49%) ndi makumi asanu ndi limodzi pa zana (51%), motsatana (CSO, 2013c). Chiwerengero cha anthu a mumzinda wa Lusaka ndi makumi atatu pa zana (32%) mwa anthu onse a m'tauni mu Zambia ndipo chakhala chikukwera pa avareji ya 3.7% pachaka kuyambira 1980 mpaka 2010. Zaka Makumi atatu (30).

Anthu Omwe Amakhala Kumeneko: Anthu ambiri a m'dera la Chunga amalankhula chinenero chimodzi mwa zinenero izi: Nyanja, Chibemba, Chitonga, Chilozi, Chisoli, Chilenje kapenanso zina zambiri. Chifukwa cha kukula kwa mzinda wa Lusaka komanso kukula kwa mizinda, anthu ambiri ochokera m'mitundu yosiyanasiyana asamukira kumadera ozungulira mzindawu kuti akapeze ntchito.

Maphunziro: Panthawi yoyeserera, masukulu anayi adawonedwa kuti ali pafupi ndi dera la WWTP. Panalibe sukulu yogonera yomwe idadziwika m'derali, kapena masukulu apamwamba. Ana ambiri mderali amaloledwa kusukulu za kunja kwa matauni a Chunga monga Matero, ndi Lilanda. Izi zitha kukhala chifukwa cha kuchuluka kwa masukulu ku Chunga. Sukulu zapafupi ndi Chunga WWTP ndi Chunga Secondary School, Nelson Mandela Secondary School, New Chunga Primary School, ndi Twalumba School.

Kugwirizana pakati pa amuna ndi akazi komanso chilungamo: Makampani onse opereka madzi ndi zimbudzi m'dziko muno akulamulidwa ndi NWASCO ndipo, monga gawo la kayendetsedwe kake, NWASCO idalamula kuti mabungwe onse opereka madzi m'dziko muno azitsatira mfundo zokhuza chikhalidwe cha amuna ndi akazi m'mapologalamu, ndondomeko, ndi ntchito zawo zonse. pokhazikitsa ndondomeko ya mfundo zokhudza jenda. Kulingana pakati pa amuna ndi akazi mu LWSC kumalimbikitsidwa m'magawo osiyanasiyana omwe akuphatikizapo, koma osati, makomiti a madzi, makomiti achitukuko a ma ward, ndi mabizinesi ammudzi. Chiyanjanochi ndi cha maudindo, mwayi, kupanga zisankho, kupeza, ndi kuyang'anira chuma.

Ntchito Zazachuma: Ntchitoyi ili mdera laling'ono kwambiri lomwe lili ndi mashopu ang'onoang'ono ogulitsa komanso kugulitsa zokolola zaulimi zochokera m'mafamu oyandikana nawo a Chunga. Ndi mabanja ochepa, ngati alipo, omwe angathe kukwaniritsa zosowa zawo zonse pogwiritsa ntchito ntchito imodzi, choncho chizindikiro chachikulu cha njira zopezera ndalama ndi kuphatikiza ntchito. Anthu amafuna kulinganiza nthawi, chuma, ndi chiwopsezo choperekedwa ku ntchito zosiyanasiyana, kotero kuti, pamodzi, zosowa zambiri zikukwaniritsidwa; ndipo izi zimachitika poika patsogolo zofunika zofunika poyamba. Njira zomwe zimagwiritsidwa ntchito ndizosintha komanso momwe zinthu zilili, motero njira zazikulu zomwe zimagwiritsidwa ntchito ndikuphatikiza mabizinesi ang'onoang'ono okhala ndi ntchito zamalipiro zomwe zimakhalapo pokhapokha.

Ntchito Zopereka Madzi: Anthu ambiri ali ndi madzi akumwa. Pafupifupi makumi asanu ndi limodzi mphambu zisanu (65%) ya anthu ali ndi zida zolumikizirana m'nyumba. Nyumba mu Polojekiti AoI zonse ndi zolumikizidwa ku LWSC ndipo ndi nyumba zochepa zomwe zili ndi zimbudzi za maenje. Pakuchepa kokhazikika pakugwiritsa ntchito zimbudzi za dzenje chifukwa cha mapologalamu olimbikitsa anthu kuzungulira Lusaka.

Zipatala: Chipatala chomwe chimathandiza polojekiti AoI ndi Chipatala cha Chunga komanso Chipatala cha Matero Level 1 chomwe chili ni zipatala za odwala kunja komanso odwala. Chipatalachi chakonzedwanso ndi GRZ mothandizidwa ndi EU kudzera mu Millennium Development Goal Initiative (MDGi).

Kugwiritsa Ntchito Malo ndi Kusunga Malo: Mtundu wogwiritsa ntchito malo wa Projekiti AoI makamaka umakhala waulimi, koma pang'onopang'ono ukuyamba kukhala PUA yokhala ndi anthu ambiri okhala mosaloledwa komanso nyumba zosakhazikika. Anthu ena amakhala ndi malo omwe akukhalapo ndipo ena amabwereka magawo a malowo, koma makamaka malo oyandikana ndi WWTP, mwachitsanzo, Mafamu Atsopano a Boma Latsopano ndi Zanimuone East, ndi a anthu omwe ali ndi minda ya leasehold. Pantchito yowunika, panalibe malo omwe adapezeka pamalo achikhalidwe.

Chikhalidwe ndi Cholowa: Mlangizi sadziwa za zotsalira zakale zomwe zilipo mkati mwa Polojekiti AoI. Pakapezeka malo aliwonse ofukula zinthu zakale opezeka panthawi yomanga, maguluwa azidziwitsa National Heritage and Conservation Commission (NHCC). Manda a Chunga ali pafupi ndi WWTP komanso msewu wolowera. Pakapezeka manda aliwonse panthawi yomanga, maguluwa adziwitsa a National Heritage and Conservation Commission (NHCC) ndikutsatira ndondomeko ya Annex 17 - Chance Find Procedure.

Mayendedwe, kulumikizana, ndi kupezeka kwa malo a polojekiti: Mzinda wa Lusaka uli ndi misewu yokonzedwa bwino yolumikiza Boma kumadera osiyanasiyana komanso matauni ena ndi mizinda yosiyanasiyana mdziko muno. Misewu ikuluikulu ku Lusaka imapanga dongosolo lakumatauni m'mphepete mwa Great North Road (T2), Great East Road, Kafue Road, Mumba Road (M9), ndi Cairo Road. Sitima yapamtunda ya kumupoto ndi kumwera imagawaniza tawuni kumadzulo ndi kum'mawa. Ma bwalo ya ndeke awiri mu Lusaka, City eyapoti ndi Kenneth Kaunda International Airport, akugwira ntchito ngakhale kuti City eyapoti imagwiritsidwa ntchito kwambiri ndi a Zambia Air Force. Msewu wolowera ku WWTP ndi msewu wawung'ono, wopanda phula womwe uli wovuta ndipo utali wonse wa mamita 3,600. Msewuwu ndiwonso wolowera kumudzi wa New Government Farms ku Mwembeshi Ward ndipo umadutsa m'malo okhala anthu.

Kuchuluka kwa magalimoto: Chifukwa cha kuchuluka kwa anthu komanso kuchuluka kwazachuma, Mzinda wa Lusaka wakhala ukuwonjezeka kwambiri, makamaka mzaka khumi ndi theka zapitazi. Kuwonjezekaku kumabwera chifukwa chakuchulukira chulukira kwachuma mu mzindawu ndipo kwapangitsa kuti magalimoto otsika mtengo abwere kuchokera ku Japan ngati zoyendera kuti zithandizire ntchito zachuma.

Kulumikizirana: Polojekiti AoI ili ndi wailesi ndi intaneti yabwino kwa anthu omwe ali ndi mafoni ndi zida zina zomwe zingagwiritsidwe ntchito polumikizirana. Kwawayilesi, kuwulutsa kwake kumakhala kofanana ndi mawayilesi ambiri, makamaka mawayilesi aboma ndi wailesi yakanema. Opereka chithandizo cham'manja Airtel, MTN, ndi ZAMTEL alipo mdera la polojekitiyi. Ma netiweki ali m'mbali mwa njanji ndi misewu.

Ntchito zamagetsi: Chigawo cha Lusaka ndi cholumikizidwa ku Zambian Electricity Supply Corporation (ZESCO) National Grid ndipo nyumba zambiri zomwe zili m'dera la polojekitiyi zimalumikizidwa ndi Grid, kupatula mabanja ochepa omwe ali pachiwopsezo m'derali. Nyumba zomwe sizinalumikizidwe ndi mizere ya ZESCO mwina zimagwiritsa ntchito solar kapena zimadalira makandulo usiku komanso mbaula zamakala pophikira chakudya chawo.

Miyambo ndi Zipembedzo: Anthu a Polojekiti AoI ndi Akhristu ambiri ndipo mipingo ingapo kuphatikiza Katolika, Mboni za Yehova, ndi Seventh Day idapezeka.

Zinthu za cheru: Poganizira za kafukufuku woyambira pa Polojekiti AoI, zolandilira zazikulu za E&S ndi motere:

- Palibe zamoyo kapena zomera zomwe zatsala pang'ono kutha kapena zomwe zatsala pang'ono kutha zomwe zidalembetsedwa kapena zodziwika kuti zilipo.
- Palibe malo okhalamo kapena osalimba omwe adadziwika potengera kukula ndi kukula kwa ntchito.
- Palibe mitundu ya zinyama kapena zomera zomwe zingagwiritsidwe ntchito pazamalonda zomwe zidadziwika.
- Kukula kwa Projekiti AoI sikusokoneza malo aliwonse otetezedwa.
- Kulibe mipingo, zipatala, kapena masukulu.
- Madera a Chunga ndi Matero.
- Alimi kunsi kwa mtsinje wotayira madzi amathirira mbewu ndi madzi otuluka m'madzi otaya madziwo asanalowe mumtsinje wa Chunga.

Zotsatira Zachilengedwe ndi chikhalidwe

Cholinga chachikulu cha lipoti ya zichilengedwe ndi chikhalidwe ndikuwunika zotsatira za E&S zomwe zimayambitsidwa ndi polojekiti, zomwe zimalola kufotokozera njira zotetezera zomwe ziyenera kutsatiridwa panthawi yokhazikitsa polojekiti. Poyambirira, mitu yofunika kwambiri ya chilengedwe idafotokozedwa, ndiye kuti chizindikiritso chokhudzidwacho chinachitidwa ndi magulu olekanitsidwa ndi milingo yofunikira yomwe idaperekedwa ku zotsatira zilizonse. Kuchokera mu ndondomeko yapitayi, miyeso yeniyeni ya zotsatira zake zonse, malingana ndi msinkhu wake, zinaperekedwa kuti zigwiritsidwe ntchito mu polojekitiyi.

Table 2 Chidule cha zotsatira za E&S za polojekitiyi

Madera	Zotsatira Zotheka	Kufunika	Kuchepetsa muyeso
Asanayambe kumanga			
Zapathupi	Kukokoloka kwa nthaka ndi kuphatikizika	Zapakati	• Khazikitsani mfundo zomangira zomveka bwino za makontrakitala pazofunikira pakukhazikika kwa nthaka m'makalata otsatsa (Zofunikira za Ogwira Ntchito).
	Kuwonongeka kwa Madzi (kulandira madzi)	Zazikulu	• Pangani WWTP kuti ikwaniritse miyezo yotulutsa madzi otayira. • Khazikitsani zitsimikizo za magwiridwe antchito pamitengo yotulutsa madzi otayira kwa makontrakitala m'makalata otsatsa.
			• Limbikitsani chithandizo chisanadze cha kutulutsa kwa mafakitale akuluakulu m'chimbudzi chisanakhazikitsidwe WWTP yatsopano. Pachifukwa ichi, akuganiziridwa kuti Zam leather Industries Ltd. ndi omwe amathandizira kwambiri ku Chromium mu ngalande ya Chunga, motero, zoyesayesa zochokera ku LWSC zokakamiza miyezo yazamalonda ziyenera kuyikidwa mumakampani awa.
	Dothi & Madzi (kulandira madzi) kuipitsa /Kupanga zinyalala	Zapakati	• Mapangidwe a WWTP pofuna kuchepetsa zitsulo zolemera zomwe zimayembekezeredwa mu mphamvu, mwachitsanzo. Chromium. • Khazikitsani mfundo zomanga zomveka bwino za makontrakitala oletsa kuwononga chilengedwe m'makalata otsatsa (mafotokozedwe a ESHS). • Gwiritsani ntchito bowser yamadzi kuti muzithirira malo osachepera kasanu patsiku. • Gwirani ntchito mkati mwa phokoso lovomerezeka la 40 dB(A) usiku ndi 50 dB(A) masana. • Chitani zinthu zaphokoso pakati pa 6 – 18 hrs. Zochita zoterezi zitha kuchitika usiku pokhapokha pazochitika zapadera monga zadzidzidzi kapena zofananira. • Onetsetsani kuti magalimoto onse omanga amasamalidwa pafupipafupi kuti achepetse mpweya wawo. • Perekani zovundikira ku zida ndi zotengera zomwe zitha kuyambitsa zovuta za fungo (matope, zinyalala, grit material). • Adopt ZEMA ndi malamulo apadziko lonse lapansi ndi miyezo ya mpweya wabwino. • Ikani zomera m'madera ozungulira malo a WWTP.
	Kuwonongeka kwa mpweya /phokoso	**Zazing'ono**	
Zamoyo zosiyanasiyana	Kuwonongeka kwa malo	Zapakati	• Khazikitsani ziganizo za chilengedwe za makontrakitala zochepetsera kukhudzidwa kwa malo mu Works Contract (mafotokozedwe a ESHS)
	Kuwonongeka kwa Flora & Fauna /Malo Okhalamo & Zachilengedwe	**Zazing'ono**	• Khazikitsani zitsimikizo za magwiridwe antchito pamitengo yotulutsa madzi otayira kwa makontrakitala m'makalata otsatsa.

Madera	Zotsatira Zotheka	Kufunika	Kuchepetsa muyeso
Chikhalidwe	Chiwopsezo chosiyanitsidwa ndi anthu omwe ali pachiwopsezo	Zapakati	• Pangani SEP mogwirizana ndi zofunikira za EIB/KfW ndi Zambia. • Dziwitsani anthu omwe ali pachiwopsezo.
			• Phatikizani amayi mwadongosolo pazokambirana zonse za okhudzidwa nawonso pamlingo wopindula. • Itanani bungwe la Gender Council kuti lichite nawo misonkhano yokhudzana ndi anthu okhudzidwa m'madera. • Khazikitsani ndikukhazikitsa GRM yogwira ntchito.
	Kuchuluka kwa Akunja (Ogwira Ntchito Zomanga)	**Zazing'ono**	• Onetsetsani kuti Kontrakitala amatha kukonzekera ndi kukhazikitsa njira za H&S poyika zofunikira zoterezi (zoyenerera, zochitika) m'mabuku a Prequalification. • Khazikitsani ziganizo za H&S za makontrakitala ogwira ntchito yomanga mu Works Contract (mafotokozedwe a ESHS).
Thanzi & Chitetezo	Community H&S	**Zazing'ono**	• Onetsetsani kuti makontrakitala atha kukonzekera ndikukhazikitsa njira za H&S. • Khazikitsani ziganizo za makontrakitala ammudzi ndi ogwira ntchito yomanga H&S.
	Ogwira Nchinto H&S	Zapakati	
Kusintha kwanyengo	Kuchepetsa nyengo/kusintha	**Zazing'ono**	• WWTP idapangidwa kuti ipulumutse mphamvu ndi zinthu, kuchepetsa zosowa zopopa ndikugwiritsa ntchito zida zogwiritsa ntchito mphamvu komanso kuphatikiza kupanga mpweya wa biogas ndi kubwezeretsa mphamvu. • WWTP idapangidwa kuti ikhale yolimba polimbana ndi kusefukira kwamadzi chifukwa cha CC.
Construction			
Zapathupi	Nthaka ndi kuphatikizika	Zapakati	• Kuwongolera kuipitsidwa popatula malo osungiramo zinthu, ndikuyika zokutira zoteteza m'malo omwe mafuta ndi zonyansa zina zimagwiridwa. • Yang'anani ndi kukonza makina mosalekeza kuti mupewe kutayikira. • Perekani zida zotayira m'malo onse ogwirira ntchito, makamaka komwe mafuta ndi zonyansa zina zimagwiridwa. • Funsani akuluakulu aboma ndi anthu ammudzi musanagwiritse ntchito magwero a madzi panthawi yomanga. Zilolezo zochotsa madzi ziyenera kupezeka ku Water Resources Management Authority (WARMA). • Pangani mapoto/madamu amadzi kuti mupope madzi amvula m'nyengo yamvula ntchito yomanga isanayambe. • Kukhazikitsa miyezo yabwino yaukhondo ndi kasamalidwe koyenera ka zimbudzi. • Sungani zinthu m'malo otetezedwa kuti muchepetse kutayikira. • Tetezani ndi kusunga zida zomangira zotsala mokwanira, mwachitsanzo pomanga ndi kuphimba malo osungira. • Sungani pamalo osatha madzi mankhwala onse, ma hydrocarbon, ndi zinthu zina zomwe zingawononge.

Madera	Zotsatira Zotheka	Kufunika	Kuchepetsa muyeso
			• Ikani malo oyenera a zimbudzi za dzenje kutali ndi malo odzaza madzi. • Onjezerani kugwiritsidwanso ntchito kwa zinthu posunga kwakanthawi ndikusanja pamalopo pamikhalidwe yoyenera. Zinthu zomwe sizinagwiritsidwenso ntchito zidzatengedwa kuchokera pamalopo kupita kumalo omwe LWSC idagwirizana. Zinthu zosungidwa zidzasamalidwa bwino m'malo osankhidwa, osatayidwa mumtsinje kapena kuziyika m'mphepete mwa mitsinje. Njira zopewera kukokoloka ziyenera kukhazikitsidwa m'malo onse opangira nthaka. • Pewani kugwiritsa ntchito makina olemera m'madera omwe sanapangidwe kuti amange. • Tayani dothi mukamaliza kumanga ndi kubzala zomera kuzungulira misasa. • Pewani kukumba m'madera omwe ntchito yomanga sinakonzedwe. • Tetezani /kulekanitsa madera osamanga. • Madera a masamba kumene kulibe ntchito yomanga. • Bwezerani ndi kukonzanso malo omanga masamba atangomaliza ntchito yomanga kuti malo otsetsereka akhazikike. • Pewani kuwonongeka kwa katundu waumwini ndi kuchepetsa zotsatira zoipa za chilengedwe (mwachitsanzo kuchotsa mitengo yosakonzekera, ndi zina zotero) panthawi yomanga. • Lipirani zowonongeka zonse zomwe sizikuyembekezeredwa kuzinthu zachinsinsi komanso chilengedwe. • Kupanga ngalande ndi malo ena otayirapo kuti nthaka ikhale yokhazikika komanso chithandizo choyenera.
	Dothi & Madzi (kulandira madzi) kuipitsa /Kupanga zinyalala	Zapakati	• Imafunika makontrakitala ogwira ntchito kuti apange ndi kukhazikitsa ndondomeko yatsatanetsatane ya Waste Management Plan (WMP) kuphatikizapo tsatanetsatane wa malo otayirapo zinthu zofukulidwa ndi zinyalala zomangira. • Khazikitsani nkhokwe zotayira zinyalala m'malo abwino kwambiri pamalopo. • Ikani chindapusa kwa wogwira ntchito aliyense wopezeka akutaya zinyalala m'malo omwe sanatchulidwe. • Gwiritsani ntchito malo ovomerezeka komanso ovomerezeka otaya zinyalala. • Pewani kugwiritsa ntchitonso matope ndi dothi ngati zili ndi kachilombo. Izi ziyenera kutayidwa mosamala. • Sungani m’malo osungira zinyalala zowopsa kwakanthawi zinyalala zowopsa; Derali liyenera kuzunguliridwa ndi mipanda yawaya, yosindikizidwa pansi, ndi kutetezedwa ku mvula. Zida zogwetsedwa zitha kukhala zowopsa ndipo ziyenera kutayidwa bwino. • Sonkhanitsani ndikuchotsa zinyalala zomwe sizikhala zowopsa zomwe zimapangidwa pamalowo. Kutaya zinthu izi mu mzinda ndi zinyalala zolimba zotayiramo.

Madera	Zotsatira Zotheka	Kufunika	Kuchepetsa muyeso
			• Tulutsani madzi otayira m'nyumba opangidwa mu WSP yomwe ikuyenda. • Letsani kuchita zinthu pafupi ndi mtsinje monga kuthiranso mafuta kapena kuthira mafuta m'galimoto, ndi kusungitsa zinthu, pakati pa zinthu zina zomwe zingakhale zoopsa pamadzi awa. • Pangani ngalande (madzi otayira) kuti mupewe kuthamanga ndi kutayikira.
	Kuwonongeka kwa mpweya /phokoso	**Zazing'ono**	• Limbikitsani ntchito makontrakitala a' pakukonza makina ndi magalimoto oyendera (kuchepetsa kuwonongeka kwa mpweya). • Pewani kutayika kwa mafuta ndi mafuta, pokhazikitsa kusungirako koyenera kwa migolo yamafuta ndi mafuta. • Imafunika kugwiritsa ntchito zida zodzitetezera za H&S (kuphatikiza zida zoteteza phokoso). • Kuchepetsa kutululutsa phokoso pafupi ndi malo okhalamo mpaka maola ogwira ntchito. Kuwunika kwaphokoso kozungulira sikofunikira. • Gwiritsani ntchito bowser m'madzi kuti muzithirira m'malo ndikupondereza fumbi kasanu patsiku m'nyengo yachilimwe. • Zida zotsekedwa zomwe zimagwiritsidwa ntchito popanga njira zomwe zimatha kupanga fumbi. Izi zikuphatikizapo zipangizo monga zophwanya miyala ndi zowonetsera miyala. • Tsatirani malamulo a ZEMA ndi miyezo yapadziko lonse lapansi yokhudzana ndi mpweya wabwino. • Gwirani ntchito mkati mwa phokoso lovomerezeka la 40 dB (A) usiku ndi 50 dB (A) masana. • Amafuna makontrakitala kuti agwiritse ntchito Best Management Practices (BMPs) pophulitsa, monga njira yamankhwala kuti aphwanye miyala ndi kufooketsa mapangidwe a miyala, kupanga ndi kugwiritsa ntchito mapulani enieni ophulika, kuphulika kwa mphasa, kulipiritsa koyenera, ndi kuphulika kwapang'onopang'ono kuti muchepetse phokoso ndi kugwedezeka. • Imafunika antchito onse kuvala PPE yoyenera nthawi zonse, kuphatikizapo chitetezo chakumva. • Chitani zinthu zaphokoso pakati pa 07-22hrs. • Gwiritsani ntchito makina ogwiritsidwa ntchito bwino kuti muchepetse kutululutsa phokoso. • Ikani zomera m'madera ozungulira malo a WWTP. • Konzani ndikukulitsa msewu wopita ku Silvia Masebo Compound. • Letsani liwiro la galimoto ya project's mkati/m'malo okhala anthu.
	Kuwonongeka kwa malo	Zapakati	• Phunzitsani ogwira ntchito m'machitidwe abwino a chilengedwe.

Madera	Zotsatira Zotheka	Kufunika	Kuchepetsa muyeso
Zamoyo zosiyanasiyana	Kuwonongeka kwa Flora & Fauna /Malo Okhalamo & Zachilengedwe	**Zazing'ono**	• Pewani ntchito zopanga phokoso komanso kuyatsa malo omanga usiku kuti muchepetse kusokonezeka kwa nyama zakuthengo. • Sungani dothi lapamwamba lomwe lachotsedwa kuti ligwiritsidwenso ntchito pobwezeretsa zomera. • Bzalanso mitengo/zomera zomwe zimakololedwa panthawi yomanga. • Pewani kudula mitengo ndi kuchotsa zomera m'madera omwe sangapangidwe.
Chikhalidwe	Chiwopsezo chosiyanitsidwa ndi anthu omwe ali pachiwopsezo	Zapakati	• Kukhazikitsa SEP mogwirizana ndi EIB/KfW ndi zofunikira za Zambia. • Kubwezeretsanso zowonongeka ndi/kapena kupereka chipukuta misozi pa zowonongeka zonse zomanga ndi mtengo wolowa m'malo kuti zikhale zokhutiritsa kwa PAPs.
	Kuchuluka kwa Akunja (Ogwira Ntchito Zomanga)	**Zazing'ono**	• Ikani patsogolo anthu okhala m'deralo kuti apeze ntchito zomwe zimafuna anthu opanda luso (ngati zilipo komanso zofunikira). • Kukhazikitsa njira zabwino zowonetsera malo ogwirira ntchito komanso kulemekeza maola ogwira ntchito. • Konzekerani ndondomeko yoyendetsera anthu ambiri kuti muchepetse kuchuluka kwa ogwira ntchito osamukira kumayiko ena. • Kuchulukitsa ntchito kwa ogwira ntchito m'deralo kuti achepetse kuchuluka kwa anthu ogwira ntchito.
Thanzi & Chitetezo	Community H&S	**Zazing'ono**	• Konzani msewu wolowera. • Konzani ndikusintha (ngati kuli kofunikira) Dongosolo Loyang'anira Magalimoto, poganizira zambiri za maola apamwamba komanso osakwera kwambiri panjira yopita kumalo a Project. • Langizani madalaivala kuti aziyendetsa bwino komanso kutsatira malamulo apamsewu. • Ikani zikwangwani zamagalimoto m'malo onse omanga ndi mipanda yomanga. • Ikani milatho yotetezeka yodutsa m'ngalande za anthu oyenda pansi, makamaka pakhomo la nyumba. • Sungani zotchinga zonse ndi zikwangwani pamalo nthawi yausiku, ndikuwunikira ndi/kapena zikwangwani za fulorosenti zomwe zimayikidwa momwe zimafunikira kuchenjeza magalimoto ndi oyenda pansi. • Limbikitsani malamulo a zaumoyo ndi chitetezo cha anthu. • Chitani kampeni yodziwitsa anthu za umoyo wabwino pakati pa anthu ammudzi ndi ogwira ntchito za polojekiti za kuopsa kwa mliri wa malungo ndi HIV/AIDS, pokambirana ndi zipatala za m’deralo.Provide workers with information on the existence of anonymous VCT centres (Testing, pre-test, post counseling) through referrals. • Limbikitsani H&S pothandizira mapulogalamu omwe cholinga chake ndi kuchepetsa kufalikira kwa matenda.

Madera	Zotsatira Zotheka	Kufunika	Kuchepetsa muyeso
			• Dziwani masukulu ndi mipingo za kuopsa kwa malo omanga. • Gwiritsani ntchito gulu lothandizira ozunzidwa kuti akambirane ndi ogwira ntchito ndi anthu ammudzi pa zoipa za GBV ndi kugonana ndi mitundu ina ya kuzunzidwa kuntchito. • Limbikitsani mapulogalamu omwe angalimbikitse chitetezo cha amayi ndi ana ku nkhanza zogonana.
	Ogwira Nchito H&S	Zapakati **Zazing'ono**	• Pangani Mapulani a Zomangamanga ndi Ntchito H&S Management Plans. • Onetsetsani ndi kuyang'anira ukhondo ndi ukhondo woyenera kwa ogwira ntchito m'misasa yachibalo ndi malo ogwira ntchito. • Pangani Mapulani Oyang'anira Zinyalala (WMP). • Phunzitsani ogwira ntchito ndi ma contract ang'onoang'ono. • Limbikitsani njira zoyenera zolekanitsa zinyalala ndi kasamalidwe ka zinthu zopanda mphamvu, zinthu zobwezerezedwanso kuphatikiza kulongedza, zinthu zowopsa (ngati kuli kotheka), ndi zinyalala zina zomanga. • Letsani kuwotcha zinyalala. • Onetsetsani zizindikiro zoyenera zamagalimoto, chizindikiro cha malo omanga, ndi zotchinga. • Onetsetsani kuti makina akugwira ntchito mokwanira ndi zinthu zoopsa zomwe zili mkati mwa malo ogwirira ntchito ndi omanga. • Pangani zida zozimitsa moto kupezeka pamalo omanga ndikukonza nthawi zonse. • Konzani dongosolo lokonzekera mwadzidzidzi ndi kuyankha kwa gawo la Project. • Phunzitsani onse ogwira ntchito ndi makontrakitala’ ogwira ntchito pakagwa mwadzidzidzi. • Pangani malangizo a chitetezo kwa madalaivala, omwe adzafotokoze zofunikira kwa madalaivala ndi luso la magalimoto; ndi kuwalangiza moyenerera. • Letsani kuyendetsa galimoto ataledzera, kugwiritsa ntchito mafoni a m'manja poyendetsa galimoto, kugwiritsa ntchito malamba otetezedwa, ndi zina, ngati kuli kofunikira, kuphatikizidwa. • Perekani chitetezo cha maola 24 pa malo onse a polojekiti ndikupititsa patsogolo madera ozungulira. • Limbikitsani kulemekeza ufulu wachibadwidwe kudzera m'malamulo a olemba anzawo ntchito.
Kusintha kwanyengo	Kuchepetsa nyengo	**Zazing'ono**	• Kuchepetsa mpweya wochokera m'magalimoto omanga • Limbikitsani khalidwe losamalira zachilengedwe pakati pa ogwira ntchito.
Operation			

Madera	Zotsatira Zotheka	Kufunika	Kuchepetsa muyeso
Zapathupi	Kuipitsa nthaka	Zapakati	• Yang'anirani ubwino wa matope oyeretsedwa. • Khazikitsani gawo lochizira zitsulo zolemera ngati pakufunika. • Khazikitsani ziganizo za chilengedwe kwa wogwiritsa ntchito popewa kuwononga chilengedwe.
	Kuwonongeka kwa Madzi (kulandira madzi)	Zazikulu	• Khazikitsani ziganizo za chilengedwe kwa wogwiritsa ntchito popewa kuwononga chilengedwe. • Tsatirani miyezo ya utsi. • Tanthauzirani zotsatsa zowunikira magawo ofunikira a WWTP. • Yang'anirani madzi otayira oyeretsedwa pa WWTPs. • Yang'anirani ubwino wa madzi a madzi omwe akulandira.
Chikhalidwe	Chiwopsezo chosiyanitsidwa ndi anthu omwe ali pachiwopsezo	Zapakati	• Pangani mitengo yokwanira yamagulu onse amakasitomala mkati mwa ntchito zaukhondo zomwe zakonzedwa bwino (mwachitsanzo mitengo ya anthu). • Chitani zokambirana pafupipafupi ndi madera omwe ali mkati mwa AoI. • Kukhazikitsa malamulo ndi njira zofananira pakati pa amuna ndi akazi monga kufanana pamalipiro pakati pa amayi ndi abambo, kukonda amayi omwe ali ndi ziyeneretso zofanana, komanso kuphatikizidwa pakupanga zisankho.
Thanzi & Chitetezo	Community H&S	Zapakati	• Kukhazikitsa kwa GRM yogwira ntchito. • Konzani njira zochenjeza msanga za zochitika zosafunikira monga kuipitsidwa kwa madzi a mitsinje ndi kuphunzitsa moyenerera okhudzidwawo.
	Ogwira Nchito H&S	Zapakati	• Kukhazikitsa njira zoyeretsera ndi kukonza nthawi ndi nthawi. • •Kukhazikitsa Dongosolo Loyang'anira Zinthu Zowopsa ndi dongosolo lophunzitsira antchito • •Konzani ndikukhazikitsa mapulogalamu oyendera zida. • •Perekani PPE yeniyeni ndi maphunziro ofunikira kuti muyankhe pazochitika zadzidzidzi.

Dongosolo Chilengedwe Ndi Chikhalidwe Kasamalidwe

ESMP imatanthawuza njira zoyendetsera zovuta zonse zomwe zadziwika, njirazi zidapangidwa ngati ntchito ya zoopsa zomwe zawunikiridwa. Muyeso uliwonse umatchula ntchito zomwe ziyenera kupangidwa, maudindo, nthawi ndi nthawi, ndi gawo la kukhazikitsa. ESMP yayikulu ikuphatikiza OHS ndi dongosolo la kasamalidwe ka mikhalidwe yantchito kuti athe kuyang'anira ndi kuchepetsa zovuta zilizonse zomwe zingachitike potsatira mfundo za dziko ndi mayiko.

Dongosolo yo thetsa ntchito ndi Kukonzanso

Gawoli liphatikiza kukonzekera njira yochotsera zida zomwe zilipo, WWTP yatsopano ikadzatumizidwa ndikugwira ntchito. Kuthetsedwa kotheratu kukutanthauza kuchotsedwa kwa zida zonse ndikutaya zinthu

zomwe zathetsedwa pamalo osankhidwa ovomerezedwa ndi ZEMA. Izi zidzatsatiridwa ndi kubzala ndi kukonza malo omwe akhudzidwa.

Kuwonetsetsa kuti izi zatheka, kukonzanso kopitilira muyeso kwa deralo kudzayamba poyambira ntchito za WWTP yatsopano pamalopo. Monga mbali yofunikira ya ntchito za zomera. Madera onse omwe asokonekera adzakonzedwa pang'onopang'ono ntchito ikatha m'derali.

Pomaliza ndi Malangizo

Zofunikira zazikulu za chikhalidwe ndi chilengedwe zidadziwika panthawi yoyeserera. Nkhani zosiyanasiyana zomwe anthu okhudzidwa ndi anthu okhudzidwa ndi anthu ammudzi adakambirana pamisonkhano ndi zoyankhulana zinaganiziridwa mu lipoti ya zichilengedwe ndi chikhalidwe ndipo zinaphatikizidwa pokonza ESMP ya polojekiti yomwe ikufunidwa. Zotsatirazi ndi zina mwazolimbikitsa kwa wopanga:

- Kupanga zisankho kuyenera kutsatiridwa ndi kuphatikizirapo anthu omwe ali pachiwopsezo, kuti izi zitheke kukhala chitukuko chophatikizana kwa anthu ammudzi ndi Zambia;
- Mafakitale ayenera kulimbikitsidwa kuti asamagwiritse ntchito mankhwala a WWTP kuti asamawononge zitsulo zolemera kwambiri, ndi zinyalala zina za mafakitale;
- Zinyalala zochokera ku WWTP ziyenera kuganiziridwa ngati mphamvu zina, mwachitsanzo gasi wa biogas;Dothi loyeretsedwa liyenera kugulitsidwa kwa alimi pamitengo yotsika

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ABBREVIATIONS AND ACRONYMS

A
Area of Influence · *AoI*
G
Gender-Based Violence · GBV
M
Millennium Development Goal Initiative · *MDGi*, *MDGi*
N
National Heritage and Conservation Commission · *NHCC*, *NHCC*
A
African Development Bank · *AfDB*
Area of Influence · *AoI*
B
Biological Oxygen Demand · *BOD*
C
Capital Expenditure · *CAPEX*
Central Statistical Office · *CSO*
Climate Change – *CC*
Chemical Oxygen Demand · *COD*
Combined Heat and Power · *CHP*
Convention on Biological Diversity · *CBD*
Conventional Activated Sludge · CAS
Core Labor Standard · *CLS*
D
Disaster Management and Mitigation Unit - *DMMU*
E
Engineering Institute of Zambia – *EIZ*
Environmental and Social · *E&S*
Environmental and Social Impact Assessment · *ESIA*, *ESIA*
Environmental and Social Management and Monitoring Plan · *ESMMP*
Environmental and Social Management Plan · *ESMP*
Environmental and Social Standards · *ESS*
Environmental Impact Assessment · *EIA*
Environmental Impact Statement · *EIS*
Environmental Protection and Pollution Control Act · *EPPCA*
Environmental, Health and Safety · *EHS*
Environmental, Social, Health and Safety · ESHS
European Investment Bank · *EIB*
European Union · *EU*

P
Personal Protection Equipment · *PPE*
W
Waste Management Plan · WMP
Z
Zambian Dempgraphic Health Survey: ZDHS · *See*
Zambian Electricity Supply Corporation · *ZESCO*, *ZESCO*

F
Faecal Sludge Management · *FSM*
Feasibility Study · *FS*
Fédération Internationale des Ingénieurs-Conseils/The International Federation of Consulting Engineers · *FIDIC*
Functional Design Report · *FDR*
G
Gender-Based Violence · GBV
Geographic Information System · *GIS*
Good International Industry Practice · *GIIP*
Government of the Republic of Zambia · *GRZ*
Greenhouse Gas · *GHG*
Grievance Redress Mechanism · *GRM*
I
Instrumentation & Control – *I&C*
International Development Association · *IDA*
International Financing Corporation · *IFC*
International Labor Organization · *ILO*
K
Kredit für Wiederaufbau · *KfW*
L
Local Authorities · *LA*
Lusaka City Council · *LCC*
Lusaka Sanitation Program · *LSP*
Lusaka Water Supply and Sanitation Company · *LWSC*
M
Millennium Development Goal Initiative · *MDGi*
Ministry of Health · *MoH*
Ministry of Local Government and Housing · *MLGH*

Ministry of Mines, Energy and Water Development · *MEWD*
Ministry of Tourism, Environment and Natural Resources · *MTENR*

N

National Biological Diversity Strategy and Action Plan · *NBSAP*
National Conservation Strategy · *NCS*
National Env. Action Plan · *NEAP*
National Heritage and Conservation Commission · *NHCC*
National HIV and AIDS Strategic Framework · *NASF*
National Policy on Environment · *NPE*
National Water and Sanitation Council · *NWASCO*
National Water Policy · *NWP*
Non-Governmental Organizations · *NGO*

O

On-site Sanitation · *OSS*
Operation & Maintenance · *O&M*
Operational Expenditure · *OPEX*

P

Peri-Urban Areas · *PUA*
Person Equivalent - *PE*
Personal Protection Equipment · *PPE*
Project Affected People · *PAP*
Project Executing Agency · *PEA*

R

Resettlement Action Plan · *RAP*

S

Sludge Management Plan · *SMP*
Stakeholder Engagement Plan · *SEP*
Suspended Solids · *SS*

T

Terms of reference – *ToR*
Trickling Filters · *TF*, *TF*

U

United Nations · *UN*
United Nations Framework Convention on Climate Change · *UNFCCC*

V

Volatile Organic Compounds · *VOC*

W

Waste Management Plan · *WMP*
Wastewater Stabilization Ponds · *WSP*
Wastewater Treatment Plants · *WWTP*
Water Resources Management Authority · *WARMA*
Water Sector Performance Improvement Project · *WSPIP*
World Bank · *WB*

Z

Zambian Demographic and Health Survey - *ZDHS*
Zambian Electricity Supply Corporation · *ZESCO*
Zambian Environmental Management Agency · ZEMA

1 INTRODUCTION

1.1 Summary of Project Description and Rationale

It is estimated that 70% of Lusaka's two million residents live in Peri-Urban Areas (PUA), most of whom have poor sanitation, which has resulted in severe health and environmental issues, with regular outbreaks of cholera, typhoid and dysentery. Approximately 90% of the PUA population uses on-site sanitation facilities, most of which are in poor condition, while 57% of Lusaka's water supply is from groundwater sources within the city, which is prone to sewage contamination.

Based on the 2000 and 2010 census data, Lusaka's population is expected to grow by 4.9% per annum to reach approximately five million by 2035. Sewerage networks in Lusaka cover approximately 30% of the areas with reticulated water supply systems and comprise gravity and pumped sewerage networks flowing to centralized wastewater treatment facilities.

The Lusaka Water Supply and Sanitation Company Limited (LWSC), formerly named the Lusaka Water and Sewerage Company, managed the sewerage network in Lusaka covers approximately 10 to 20% of the population and is divided into five sewer sheds, namely: Chunga, Ngwerere, Manchinchi, Kaunda Square, and Chelston. The existing sewerage system consists of approximately 480 km of pipes, eight sewage pumping stations, two conventional Wastewater Treatment Plants (WWTPs) employing Trickling Filters (TF) and five sets of stabilisation ponds (SPs). Most of the sewerage networks are in poor condition and are inadequate for the future population growth. However, the majority of the population is reliant on onsite facilities (pit latrines), with a small percentage of the population having no access to standard sanitation.

Parallel financing support has been provided by the World Bank (WB), African Development Bank (AfDB), European Investment Bank (EIB), and Kredit für Wiederaufbau (KfW) to implement the Lusaka Sanitation Program (LSP) which consists of Wastewater Collection and Treatment, On-site Sanitation and Institutional Improvements. The LSP, will improve overall sanitation, reduce environmental pollution to water bodies, and thus minimise health and environmental issues associated with water-borne diseases.

The LSP consists of four investment components (A, B1, B2 and B3). Investment Component A, which is funded by the EIB and KfW, covers the provision of new WWTPs at Chunga and Ngwerere (this Consultancy).

In accordance with the Water Supply and Sanitation Master Plan developed under other components of LSP, the Feasibility Study (FS) prepared in December 2015 and updated in May 2016 (COWI, 2016), and the WWTPs draft Functional Design Report (FDR) prepared on March 2022 (GIC - HYDROMENT- Bari Zambia, 2022); it is proposed to construct new WWTPs at Ngwerere and Chunga existing WWTP sites applying a Conventional Activated Sludge (CAS) treatment technology[8], with an average dry weather flow capacity of 54,184 m^3/d (425,573 p.e.) and 18,714 m^3/d (146,171 p.e.) respectively to treat the wastewater generated in Phase A 2030, and 131,430 m^3/d (1,223,207 p.e.) and 44,541 m^3/d (396,606 p.e.) respectively in Phase B for the year 2045. The new WWTP at Ngwerere will receive the wastewater flows currently treated at the existing Manchinchi WWTP in addition to the existing Ngwerere flows. Following the completion and commissioning of the new Ngwerere WWTP the existing Manchinchi WWTP will be decommissioned.

1.2 Project Objective

The general objective of Component A of the LSP is that Lusaka WWTPs at Chunga and Ngwerere are upgraded, expanded, operated and maintained by LWSC in a technically, financially and environmentally sustainable manner, providing compliance with ZEMA effluent discharge standards. The new WWTPs will significantly improve the treatment for wastewater originating from the Chunga, Manchinchi and Ngwerere sewerage catchment areas in Lusaka.

The specific objective of the proposed Consultancy services is the design, procurement supervision of the construction and commissioning of the new Ngwerere WWTP and new Chunga WWTP.

[8] The COWI FS of 2016 was approved considering Option 5, with TF as main treatment technology. However, as a result of the assessment of the Consultant during the inception phase, it was considered to keep the Option 5 as the overall concept, but changing the treatment technology to CAS due to several reasons explained in the Inception Report (GIC - Hydroment - Bari Zambia, 2021).

1.3 Project Location

The following figure shows the location of the existing WWTP intervention in the Project. The entrance to the Chunga WWTP coordinates are (15°20’51.66” S, 28°15’15.17” E); and Table 1 shows the project’s area coordinates.

Table 3 Coordinates of the Ngwerere WWTP

	Projected coordinates (UTM 27)		Geographic Coordinates, decimal (WGS 84)	
OBJECTID	North	East	North	East
A	8303503,040	634548,200	-15,3442	28,2535
B	8303520,290	634698,320	-15,3440	28,2549
C	8303548,660	634702,070	-15,3438	28,2549
D	8303542,430	634748,830	-15,3438	28,2553
E	8303512,730	634744,950	-15,3441	28,2553
F	8303452,160	634894,950	-15,3446	28,2567
G	8303090,580	634845,730	-15,3479	28,2563
H	8303139,750	634483,430	-15,3475	28,2529
J	8303411,510	634520,430	-15,3450	28,2532
K	8303409,500	634535,640	-15,3450	28,2534

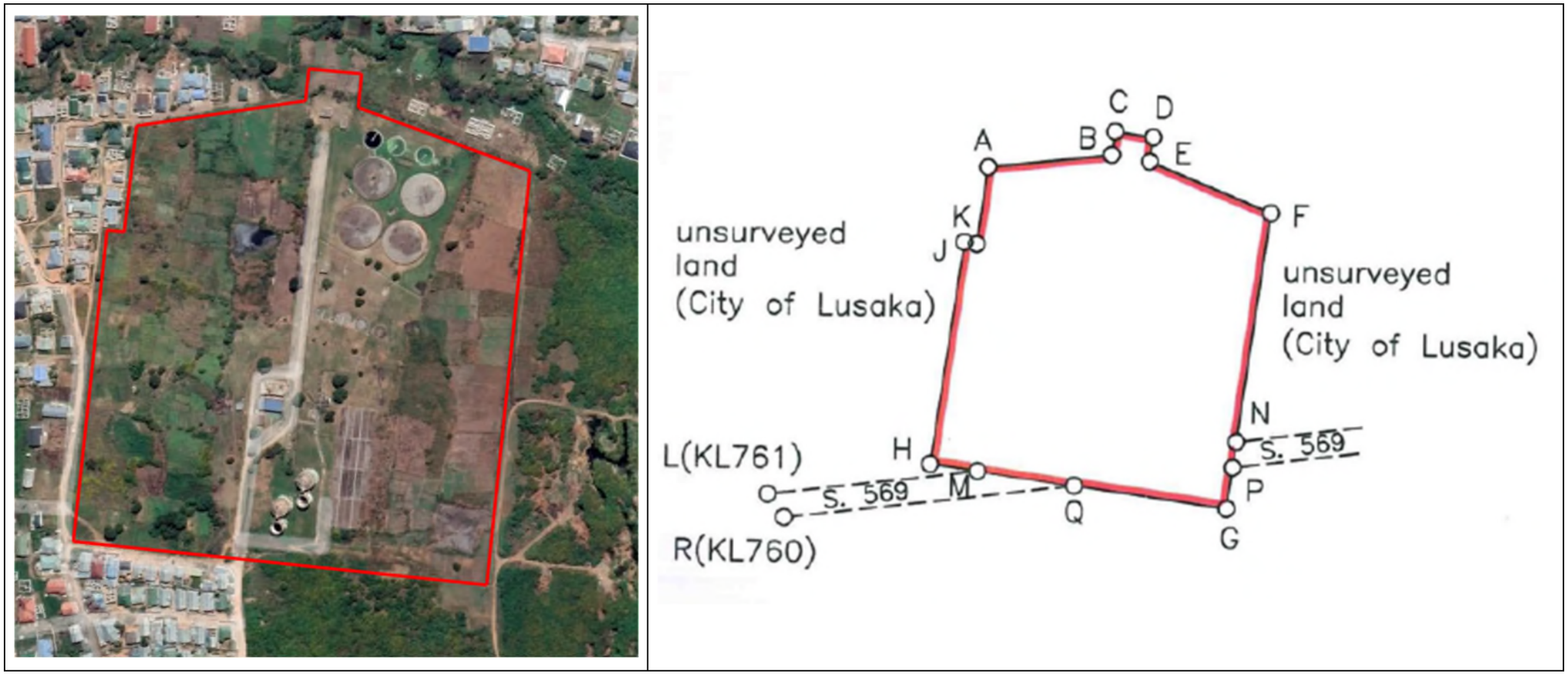


Figure 3 Location of Chunga WWTP

The proposed WWTP is located north of the Lusaka CBD in Chunga township next to Matero and Lilanda, 3.6 km from the Great North Road. The notable landmarks around the Chunga WWTP are the Nelson Mandela School which is south of the plant and 1 km from the entrance of the plant. Other landmarks are the Church of Central Africa Presbyterian and the bus stop which is named after the church. Just next to the WWTP on the southern side is the Chunga Cemetery which has been decommissioned to the public.

The settlements that are near the WWTP are Zanimuone East and Government Farms which are North and West of the WWTP respectively and share the same perimeter fence with the project area whose residents use the water from the Chunga for gardening purposes. The map in the table above gives a schematic representation of the location of the WWTP with respect to the Great North Road and surrounding developments.

1.4 Shareholding Information

LWSC operates using a non-executive Board of Directors which is appointed by the shareholders. LWSC is wholly owned by the Local Authorities (LA) in Lusaka province. All the districts in the province, have shares in LWSC.

LWSC was established in 1988 and commenced operations in 1990 after the water sector reforms. Its mandate is defined in the Water Supply and Sanitation Act No. 28 of 1997 ("to provide water supply and sanitation services to the areas falling under its jurisdiction, except an area where a person provides such services solely for that person's benefit"). LWSC is the largest provider of water and sanitation services to a population of 2.4 million both in urban and PUA of Lusaka province in Zambia.

The LWSC owns and operates water supply and sewerage assets in Lusaka city proper and outlying communities. In addition to the usual planning, engineering, construction, plant operations and maintenance functions, the LWSC also maintains a Geographic Information System (GIS), mapping capability, computer networks, Instrumentation and Control (I&C), and administrative functions for governance, management, human resources, service rates, collections, disbursements and finance. Project Developer's Contact Details

Table 4 Developer's contact details

Item	Details
Developer	LWSC
Contact person	Jonathan Kampata
Designation	Managing Director
Physical address	Plot 871/2 Katemo Road, Rhodespark, Lusaka
Phone	0211 257 579

1.5 Track Record of LWSC

LWSC has already implemented several large projects of a similar nature and magnitude. The Kafue Bulk Water Supply Project (US$ 150M) is now nearing completion, and the rehabilitation of the Kaunda Square waste ponds completed recently is an example of a project of similar nature.

LWSC has continued to work towards increasing sanitation coverage. Only Lusaka and Kafue have sewerage systems while the rest of the districts of Lusaka Province are serviced by on-site systems. LWSC has three conventional treatment plants, namely Manchinchi and Chunga in Lusaka; and Chawama in Kafue; with seven sets of WSP in Lusaka and one in Kafue. As of December 2019, the total sewer network is about 524 km representing 16% for reticulated sewer.

To scale up on sanitation access, LWSC has integrated OSS services and FSM within its overall business strategy. This implementation of this service has started in areas that will not be serviced in the medium to long term due to technical and socio-economic considerations. These interventions have accounted for 69% of safely managed sanitation.

Having evolved from a small department within Lusaka Urban District Council, the utility had 34,000 water connections in 1990 and as of December 2019, the number of connections stood at 115,567 which include domestic, commercial and government residing in both the urban and PUA of all the towns in the province.

The number of employees has equally grown to the current 888 employees across the province in all districts served. This presents a wide range of skills and qualifications among them engineering, management and

business expertise necessary for meeting and improving the services provided. LWSC pride itself on the values of customer focus, innovation, teamwork, integrity, gender responsiveness, and social inclusion in the quest to meet the stakeholders' needs.

1.6 Project Total Investment Cost

The EIB together with KfW agreed on a loan of EUR 102.5 million (one hundred and two million and five hundred thousand Euro) . to the Government of the Republic of Zambia (GRZ) in order to implement the LSP. Subsequently the GRZ agreed on a subsidiary loan agreement with the LWSC. The subsidiary loan agreement dated 04.06.2018 indicates the following:

- The GRZ agreed to on-lend EUR 20.5 million (twenty million and five hundred thousand Euro). to the LWSC for the LSP.
- The GRZ agreed to on-grant EUR 82 million (eighty-two million Euro) . to the LWSC for the LSP.

The WWTP investment cost will be covered under Investment Component A, with a total estimated budget for Phase A of EUR 22.9 million (twenty-two million and nine hundred thousand Euro). for Chunga WWTP and EUR 50.2 million (fifty million and two hundred thousand Euro). for Ngwerere WWTP, according to the draft FDR (GIC - HYDROMENT- Bari Zambia, 2022) & (GIC - HYDROMENT - Bari Zambia, 2022).

1.7 Project Implementation Date

The construction works are expected to commence in the 2nd half of 2023 and be finalised in the 1st half of 2025.

1.8 Consulting Services

The consultancy for Component A is split into two parts, hereinafter referred to as the Consultancy:

- Part A involves the preparation of FDR, Environmental and Social Impact Assessment (ESIA) study and bidding documents for the new WWTPs, assistance in tendering and contract negotiation, and review of the Contractor's designs under FIDIC yellow book Design & Build Contract.
- Part B involves the construction supervision of the two WWTPs, superintendence during the DNP, and development of training plans and monitoring the implementation of training for two years following the DNP.

The Consultancy is undertaken by a consortium consisting of GITEC-IGIP GmbH from Cologne, (Germany); HYDROMENT from Athens, (Greece); and BARI Zambia from Lusaka, (Zambia), hereinafter referred to as the Consultant.

1.9 Zambian Environmental Management Agency (ZEMA)

Consultations with ZEMA at the FS stage in 2015 revealed that, as in many other countries, ESIA studies, according to national laws, are being requested by the national environmental authorities during the design stage. Complying with this requirement, it was considered that a subsequent individual ESIA study for each WWTP shall be undertaken in accordance with the Zambian regulations of the Environmental Management Act No.12 of 2011.

Under the scope of the Consultancy, the Consultant has to prepare an individual ESIA study for each of the WWTPs, Chunga and Ngwerere.

The main objective of the ESIA is to identify the positive and negative impacts that will arise from the implementation of the construction of the WWTP in Chunga.

The Environmental and Social (E&S) scoping report and ToR were submitted in July to LWSC. Comments from LWSC were received, and the documents were resubmitted in October 2021. In December 2021, LWSC approved the scoping report and ToR and submitted them to ZEMA. ZEMA comments were received in March 2022. The Consultant replied to the comments, adjusted the Scoping report and ToR, and submitted them to LWSC on April 2022.

1.10 ESIA International Requirements and Categorization

According to the EIB Environmental and Social Standards (ESS) (European Investment Bank, 2018) No.1 and EU EIA Directive 2011/92/EU for ESIA (European Union, 2011), the categorization into Annex I or II of the EU EIA Directive determines the comprehensiveness of the ESIA study.

Annex I projects comprise potentially significant adverse or irreversible impacts or risks to human health, the environment, or the climate. Examples of projects that may cause irreversible impacts – such as resettlement – include infrastructure projects (e.g. the construction of new highways), basic industry projects (including the construction of refineries), or energy projects (e.g. the construction of large hydropower projects).

Significant adverse E&S impacts or risks may also arise from Annex II projects, but these are less severe and can usually be mitigated with state-of-the-art measures or standard solutions. Examples include metalworking or pharmaceutical industry projects in existing industrial zones. For Annex II projects, the scope, focus and depth of assessment are defined according to specific characteristics of the project.

According to the EU EIA Directive (European Union, 2011), WWTPs with a capacity exceeding 150,000 p.e. fall into Annex I. Therefore, both Chunga and Ngwerere WWTPs fall into this category.

According to the FS ESIA (CES, 2017), the Project was considered to be **Category A** according to KfW´s E&S project categorization, which is in line with the ESIA to be done under Annex I from the EU EIA Directive (European Union, 2011).

In summary, LSP is financed by WB, AfDB, EIB, and KfW; but specifically, the LSP Component A investments are financed by EIB and KfW. Therefore, the international requirements adopted for the development of this ESIA are EIB's Environmental and Social Standards (ESS) and the KfW's Sustainability Guideline Assessment and Management of Environmental, Social, and Climate Aspects: Principles and Procedures; which simultaneously embrace the Environmental and Social Standards of the World Bank Group, i.e. their Environmental and Social Standards (ESS). All the previous aligned to the EU Directive 2011/92/EU and its categorization.

1.11 ESIA Objectives

The ESIA study is carried out to deliver on the following objectives:

- To identify and assess all potential significant E&S impacts of the proposed project and recommend appropriate mitigation and enhancement measures;
- To evaluate potential impacts of engineering and design activities during site preparation, construction, and operational phases of the Project;
- To verify compliance of the Project with stipulated national and international E&S standards and regulations;
- To generate baseline data for monitoring and evaluation of how well the mitigation measures will be implemented during the Project cycle;
- To foster public involvement and participation throughout the major Project phases;
- To recommend environmentally and socially sound, cost-effective measures to be implemented in the entire course of the proposed Project, and
- To prepare an ESIA report compliant with relevant national legislation and EIB ESS framework (European Investment Bank, 2018), as well as the standard international treaties and conventions.

1.12 Structure of the ESIA document

For the international ESHS studies, the Consultant proposes to develop an international ESIA as a joint document, which is commensurate with the Project impacts and complies with the requirements of the EIB ESS Framework (European Investment Bank, 2018). According to the ToR, the following is the ESIA Structure and the complementary relevant documents.

Policy, legal and institutional framework

Description of the current wastewater infrastructure and project description

- Condition Assessment, Key Challenges and Major Shortcomings
- Environmental and Social Implications
- Scope of Works
- Products generated
- Resources Required for the Project (Raw Materials)
- Main Activities

Project alternatives

Environmental and social baseline

- Methodology
- Project Area of Influence (AoI)
- Physical environment
- Biological environment
- Socio-economic environment
- Sensitive Receptors

Environmental and social impact scoping

- Specific considerations of key environmental impacts
- Objectives and Approach
- Impact Assessment and Mitigation Measures
  - Potential Physical Impacts (P)
  - Potential Biodiversity Impacts (B)
  - Potential Social Impacts (S)
  - Potential Impacts on Community and Worker Health & Safety (HS)
  - Potential Climate Change Impacts (CC)

Environmental and Social Management Plan (ESMP)

- Environmental and Social Management and Monitoring Plan (ESMMP)
- ESIA Schedule

Decommissioning and Rehabilitation Plan

Bibliography

Additionally, the following documents are an integral part of ESIA, therefore are presented as an annex.

- Sludge Management Plan (SMP);
- Stakeholder Engagement Plan (SEP);
- Grievance Redress Mechanism (GRM), and;
- Resettlement Action Plan (RAP), including a Livelihood Restoration Plan (LRP).

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

An institutional framework for sanitation and water management consists of a range of different organizations that are in place (or need to be in place) to develop and manage water resources and the delivery of water and sanitation services at different levels of society. A lack of a sound institutional framework is a root cause of many failures in service delivery — and a major cause of failed water and sanitation provision.

The present chapter discusses the existing organizational structures relevant to the LSP, outlining the responsibilities of the respective institutions. For a better understanding of the LSP environment, the key involved organizations/stakeholders, distinguishing between the regulatory, financial, implementation and operational components of the LSP, are described in the following subchapters.

2.1 Ministry of Mines, Energy and Water Development (MEWD)

The MEWD is responsible for initiating the overall national water management policies and for setting national standards and priorities for water development and management.

2.2 National Water and Sanitation Council (NWASCO)

The NWASCO is a statutory body established by the Water Supply and Sanitation Act No. 28 of 1997. According to the Act in Clause 4, NWASCO is mandated to regulate the provision of water supply and sanitation services. The NWASCO reports through the MEWD, this is in order to keep the regulatory function separate from the water and sanitation implementation function housed under the MLGH. The NWASCO has responsibilities for:

- developing policies regarding water and sanitation;
- setting standards and guidelines regarding water and sanitation;
- licensing water and sanitation utilities and monitoring their performance; and
- taking any necessary actions to ensure efficient and sustainable provision of water and sanitation services.

2.3 Zambia Environmental Management Agency (ZEMA)

ZEMA is a statutory body created under the Environmental Management Act of 2011 and is mandated to protect the environment and control pollution so as to provide for the health and welfare of persons, and the environment. Part VI (49) of the act assigns ZEMA certain roles and responsibilities, amongst which are the following:

- formulate and provide standards on the classification and analysis of waste and formulate and advise on standard disposal methods and means;
- publicize the correct means of storage, collection and disposal of any class of waste, and;
- maintain statistical data on the nature, quantity and volume of waste generated and on sites where waste disposal is taking place or has taken place.

2.4 Lusaka Water Supply and Sanitation Company (LWSC)

LWSC was established in 1988 and commenced operations in 1990 after the water sector reforms. Its mandate is defined in the Water Supply and Sanitation Act No. 28 of 1997 (“to provide water supply and sanitation services to the areas falling under its jurisdiction, except an area where a person provides such services solely for that person’s benefit”). LWSC is the largest provider of water and sanitation services to a population of 2.4 million both in urban and PUA of Lusaka province in Zambia.

LWSC operates using a non-executive Board of Directors which is appointed by the shareholders.

The LWSC owns and operates water supply and sewerage assets in Lusaka city proper and outlying communities. In addition to the usual planning, engineering, construction, plant operations and maintenance functions, the LWSC also maintains a Geographic Information System (GIS), mapping capability, computer networks, Instrumentation and Control (I&C), and administrative functions for governance, management, human resources, service rates, collections, disbursements and finance.

The PEA is LWSC which has experience in implementing similar projects. These include the Water Sector Performance Improvement Project (WSPIP) in which the installation of water networks and water treatment

plants in Chongwe and Luangwa Districts were installed. Other projects include the sewer network installation in the new Maiteneke, Kaunda Square, Kalingalinga and Mass Media area.

2.5 Lusaka City Council (LCC)

The LCC is the governing local authority for the City of Lusaka, deriving its authority from several Zambian laws, but most immediately, Section 61 of the Local Government Act, which lists 63 functions of local authorities. The LCC responsibilities include, but are not limited to:

- provision and maintenance of supplies of clean water and the establishment of water works and water mains;
- construction and maintenance of sanitary lines;
- establishment and maintenance of sanitation and drainage systems to facilitate the removal of refuse and effluent;
- prohibit and control the use of land and erection of buildings in the interest of public health, safe and orderly development of the Council area; and
- approval to formalize unplanned settlements.

2.6 Particulars of Shareholders/Directors

LWSC is owned by the Local Authorities (LA) in Lusaka province. All the districts in the province, have shares in LWSC. Therefore, the shareholders, include among other LA:

Table 5 Shareholding Stake

No.	Local Authority Name	Percentage of Shareholding (%)
1.	Lusaka City Council	40
2.	Kafue Town Council	15
3.	Chongwe Town Council	7.5
4.	Luangwa Town Council;	7.5
5.	Chirundu Town Council	7.5
6.	Chilanga Town Council	7.5
7.	Rufunsa Town Council;	7.5
8.	Shibuyunji Town Council	7.5

Source: Special Report of the General Auditor (2018) (Report, 2018)

According to the Special Report of the General Auditor (2018) (Report, 2018), LWSC's Board of Directors Details are as follows:

- A Mayor or Council Chairperson of participating councils;
- A Town Clerk or Council Secretary of participating councils;
- A Representative from the Law Association of Zambia (LAZ);
- A Provincial representative from the Engineering Institution of Zambia (EIZ);
- A representative Local Government Officer;
- A representative from the Ministry of Water Development, Sanitation and Environmental Protection;
- A representative from the Zambia Institute of Chartered Accountants;
- The Executive Director of Zambia Competition and Consumer Protection;
- Commission representing the Consumer Category;
- A representative from the Zambia Institute of Human Resources Management;
- A representative from the Ministry of Finance;
- Managing Director of the Company appointed by the Board of Directors.

2.7 Financing Agencies

LSP is financed by WB, AfDB, EIB, and KfW. The LSP Component A investments are financed by EIB and KfW, providing financing for the implementation of the new Chunga and Ngwerere WWTPs. The beneficiary (the Republic of Zambia) contributes to PEA Operation (LSP), taxes and land acquisition (if needed).

2.8 E&S roles and responsibilities

In the following table, the specific E&S roles and responsibilities are listed:

Table 6 E&S responsibilities

Stakeholder	Reference of legislation	E&S roles and responsibilities
LWSC	n/a	• Overall Program responsibility as the PEA; • Land acquisition and compensation (if needed); • Application for licenses and permits.
EIB, KfW	n/a	• Setting of international E&S requirements; • Monitoring of fulfilment of the E&S requirements and Project objectives.
Ministry of Tourism, Environment and Natural Resources (MTENR)	National Env. Action Plan (NEAP) of 2014 National Policy on the Environment (NPE) of 2010 Constitution of the Republic of Zambia	• Environmental policy development; • Environment and natural resource management; • Raising public awareness of environmental Issues; • Strategy development related to environmental Improvements; • Effect of international policy and principles on the environment.
ZEMA	Environmental Man. Act No 12 of 2011 Environmental Man. (Licensing) Regulation Statutory Instrument No. 28 of 1997 ESIA Regulation	• Monitoring and enforcement of environmental regulations; • Execution and monitoring of ESIA procedures; • Licensing of generation, transportation, storage and disposal of wastewater; • Coordinating & advisory roles related to the environment; • Raising public awareness of the environment.
National Water Supply and Sanitation Council (NWASCO)	Water Supply & Sanitation Act, No 28 of 1997	• Water supply and sanitation services; • Monitoring water quality.
City, Municipal and District Councils	Local Government Act, Cap 281 Town and Country Planning Act, Cap 283 EMA of 2011	• Development plans for the area under their responsibility; • Wastewater treatment, including identification of WWTP developments; • Setting tariffs and applicable by-laws.
Ministry of Local Government and Housing (MLGH)	Local Government Act, Cap 281 Town and Country Planning Act, Cap 283	• Local government policy development; • Oversight and advisory role to Councils; • Approval of development plans; • Payment of grants to Councils.
Ministry of Finance		n/a
Implementation Consultant	n/a	• Preparation of the international ESIA;

Stakeholder	Reference of legislation	E&S roles and responsibilities
		• Supporting LWSC in establishing GRM, SEP, and RAP; • Supporting LWSC in applying for relevant national licenses and permits; • Approval of developed technical concepts from the E&S perspective.
Contractors	n/a	• Implementation of the ESMP.

All the government bodies listed above enforce individual pieces of legislation as they pertain to E&S safeguards in the water and wastewater sector. The main ones include the:

- National Policy on Environment / National Environmental Action Plan (NEAP) of 1994;
- Environmental Management Act of 2011;
- Statutory Instrument (SI) No.28 under the Environmental Protection and Pollution Control (ESIA) Regulations of 1997;
- Water Supply and Sanitation Act of 1997;
- The Town and Country Planning Act.

2.9 National legal Framework

This section presents the key environmental laws of Zambia, which constitute the national legal framework.

Table 7 Policies, Legislation and Framework

Legislation	Interpretation of Legislation	Relevance and Compliance on the Project
The Environmental Management Act No.12 of 2011	An Act to continue the existence of the Environmental Council and re-name it as ZEMA that provides for: • integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources; • the preparation of the State ofthe Environment Report, environmental management strategies and other plans for environmental management and sustainable development; • the conduct of strategic environmental assessments of proposed policies, plans and programs likely to have an impact on environmental management; • the prevention and control of pollution and environmental degradation; • public participation in environmental decision-making and access to environmental information; establish the Environment Fund; • environmental audit and monitoring; • facilitate the implementation of international environmental agreements and conventions to which Zambia is a party; • repeal and replace the Environmental Protection and Pollution Control Act, 1990, and; • matters connected with, or incidental to, the foregoing.	**Relevance:** The act provides for overall guidance on conducting environmental assessments and for integrated environmental management and the protection and conservation of the environment through sustainable management and use of natural resources. **Compliance:** The Consultant will comply with the provisions of this Act through the preparation of an ESIA, ESMP and RAP for submission to ZEMA and subsequent review and approval. During the construction stage, the Consultant will monitor the Contractor's adherence to the ESMP.

Mines and Minerals Act Cap 213 of 2015	An act to revise the law relating to the exploration for mining and processing of minerals that provide for; • safety, health and environmental protection in mining operations; • establishment of the mining appeals tribunal; repeal and replace the mines and minerals development act, 2018, and; • matters connected with or incidental to the foregoing.	**Relevance:** The act guides conducting mining and mining-related activities. The project might require blasting of rocks in certain areas before construction begins. **Compliance:** The Contractor will obtain the necessary licenses before the commencement of any construction and blasting activities
The Employment Code Act of 2019	• An Act to regulate the employment of persons; • prohibit discrimination at an undertaking; • constitute the Skills and Labour Advisory Committees and provide for their functions; • provide for the engagement of persons on contracts of employment and the form and enforcement of the contracts of employment; • provide for employment entitlements and other benefits; • provide for the protection of wages of employees; • provide for the registration of employment agencies; • regulate the employment of children and young persons; • provide for the welfare of employees at an undertaking; • provide for employment policies, procedures and codes in an undertaking; • repeal and replace the Employment Act 1965, the Employment (Special Provisions) Act 1966, the Employment of Young Persons and Children Act, 1933 and the Minimum Wages and Conditions of Employment Act, 1982, and; • provide for matters connected with, or incidental to, the foregoing.	**Relevance:** The Project will employ human resources for the satisfactory completion of the WWTP. The people employed have to be protected in terms of labour laws and job security and will have to realise their benefits at the end of the day. **Compliance:** The Employer will monitor that the Contractor abides by this act to protect the interests of the persons employed on the project. The employees should be given contracts that will stipulate the working conditions that the employees will be bound to.
Land Survey Act, (Amendment) 2021 (Part 2 Section 10 and 11 and Part 7 Section 38)	An Act to make further and more comprehensive provisionsfor the registration and licensing of land surveyors that provide for; • the manner in which land surveys shall be carried out anddiagrams and plans connected therewith shall be prepared; • the protection of survey beacons and other survey marks; • the establishment and powers ofa Survey Control Board which will be responsible for the registration and licensing of land surveyors and the exercise of disciplinary control over such surveyors, and; • matters incidental to and connected with the foregoing.	**Relevance:** engineering surveys in the proposed area for the new WWTP. **Compliance:** The Consultant will engage surveyors and involve the necessary authorities in the surveys.
The National HIV/AIDS/STI /TB Council Act of 2002	The Act provides for the establishment of the HIV/AIDS/STI/TB Council whose functions include the coordination and provision of support to the development, monitoring and evaluation of multi-sectorial response for the prevention and combating of the spread of HIV/AIDS/STI and TB in order to reduce the personal, social and economic impacts of HIV/AIDS/STIs and TB.	**Relevance:** Interactions between community members and construction workers might result in workers indulging in casual sexual acts resulting in the spread of HIV/AIDS, and STIs. **Compliance:** The Contractor will conduct HIV/AIDS awareness

		campaigns as well as distribute condoms among construction workers and project staff during the project implementation.
Energy Regulation Act, 2019 (Part III, IV and VI)	An Act to provide for the licensing of enterprises in the energy sector; continue the existence of the Energy Regulation Board and re-define its functions; re-constitute and revise the functions of the Board; repeal and replace the Energy Regulation Act, 1995; and provide for matters connected with, or incidental to, the foregoing	**Relevance:** The Project will involve the procurement and storage of fuels and lubricants and this will require obtaining authorization from the Energy Regulation Board (ERB). **Compliance: The Contractor on site** will need to obtain licenses from ERB for the storage of fuels and lubricants. The Project will further obtain guidance from ZEMA on the management of hydrocarbon-based fuels.
Forest Act of 2015 (Part IV, V and X)	An Act to provide for: • the establishment and declaration of National Forests, Local Forests, joint forest management areas, botanical reserves, private forests and community forests; • the participation of local communities, local authorities, traditional institutions, non-governmentalorganizations and other stakeholders in sustainable forest management; • the conservation and use of forests and trees for the sustainable management of forests ecosystems and biological diversity; • establishment of the Forest Development Fund; • the implementation of the United Nations Framework Convention on Climate Change, the Convention on International Trade in Endangered Species ofWild Flora and Fauna, the Convention on Wetlands of International Importance, especially as Water Fowl Habitat, the Convention on Biological Diversity, the Convention to Combat Desertification in those Countries experiencing Serious Drought and/or Desertification, particularly in Africa and any other relevant international agreement to which Zambia is a party; • repeal and replace the Forests Act, of 1999, and; • matters connected with, or incidental to, the foregoing.	**Relevance:** The construction, operation and decommissioning phase of the WWTP will involve excavation works that will result in the loss of vegetation cover including trees. Furthermore, the discharge of untreated sewer effluent is likely to impact forests and vegetation within the vicinity of thereceiving water bodies. These activities are likely to impact theecosystem including the flora and fauna. **Compliance:** The Consultant will ensure that the project footprint is kept to a minimum to reduce vegetation and forest losses. Ensuring the effluents are within ZEMA limits will further protect vegetation and forests in the receiving areas. During the construction phase, the Forest Department will be engaged should rare species or sensitive biodiversity areas beencountered.
Urban and Regional Planning Act of 2015 (Part II and III)	An Act to provide for; • development, planning and administration principles, standards and requirements for urban and regional planning processes and systems; • a framework for administering and managing urban andregional planning; • a planning framework,guidelines, systems and processes for urban and regional planning; establish a democratic, accountable, transparent,participatory and inclusive process for urban and regional planning that allows for the involvement of communities, the privatesector, interest groups and other stakeholders in the planning, implementation and operation of humansettlement development;	**Relevance**: This Act Prescribes the planning, use and zoning of land by constituted authorities, and its subsequent acquisitionfor development by the proponent. The WWTP will need app the roval of planners before construction proceeds. **Compliance**: The construction of the new WWTP and support infrastructure will be designed to fit into the urban and regional planning master plan for Lusaka.

	• ensure functional efficiency and socio-economic integration by providing for the integration of activities, uses and facilities; • establish procedures for integrated urban and regional planning in a devolved system of governance so as to ensure multi-sector cooperation, coordination and involvement of different levels of ministries, provincial administration, local authorities,traditional leaders and other stakeholders in urban and regional planning; • ensure sustainable urban and rural development by promoting environmental, social and economic sustainability in development initiatives and controls at all levels of urban and regional planning; • ensure uniformity of law and policy with respect to urban and regional planning; repeal the Town and Country Planning Act, 1962, and the Housing (Statutory and ImprovementAreas) Act, 1975, and; • matters connected with, orincidental to, the foregoing.	
The Local Government Act No. 2 of 2019 (Part II)	An Act to provide for: • an integrated three-tier local administration system; • to define the functions of local authorities; • to repeal the Local Administration Act and certain related laws, and; • matters connected with or incidental to the foregoing.	**Relevance:** The WWTP is under the jurisdiction of municipalities and councils that fall under the MLGH **Compliance**: The Consultant will continue to work closely with the municipalities and councils to ensure effective service delivery.
The Factories Act of 1994 (Part V, VI, VII, IX, X and XI)	An Act to make further and better provisions for: • the regulationof the conditions of employment in factories and other places as regards the safety, health and welfare of persons employed therein; • the safety, examination andinspection of certain plants and machinery, and; • purposes incidental to or connected with the matters aforesaid.	**Relevance:** The WWTP construction will involve the engagement of workers inplants and associated infrastructure. This will requirethat the health, safety and general welfare of personnel be apriority in areas of operation. **Compliance:** The Consultant will ensure the Contractor adheres to best practices with regard to the health, safety and general welfare of the workers and provided for in the factories act.
The Water Resources Management Act of 2011 (Part V, VII, VIII, IX and XII)	An Act to establish the Water Resources Management Authority and define its functions and powers; provide for: • themanagement, development, conservation, protection and preservation of the water resource and its ecosystems; • the equitable, reasonable and sustainable utilization of the water resource; • ensure the right to draw or take water for domestic and non-commercial purposes, and that the poor and vulnerable members of the society have an adequate and sustainable source of water free from anycharges; • create an enabling environment for adaptation to climate change;	**Relevance**: The WWTP operations will involve the discharge of effluent into rivers and water bodies. **Compliance:** the project will not include any water supply service.

	• the constitution, functions and composition of catchment councils, sub-catchment councilsand water users associations; • international and regional cooperation in, and equitable and sustainableutilization of, shared water resources; • the domestication and implementation of the basic principles and rules of international law relating to the environment andshared water resources as specified in the treaties, conventions and agreements to which Zambia is a State Party, and; • repeal and replace the Water Act, of 1949, and; matters connected with, or incidental to, the foregoing.	
Water Supply and Sanitation Act of 2005 (II, IV, V)	An Act to establish the National Water Supply and Sanitation Council and define its functions, to provide for: • the establishment, by local authorities, of water supply and sanitation utilities; • the efficient and sustainablesupply of water and sanitation services under the general regulation of the National Water Supply and Sanitation Council, and; • for matters connected with or incidental to the foregoing.	**Relevance**: The act requires that any water service provider supplying water to more than 500 persons has to be regulatedby NWASCO. If the service provider operates on a commercialbasis, NWASCO is concerned with the service level and waterquality. A utility or service provider may construct any facility within or outside its area for the provision of water supply andsanitation services. **Compliance:** The Project will ensure that it adheres to the service level standards as stipulated in the operatinglicense for LWSC on the provision of sanitation services.
Worker's Compensation Act (Part V, VI, VII, VIII, IX)	An Act to make provision for: • the establishment and administration of a Fund for the compensation of Workers disabled by accidents too, or diseases contracted by, such Workers in the course of their employment, and for the payment of compensation to dependants of Workers who die as a result of such accidents or diseases; • the paymentof contributions to such Fund by employers; • the grant of pensions and allowances to certain dependants of Workers who, being in receipt of pensions for such disablement, die from causes not connected with such accidents or diseases; • the appointment and powers of a Workers' Compensation Commissioner and the establishment and powers of a Workers' Compensation Board and an Appeal Tribunal, and; • matters incidental to and connected with the foregoing.	**Relevance:** During Project implementation and operations on the WWTP, incidences related to occupational risks are likely to occur. **Compliance:** Contractors and management will be required to subscribe to the compensation fund where relevant.
Public Health Act (Part III, IV, V, VII, IX, X, XI, XII and XIII)	An Act to provide for the prevention and suppression of diseases and generally to regulate all matters of public health in Zambia.	**Relevance:** The implementation of the WWTP will result in improved sanitation in residents and households across Lusaka. This will help reduce the public health risks associatedwith the management of sewers.

		Compliance: LWSC will adhere to the provision of the Public Health Act by ensuring that sewerage installation operates efficiently and the public health risks are reduced to the minimum.
Occupational Health and Safety Act of 2010 (Part IV)	An Act to establish the Occupational Health and Safety Institute and provide for its functions, and provide for: • the establishment of health and safety committees atworkplaces and for the health, safety and welfare of personsat work; provide for the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; provide for the protection of persons, other than persons at work, against risks to health or safety arising from,or in connection with, the activities of persons at work, and; • matters connected with, or incidental to, the foregoing.	**Relevance:** The Act provides for the safety and welfares of workers that shall be recruited through Contractorsand LWSC to work at the WWTP. The Act provides for theestablishment of safety committees and the protection of workersfrom any potential risks by the provision of Personal Protective Clothing (PPE). **Compliance**: The Consultant will comply with the provisions of this Act by ensuring that all workers are equipped with Personal Protection Equipment (PPE) and that safety and health awareness is carried out by the Contractors before project implementation.
Human Rights Commission Act of 1996	An Act to provide for: • the functions and powers of the HumanRights Commission; • its composition, and; • matters connected with or incidental to the foregoing.	**Relevance:** Access to clean water and provision of safe sanitation facilities add to improved quality of life and further foster the dignity of humanity. This is in line with the basic human rights for any society to develop and enjoy improved quality of life. **Compliance:** The Project taps into the vision of safeguarding the rights of residents in areas of LWSC operation.
Fisheries Act of 2011 (Part II, III and V)	An Act to provide for: • the appointment of the Director of Fisheries and fisheries officers and their powers and functions; • promote the sustainable development of fisheries and a precautionary approach in fisheries management, conservation, utilization and development; • establish fisheries management areas and fisheries management committees; • the regulation of commercial fishing and aquaculture; establish the Fisheries and Aquaculture Development Fund; • repeal and replace the Fisheries Act, 1974, and; • for matters connected with, or incidental to, the foregoing.	**Relevance:** The LSP envisages addressing issues relating to sanitation in areas within the jurisdiction of the LWSC operations. This will involve the provision of sewage treatment facilities and treatment plants. The abstraction of water by LWSC and release of effluent from/into water bodies, surface and groundwater is likely to affect water quality and composition that is likely to affect aquatic life including fisheries **Compliance:** Improved Sewerage infrastructure and effluent treatment will minimize possible contamination of surface/groundwater and receiving water bodies. By upgrading and improving wastewater treatment, the effluent that will be discharged into the open environment will be below ZEMAlimits for wastewater. This will ensure the aquatic

		ecosystem is protected and fish populations continue to flourish.
Explosives Act of 1995	An Act to make provision for regulating control over the manufacture, use, possession, storage, importation, exportation, transportation and destruction of explosives;and to provide for matters incidental thereto or connected therewith.	**Relevance:** The construction phase of the WWTP may involve the use of explosives during excavation to pave the way for theinstallation of sewerage systems and auxiliary facilities. **Compliance:** Should the need arise for the use of explosives during the construction phase on the WWTP site, the provisions as provided by the explosives act will be adhered to.
Disaster Management Act of 2010 (Part II, section 7)	An Act to establish and provide for: • the maintenance and operation of a system for the anticipation, preparedness, prevention, coordination, mitigation and management of disaster situations and the organization of relief and recoveryfrom disasters; • establish the National Disaster Management and Mitigation Unit and provide for its powers and functions; • the declaration of disasters; • establish the NationalDisaster Relief Trust Fund; • the responsibilities and involvement of the members of the public in disaster management, and; • for matters connected with, or incidental to, the foregoing.	**Relevance:** The Consultant will endeavour to install and operationalizesanitation infrastructure which is going to prevent occurrencesof disasters normally associated with poor sanitation, such as cholera. The Disaster Management and Mitigation Unit (DMMU) is the arm of the government that will respond to natural disasters should they occur in the areas in which LWSC operates. **Compliance:** The Consultant will use modern resilient materials in theconstruction of the infrastructure. The materials used will withstand incidences of pipe corrosion and bursting. LWSCwill notify DMMU should there be any incidences of such pipebursting that may pose harm to the environment.

2.10 Applicable Statutory Instruments

This section presents the applicable Statutory Instruments of Zambia.

Table 8 Statutory Instruments

Statutory Instrument	Interpretation	Relevance and Compliance on the Project
Environmental Management Act No 12, 2011 (Environmental Impact Assessment) Regulations, SI No. 28 of 1997	A developer shall not implement a project for which a project brief or an Environmental Impact Statement (EIS) is required under these Regulations, unless the project brief or an environmental impact assessment has been concluded in accordance with these Regulations and the Council has issued a decision letter.	**Relevance:** The activities to be undertaken during the construction, operational and decommissioning phases are likely to trigger E&S impacts that require an ESIA and associated ESMP to be prepared in accordance with the EIA regulations. The Project will further involve involuntary resettlement during the construction phase requiring that a RAP be prepared to address the interests of affected households. **Compliance:** This ESIA and associated ESMP, including the RAP will be prepared in accordance with the provisions of the EIA regulations as the project falls in the second schedule. The LSP will ensure that the impacts that are likely to arise during

Statutory Instrument	Interpretation	Relevance and Compliance on the Project
		the construction, operational and decommissioning phases of the project are managed in line with the ESMP.
Environmental Management (Licensing) Regulations, Statutory No.112 of 2013 part II; Air Pollution Control (Licensing of Emission or Contaminant into the Environment)	These regulations provide for the licensing of gaseous waste released to the environment and also provide for the statutory discharge limits for the respective parameters.	**Relevance:** During the construction phase of the project, dust will be generated, hence the necessity to comply with the provisions of this section. Volatile Organic Compounds (VOCs) will be released during the construction phase through the delivery of fuel to the tanks and vehicles working on the construction site. Dust will also be generated by the construction vehicles' movements. **Compliance:** During construction it will be ensured that the water is sprayed to suppress the dust and all the machinery during construction will be routinely serviced to avoid abnormal exhaust fumes emissions. The Contractor will also ensure that they put other strict measures as will be guided by the Environmental Management Plan to mitigate the effects of Air Pollution.
Environmental Management (Licensing) Regulations, Statutory No.112 of 2013 part III-Waste Management (Licensing of Transporters of waste to disposal sites)	These regulations provide for the licensing of solid non-hazardous waste transportation and operation of and owning of non-hazardous disposal sites.	**Relevance**: These regulations are relevant in that the proposed project will generate solid waste from the construction, operational and decommissioning phases. **Compliance:** All solid waste that will be generated during the preparation, construction, and operation and decommissioning of the Project will be governed and handled in accordance with the provision of this section by the Contractor. All provisions of this act will be followed and the Contractor shall employ a qualified candidate to handle all solid waste matters.

2.11 National Policies, Strategies and Plans

This section presents the relevant policies, strategies and plans of Zambia.

Table 9 National Policies Strategies and Plans

Description of Policy, strategy or Plan	Relevancy to the Project
The National Policy on Environment (NPE) is the principal policy that coordinates environmental management in Zambia. The NPE is designed to create a comprehensive framework for effective natural resource utilization and environmental conservation which will be sensitive to the demands of sustainable development. The specific objectives of the NPE are to: • Promote the sound protection and management of Zambia's environment and natural resources in their entirety, balancing the needs for social and economic development and environmental integrity to the maximum extent possible, while keeping adverse activities to the minimum; manage the environment by	The Consultant will endeavour to tap into the vision of the NPE by the provision of sanitation services and further enhancing environmental protection.

Description of Policy, strategy or Plan	Relevancy to the Project
linking together the activities, interests and perspectives of all groups, including the people, nongovernmental organizations (NGOs) and government at both the central and decentralized local levels; • Accelerate environmentally and economically sustainable growth in order to improve the health, sustainable livelihoods, income and living conditions of the poor majority with greater equity and self-reliance; • Ensure broadly-based environmental awareness and commitment to enforce environmental laws and to the promotion of environmental accountability; • Build individual and institutional capacity to sustain the environment; Regulate and enforce environmental laws; and Promote the development of sustainable industrial and commercial processes having full regard for environmental integrity.	
The National Water Policy (NWP) is the overarching policy framework for the water and sanitation sector in Zambia. The policy was developed and adopted by the GRZ in 1994, and subsequently updated in 2010. The NWP envisions "*to optimally harness water resources for the efficient and sustainable utilization of this natural resource to enhance economic productivity and reduce poverty*". In order to achieve the national goal of increasing accessibility to reliable safe water by all sectors of the economy the policy addresses two broad categories of water resources management and development. The major outcome of the policy is to improve the management of water resources, institutional coordination and defined roles and responsibilities. The policy encourages the use of water resources in an efficient and equitable manner consistent with the social, economic and environmental needs of present and future generations.	The Consultant will endeavour to tap into the vision of the NWP by the provision of sanitation services and further enhancing environmental protection.
The National Conservation Strategy (NCS) formulated in 1985 has been the main policy document on the Environment and Natural Resources in Zambia. The NCS was prepared by the Government to manage natural resources and the environment in the context of a centrally planned and controlled economy. The strategy's main goal is to: *"satisfy the basic needs of all the people of Zambia, both present and the future generations, through the wise management of natural resources"*. The strategy establishes policies and devises plans to fully integrate conservation into Zambia's social and economic development. It also aims to analyse trends and current issues to better anticipate problems and needs. The main objectives of the NCS are to: • Ensure the sustainable use of Zambia's renewable natural resources such as forests; • Maintain Zambia's biological diversity; and • Maintain essential ecological processes and life support systems in Zambia. The NCS triggered the enactment in 1990 of the Environmental Protection and Pollution Control Act (EPPCA), which is essential in the effluent discharge compliances for the subprojects.	The Consultant will endeavour to ensure sustainable use of resources by ensuring that the newly constructed WWTPs cater to both present and future generations without causing harm to the environment. During operation, LWSC shall ensure that effluent discharged into the receiving streams comply with ZEMA standards with the view of conserving the environment and sustaining the ecological process in the receiving environment.

Description of Policy, strategy or Plan	Relevancy to the Project
The focus of the National Environmental Action Plan (NEAP) of 1994 is to identify environmental problems and issues, analyse their causes, and recommend necessary interventions. The NEAP was prepared as a comprehensive plan to contain the ever-increasing environmental degradation in Zambia. The preparation of NEAP was a result of Government's desire to update the NCS for the following reasons: • The economy was undergoing a period of liberalization; • The main NCS recommendations had been implemented; • The technical information in the NCS needed updating, and; • There was a requirement by World Bank for a NEAP as a prerequisite for International Development Association (IDA) loan funding. The NEAP is founded on three fundamental principles: The right of citizens to a clean and healthy environment; Local community and private sector participation.	The PEA shall comply with national environmental action plans on the management of the environment by identifying priority areas for installation of sewers so as to prevent ground and surface water pollution.
In May 1993 Zambia ratified the Convention on Biological Diversity and as part of the commitment to fulfil its objectives Zambia developed the National Biological Diversity Strategy and Action Plan (NBSAP), which was finalized in 1998. The main goals of the NBSAP are to: • Ensure the conservation of the full range of Zambia's natural ecosystems through a network of protected areas; • Conserve the genetic diversity of Zambia's crops and livestock; • Improve the legal and institutional framework and human resources to implement the strategies for conservation, sustainable use and equitable sharing of benefits from biodiversity management; • Sustainable management and use of Zambia's biological resources, and; • Develop an appropriate legal framework and the needed human resources to minimize the risks of the use of genetically modified organisms. The subproject safeguards documents will ensure that the objectives of this policy are mainstreamed into the subproject environment management processes.	The PEA shall ensure that all living organisms both aquatic and terrestrial are conserved by ensuring the conservation of ecosystem during the implementation of the Project. The WWTP safeguards documents will ensure that the objectives of this policy are mainstreamed into project implementation.
The mission statement of the forestry sector is to ensure sustainable flow of wood and non-wood forest products and services while at the same time ensuring protection and maintenance of biodiversity for the benefit of the present and future generations. The Policy is based on the following principles: • Ensure sustainable forest resources management; • Develop capacity of stakeholders in sustainable forest resources management and utilization; • Promote a participatory approach to forest development by developing close partnership among stakeholders; • Facilitate private sector involvement in forestry development;	The construction, operational and decommissioning phase on the WWTP will involve excavation works that will result in the loss of vegetation cover including trees. Furthermore, the discharge of treated sewer effluent is likely to impact forests and vegetation within the vicinity of the receiving water bodies. These activities are likely to impact the ecosystem including the flora and fauna

Description of Policy, strategy or Plan	Relevancy to the Project
• Promote equitable participation by women, men and children in forestry development, and; • Adopt an integrated approach, through intra and inter-sectoral coordination in forestry sector development. While there are no forests within the project areas, the implementation of the subprojects will ensure maximum conservation of vegetation within the project areas.	
National HIV/AIDS Strategic Framework: The National HIV and AIDS Strategic Framework (NASF) 2006-2010 was built on the process of joint annual reviews and a broad consultative process with the cooperating partners. The management intent of the NASF is to: • Support coordinated, prioritized and knowledge-based scale up of the response; • Facilitate broad ownership of the response by all partners and practical partnerships for the implementation of the response; • Represent joint strategic direction of all Partners; • Enable the involvement of key sectors and decentralized levels in all stages of the process; • Guide resource management at the strategic level. The six themes of the NASF represent the cooperating partners' priority action areas and include: • Intensifying efforts for prevention of HIV; • Expanding treatment, care and support for people affected by HIV and AIDS; • Mitigating the socioeconomic impact of HIV and AIDS; • Strengthening the decentralized response and mainstreaming HIV and AIDS; • Improving the monitoring of the multi-sectoral response, and; • Integrating advocacy and coordination of the multi-sectoral response.	The Consultant shall ensure the Contractor provides adequate HIV/AIDS awareness in the project areas by ensuring broad consultative process with affected communities in the Project corridor and provision of condoms through work station

2.12 National permitting requirements

More generally, the following permits and licenses were identified as potentially required for the investments:

Table 10 Permit requirements

No.	Permit / License	Process Time (max.)	Competent Authority
1	Environmental permit (and separate approval/requirement on soil stripping/re-cultivation plan)	15 days: screening decision if the project is subject to environmental decision 30 days: scoping decision 55 days: environmental decision (⇨after selection of projects and concepts)	ZEMA
2	Planning Permission	90 days	Lusaka City Council / Chongwe Municipal Council
3	Building permit (and clearance from utilities)	90 days (⇨after approval of detailed design)	Local Municipal Authorities (LCC & CMC)

No.	Permit / License	Process Time (max.)	Competent Authority
4	Discharge permit	30 days (⇨after detailed design)	ZEMA
5	Groundwater abstraction permit	n/a the permitting procedure starts after the tendering process for the construction company	Water Resources Management Authority (WARMA)
6	Cultural heritage clearance	Contact required is artifacts discovered during ground clearance and excavation	National Heritage Conservation Commission
7	Water and Sewerage Connection application	30 days (⇨before start of operation)	LWSC
8	Registration of Construction Contractor	After signing of works contract	National Council for Construction
9	Registration of Project	After signing of works contract	National Council for Construction

2.13 International Regulations and Environmental and Social Standards (ESS)

Irrespective of the national ESIA process, an international ESIA is required by EIB, corresponding to EIB ESS (European Investment Bank, 2018), which are listed in this chapter. All project activities have to comply with the following standards and guidelines used by EIB an KfW, in addition to the relevant host country laws and regulations:

- The EIB E&S Standards and Principles Sustainability Guideline (2018) (European Union, 2011);
- The KfW Sustainability Guideline (2022) (KfW Development Bank, 2022);
- IFC WB Group's General Environmental, Health and Safety (EHS) Guidelines (2007) (World Bank Group, 2007);
- Industry Specific Guidelines, as applicable, in particular IFC WB Group's Environmental, Health and Safety Guidelines for Water and Sanitation (World Bank Group, 2007).

2.13.1 European Investment Bank – Environmental and Social Standards (EIB ESS)

The EIB Group Environmental and Social Sustainability Framework is an overarching policy framework that allows the Group to focus on sustainable and inclusive development, committing to a just and fair transition and supporting the transition to economies and communities that are climate and disaster resilient, low carbon, environmentally sound and more resource efficient.

It consists of a Group-wide Environmental and Social Policy and a set of EIB ESS which describe the requirements that all EIB-financed projects must meet.

The following EIB ESS are applicable for the project.

Table 11 Applicable EIB ESS

No.	EIB ESS	Applicability	How is being triggered
1	Assessment and management of environmental and social impacts and risks	Yes	The general development of the ESIA address this aspect from an holistic perspective.
2	Pollution Prevention and Abatement	Yes	Conducting a comprehensive assessment of potential pollution sources and their impacts. Developing and implementing pollution prevention measures, such as using cleaner technologies and practices, waste management systems, and pollution control equipment. Monitoring and regularly report on pollution levels to ensure compliance with relevant regulations and standards.

No.	EIB ESS	Applicability	How is being triggered
3	EIB Standards on Biodiversity and Ecosystems [9]	Yes	Identifying and assessing the potential impacts of the project on biodiversity and ecosystems. Implementing measures to conserve and restore biodiversity and ecosystems, such as areas restoration and reforestation.
4	EIB Climate Related Standards	Yes	Conducting a the impact assessment, which includes the climate risk assessment to identify potential climate-related impacts on the project. Implementing measures to reduce greenhouse gas emissions, such as energy efficiency improvements and renewable energy integration in the project design.
5	Cultural Heritage	Yes	Identifying potential impacts of the project on cultural heritage sites, artifacts, and/or traditions. Including in the ESMP measures to avoid, minimize, and mitigate adverse impacts.
6	Involuntary Resettlement	Yes	Developing a resettlement action plan that includes measures to minimize displacement, provide adequate compensation and livelihood restoration, and ensure the participation and consultation of affected communities.
7	Rights and Interests of Vulnerable Groups	Yes	Identifying potential impacts of the project on vulnerable groups, such as women, children, and persons with disabilities. Formulating measures to protect and promote the rights and interests of these vulnerable groups. And implementing measures to ensure their meaningful participation.
8	Labour Standards	Yes	Identifying potential impacts on workers' rights, health, and safety. Developing measures to ensure compliance with labor standards, fair employment practices. Defining strategies to monitor and report on labor conditions to ensure compliance with relevant standards and regulations.
9	Occupational Health Safety and Security	Yes	Developing guidelines to require contractors measures to prevent accidents, provide training and protective equipment, and ensure emergency preparedness. Also the regularly monitor of the safe working environment.
10	Stakeholder Engagement	Yes	Developing a stakeholder engagement plan (SEP) that includes strategies to identify, consult, and involve relevant stakeholders throughout the ESIA process. Conducting meaningful and inclusive consultations, public hearings, and information disclosure to ensure transparency and accountability. Addressing stakeholder concerns and grievances through effective grievance mechanisms and dispute resolution processes.

Hence, the project triggers the applicability of EIB ESS and simultaneously this have enhanced the whole managing process of the project at an strategic level, since they require to develop and implement an environmental and social management system, as a dynamic, adaptive, and continuous process, initiated and supported by the promoter's senior management, while fostering meaningful communication and dialogue between the promoter, its workforce, local communities and, where appropriate, other stakeholders.

[9] It shall be mentioned that this ESS is positively triggered as the quality of the treated wastewater will be improved with the Project, hence improving the water river quality and biodiversity of the receiving water body.

Also, the engagement aspect for the EIB ESS results relevant, ensuring that stakeholders are appropriately engaged with environmental and social issues that could potentially affect them, applying the principles of prior, informed and free engagement and informed participation. Hence, factors such as literacy, unequal gender relations and access to dissemination media constitute key factor to be carefully addressed in all approaches to stakeholders. This should be developed after an appropriate stakeholder identification and analysis, paying particular attention to the presence of vulnerable individuals and groups in prthe oject´s area of influence. Likewise, the project should be properly responsive to stakeholders' concerns related to the project in a timely manner, by implementing suitable Grievance Mechanisms. All the previous must be adequately structured in a coherent and effective Stakeholder Engagement Plan.

As detailed in the Project Description section of this study, there are some communities that currently are using the area of intervention of the current project. Therefore, to properly manage social impacts that might bring about the displacement of these communities, the EIB ESS require to develop and implement a Resettlement Action Plan (RAP). According to standards, any eviction which is exceptionally required should be carried out lawfully, with respect to the rights to life, dignity, liberty and security of those affected; and ensure that resettlement measures are designed and implemented through informed and meaningful consultation and participation of the project-affected people. Vulnerable groups are relevant to the standards for these processes, requiring special assistance and fostering their participation should be vigilant.

EIB ESS deliver strategic guidelines for an adequate assessment of the environmental and social impacts and risks, considering not only the protection of the environment but also human well-being. In this sense, the assessment of environmental and social impacts and that risks might be caused by the construction and operation of the WWTP should include their significance and materiality. Whereof, subsequent development of suitable environmental management plans and programmes as a function of the identified impacts and risks achieved lead to sound environmental and social performance.

Accordingly, the EIB ESS promote pollution prevention, energy and resource efficiency. In this regard, the environmental components such atmosphere, water and soil result significant for the standards. And specific aspects of the project such as the handling of wastes generated by the WWTP, are required by the EIB ESSS to be prioritized considering reducing, recycling or reusing over the disposal in landfills; by means of the safe management of materials so as to minimise the adverse effects on human health and the environment, following a strict control. In general, the standards enhance pollution prevention strategies, requiring the project to implement processes to ensure that all emissions are monitored on a regular basis, including regular maintenance. Also, the constant communication of the monitoring emission results shall be properly implemented by the promoter transparently crosswise to the environmental management system.

2.13.2 KfW Sustainability Guideline

Internationally, the KfW Sustainability Guideline (2022) (KfW Development Bank, 2022) set high standards requiring the projects and stakeholders involved to comply with certain sustainable principles. The guideline implies consistency with international environmental, social, health, safety and labour standards.

In terms of public participation, the guideline stipulates that an important element of the ESIA planning and decision-making process is to involve the communities concerned and keep the public informed.

Moreover, it is crucial to use appropriate media channels to provide the affected communities, and as the case may be the general public, with comprehensive information at all phases of the project. This information shall be provided by the LWSC Public Relations office in a timely and culturally suitable manner. Interested parties in a climate change assessment (e.g. those affected, the public) should also be involved in relevant cases.

Due to the COVID-19 pandemic and the presidential elections in 2021, public participation had to be carried out by conducting the scoping workshop through advertisements, radio phone-ins, as well as carrying out several low-key community interviews.

2.13.3 World Bank (WB) Environmental and Social Framework and International Financing Corporation (IFC) Health and Safety (EHS) Guidelines

The World Bank's Environmental and Social Framework (World Bank Group, 2017) is a set of Environmental and Social Standards (WB ESS) for the identification and assessment of environmental and social risks and impacts associated with projects which adopt these standards. Their application aims to the identification and management of environmental and social risks when seeking the goal to reduce poverty and increase prosperity in a sustainable manner for the benefit of the environment and their citizens.

Table 12 Applicable WB ESS

No.	WB ESS	Applicability	How is being triggered
1	Assessment and Management of Environmental and Social Risks and Impacts	Yes	The ESIA process address component.
2	Labor and Working Conditions	Yes	Identifying potential impacts on workers' rights, health, and safety; developing measures to ensure compliance with labor standards, and fair employment practices; and defining strategies to monitor and report on labor conditions to ensure compliance with relevant standards and regulations.
3	Resource Efficiency and Pollution Prevention and Management	Yes	The construction and operation phases are likely to consume resources and generate potential solution pollution. Hence this component is triggered when conducting a comprehensive assessment of potential pollution sources and their impacts. Developing and implementing pollution prevention measures, such as using cleaner technologies and practices, waste management systems, and pollution control strategies within the ESMP. Monitoring and regularly reporting on pollution levels to ensure compliance with relevant regulations and standards.
4	Community Health and Safety	Yes	Developing procedures for contractors so as to implement measures to avoid or reduce community risks from project execution and ensure emergency preparedness should a situation occur.
5	Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Yes	Developing a resettlement action plan that includes measures to minimize displacement, provide adequate compensation and livelihood restoration, and ensure the participation and consultation of affected communities.
6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes	Evaluating and analyzing the possible effects of the project on biodiversity and natural habitats. Enforcing strategies to protect the ecosystems, such as restoring and replanting areas within the ESPM´s measures, and reviewing the progress reports throughout the project's execution.
7	Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	No	Not triggered.
8	Cultural Heritage	Yes	Assessing the potential effects of the project on cultural heritage sites such as graves, and/or traditions and incorporating measures within the mitigation measures to prevent, reduce, and address any negative impacts.
9	Financial Intermediaries	No	Not triggered.
10	Stakeholder Engagement and Information Disclosure	Yes	Creating a comprehensive stakeholder engagement plan (SEP) that incorporates tactics for identifying, consulting, and

No.	WB ESS	Applicability	How is being triggered
			involving relevant stakeholders at every stage of the ESIA process. Facilitating meaningful and inclusive consultations, public hearings, and the transparent disclosure of information to ensure transparency and accountability. Resolving stakeholder concerns and grievances through efficient grievance mechanisms and dispute resolution procedures.

As a member of the World Bank Group, the International Financing Corporation also defines the Environmental, Health and Safety Guidelines (EHS Guidelines) as technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) which are referred to in the WB's Environmental and Social Framework (World Bank Group, 2017) and in IFC's Performance Standards (International Finance Corporation - World Bank Group, 2012).

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the WB Group, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology.

The following WB EHS guidelines are applicable to the project.

Table 13 Applicable WB EHS Guidelines

No.	WB EHS	Applicability
1. Environmental		
1.1	Air Emissions and Ambient Air Quality	Yes
1.2	Energy Conservation	Yes
1.3	Wastewater and Ambien Quality	Yes
1.4	Water Conservation	Yes
1.5	Hazardous Materials Management	No
1.6	Waste Management	Yes
1.7	Noise	Yes
1.8	Contaminated Land	Yes
2. Occupational Health and Safety		
2.1	General Facility Design and Operation	Yes
2.2	Communication and Training	Yes
2.3	Physical Hazards	Yes
2.4	Chemical Hazards	No
2.5	Biological Hazards	Yes
2.6	Radiological Hazards	No
2.7	Personal Protective Equipment	Yes
2.8	Special Hazard Environments	No
2.9	Monitoring	Yes
3. Community Health and Safety		
3.1	Water Quality and Availability	Yes
3.2	Structural Safety of Project Infrastructure	Yes
3.3	Life and Fires Safety	Yes

No.	WB EHS	Applicability
1. Environmental		
3.4	Traffic Safety	Yes
3.5	Transport of Hazardous Materials	No
3.6	Disease Prevention	Yes
3.7	Emergency Preparedness and Response	Yes
4. Decommissioning		
4.1	Environment	Yes
4.2	Occupational Health and Safety	Yes
4.3	Community Health and Safety	Yes

2.13.4 Core Labor Standard (CLS) of the International Labor Organization (ILO)

The International Labor Organization (ILO) is a tripartite organization consisting of trade unions, governments and companies, and is part of the UN system. In 1998, the ILO produced the Declaration on Fundamental Principles and Rights at Work. In the Declaration, ILO member states agreed that they should all respect, promote, and realize **Core Labor Standards (CLS)** (whether or not they have ratified them).

The CLS consists of four standards, laid out in eight conventions:

- Freedom of association and the effective recognition of the right to collective bargaining (Convention No. 87 & No. 98).
- The elimination of all forms of forced and compulsory labour (Convention No. 29 & No. 105).
- The effective abolition of child labour (Convention No. 138 & No. 182).
- The elimination of discrimination in respect of employment and occupation (Convention No. 100 & No. 111).

Today all IFI including the EIB have fully adopted CLS in their activities.

2.14 International Agreements and Conventions

2.14.1 Convention on Biological Diversity

The major aim of the CBD is to effect international cooperation in the conservation of biological diversity and to promote sustainable use of natural resources worldwide. It also aims at bringing about sharing of the benefits arising from the utilization of natural resources. A number of plans in this convention fall under the Departments of Agriculture, Forestry, Fisheries and ZAWA.

2.14.2 Ramsar Convention

The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The general objective of the Ramsar Convention is to curtail the loss of wetlands and to promote the wise use of all wetlands. The convention addresses one of the most important issues in Southern Africa, namely the conservation of water supplies and the use of the natural and human environments in a responsible manner for intergenerational benefit.

2.14.3 United Nations Framework Convention on Climate Change (UNFCCC)

The ultimate objective of the Convention is to stabilize Greenhouse Gas (GHG) concentrations “at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system." It states that “such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."

The Convention was signed by Zambia in 1992. The main objective is to achieve stabilization of GHG in the atmosphere. Zambia recognizes that the largest source of carbon dioxide is from burning wood fuel and the use of coal and oil.

2.15 Gap Analysis

The gap analysis between the national legislative framework and the international requirement has the objective to define specific topics where stricter requirements and limit values need to be applied:

- For environmental issues, this means that if the international framework is stricter in limit values than the national framework, the international standards need to be adopted.
- For resettlement issues, the safeguards, which are more beneficial to Affected Persons need to be applied, even if this goes beyond the national requirements. A clear and specific agreement between development partners needs to be fixed on how to bridge the gaps.

If some Zambian standards are more stringent than EIB ESS and if they should jeopardize the sustainability of the investments (limited O&M resources), then the Consultant will raise this issue accordingly to the LWSC and the relevant Authorities. This is the case, for example, with the stricter ZEMA effluent standards than the EU for some parameters. The aspect of the effluent discharge standards is described in section 2.16. The EIB ESS, WB ESS, and WB EHS, applicable to the project and the gap analysis between them and the Zambian legislation are described in the table below.

Table 14 Gap Analysis EIB ESS and Zambian Legislation

Issue	EIB ESS	WB ESS	WB EHS	Provision of Zambian legislation	Identified gaps	Measures to bridge the gaps
Environmental Impact Assessment	**1. Assessment and Management of Environmental and Social Impacts and Risks** An ESIA needs to be prepared according to EIB ESS standards.	**1. Assessment and Management of Environmental and Social Risks and Impacts (ESS1)** An ESIA should be developed to assess the environmental and social risks and impacts of a project throughout the project life cycle	The General Approach to the Management of EHS Issues at the Facility or Project Level defines Prioritizing risk management strategies with the objective of achieving an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and/or significant impacts.	**Environmental Management Act No 12, of 2011** ESIA needs to be prepared on a decision by ZEMA (approval of Terms of Reference - ToR).	No gaps.	Commensurate ESIA and ESMP are being prepared considering both EIB ESS and WB ESS guidelines; embracing WB EHS-specific definitions and meeting ToR approved by ZEMA
Prevention of Pollution	**2. Pollution Prevention and Abatement** These are key pillars of EU environmental policy. All EIB-financed operations should comply with local regulations; but when the EU standards are the most restrictive, the EU regulations should be embraced	**3. Resource Efficiency and Pollution Prevention and Management (ESS3)** WB ESS3 Promotes avoiding or minimizing pollution from project activities and the sustainable use of resources, including energy, water, and raw materials.	All its recommendations favor strategies that eliminate the cause of the hazard at its source, for example, by selecting less hazardous materials or processes. And when avoidance is not feasible, suggest engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences.	**Environmental Protection and Pollution Control Act No. 13 of 1994** An Act to provide for the protection of the environment and the control of pollution	In general, all guidelines have the same target. Both EIB ESS and WB ESS emphasizes on avoid the release of pollutants and when avoidance is not feasible, they foster minimize and control the concentration and mass flow by means of performance levels and proper measures. Also WB ESS proposes the efficient consumption of energy, water, and raw materials, as well as other resources.	Both EIB ESS and WB ESS have been applied for assessing environmental impacts and formulating management measures. Regarding the effluent discharge, the following standards analysis is presented in section 2.16. For the sludge reuse standards, an agreement on which standards to follow will have to be agreed upon between the financiers and the Client. With regards to noise levels, it has been considered not to exceed 55dB from 07:00 to 22:00 and 45 dB from 22:00 to 07:00 for the residential areas. And with respect to land contamination-specific considerations, the World Bank guidelines are being followed.
			1.1 Air Emissions and Ambient Air Quality This guideline applies to facilities or projects that generate emissions into the air at any stage of the project life cycle.	Environmental Management (Licensing) Regulations, Statutory No. 112 of 2013 part II; Water and Air Pollution Control (Licensing of Emission or Contaminant into the Environment).	Regarding air quality, there are no significant gaps.	
			1.3 Wastewater and Ambient Water Quality This guideline applies to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations, or stormwater to the environment. Effluent Standards are explained in section 2.16. Only the EU effluent discharge standards have been considered in the comparison.	**Environmental Management Act No12 of 2011** Criteria for the classification of effluent and wastewater shall be as prescribed in the second schedule of the Local Government Act attached in Annex 9 - ZEMA Effluent Standards: Effluent Standards are explained in section 2.16. There are no national standards for sludge reuse	Concerning wastewater and ambient water quality, a comprehensive comparison is presented in section 2.16.	
			1.4 Water Conservation Water conservation programs should be implemented commensurate with the magnitude and cost of water use.	**The Water Resources Management Act of 2011.** The National Water Policy	All these guidelines seek the conservation of water resources. The key issue is the “sustainable” use of water resources and all recommend the recirculation of water being used for project purposes.	
			1.6 Waste Management These guidelines apply to projects that generate, store, or handle any quantity of waste across a range of industry sectors. It is not intended to apply to projects or facilities where the primary business is the collection, transportation, treatment, or disposal of wastes. Specific guidance for these	Environmental Management Act No 12 of 2011	There are no gaps.	

Issue	EIB ESS	WB ESS	WB EHS	Provision of Zambian legislation	Identified gaps	Measures to bridge the gaps
			types of facilities is presented in the EHS Guidelines for Waste Management Facilities.			
			1.7 Noise	**Environmental Protection and Pollution Control Act No. 12 of 1990 Part VIII (Noise)**	Both WB EHS and Zambian legislation address noise prevention and mitigation.	
			1.8 Contamination of Land	**Environmental Protection and Pollution Control Act No. 12 of 1990**	The WB ESHS guidelines give detailed risk management strategies for contaminated land.	
Protection of Biodiversity	**3. Biodiversity and Ecosystems** Promotes maintaining the integrity of areas important for biodiversity as well as the natural functions, processes, and resilience of ecosystems, with the aim of achieving no net loss or a net gain of biodiversity and ecosystem	**6. Biodiversity conservation and sustainable management of living natural resources (ESS6)** Fosters the conservation of biodiversity and habitats, the sustainable management of living natural resources and suitable practices that integrate conservation needs and development priorities.	No specific provisions.	**Zambia Wildlife Act of 2015** The Forestry Act of 2015 National Biodiversity Strategy and Action Plan	There are no significant gaps among all the guidelines, in general ecosystems and biodiversity should be conserved maintaining a balance with the needs and development priorities.	Comply with all.
Climate change	**4. Climate-Related Standards** Requires that is aligned with EU climate policy.	**3. Resource Efficiency and Pollution Prevention and Management (ESS3)** Focuses on avoiding and/or minimizing project-related emissions of short- and long-lived climate pollutants.	Provides general recommendations for the reduction and monitoring of projects that potentially generate Greenhouse Gases (GHG).	**National Policy on Climate Change** The Zambia National Policy on Climate Change is a cross-sectoral policy enacted in 2016, whose overall objective is to provide a framework for coordinating climate change programmes in order to ensure climate resilient and low carbon development pathways for sustainable development towards the attainment of Zambia's Vision 2020.	No gaps considering the specific conditions of the project.	Follow all standards in mitigating emissions that might have effects of climate change.
Culture and Heritage	**5. Cultural Heritage** The EIB recognises the significance of cultural heritage as part of individual and collective identity, and its central role in supporting the objectives of sustainable development and the promotion of cultural diversity.	8. Cultural Heritage Requires the protection of cultural heritage from adverse impact and suggests it is an integral aspect of sustainable development.	No specific provisions.	National Heritage Conservation Commission Act of 1989.	All guidelines seek the preservation of heritage and culture.	All guidelines have been embraced.
Resettlement and Compensation	**6. Involuntary Resettlement** Projects often necessitate land acquisition, expropriation and/or restrictions on land use, resulting in the temporary or permanent resettlement of people from their original places of residence or their economically affected persons and communities do not have the choice to refuse such displacement, this process is known as involuntary resettlement.	**5. Land acquisition, restrictions on land use and involuntary resettlement (ESS5)** When projects cause involuntary resettlement, require to prove timely compensation for loss of assets at replacement cost and assist displaced persons in their efforts to improve, or at least restore their livelihoods and living standards.	No specific provisions.	**Zambia National Resettlement Policy**	The EIB standards give consideration to people who do not formally own the piece of land or property while the Zambian guidelines require proof of ownership for the compensation to be fully effected. Both EIB ESS and WB ESS reckon the economic displacement as a form of involuntary resettlement, requiring to implementation of a RAP. However, WB ESS require projects to prepare an additional plan when economic displacement is caused, setting additional measures relating to livelihood restoration. And both standards take into consideration minorities and other vulnerable groups	Both international guidelines are being followed and squatters will be assisted in resettling by means of a RAP. And the WB ESS are been adopted with regard to the development of an additional plan for addressing additional measures related to livelihood restoration.

Issue	EIB ESS	WB ESS	WB EHS	Provision of Zambian legislation	Identified gaps	Measures to bridge the gaps
					requesting them to be effectively consulted and how their views are taken into account.	
Rights and Interests of vulnerable groups	**7. Rights and Interests of Vulnerable Groups** Some individuals or groups may be less resilient to the risk and adverse impacts than others. Within the context of EIB operations, individuals and/or groups who are at a higher risk of being unable to anticipate, cope with, resist and recover from project-related risks and/or adverse impacts are considered vulnerable. Vulnerable individuals or groups may include women, children, the elderly, the poor, ethnic, religious, cultural, or linguistic minorities or indigenous groups.	**1. Assessment and Management of Environmental and Social Risks and Impacts (ESS1)** Requires to adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable so that they are not disadvantaged in sharing development benefits and opportunities resulting from the project.		**Human Rights Commission Act of 1996** An Act to provide for the functions and powers of the HumanRights Commission; to provide for its composition and to provide for matters connected with or incidental to theforegoing.	Standard 7 is specifically for people deemed vulnerable to risks and impacts of the project while the human rights commission protects the rights of all people affected by the project.	Considering that the EIB ESS define a specific chapter to promote equal rights and no discrimination and protection for the vulnerable groups in society, these are being specifically followed, also having into consideration both the Zambian legislation and the WB ESS.
Labour Rights and Protection	**8. Labour Standards** The workforce is a valuable asset for any company. Sound management of human resources and worker relations is key to sustainable business practices.	**2. Labor and Working Conditions (ESS2)** Fosters the fair treatment, non-discrimination, and equal opportunity of project workers	No specific provisions.	**The Employment Code Act of 2019.**	All guidelines promote good management of the human resource in line with their rights at their respective places of work.	Both international standards and the Zambian legislation have been adopted by fostering fair and equal treatment of workers on site.
Health and Safety of employees and the community	**9. Occupational and Public Health, Safety and Security** Embraces ILO's Guidelines on occupational safety and health management systems, the OSH Framework Directive as well as the UN Guidelines on Business and Human Rights. Stresses the employers' duty of care towards project workers and society, in safeguarding occupational and public health, safety and wellbeing within the area of influence of their operations and at associated facilities.	**2. Labor and Working Conditions (ESS2)** Promotes safety and health at work. **4. Community Health and Safety (ESS4)** Promotes safety and health at work and anticipates and avoids adverse impacts on the health and safety of project-affected communities during the project life cycle, such as minimize community exposure to project-related traffic and road safety risks,	**2. Occupational Health and Safety guidelines.** **2.1 General Facility Design and Operation** **2.2 Communication and Training** **Provisions should be made to** **2.3 Physical Hazards** **2.7 Personal Protective Equipment (PPE)** **2.9 Monitoring** **3.1 Water Quality and Availability** **3.6 Disease Prevention** **3.7 Emergency Preparedness and Response**	**Occupational Health and Safety Act of 2010** **Factories Act** **Water Resource Management Act of 2011** **The Public Health Act of 1995** An Act to provide for the prevention and suppression of diseases and generally to regulate all matters connected with public health in Zambia **Disaster Management Act No. 13 of 2010**	There are no gaps between all these guidelines. All of these guidelines require the safety and health of workers as a top priority. Both the National and International guidelines emphasize safety in the design and makeup of the worker's workplace. All have provisions for conducting training for the workforce. No significant gaps between these guidelines have been identified. All guidelines emphasize the issue of emergency preparedness.	All guidelines together are being followed. All guidelines have been followed. Water quality and quantity for the community will be improved by the project and consequently embrace all guidelines. Disease prevention is being defined as a priority for the project so all guidelines together will be followed.
Public Participation	**10. Stakeholder Engagement** Promotes the right to access to information, as well as public consultation and participation; the right to access to remedy, including through grievance resolution.	**10. Stakeholder Engagement and Information Disclosure (ESS10)** Requests to build and maintain a constructive relationship with stakeholders by means of effective and inclusive engagement.	No specific provisions.	**Environmental Management Act No. 12**	There are no significant gaps between these guidelines	All guidelines have been embraced with the development of a stakeholder engagement Plan

2.16 WWTP Effluent Discharge Standards

The effluent standards for disposal of treated effluent into water bodies have been specified in the Environmental Management Regulations SI 112 issued by the Zambian government in 2013. According to the 3rd schedule (regulation 7 (2)) of this document, the effluent limits for the basic pollutants have been specified as per Table 15.

The EU effluent standards for WWTPs are set in the Urban Wastewater Treatment Directive (91/271/EEC) (European Union, 1991). It must be noted that the EU requirement, besides quality requirements, also set requirements for the type of sampling and sampling frequency, as well as defining the compliance criteria.

Table 15 ZEMA and EU effluent discharge standards

Parameter	Units	ZEMA	EU Standards
Chemical Oxygen demand COD	mg/l	90	125
Biological Oxygen demand BOD	mg/l	50	25
Suspended Solids, SS	mg/l	100	35
Ammoniac nitrogen N-NH4	mg/l	7.8[a]	
Nitrate and Nitrite Nitrogen N-NOx	mg/l	11.3[b]	
Total Nitrogen, TN	mg/l	-	10[d]
Total Phosphorus, TP	mg/l	2[c]	1[d]
Dissolved oxygen	mg/l	5	

a. The effluent concentration of 10mg NH_3 /l equals to a ammoniacal -nitrogen effluent concentration of 7.8 mg/l.
b. The effluent concentration of 50mg NO_3 /l equals a nitrate-nitrogen effluent concentration of 11.3 mg/l.
c. The effluent concentration of 6mg PO_4/l equals a phosphorus effluent concentration of 2 mg/l.
d. discharges from urban wastewater treatment plants to sensitive areas which are subject to eutrophication.

Since the beginning of the Consultancy, discussions were held between ZEMA, LWSC, donors and the Consultant regarding the effluent discharge standards to be applied. Following the concerns from the donors regarding the implementation of WWTPs for full nutrient removal, it was proposed that the FD and bidding documents will include options for a phased implementation of ZEMA effluent discharge standards.

The FD and bidding documents will now include a base option for 2030 (A1) which includes carbon removal and nitrification only (as proposed in the FS) and an 'Advanced option' for 2030 (A2) for full treatment which will include denitrification and removal of Nitrogen and Phosphorous. Phase B for 2045 considers only full nutrient removal.

Since the requirement from ZEMA for COD of 90 mg/l is rather strict, while ZEMA requirements for BOD and suspended solids (50 and 100 mg/l respectively) are much more relaxed, the BOD and SS effluent requirements proposed are the ones specified in EU regulations, so effluent concentrations of 25mg/l and 35mg/l are adopted for BOD and SS.

Given the phasing of the Project, the design effluent requirements for the main pollutants are summarized in the following table:

Table 16 Design effluent standards

Parameter	Units	Phase A1	Phase A2	Phase B
Chemical Oxygen demand COD	mg/l	90	90	90
Biological Oxygen demand BOD	mg/l	25	25	25

Parameter	Units	Phase A1	Phase A2	Phase B
Suspended Solids, SS	mg/l	35	35	35
Ammoniac nitrogen N-NH4	mg/l	7.8	7.8	7.8
Nitrate and Nitrite Nitrogen N-NOx	mg/l	-	11.3	11.3
Organic nitrogen N. org	mg/l	5.0	5.0	5.0
Total Nitrogen, TN	mg/l	-	24.1	24.1
Total Phosphorus TP	mg/l	-	2.0	2.0
Dissolved oxygen	mg/l	5.0	5.0	5.0

2.17 Sewage Sludge Disposal / Reuse Standards

The new WWTP will generate sewage sludge. This sludge needs to be handled safely. Facing significantly growing volumes of sewage sludge during the next years requires a regulatory framework in order to avoid negative impacts, while also allowing the safe reuse of valuable components contained in the sludge such as mineral fertiliser (nitrate, phosphorus) and organic substances.

Zambia: Currently, no clear system exists for the effective management and regulation of sludge from WWTPs. According to the current legislation, wastewater sludge is therefore categorized either as waste or as hazardous waste.

European Union: The current EU Directive for sludge management is the 86/278/EEC Council Directive of the Protection of the Environment, and in particular, the Soil, when Sewage Sludge is Used in Agriculture of 12 June 1986 (European Union, 1986). The 86/278/EEC aims to encourage the use of sewage sludge in agriculture, hereto defines a set of conditions.

Sludge shall be treated before being used in agriculture. However, EU member states may authorise the use of untreated sludge, if it is injected or worked into the soil. In this context, treated sludge is defined as having undergone “biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use".

It should be noted that Directive 86/278/ EEC was adopted almost 30 years ago and only sets limit values for seven heavy metals as shown in the table below. Most EU countries have implemented national regulations with stricter limit values.

Table 17 Sewage sludge quality parameters as per the EU directive

Parameter	Unit	Value
Cadmium	mg/kg dry matter	20-40
Copper	mg/kg dry matter	1,000 – 1,750
Nickel	mg/kg dry matter	300 – 400
Lead	mg/kg dry matter	750 – 1,200
Zinc	mg/kg dry matter	2,500 – 4,000
Mercury	mg/kg dry matter	16 – 25
Chromium	mg/kg dry matter	Not regulated

Source : (European Union, 1986)

As part of the Consultancy, a Sludge Management Plan (SMP) for the sludge generated in the new WWTPs of the Project is currently under preparation. Details about sewage sludge quality and reuse/disposal options will be analyzed in this document.

3 DESCRIPTION OF THE CURRENT WASTEWATER INFRASTRUCTURE AND PROJECT DESCRIPTION

3.1 Description of the Project Site

The site under consideration is located approximately 8 km to the north of Lusaka, adjacent to the Chunga Cemetery (see Figure below). The total area of the site is approximately 14 ha. The site is currently used by the existing Chunga WWTP, which was constructed in the 1970s, and was designed to provide screening, grit removal, primary sedimentation, biological treatment with TF, and final clarification. The treated effluent from the WWTP is discharged into the Chunga River which is located on the northern edge of the site, and flows from east to west. The sludge was stabilised in anaerobic digesters and then dried in drying beds. The following coordinates show the extent of the land.

Figure 4 Satellite view of the Chunga Site

Point A (-15.344254°, 28.253306°), Point B (-15.344753°, 28.256679°), point C (-15.347492°, 28.252811°) and point D (-15.347815°, 28.256229).

3.2 Condition Assessment, Key Challenges and Major Shortcomings

Chunga WWTP was constructed in the 1970s. Technologically is in a poor state as has so far not received any rehabilitation or upgrading. Chunga receives significant volumes of industrial wastewater. The structures are predominantly concrete and brick and are mainly sound, although there is some corrosion.

The co-settled sludge is marginally thickened and dried on the drying beds, and during the rainy season, it is stored in a sludge lagoon. The lagoon most likely does not have a protective basis layer.

Semi-dry sludge is sold to local small-scale agricultural and horticultural farmers on demand without quality monitoring.

The barely treated effluent is discharged directly into the Chunga River, which drains into the Kafue River.

3.3 Environmental and Social Implications

The following observations on current pressing issues and conflict potential have been made:

- Physical security and public health issues: no fence and no barriers are in place around the boundaries posing a high risk of drowning incidents for both children and adults. Therefore, in order to restrict access to the Ngwerere Waste Water Treatment Plant (WWTP), a new wall will be constructed around the entire site; hence, there will be a main entrance gate with security guards.
- Farmers are already taking sludge from the open lagoons. Given the fact that this sludge is a result of the treatment of a mix of domestic and industrial it is highly possible that both pathogens and heavy metals still exist in the sludge. In this context, a sludge monitoring assessment executed in May-October 2021 confirmed that the contamination of the sludge was due to the presence of Chromium. This presents not only a danger to public health but also to the farmers' own health especially while handling the sludge, as they do not use any personal protective equipment (gloves, boots, mouth and nose covering masks).
- Some manholes in the WWTP are not covered, and wastewater streams with a depth of about 3m are flowing into the Chunga stream. As the compound is not fenced, children could easily enter it to enjoy the surroundings and fall into these manholes, which are even wide enough to pose a dangerous trap for adults.
- Chunga River is a solid waste-loaded water body, which carries solid waste from a number of residential areas upstream.
- On the other side of the Chunga River and in front of the Chunga WWTP, a new residential area (middle to upper middle class) is beginning to expand. The odor caused by the treatment system could also affect future residents there, which could lead to further resistance to the WWTP at this particular location.

3.4 Scope of Works

The Project considers replacing the existing Chunga WWTP with a completely new WWTP. The new plant will be built in two phases; Phase A, is planned to start construction in 2025 and with sufficient capacity to treat all sewage flows up the to design year 2030, with an average dry weather flow capacity of 18,714 m^3/d. Following the construction of Phase B (2045) at a later date, the WWTP will have an average dry weather flow capacity of 44,541 m^3/d. Only phase A is subject to the current financing agreement.

A main concern is the high concentrations of chromium potentially to be generated from the tanning industries located in the industrial area and possibly other parts of the Chunga catchment; whilst the presence of the chromium will not affect the plant process, it would render the sludge unusable for agricultural purposes. Therefore, it has been agreed with LWSC that the concerned industries will be required to pre-treat their effluent to remove the chromium before discharge into the sewer.

The proposed treatment method is a CAS system with primary sedimentation and Anaerobic Sludge digestion, as it is shown in the figure below. The WWTP layout is shown in Annex 2 - Engineering Drawings.

The WWTP consists of the following units:

- Inlet works – coarse screening – inlet pumping station
- Screening unit
- Grit and grease removal unit
- Primary sedimentation – primary sludge pumping station, including a mixing chamber for additions of chemicals for Chromium and other heavy metals precipitation for removal in the primary sedimentation
- Intermediate pumping station
- Biological treatment consisting of
  - Anaerobic BioP tank (phase A2)
  - Denitrification tank (phase A2)

  - Nitrification – aeration
  - Nitrate return pumping station (phase A2)
- Phosphorus chemical precipitation (phase A2)
- Final sedimentation (Clarification)
- Activated sludge pumping station
- Disinfection and post-aeration unit
- Sludge treatment consisting of:
  - Primary sludge gravity thickening
  - Secondary (excess) sludge mechanical thickening
  - Anaerobic digestion (Digesters, Biogas holder, etc.)
  - Sludge dewatering

The Conventional Activated sludge (CAS) system includes biological nitrogen and phosphorus removal. The treatment process targets the fulfillment of purification goals for discharge into receiving open water bodies, as set by national legislation through ZESCO.

The aeration tanks are supplied with fine bubble air diffuser plates to guarantee sufficient oxygen availability within the basin and during treatment. The denitrification basin is supplied with stirrers to keep the wastewater and sludge flocs in a continuous mix. The sludge digestion is temperature dependent and varies between 6 to 12 days. The sludge stabilization is realized within an anaerobic digester, operated within the mesophilic temperature range.

The Biogas generated in the anaerobic digestion will be stored and burned with the flare. As optional works, the biogas can be used to recover energy in a Combined Heat and Power (CHP) Plant within the site.

The WWTP will include solar panels with a total power installed of up to 3,000 kW to provide up to approximately 50% of the annual electrical energy required in the plant (year 2030 design flow).

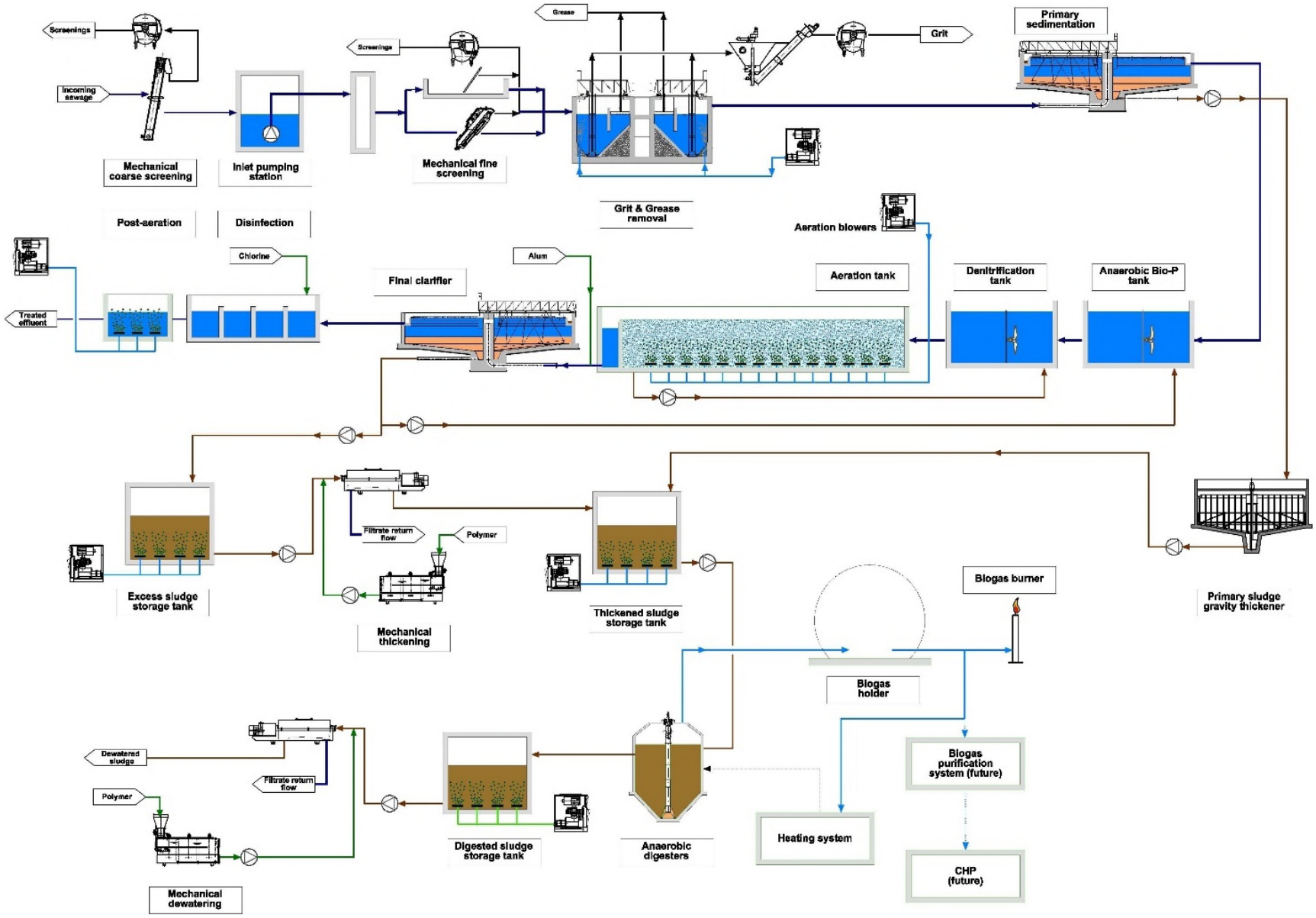


Figure 5 WWTP process flows for Chunga WWTP

3.5 Products generated

The products generated in the Chunga WWTP will be treated wastewater, dewatered sludge, screenings, sand and grit, grease and biogas.

- The effluent will be discharged into the Chunga River.
- The sewage sludge will be dried and stored for such a time until it is rendered safe for application as a soil enhancer. If the sludge is not deemed safe for use in agriculture or arboriculture then it will be disposed of in a suitable landfill.
- For the biogas it is proposed to install a combined heat and power plant which will be used to power a combustion engine driving a generator that will produce electrical power, the heat from the engine will be used to heat the Anaerobic sludge tanks.
- The screenings and grease will be removed from the wastewater during the first mechanical treatment stages. The screenings will be removed by steel screens (coarse and fine) and the grit and grease are removed in an aerated grit and grease tank (grease from the top surface and grit from the bottom). The screenings, grit and grease will be deposited in containers for transportation to the Lusaka sanitary landfill site for disposal. In the future, it may be possible for local cement factories to utilize grease for fuel.

3.6 Resources Required for the Project (Raw Materials)

The main resources for the completion of the Works are concrete, gravel, PVC Pipes, stone aggregate, wood, steel, electromechanical equipment (pumps, blowers and others), water and workforces.

3.7 Main Activities

3.7.1 Prior-Construction Phase

During this phase, the structural and civil engineering designs are carried out, which include the following field studies:

- Topographical survey of the site.
- Geotechnical survey of the site.
- Wastewater quality analysis campaign (GIC - HYDROMENT - Bari Zambia, 2022).
- Ad-hoc flora and fauna surveys.
- River water quality analysis.

In addition to the survey and design work the Contractor will commence erection of temporary site fencing and widening/grading of the existing access road, although the final surfacing will not be added until after completion of the WWTP construction activities. The Contractor will be required to provide a 1.5m buffer zone around the two graves that protrude into the existing access road alignment.

During earlier site visits by the consultant, it was noted that there are several open chambers within the existing WWTP, which are lacking safety handrailing and in which deep water streams are flowing. The contractor will be required to make these chambers safe with adequate site fencing as part of the site mobilisation works.

The Contractor will also establish his site offices and worker camp during the pre-construction period.

3.7.2 Construction Phase

The construction activities will commence with mobilization, which involves bringing equipment and relevant personnel to the site, setting out works, applying for blasting licenses (if necessary) and conducting land clearance activities.

The main activities during the construction phase will be:

- Construction of the WWTP process units, requiring excavation and pouring of concrete. It is assumed the concrete will be brought to the site from nearby ready-mix concrete plants, or possibly batched from on-site facilities. This work will entail the use of mobile cranes, excavators and concrete pumps.
- The new WWTP will be constructed on the western side of the existing LWSC site, which is currently unoccupied and mostly used for growing maize and other crops by the nearby local residents. The existing WWTP will remain in operation during the construction of the new WWTP.
- Pipeline installation (civil works, use of excavators and vehicles).
- Construction of the new effluent outlet structure and connecting pipeline. This will necessitate excavation works at the Chunga River at the North end of the site. It will be necessary to remove a small number of trees. The outfall structure will require some excavation work within the river using mechanical excavators.
- Construction of site boundary wall and entrance gate.
- Construction of sludge and/or wastewater transfer infrastructure (here interconnecting pipelines).
- Installation of the mechanical and electrical equipment.
- The new WWTP design includes for construction of an Administration Building and also a separate Overnight Accommodation Building for workers that are required to work late and start early the next morning. The Accommodation Building will have three offices, a kitchen, toilets, showers and a laboratory.
- During the construction phase the contractor will be required to provide traffic control along the main access road such that the construction traffic does not unduly delay the local residents' access and egress.
- Final construction and surfacing of the new access road along the same alignment as the existing road. At the locations where the graves from the cemetery protrude into the road, the carriageway width will be narrowed, which will then provide a curbed buffer zone around the graves and also provide traffic calming measures.

Materials that will be used for the construction works include crushed aggregates, gravel, sand, lime, cement, steel, plastic and wood. Crushed aggregates will be sourced from quarry sites and will be used in concrete and masonry works together with the cement.

It is anticipated that the Contractor will provide on-site accommodation and welfare facilities for many of the workforce, although some workers living locally will go to their own homes at the end of the day. The contract documents will limit the working hours on Monday to Friday, from 08:00 to 18:00, and on Saturdays from 08:00 to 13:00.

The Contractor will be required to provide, maintain, and service appropriate accommodation complete with sanitary facilities for the use of his site employees during working activities. The Contractor will also be required to provide living accommodation, meals and morning and evening transport to & from construction sites for his site operatives.

The Contractor will be required to ensure that the workers do not create a nuisance in the residential areas near the site and comply with all current national health and safety regulations and other construction regulations.

In addition to the specific contract requirements, further requirements are introduced by the inclusion of the standard KfW '*Environmental, Social, Health and Safety Management*' specifications into the contract documents; the contents of which are listed below:

- Environmental, Social, Health and Safety Management.
  - Responsibilities and liabilities.

- ESHS Planning Documents.
- Management of Non-Conformities.
- Resources allocated to ESHS management
- Inspections
- Reporting
- Code of Conduct
- ESHS Training
- Standards

- Protection of the Environment and People
  - Protection of adjacent areas
  - Selection of borrow areas, backfill material stockpile sites and access road
  - Pollution prevention
  - Effluents
  - Atmospheric emissions and dust
  - Noise and vibration
  - Waste
  - Vegetation clearing
  - Biodiversity
  - Erosion and sediment transport
  - Site rehabilitation
  - Documentation of site conditions
- Health and Safety
  - Health and Safety Plan
  - Health and Safety Reporting
  - Accident reporting procedure
  - Health and Safety meetings
  - Security
  - Equipment and operating standards
  - Work permit
  - Personal protective equipment
  - Dangerous substances
  - Planning for emergency situations
  - Medical checkups
  - First-aid
  - Medical Services and Personnel
  - Health care
  - Emergency medical evacuations
  - Access to health care and training
  - Health monitoring
  - Sanitary repatriation
  - Hygiene, accommodation and food
  - Substance abuse
- Local labour and relations with local communities
  - Labour conditions
  - Local recruitment
  - Transport
  - Workers´ accommodation
  - Meals
  - Community Interaction
  - Damage to people and property
  - Land acquisition and land take
  - Traffic management

- Fossils/ Archaeological Chance Finds

3.7.3 Operational Phase

The activities that will characterize the operational phase will include the normal operation of the plant.

During operation, the wastewater from Lusaka will be transferred to the new plant through a new trunk main recently constructed under Component B (by others). The wastewater will be subject to preliminary, primary and secondary treatment (see Figure 5), the sludge will be subject to thickening, anaerobic digestion, dewatering and stabilisation using lime addition and storage. The products exported from the site will be treated effluent which will be discharged into the nearby Chunga River and dewatered stabilised sludge which is intended to be used by local farmers as a soil conditioner/fertilizer. Excess sludge may be transported and deposited in the Chunga landfill. In addition to the dried sludge, there will be a small quantity of screenings, grit and grease which will be transported to the Chunga landfill for disposal.

Other movements into and out of the plant will be associated with staff entry and exit (on foot and by vehicle), delivery of chemicals for the treatment process, and delivery of spare parts.

The Overnight Accommodation Building will provide separate male and female dormitory rooms, with sufficient space for 6 male and 4 female workers, each provided with toilet, washroom and shower facilities. In addition, a further two separate rooms for senior staff, each with an en-suite toilet and shower.

4 PROJECT ALTERNATIVES

4.1 No-action alternative

Managing wastewater is linked to the management of the entire water cycle. Inadequate wastewater management pollutes water bodies which are also important sources of drinking water, the fishing industry and other industries associated with water.

The 'No Action' alternative implies that the new WWTP would not be built at Chunga. Generally, this decision is reached if there will be adverse and irreversible impacts on the environment, as well as on the socio-economic well-being of the people in the area. If this alternative were considered, the construction objectives of the WWTP, which include environmental protection, economic and social development, and the discharge of wastewater, with inadequate treatment, would have significant costs. Some of these costs are the burden of disease due to reduced drinking water quality, increased disease due to unsafe food (contaminated fish, vegetables, etc.), decreased biodiversity, etc.

Poor sanitation has resulted in severe health and environmental issues, with regular outbreaks of cholera, typhoid and dysentery where 90% of the peri-urban population use on-site sanitation facilities, most of which are in poor condition. It is also noted that 57% of Lusaka's water supply is from groundwater sources within the city, which is prone to sewage contamination. This is the reason why it is important to go ahead with the construction of the WWTP.

The project site already has an existing structure, meaning that there won't be much clearing of land. On the socio-economic aspect, it has been analysed through the reconnaissance study and the door-to-door visitation held with the community that they will greatly benefit from the construction of the new Chunga WWTP, as their livelihoods would improve based on some of the impacts mentioned in this section. This project will not only benefit the Chunga residents but most Lusaka residents and industries.

Therefore, from both a social-economic and environmental perspective a No-action alternative is not a recommended option.

4.2 Action alternatives

The project alternatives were studied in detail at the FS stage. As the alternative was selected in the final FS, in the frame of this Consultancy, the project alternatives were not studied anymore. For details on the project alternatives, please refer to the FS (COWI, 2016). which is presented in Annex 19 of this study.

A list of the different alternatives considered during the FS stage is as follows:

Sewerage Arrangements considered at FS stage:

- **Option 1**: Rehabilitating/upgrading and expanding the Manchinchi and Chunga WWTPs;
- **Option 2**: Maintaining the Manchinchi and Chunga WWTPs, but with a combined sludge management and disposal solution;
- **Option 3**: Abandoning Chunga WWTP and transferring all wastewater to Manchinchi WWTP;
- **Option 4**: Abandoning both Manchinchi and Chunga WWTPs and transporting all wastewater to the current location of the Ngwerere Ponds and constructing a new treatment plant accommodating Chunga, Manchinchi and Ngwerere wastewater systems.
- **Option 5**: Construct new WWTP at Chunga for flows from Chunga wastewater, new WWTP at Ngwerere to cater for the wastewater from Manchinchi and Ngwerere, and demolition of the existing Manchinchi WWTP allowing utilisation of the land for development.

Sewerage Arrangements considered at FS stage:

- **Stabilisation Ponds** – comprising mechanical pre-treatment, anaerobic ponds, facultative ponds and maturation ponds;
- **Trickling Filters with Anaerobic Sludge Digestion** – comprising mechanical pre-treatment, primary sedimentation, trickling filters, chlorination (or maturation ponds, if area is available), anaerobic sludge digestion and sludge dewatering in sludge drying beds,
- **Extended Aerated Activated Sludge with Aerobic Sludge** Digestion – comprising mechanical pre-treatment, activated sludge, chlorination (or maturation ponds, if area is available), aerobic or anaerobic sludge digestion and sludge dewatering in sludge drying beds.

During the FS stage, the LWSC, EIB and KfW agreed on **Option 5: Treatment concept with one large new Ngwerere WWTP in combination with a new smaller Chunga WWTP**; including:

- upgrading (replacement) of the existing Ngwerere WSP based on TF treatment technology, including a possible waste-to-energy option;
- upgrading (replacement) and expanding the Chunga WWTP based on TF treatment technology, including a possible waste-to-energy option;
- decommissioning of the Manchinchi WWTP (wastewater transfer to new Ngwerere WWTP) and the Garden ponds.

The 2016 FS analysed different options for future wastewater treatment in Lusaka. However with regard to 'site' the only options considered involved the use of the existing WWTP sites at Chunga, Manchinchi and Ngwerere and a possible agglomeration of the waste flows allowing one or more of the sites to be closed.

It must be appreciated that the location of the WWTPs is generally fixed by the downstream end of the existing sewer network. Transferring the wastewater from the downstream end of the sewer network to a new location would involve substantial energy costs due to the need to pump the wastewater. Whilst it may be possible to choose a new location the recommended option was to maintain Chunga and transfer the flows from the Manchinchi site to Ngwerere (by gravity), allowing the Manchinchi site to be later closed. Specific details regarding location could be consulted in Annex 19; additionally, the study lists the chosen alternatives in order of preference and for each set of alternatives and presents reasons for choosing the preferred alternatives and rejecting the other alternatives.

With regard to the points 'Process, Design, Technology', these all relate to very similar issues, i.e. the type of process to be used for the treatment of the wastewater and subsequent sludge. The 2016 FS analysed the alternative treatment process options and ranked these. The same study recommended Trickling Filters for the process technology together with anaerobic digestion of the sludge and the use of the biogas for heating. The excess biogas was to be flared, but this was discarded and the cogeneration option was chosen instead. The main reason for choosing the trickling filter process relates to it being a known technology to LWSC and low operating (energy) costs. **Unfortunately, the FS in 2016 failed to identify that the trickling filter technology would not provide the level of treatment required to meet the Zambian Government effluent standards in terms of nutrient removal (Nitrogen and Phosphorous).**

As a result of the Project inception phase and preliminary design calculations, Option 5 was maintained, but with the consideration to implement Conventional Activated Sludge (CAS) treatment instead of TF. This is due to the need to meet the required effluent standards under Zambian legislation; if TF were used then the area required and number of trickling filters would need to be substantially increased and an additional process treatment stage added to remove the phosphorous. After taking into consideration the larger number of filters, among other technical factors, the current consultant established that the CAS process technology was most appropriate as this will enable the

effective removal of nutrients as required by the Zambian Government effluent standards. For details on the selection of the treatment technology, please refer to (GIC - Hydroment - Bari Zambia, 2021).

The summary findings of the comparison of the two treatment alternatives are as follows:

- Since **nitrate removal is required** (according to ZEMA clarifications), CAS is the most favourable (possibly only) one of the alternatives that could efficiently perform the required denitrification.
- Since **nitrification is required**, the number and volume of TF required (12 parallel units with a total volume of at least 67.000 m3) makes the TF alternative more complicated than CAS.
- Regarding **experience and familiarity with the technology**, the CAS system is far more widely implemented globally compared to TF, it is far more advantageous with most of the Contractors, Consultants, manufacturers, etc., having extended experience in WWTPs realized with the CAS technology. More than 90% of the WWTPs in operation globally are CAS systems. Regarding the experience in Zambia, this is generally limited for both systems. In Lusaka, under the responsibility of LWSC, two of the existing plants (Manchinchi and Chunga) are TF while Kafue WWTP is CAS, all of them constructed more than 40 years ago. Both Manchinchi and Chunga WWTP have practically been out of operation for many years, with all the TF units clogged and destroyed. On the contrary, Kafue WWTP is in an acceptable condition, achieving a much better treatment efficiency compared to the two TF WWTPs.
- Regarding **investment cost**, the TF system is much more expensive, mainly due to the extent of the civil works required as well as the cost of the plastic filter media to be installed inside TF.
- The **operational cost in the TF alternative is larger** since all the phosphorus has to be removed by chemical precipitation, while in CAS a significant portion of the phosphorus is removed biologically and at low operational cost.
- While **TF is more sensitive in flow and load variations**, and susceptible to clogging in case of larger suspended solids input, CAS is much more flexible if designed properly. Especially the biological process could be adjusted by controlling the biomass concentration in the bioreactor.
- Regarding **land requirements**, the CAS system requires a much lower surface area.
- TF are disadvantageous compared to CAS in the **high possibility for odour and fly (vector) nuisance**.

4.3 Raw Materials Alternatives

Various types of raw materials were considered during the design phase of the Project. During the selection process, factors such as durability and optimum performance of the WWTP were key in determining the raw materials to be used and where they would be sourced from. Options considered were uPVC pipes, HDPE pipes, concrete pipes, irons pipes, gravel, wood, stone aggregate, steel bars, cement, water and human resource. From these options, iron pipes and concrete pipes were rejected due to their susceptibility to corrosion in acidic media.

The raw material as per the effluent to be treated in the WWTP is a mixture of municipal and industrial effluents.

4.4 Project Sustainability

The sustainability of the WWTP will be estimated through the analysis of different options namely:

- Minimizing pollution in the outflow within an acceptable CAPEX and OPEX;
- The maximum recovery of nutrients and their conversion into full-fledged products;
- The production of green energy and commitment to self-sufficiency in energy (solar panels, energy recovery from biogas);

- Reduction of the effects burdensome to the community (e.g.) odours.

4.5 By-product use

The sludge can be treated in the WWTP sludge line and sell it as manure to the local farmers. The biogas produced in the digestion of the sludge will be used in the WWTP to produce heat for the anaerobic digester. The excess biogas will be led to a gas flare.

There will also be provision for the future installation of a biogas purification system and two CHP units (in a separate future building) for biogas usage and production of electrical and thermal energy. The potential electrical power production is about 320 KW for Phase A and 900 for Phase B.

Detailed options for sludge reuse/disposal will be presented in the Sludge Management Plan (SMP) to be prepared under this Consultancy.

4.6 Energy Alternatives

The main energy supply will be from the ZESCO main transmission system, and as such the energy will mostly come from hydropower as 85% of Zambia's power generation is from Hydro. Also, sustainable energy sources considered for the new WWTP are Solar PV Panels and Combined Heat and Power (CHP) from the sludge biogas generation. Zambia is blessed with a large amount of solar irradiation, and therefore there is a great potential to utilise solar power at the plant. It would also be possible to provide around 50% of the WWTP's electrical energy demand using a CHP unit which uses the biogas as a fuel for an engine which turns a generator to produce electrical power, and the heated cooling water can also be used to warm the digesters and hot water for the administration buildings. Likewise, in early 2023 both KfW and EIB requested for the CHP to be a requirement as it was bank policy to not allow flaring off methane gas produced by the WWTP.

Another alternative energy to be used on the plant is the emergency generator which will be fuelled by diesel oil and automatically power the plant in periods when the main ZESCO power supply is cut-off and there is insufficient CHP or Solar PV to meet the electrical demands.

4.6.1 Solar PV Panels

As the CHP will (when installed) provide around 50% of the WWTP's energy demand, it was originally considered to install sufficient solar PV panels to provide 50% of the daytime electrical energy demand. However, as any excess solar PV produced will be lost to the ZESCO system without any payment for generation (ZESCO does not as yet facilitate any net metering), it was decided to reduce the installed solar PV energy generation to 25% of the daytime power.

4.6.2 Combined Heat and Power (CHP)

There shall be at least one CHP unit installed for phase A, with a capacity of at least 2,400 KW output power (considering biogas heating value of 5,500 Kcal/Nm3 – 6.4 KWh/Nm3), an electrical power production efficiency of at least 37% and total energy production efficiency of at least 80%.

The appropriate biogas purification system will be installed, including at least biogas desulfurization and drying, according to the CHP manufacturer's standards. The biogas purification system will have the capacity for the needs of phase A with adequate provisions for the extensions of phase B.

The CHP system will be installed in a separate building or in a separate section of the anaerobic digestion service building. The CHP building shall have at least two sections for the installation of machinery with modified equipment and local control panels, and the control room and local electrical sub-distribution. The operating room will be designed in such a way that it meets the requirements for noise/odor control and safety at work. Access to machines and components must be secured and unobstructed. The operating room must have a hoist for installation and maintenance requirements. Regarding the environmental conditions in the operating room, sufficient ventilation and natural lighting must be provided.

The ventilation system must be designed and verified according to the requirements of the CHP manufacturer.

The CHP unit will include an independent external cooling system capable of absorbing 100% of the heat so that the CHP unit can operate during the hot weather season without heating demands from the digesters.

5 ENVIRONMENTAL AND SOCIAL BASELINE

This chapter presents a description of the existing E&S conditions based on existing information and field surveys carried out by the Consultant. The spatial extent comprises the existing wastewater treatment facilities and the surrounding environmental conditions and communities.

5.1 Methodology

The following approach was used in the E&S baseline data collection and analysis with a particular focus on the issues and expected impacts on key receptors.

The general baseline data collection relied on existing information.

A set of environmental field surveys were carried out from June to October 2021.

In order to collect relevant socio-economic data in the communities surrounding the wastewater treatment facilities, meetings, public hearings, and questionnaires were undertaken. Due to limitations arising from the COVID-19 pandemic, the data collection could only be carried out to a certain extent. The Consultant also assessed the data contained in the initial ESIA framework (CES Consulting Engineers Salzgitter GmbH, 2017) and used some of the data to define the baseline for the E&S conditions.

The following table summarises the data collection and the source.

Table 18 Data collection and main sources

Receptors	Data Collection		Source of information
	Primary (field surveys)	Secondary (existing sources)	
Environmental receptors			
Geological conditions	No	Yes	• Existing studies
Topography	Yes	Yes	• Field survey • Existing data
Soil characteristics	Yes	Yes	• Field survey • Existing studies
Climate and meteorology	No	Yes	• Existing studies
Hydrology and Hydrogeology	No	Yes	• Existing data
The flow of receiving water body	Yes	Yes	• Field visits • Field survey (COWI, 2016)
Quality of receiving water body	Yes	No	• Field survey
Groundwater	Yes	Yes	• Field survey • Existing studies
Flow and quality of wastewater influent	Yes	No	• Field survey
Flood areas	Yes	Yes	• Community meetings • Existing studies
Air quality	Yes	No	• Field survey
Odors	Yes	No	• Community meetings

Receptors	Data Collection		Source of information
	Primary (field surveys)	Secondary (existing sources)	
Noise and vibration	Yes	No	• Community meetings
Climate change projection	No	Yes	• Existing studies
Flora / Fauna	Yes	No	• Field survey
Social receptors			
Communities	Yes	Yes	• Community meetings • Semi-structured interviews • Interviews with LWSC safeguard officers • Existing data and studies

5.2 Project Area of Influence (AoI)

The Project Area of Influence (AoI) for Ngwerere WWTP comprises:

- the existing Chunga WWTP.
- the Chunga River where the WWTP effluent is discharged.
- the Chunga and Matero communities in Mwembeshi Ward
- farmers in the communities around the current WWTP depend on the sludge and land of the WSP for their farming.
- nearby farmers downstream of the proposed WWTP effluent discharge point.
- The map with the Project AoI is shown in Annex 1 - Project AoI Maps.

5.3 Physical environment

5.3.1 Climate and Meteorology

Zambia experiences a predominantly sub-tropical climate characterized by three distinct seasons: a hot and dry season (mid-August to mid-November), a wet rainy season (mid-November to April), and a cool dry season (May to mid-August). The source of the climatic data is from World Bank Climate Change Knowledge Portal.

5.3.1.1 Precipitation

The annual rainfall in Zambia averages between 700 mm in the southern part and 1,400 mm in the northern part. The hot months are very dry, receiving almost no rainfall between May and August. The wet season (September-April) rainfall is controlled by the passage of the tropical rain belt (also known as the Inter-Tropical Conversion Zone, ITCZ) which oscillates between the northern and southern tropics over the course of a year, bringing rain between October and April of 150-300 mm per month (World Bank Group, 2021). The table below shows the monthly climatology of min-temp, mean-temp, max-temp, and precipitation in Zambia from 1991 to 2020.

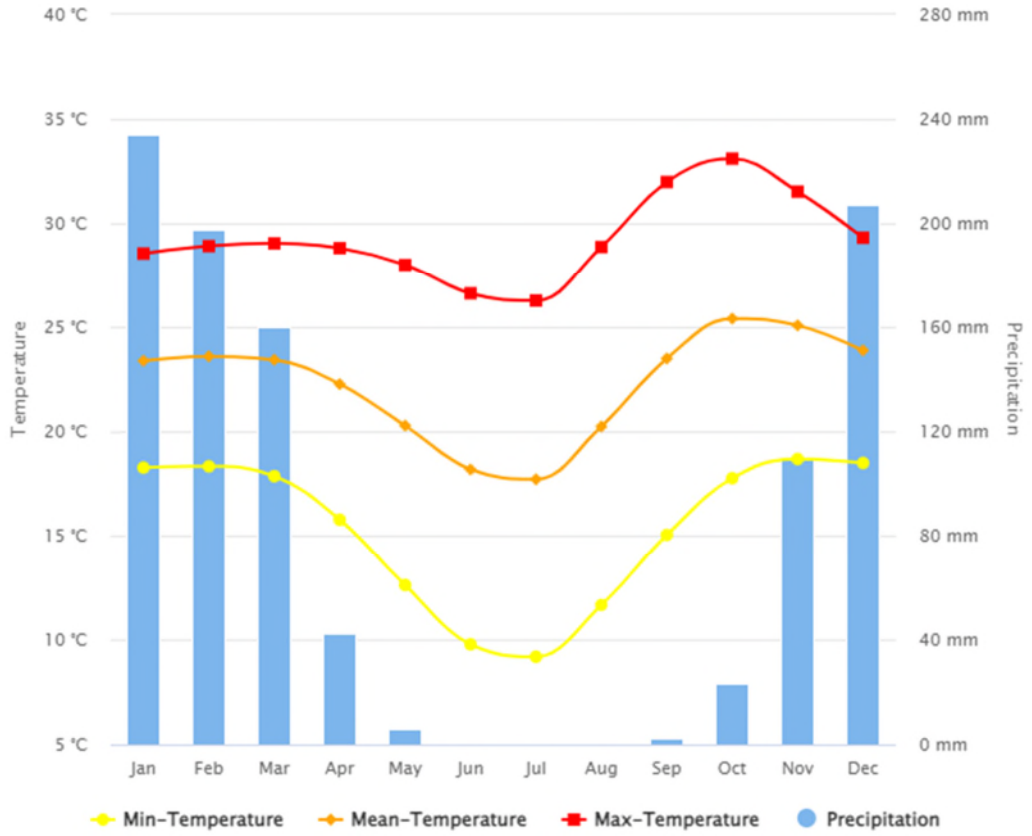


Figure 6: Mean temperatures and Precipitation of Zambia from 1991 to 2020

Source: (World Bank Group, 2021)

Lusaka receives an appreciable volume of rainfall, however mostly during the rainy season. In the season from October to April, the monthly average rainfall is 138 mm based on the monthly average rainfall recorded for Lusaka as shown below.

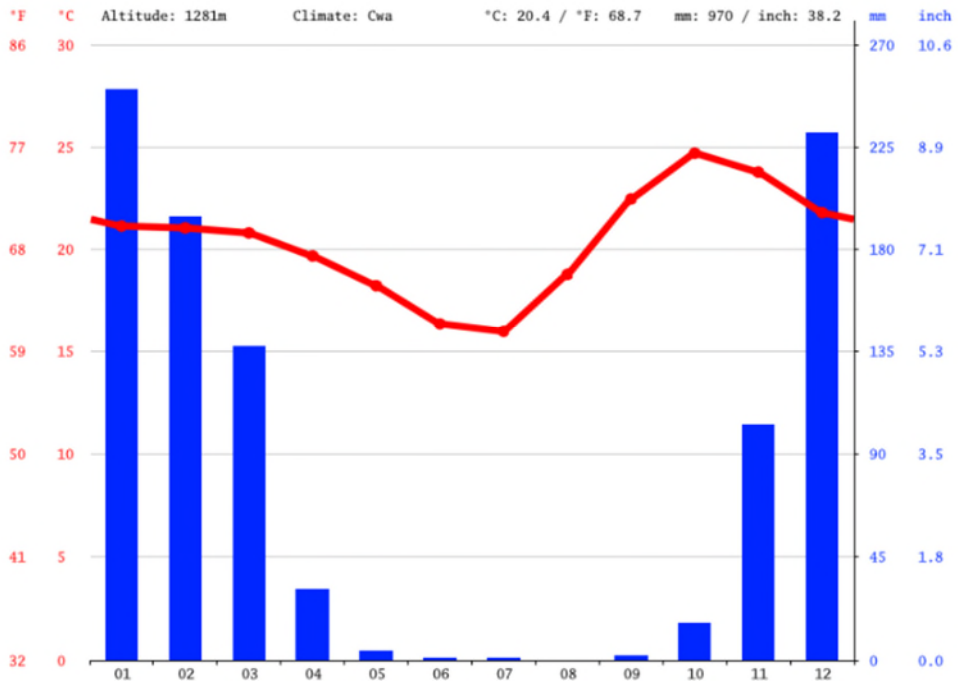


Figure 7 Monthly average rainfall and temperature in Lusaka

Source: (World Meteorological Organization, 2020)

5.3.1.2 Temperature

Mean monthly temperatures for Lusaka District range from 14°C in the cold season to about 28°C in the hot season, when humidity is comparatively high. Minimum temperatures which are as low as 11°C have been recorded in the month of July. While the hottest month of the year with temperatures of 30°C and above is October.

The following figure shows the average maximum and minimum monthly temperatures for Lusaka District recorded for the period of 1991 to 2019.

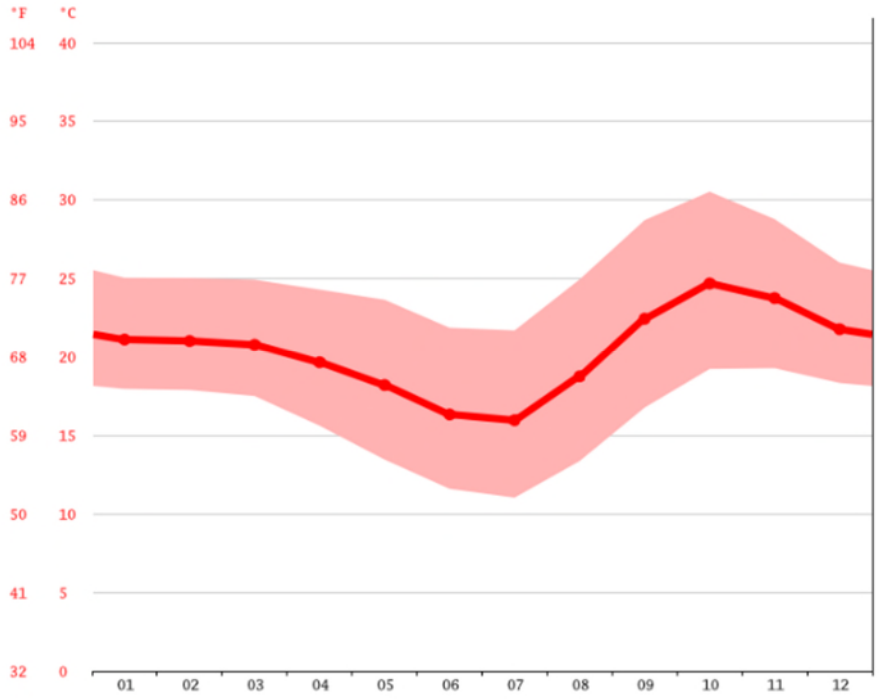


Figure 8: Lusaka Average Temperature

Source: (Climate-data.org, kein Datum)

5.3.1.3 Wind

Lusaka District experiences prevailing eastern winds during the dry season with fresh winds in the months of July and August. During the months of December to April, light variable winds predominantly from the northern and north-eastern directions prevail. Mean wind speed ranges from 1.1 m/s (4.0km/h) to 2.5 m/s (9.0 km/h). The wind rose below depicts the wind direction that is predominant in the city of Lusaka.

Figure 9 Prevailing wind direction in Lusaka.

Source: (Meteoblue, 2022)

5.3.1.4 Evaporation and Humidity

The average annual evaporation for the City of Lusaka is around 2,070 mm, ranging from 104 mm in January to 315 mm in October. Thus, it can be assumed that evaporation is at its peak during the rainy season when surfaces are wet and soils become saturated with water. Humidity, on the other hand, averages 64% throughout the year. In general, the humidity shows a decreasing trend from January to December. In January, during the peak of the rainy season, humidity rises, reaching 84% in January, then gradually reduces to a minimum monthly average of 45% in September (JICA, 2009).

5.3.1.5 Seasons

The Rainy Season (November to March)

After the hot season, the first sporadic rain may fall at the end of September, or more usually in October, when the winds blow increasingly from the north. A striking change occurs, however, between October and November. The increase in rainfall is accompanied by increases in relative humidity and cloudiness and a fall in temperature. Prolonged rain spells are uncommon, although thunderstorms and showers become more frequent throughout the wet season. The wettest months are December and January with over 400 mm of rain in each month. At this time mean maximum temperatures are about 27°C and the sky is almost completely overcast. Conditions in February are similar, although rainfall decreases.

The Post-Rainy Season (April)

During this transition period at the end of the rains, very few showers occur and the skies begin to clear. Daily sunshine increases to over 9 hours and humidity falls to about 60%. The winds are predominantly from the east again, while the days get warmer and the nights cooler. This intermediate

post-rainy season lasts until May, by which time the damp ground of late March and April, conducive to early morning mist and heavy dews, has dried out.

The Dry Winter Season (May to September)

From May onwards the true dry season starts, the days are hot, the nights cool and relative humidity is low. Mean monthly maximum temperatures fall slightly throughout May and June from about 27°C to 26°C; whereas mean monthly minimum temperatures and relative humidity both fall steeply. Frosts may occur in places until August and humidity reaches its lowest levels in September with values about 30%.

The Hot Season (October)

In this transition period the hot days, cool nights, and low humidity of the dry season are replaced by milder nights over 15°C with a rise in humidity and cloudiness. The absolute maximum temperature rises throughout the period to values over 38°C and this continues into the month of November, although mean monthly minimum temperatures are falling. Occasional thunderstorms do little to relieve the oppressive atmosphere. The wind direction gradually acquires a steady northern component, heralding the rains.

5.3.2 Air Quality

Air quality in the City of Lusaka is influenced by anthropogenic activities and predominant wind direction. The two main sources are distinguished as, namely mobile and stationary sources. Industrial activities are a major source of ambient air pollution arising from stationary sources while motor vehicles account for the majority of the air pollution emissions from mobile sources. During the community meetings, participants claimed that the smell is a major problem, especially during the rainy season.

To determine the actual air quality of the area, air samples were collected from four different points, i.e. SP1, SP2, SP3 and SP4. The tests were carried out during the day when anthropogenic activities were expected to be at their maximum, using the SKC Ltd air sampling pump. The tested parameters were sulphur dioxide, nitrogen dioxide, carbon monoxide and other oxides of nitrogen from all four points. At each sampling station, monitoring was performed for at least 30 minutes at a height of 1.5m.

The results indicated that there were low levels of SO_2, NO_x and CO_x, which could be attributed to low combustion of fossil fuels and less traffic of motor vehicles in the area. Annex 14 - Air Quality Analysis shows the results.

5.3.2.1 Odours

During the community meetings held between 1st and 9th July 2022, participants claimed that smell is a major problem. The foul smell of varying intensity is experienced by the entire community during the day and at night.

5.3.3 Geological conditions

Lusaka comprises a pre-Cambrian basement complex consisting of granites, gneisses and quartzite which is overlaid by limestones and dolomite rocks. At a greater depth, the underlying rock formation shows a decreasing variation in fracturing intensity. The occurrence and layer stratification of the fractures has significantly dictated the groundwater flow in the Lusaka aquifer.

The structural setting of the lithographic units is subdivided by the long striking (WNW-ESE) “Lusaka Fault”. The Lusaka Fault steeply dips into an SWS orientation and separates the subsurface geology of the Lusaka area into a “Northern Domain” and a “Southern Domain”. The Northern Domain constitutes the early Proterozoic Basement Complex and is situated at relatively shallow depths while the Southern Domain characterizes the maximum thicknesses of the Katanga system meta-sediments (Gauff, Preparation of Feasibility Studies (30%) and Preliminary Design for Water and Sanita-tion Projects Lusaka, Zambia, 2012).

The Northern Domain is bounded by the "Lusaka" and "Chelston" normal faults. The Early Precambrian basement is situated at a comparably shallow depth; hence the meta-sediments of the Katanga system show reduced thickness. In the Southern Domain, a higher structural level is exposed reflecting a thick-skinned (basement-involved) "fold-and-thrust belt" tectonic. Here the early Proterozoic basement is situated at a much higher depth, and the meta-sediments of the Katanga group reach maximum thickness.

Regionally, the Lusaka rocks are part of the Zambezi Belt and by definition are separated by the Mwembeshi Shear Zone from the Lufilian Belt to the north. Specifically, the Lusaka area is covered by strongly folded over-trusted meta-sedimentary rocks from the Katanga (Neoproterozoic) age which were introduced by granitic and basic bodies.

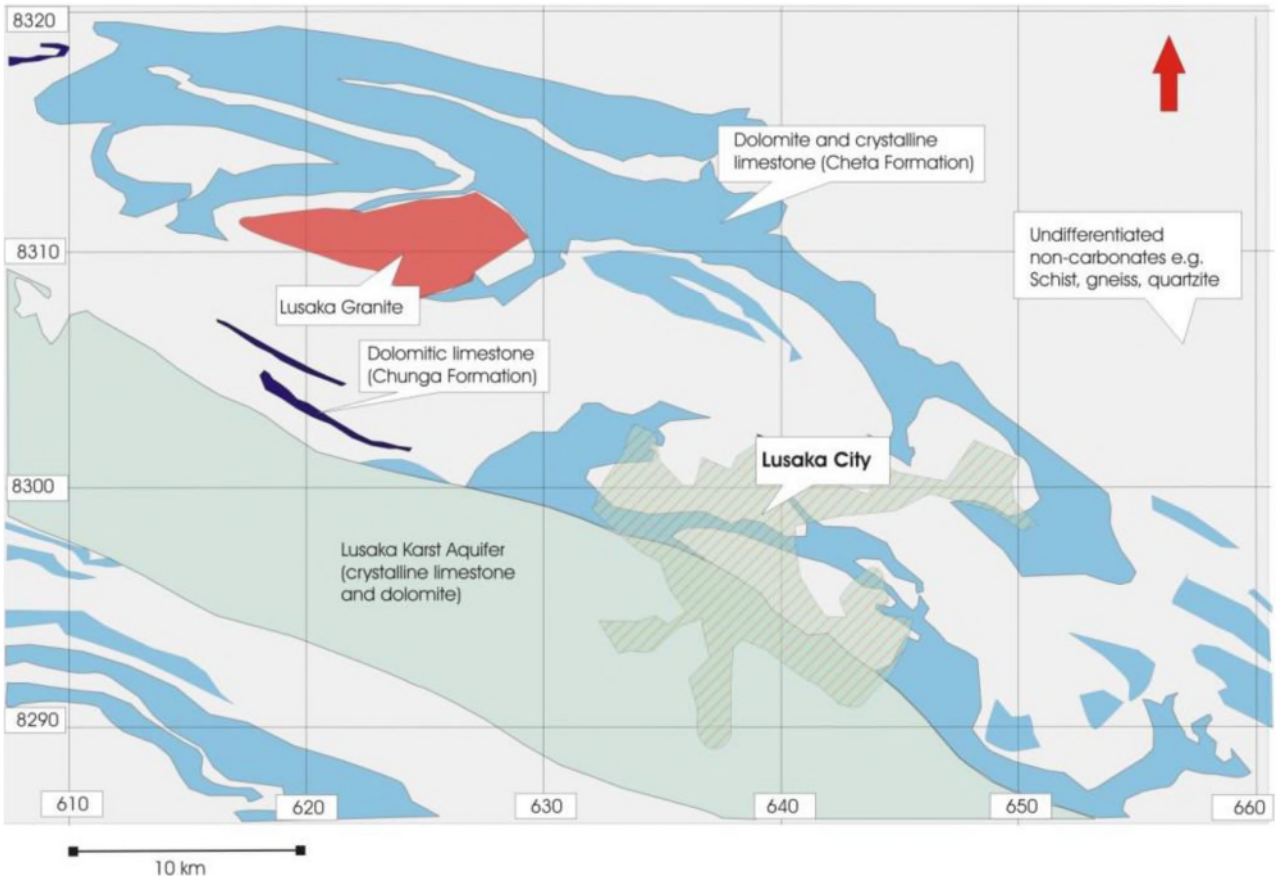


Figure 10 Lusaka Geology

Source: (Gauff, Preparation of Feasibility Studies (30%) and Preliminary Design for Water and Sanita-tion Projects Lusaka, Zambia, 2012)

5.3.4 Hydrology and Hydrogeology

Lusaka is drained by a number of small watercourses, namely Chunga, Chalimbana and Ngwerere. The Chunga River and its tributaries flow westwards and then south into the Mwambeshi while the Ngwerere and Chalimbana Rivers flow north-east and east respectively to join the Chongwe River.

The proposed Chunga WWTP will be discharging its effluent in the Chunga River which drains into the Mwambeshi River and then into the Kafue River, a major tributary of the Zambezi River.

Figure 11: Kafue River Catchment Area of Which Chunga River is a Tributary

Source: (WARMA, 2019)

The Chunga River shows very different flow patterns due to a large contribution of its waters coming from urban stormwater, springs in its catchment area and discharge from the WWTP in Chunga. A lot of wastewater from the industries flowing into the River is untreated for heavy metals, inorganic and organic waste. Farmers and residents downstream use the water from the River for their gardening and other day-to-day activities requiring the usage of water. Annual runoff water from the Chunga River varies due to rainfall variability and human influence on the River. This has been evidenced after a measuring station was set up in 2009 at the confluence with the Mwembeshi River.

Figure 12 Chunga River

Table 19 Annual Run-off totals of water in Chunga River

Station no. & river	Start of records	No.[3]	Area [4] in [km²]	Annual runoff in [m³/s]			Annual runoff in [mm]		
				Min. [5]	Mean	Max.	Min. [5]	Mean	Max.
4-918 Mwembeshi	1977	21	73	0.016	0.28	0.67	7	121	289
4-935 Chunga	2009	2	560	--	(2.2)	--		(124)	

3) Number of years included in the statistical analysis; these are years with validated runoff data and existing gaps not exceeding one month 4) Catchment areas (above the station) derived from DEM 5) Zero runoff includes periods with negligible flow below measurement limit (trickle)
Source: Development of a Groundwater Information & Management Program for the Lusaka Groundwater Systems, Report Number. 7)

The underground water systems (aquifers) were identified based on the rock formations (lithology) in the area. With over 90 coverage, aquifers hosted by hard rock prevail in the catchment and sub-catchments of the Chongwe River. In this catchment area, the proportion of carbonate aquifers is small with over 85% of the area being covered by Precambrian metamorphic rocks like gneiss and schist.

5.3.4.1 Flow in the WWTP effluent receiving water body

A water and sludge quality monitoring campaign was undertaken in 2015 as part of the key deliverables under the EIB FS (COWI, 2016). River flow measurements of the receiving water body were undertaken in order to assess the dilution factor of the discharged WWTP effluent. These measurements were carried out in June, representing a dry season situation when dilution is the lowest. By that time, there was no flow upstream of the outlet from the Chunga WWTP, meaning that the flow downstream is mostly effluent.

Table 20 Flow in the WWTP effluent receiving water body

Current receiving water body	Upstream flow	Downstream flow (m^3/d)	Calculated WWTP Flow (m^3/d)	Dilution Factor
Chunga River	5,593	30,197	24,604	1.23

Source: (COWI, 2016)

5.3.4.2 River Water Quality

The water quality in the receiving water body of the Chunga WWTP effluent upstream of the discharge point was analysed. All results are shown in Annex 12 - Water test results from Chunga WWTP. The main results related to wastewater pollution are shown below.

Table 21 Water quality analysis results related to wastewater pollution in the WWTP effluent receiving water body

Parameter	Unit	Value	ZEMA effluent discharge
pH	-	6.67	6-9
COD	mg O_2/l	290	90
BOD	mg O_2/l	84	50
Nitrate	mg/l NO_3 - N	<0.01	50
Total phosphates	mg/l	5.0	6.0
Dissolved Oxygen	mg O_2/l	2.8	5.0
Total coliforms	No./100 ml	1,900	5,000
Faecal coliforms	No./100 ml	1,600	2,500

The high concentrations of COD, BOD and coliforms show the contamination due to untreated wastewater discharges into the river.

5.3.4.3 Groundwater

The dolomitic limestone underlying most of the city constitutes a karstic aquifer of both local and regional importance. A total of 130,000 m^3/d is abstracted from groundwater in Lusaka. On average,

the production boreholes of the LWSC are 50 m deep. The general groundwater trend in Lusaka is a decrease in the dry season and a recovery period during the rainy season. The fluctuations of the water table, though at different levels, remain moderate, seldom exceeding 5 m (Gauff, ESIA for Water Supply and Sanitation, Millennium Challenge Corporation, 2013), and these fluctuations reflect the general behaviour of groundwater during times of recharge and discharge.

The volume of the productive aquifer in Lusaka was calculated at 12 km^3, with recharge values ranging from 37 to 775 mm, i.e. from 5% to 95% of the annual rainfall (Gauff, ESIA for Water Supply and Sanitation, Millennium Challenge Corporation, 2013). Groundwater recharge is directly through sinkholes while in areas of outcropping karst, all the rainwater seeps into the underground.

Water from the nearest two boreholes to the Chunga WWTP was also collected and tested. Borehole 1 had high concentrations of chromium, ammonia, manganese, and iron (World Health Organization, 2006). This shows contamination of the underground water near the WWTP due to the leaching of septage and industrial effluents.

5.3.4.4 Wastewater quantity and quality at Chunga WWTP

Details of this campaign can be found in (GIC - HYDROMENT - Bari Zambia, 2022).

The monitoring campaign at Chunga was designed with the objective to support the design of the Chunga WWTP. Effluent from the Chunga WWTP is inadequately treated as all the units are not functional and the sewage is bypassed to the Chunga River.

Table 22 Influent wastewater quantity and quality analysis results at Chunga WWTP

Parameter	Units	Mean
Average dry weather flow	m^3/d	7,409
pH	-	6.6
T	°C	27.5
COD, total	mg/l COD	3,356
BOD5, total	mg/l BOD5	2,458
TSS	mg/l TSS	938
NH3	mg/l NH3-N	28
NO2	mg/l NO2-N	8.2
NO3 + NO2	mg/l NO3-N	14.1
Nt	mg/l N	85
PO4	mg/l PO4	25
Pt	mg/l P	12.4
Cd	mg/l Cd	0.0015
Cr	mg/l Cr	0.576
Pb	mg/l Pb	<0.01
Ni	mg/l Ni	<0.01
Zn	mg/l Zn	0.31
Cu	mg/l Cu	0.056

The raw wastewater received at Chunga WWTP can be classified as highly concentrated, with a significant contribution of industrial effluents.

5.3.4.5 Flood areas

Floods are experienced in some parts of Lusaka every rainy season and these occur mainly in the months of January and February during the peak period of the rainy season. Nonetheless, inundations also occur in December. (JICA, 2009) documented the floods that occurred in Lusaka between October 2007 and February 2008, affecting a total of 21 sites, 15 of which were flooded by the second week of December. The majority of these areas were located in the western, north-western and south-western parts of the City.

Flooding does not represent a problem at Chunga WWTP. During community meetings and site visits, no respective information was received.

5.3.5 Topography

The Lusaka area is part of the mid-tertiary pen plain of Central Africa, which here stands at 1,280 m above sea level. Ngwerere area falls under the Chongwe catchment area whose topography will be highlighted. The upper part of the Chongwe catchment forms a gently dipping overall weakly dissected surface slopping southwards with elevation dropping from about 1,200 m to about 1,180 m above sea level. To the east of the Chongwe catchment the Changala and Chainama Hill ranges rise abruptly from the general surface level reaching maximum altitudes of above 1,400 m. The elevation then drops along the Zambezi graben system from above 1,000 m to about 365 m meters above sea level. The figure below shows the general elevation of Lusaka.

The topography at the Chunga WWTP premises is generally flat at the entrance from the Southern direction (gate next to the cemetery) and begins to slope towards the Chunga River, as one approaches the midway point.

The topography of the site is shown in Annex 1 - Project AoI Maps.

The figure below shows the general elevation of Lusaka.

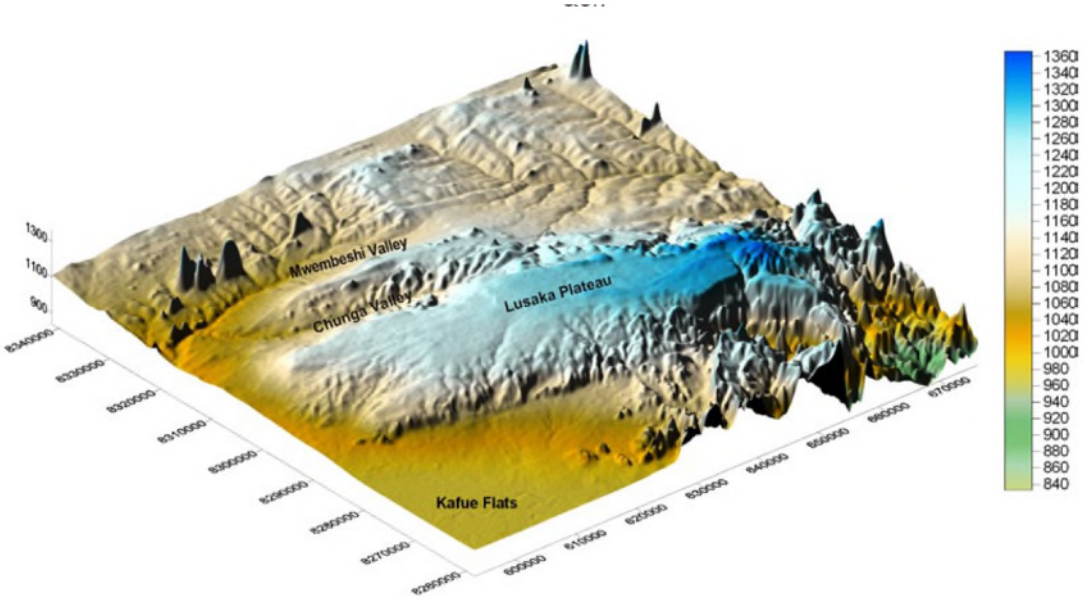


Figure 13 General Topography of Lusaka Town

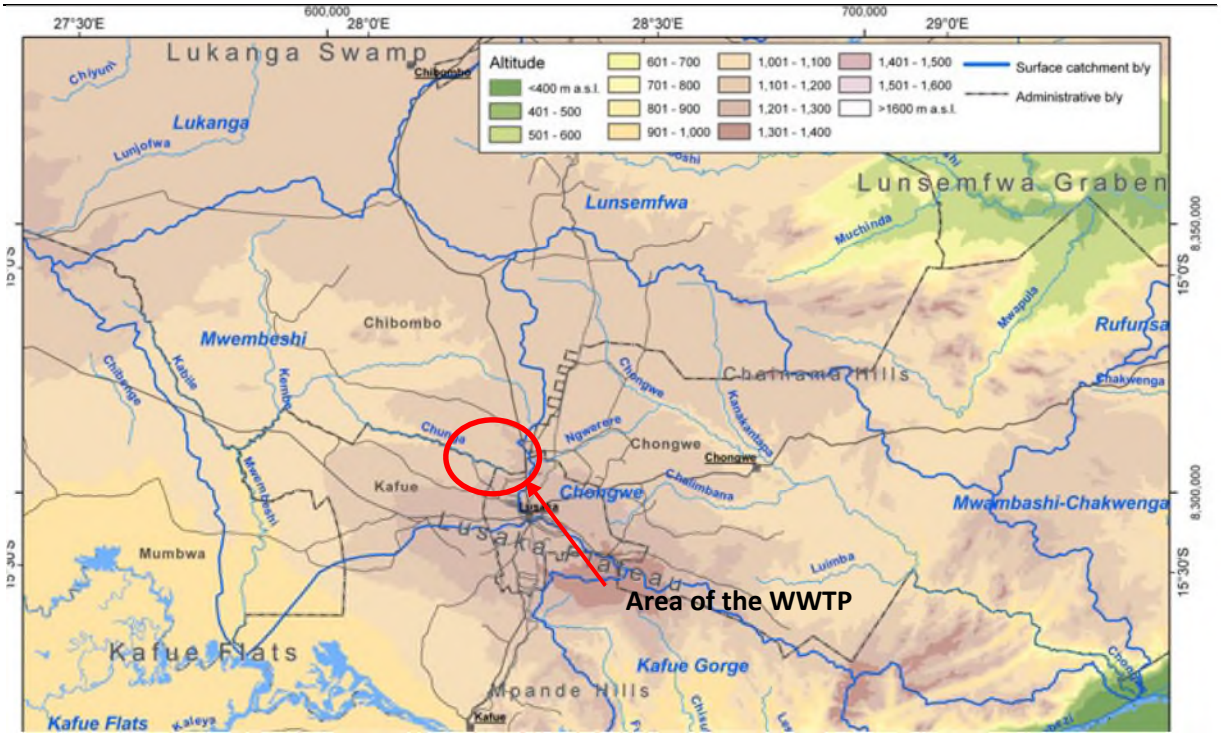


Figure 14 Digital Elevation Model (DEM) Showing Zones at 100 m Intervals

5.3.6 Soil characteristics

The soils (and vegetation) show a marked correspondence to the geological formations. Four distinct soil groups are recognized (Gauff, Preparation of Feasibility Studies (30%) and Preliminary Design for Water and Sanita-tion Projects Lusaka, Zambia, 2012).

Specialized plateau soils: The Lusaka dolomite and parts of the calcareous horizons of the Cheta Formation are overlain by a variable thickness of pisolitic laterite with thin clayey or fine sandy soils often containing large numbers of laterite pisoliths. Where laterite reaches the surface, it forms hard undurated pavements with little soil cover; south and west of Lusaka, dolomite outcrops over a wide area.

Plateau soils: Immediately north of the Lusaka Dolomite outcrop and in the extreme northeast the fine sandy soils typical of the plateau are products of prolonged weathering of dominantly acenaceous rocks on a maturely eroded landscape.

Upper valley soils (i): South of the laterite soil zone there is a north-west trending belt of rich red-brown and dark brown loams of mixed colluvial origin.

Upper valley soils (ii): The soils underlying the gneisses, schists and quartzites of the Basement Complex are sandy loams. South-east of a line through Ngwerere and Chikumbi sidings there is a wide flat area of ill-drained swampy ground. The soils are thick and of a mixed colluvial and alluvial origin. Along the lower reaches of the Chunga River a broad, flat, alluvial plain supports valley or flood-plain grasslands.

The Chunga WWTP is expected to have polluted soils due to its long-term operation, both inorganic and organic pollution. The main possible spots of this pollution are the drying beds where untreated sludge is placed to dry for resale.

In order to find out about the mineral content of the soils from Chunga, samples were collected from three different points, A, B and C at a depth of at least 50 cm. The soil was then put in sterile plastic bags that were transported to the lab for testing. The soil analysis showed that sample A was a neutral soil while samples B and C were alkaline in nature while the organic matter content was quite high in all three samples. Sample A was collected from a close proximity to the drying beds, while sample be

was collected next to the grit trap and sample C came from the banks of Chunga River. The table below highlights the contents of the nutrients in the soil samples.

Table 23 Soil Content from Chunga WWTP

Lab No.	Sample ID	pH	Organic Matter	N	P	K	S
20210643	Chunga A	Neutral	High	Low	High	High	Sufficient
20210644	Chunga B	Alkaline	High	Low	High	High	Sufficient
20210645	Chunga C	Alkaline	High	Low	High	High	Sufficient

Source: UNZA Lab (School of Agriculture). The full report of the soil analysis is shown in Annex 13 - Soil Results.

5.3.7 Noise and Vibration

Most of the city experiences noise and vibrations that are generated by the various activities of the city. No qualitative or quantitative data indicating the noise around the site is available. Given this fact, the Consultant carried out observatory techniques to determine the noise in the area due to the unavailability of a noise level meter.

The WWTP is surrounded by medium and densely populated settlements characterized by small-scale activities, hence the typical noise in the area is that of daily business activities and traffic. It was concluded that the noise levels in the area are within acceptable limits. The mechanical and electrical installations of the WWTP are not working. Therefore, noise is considered insignificant.

5.3.8 Climate change projection

Synthesizes information regarding climatology, climate variability, and near-term climate change in Zambia. Country, regional, and climate studies have been integrated into a comprehensive picture of Zambia's current and near-future climate (Climate Centre Project, 2015).

Climate change is likely to affect the sustainability of the planned infrastructure investment. For the Project, the main climate-induced effects to consider are rising temperatures, heavy rainfall and flooding, drought and water scarcity and heavy storms.

Rising temperatures: Historical trends indicate that the mean annual temperature has increased by 1.3°C since 1960 and average rainfall by 1.9 mm/month, with shorter and more intense rainy seasons. As a result, a rise in the number and frequency of floods and droughts has been recorded, as well as the areas affected (GRZ, Zambia Strategic PPCR Programme, 2011).

Variable precipitation: Rainfall averages about 960 mm annually, but is variable across the Zambezi river basin, from 1,500 mm annually in the northern highlands to 600 mm in the south-west (Beilfuss, 2012). The past 40 years have seen a slight reduction in annual precipitation, along with increased variability in rainfall year-to-year, and an increase in extreme precipitation events.

Floods and droughts: Historically, Zambia has been prone to extreme rainfall events resulting in widespread flooding. A recent flooding event during the 2006-2007 rainy season saw nearly 1.5 million people affected (GRZ, The National Adaptation Programme of Action (NAPA), 2007). Amongst others, typical impacts from a major flooding event included collapsed houses and buildings, destruction of infrastructure (roads, sanitation facilities), contaminated water supplies and an increase in human diseases.

Zambia generates over 90% of its power from hydroelectricity, making energy security highly dependent upon precipitation patterns. Reduced power generation in recent years has had a negative impact on economic productivity as this leads to increased power shortages, forcing industries to reduce their levels of production.

Due to the limited availability of relevant data, the future prediction of climate change effects is linked with significant uncertainty. This statement especially refers to regional climate models.

Increased annual variability: The increasing variability in Zambian rainfall throughout the 20th century is notable and related to more spatially widespread and intense droughts associated with El Niño (Fauchereau, 2003). The connection between El Niño/La Niña and Zambian rainfall has been increasing in strength over time (Fauchereau, 2003) (Christensen, 2013). It is indicated that this has led to increasing drought potential and wet spells in both their severity and extent.

While, according to (Climate Service Center, 2013) climate models do not project a clear trend in precipitation amounts. For the end of the century, a change in annual total precipitation in the range of -6 to +5 percent (compared to the reference period from 1961 to 1990) is likely to occur. Furthermore, projections suggest a tendency towards more intense and more frequent heavy rainfall events as well as a substantial elongation of dry spells.

5.4 Biological environment

Zambia is endowed with a variety of fauna and flora. The forests consist of forest reserves, forest areas under traditional leadership and plantation forests. Apart from the provision of food, building materials, medicine and wood fuel, the forests also play a major role in the maintenance of ecological balance and the hydrological cycle.

The assessment of flora and fauna focused on Project AoI. These were assessed by ad-hoc inventories and observations made during the site visits. Interviews were conducted with both locals and WWTP operational staff.

5.4.1 Flora

The vegetation on site was observed to be mainly concentrated on the western side of the WWTP. The vegetation is a mixture of grass, shrubs and scattered trees. There are some areas that have been cleared and are being used as vegetable gardens by the LWSC staff that are working at the WWTP. The far eastern side of the plant also still has some vegetation the predominant one being grass with a few shrubs in certain areas. The table below highlights the types of species of plants that are found at the Chunga WWTP.

Table 24 Terrestrial and Aquatic Flora in the Project AoI

Species	Identified
Shrubs/Thickets	
Acacia polyacantha	✓
Brachystegia boemhii	✓
Dichrostachys cinerea	✓
Phyllanthus leucanthus	✓
Datura stramonium	✓
Tithonia longifolia	✓
Sambucus spp.	✓
Grasses	
Hypperrhenia spp.	✓
Andropogon spp.	✓
Cyperus esculentus	✓
Eragrostis aspera	✓

5.4.2 Fauna

Animal life within Project AoI is not significant as there has been a human disturbance, hence animals have migrated to other areas. Regardless, some animal activity was seen as rodents, insects and bugs.

Aquatic fauna was also observed in the Chunga River and the fish commonly occurring in the Chunga stream is the barbel fish, though the population has been affected due to pollution of water mainly from the untreated effluent heading into the waters and harvesting of the fish by the local community. The table below indicates both the aquatic and terrestrial fauna at the site.

Table 25 Terrestrial and Aquatic Fauna in the Project AoI

Species	Identified
Terrestrial Fauna	
Ichnotropis squamulosa (Common rough-scaled lizard)	✓
Ants (black and red)	✓
Arachnidae (spiders)	✓
Coleoptera (beetles)	✓
Caelifera (grasshoppers)	✓
Culicidae (mosquitos)	✓
Hymenoptera *Musca domestica*	✓
Nymphalidae (butterflies)	✓
Aquatic Fauna	
B.barbus (barbel fish)	✓

No bird species were observed on-site at the time of field site assessment. However, some of the reported bird species in the project area are as follows; black-eyed bulbul (*pycnonotus barbatus*), yellow-mantled widowbird (*euplectes macrourus*), yellow bishop (*euplectes capensis)*, and neddicky (*cistocola fulvicapilla*).

The bird species reported in the project area are mainly in the least concern or unknown category under the IUCN Red List database.

5.5 Social-economic environment

Information on the socio-economic environment is presented with reference to a higher community level (district, province) in order to provide a general overview. This information is then, as far as available, backed up with data at the project area level. Hereto, community meetings were held at Project AoI. The collected information was assessed by the Consultant and subsequent verification interviews were conducted with the responsible ward councillors.

The community potentially affected by the project implementation is the **Chunga and Matero communities in Mwembeshi Ward.** The information protocols (questionnaires) are shown in Annex 11.

5.5.1 Population and Gender Distribution

5.5.1.1 In Lusaka Province

The City of Lusaka covers an area of 360 km² (the total municipal area is approximately 423 km²). The seven constituencies forming Lusaka are Lusaka Central, Kabwata, Kanyama, Matero, Mandevu, Munali and Chawama. (Zambia Statistics Agency, kein Datum)

The City's population of 2,204,059 comprises 1,059,480 males and 1,144,579 females, representing 48% and 52%, respectively (Zambia Statistics Agency, 2022). Lusaka's population accounts for 32% of the total urban population in Zambia and has been growing at an average rate of 3.7% per annum from 1980 to 2010. Nevertheless, the growth rate between 2010 and 2022 decreased to 2.0% (Zambia Statistics Agency, 2022). The population is predominately young, with up to 70% of the population estimated to be below the age of 30.

5.5.1.2 In the Project AoI

In the communities affected by the Project, the distribution of population by gender and age is as follows.

Table 26 Population statistics by gender and age for the Project AoI

Age group	Male	Female
0-4	5,095	5,088
5-9	4,309	4,528
10-14	4,460	4,756
15-19	4,027	4,524
20-24	3,245	3,890
25-29	3,081	3,491
30-34	2,911	2,736
35-39	2,576	1,959
40-44	1,676	1,139
45-49	1,084	916
50-54	696	578
55-59	455	332
60-64	282	262
Above 65	362	420
Total	**34,259**	**4,619**

Source: (CSO, 2013a)

As per the most vulnerable group in the communities, the orphaned children, (CSO, 2013a) published the following data revealing a significant part of the population in the affected communities is highly vulnerable. Given the fact that the majority of the orphans lost their fathers, the poor economy of the female or children-headed households is a great challenge for community development.

Table 27 Orphaned children

Age group	Orphans				% Orphans within the group	% Orphans in the total population
0-17	Paternal	Maternal	Both	Total		
32,912	2,905	737	944	4,586	14	6.6

Source: (CSO, 2013a)

5.5.2 Indigenous people in the Project area

Due to the growth of Lusaka and general urbanization, many people from different ethnic tribes have migrated to the city surrounding areas to find work. The areas have a blend of different cultures, as well as a very definitive influence of Western standards. Therefore, there are no indigenous people in the Project AoI.

5.5.3 Educational Level and Facilities

In Lusaka Province

In Lusaka Province, there is a total of 401,098 students and pupils i.e. secondary and primary broken down as 118.215 for secondary schools and 519,313 for primary schools. The number of teachers in total stands at approximately 15,000 broken down as approximately 11,000 for primary school teachers and 4,000 for secondary school teachers. The number of students attending school at both secondary and primary levels stands at approximately 500,000 students and pupils. The breakdown is shown in Table 28.

In the Project AoI

During the scoping exercise, four schools were noticed to be near the WWTP. There was no boarding school identified in the area, nor tertiary institutions. Most children in the area are actually admitted to schools outside of Chunga township such as Matero, and Lilanda townships. This may be attributed to the limited number of schools in Chunga. The table below shows the demographics of the schools in the project AoI.

Table 28 Basic and secondary schools near the Project AoI

S/N	SCHOOL NAME	NAME OF HEADMASTER	CONTACT NUMBER	B	G	TOTAL
1	CHUNGA SECONDARY SCHOOL	MUZENGA CHRISTOPHER	979,376,733	1737	1459	3196
2	NELSON MANDELA SECONDARY SCHOOL	HENRY KAMPWITA	978,261,768	1479	1528	3007
3	NEW CHUNGA PRIMARY SCHOOL	TEMBO BISTONE .T.	977,746,001	1251	1329	2580
4	TWALUMBA COMBINED SCHOOL	CLETUS LONGWA	977,410,028	1633	1771	3404

Source: Provincial Education Office, Lusaka (2021)

5.5.4 Gender Equity

Zambia has shown commitment to mainstreaming gender by being a state party to many international instruments and protocols that are championing the significance of integrating gender equity in mainstream institutions and the project cycle, with the aim of attaining gender equality as an outcome. Notable among the instruments include the revised National Gender Policy 2014, and international instruments such as the SADC protocol, the Convention for the Elimination and Discrimination Against Women, Beijing Platform of Action 1995. In an effort to attain these global commitments, the government of Zambia sanctioned that there should be a ministry of Gender to specifically look into the issue of Gender mainstreaming in various sectors of development.

All water supply and sewerage companies in the country are regulated by NWASCO and as part of its regulatory role, NWASCO directed that all water supply institutions in the country adhere to Gender mainstreaming in all their programs, policies and operations by institutionalizing gender mainstreaming agenda. In response to the above directive and also in compliance with regional and national gender policy, LWSC developed its own Gender policy in 2014 and institutionalized gender mainstreaming in order to attain equity and later on, equality.

Outcomes for Zambian women and girls are strongly shaped by social norms which support widespread discrimination. Women are generally regarded as subordinate to their male counterparts, having less voice, less autonomy, fewer opportunities and lower self-esteem. LWSC recognizes the facts that change in the male-female relationship would address some of the vulnerabilities and improve the chances to better participate in water supply, sanitation and hygiene. Gender equity is not only a human rights issue but it is a means to attaining gender equality.

Gender equity in LWSC is promoted at various levels which includes but are not limited to water committees, ward development committees, and community-based enterprise level. This equity is in terms of roles, responsibilities, opportunities, decision-making, and access to and control over resources. LWSC is committed to gender mainstreaming and as such, all gender entry points, such as policies, and operation procedures have been engendered and gender awareness meetings will be routinely conducted for both the project implementers and the local communities. Furthermore, LWSC is committed to affirmative action (positive discrimination), in order to encourage the discouraged groups of men in the decision-making positions such as structures mentioned above.

5.5.5 Gender Mainstreaming

The mainstreaming of gender within any developmental project means that the project will give equal opportunities to both men and women as participants and beneficiaries. Mainstreaming ensures that the needs of the people both male and female are accommodated and this includes women's productive capacity to alleviate poverty and maximize economic input. The community in Chunga is a well-organized community where men and women have shared resources and opportunities to foster development in their area. It was evident during the scoping exercise that some women have taken up jobs that were once only considered masculine jobs such as gardening, bricklaying and other laborious jobs. Some of the households visited actually depended on the woman to provide for their daily needs while the men remained looking for jobs and other sources of income. This may have an effect on the egos of the men living in the women-dominated households which is one of the major causes of GBV, when either gender feels inferior to the other. However, in the Chunga community, very few cases of vice have been recorded.

Female-dominated activities in the community include farming, selling farm produce at the market, running shops locally known as tunthemba and sweeping the streets under contracts with the local councils and gardening. The men-dominated fields include crafts such as carpentry, metal fabrication, plumbing, electronic and electric technician, grave digging, bricklaying and working on farms as labourers. In terms of communal resources such as land and water, there was no conflict expressed by either gender during the survey, land and water are equally shared in the community. In the interest of fostering development in an area while providing equal opportunities to both men and women, a gender assessment in Government Farms and Zanimuone East compound was carried out using data from the Zamstats population projections and information collected during the scoping exercise. The focus was on two settlements due to the restricted movement during the Covid-19 pandemic when the exercise was carried out.

Some challenges faced by the community in line with gender mainstreaming include the following:

- Underrepresentation of women in decision-making processes
- Within some households, there were some inequalities in decision making and negotiating potential observed, this is in a case where the families were asked what other developments they wanted to see accompany the coming of the WWTP, mostly the males answered
- Some women complained about the gender division of labour. Their spouses were not allowing them to take part in certain types of work such as those considered "only for men"
- There were some complaints of discriminatory attitudes towards women especially from the younger generation who were brought up mainly seeing women take care of homes and not take part in developmental activities

Considering the above problems that usually arise in communities, gender mainstreaming sometimes may cause mistrust, confusion and anger in communities that have not yet understood its importance. In this case, sensitization programmes will give in place before and during the construction period to help the community understand the importance of involving both genders in developmental projects. Some of the important factors to note about gender mainstreaming are:

- Mainstreaming helps promote gender equality, which has a positive impact on economic development and poverty reduction because women tend to invest more in their families' welfare than men;
- Women become highly motivated as their situation improves once gender mainstreaming is applied. From this follows a positive impact on the development of society;
- The possibility that women can take full advantage of the resources and other benefits that projects bring to communities is increased;
- Women's opportunities to access and influence decision-makers are increased;
- There will be an opportunity for men to work with – and share responsibilities with – women in the context of projects.

5.5.6 Gender-Based Violence

Ensuring fair or equal representation of men and women in the preparation of the project design, scoping meetings and disclosure of the ESIA report, the Consultant was committed to taking consideration of the participation of both males and females. Despite differences in roles, responsibilities, opportunities and control over resources, a deliberate approach was adopted to mainstream gender in the scoping studies and the compilation of the ESIA reports. This was meant to reduce cases of gender exclusion which may sometimes lead to cases of Gender-Based Violence (GBV).

GBV has become a vice that has seen a considerable rise in the past few years. It is an issue that for some time society was scared to talk about, especially the victims of GBV, be it male or female. NGOs, support groups and law enforcement agencies have played a significant role in curbing this scourge. During the scoping meetings, sensitization was carried out on GBV to all the community members that were being engaged at a personal level. More would have been done in terms of sensitization but the conditions at the time of the scoping exercise did not allow i.e. volatile election atmosphere, the COVID-19 pandemic and restrictions on gatherings. However, the Consultant still managed to have some information gathered concerning GBV in the area from the participants of the scoping survey.

Generally, the Chunga community is a peaceful community with most neighbourhoods being close to each other and its occupants being close too. The majority said they have not heard of many GBV cases in the area and that the few they have heard have been dealt with accordingly by law enforcement agencies. They attribute the low cases of GBV to the proactiveness of the law enforcement agencies on the matter, would be offenders are scared of being on the wrong side of the law, so they say. Regardless of these views, the empowerment of community members from such projects has the potential to increase GBV cases for a number of reasons, some of which could be one gender feeling superior over the other due to financial power and not wanting to be told what to do, the other could be spending money on illicit activities and neglecting the family at home, among many others.

These are some of the issues that will be taken with the seriousness they deserve once the Work commences, the grievance redress mechanism will handle such cases and will encourage affected parties to come forward and have their grievances heard by an impartial committee comprising also of community members. This will be very vital because, GBV can have lasting implications on the communities and the young population. It would also have negative implications on the project because the financiers are against such vices and they may warrant withdrawal of the financiers from the Project, which would negatively affect the Nation as a whole.

5.5.7 Economic Activities and Livelihoods

5.5.7.1 In Lusaka Province

The economy of Lusaka has become more diversified with its physical expansion and population growth. It has in fact grown from the provision of a few services to commercial farmers who had established themselves around it to the provision of higher-order services, such as financial and technical services, construction and even manufacturing activities.

As the capital city of Zambia, Lusaka also provides services including administrative functions to Zambia as a whole. Information from (Zambia Statistics Agency, kein Datum) shows a decline in unemployment levels in the city between 2005 and 2012 and an increase in employment levels both in the formal and informal sectors.

The informal sector has the largest number of people and recent studies in the project area also indicated a higher number of informally employed residents.

In terms of livelihood and income generation, in 2015 the average per capita income of Lusaka was ZMW 800 for both male and female-headed households. The trend shows a rapid increase from 2008 which also showed a drastic drop in the unemployed population.

The following table gives the average monthly income distribution for Lusaka Province.

Table 29 Average monthly income of households in Lusaka Province: % of households, and their distribution across urban population strata

Province / Residential Area	Average monthly income									
	Less than 50	50-150	151-300	301-450	451-600	601-800	801-1000	1001-1200	Above 1200	Average income (ZMW)
Lusaka	2.4	3.3	7.2	10.8	9.7	11.4	8.4	6.2	40.6	1,779
Low cost	1.4	3.3	9.8	12.2	11.4	12.5	9.3	6.7	33.2	1,403
Medium cost	1.3	1.6	2.3	5.2	3.8	5.6	5.9	4.8	69.4	2,852
High cost	1.9	0.5	3.0	5.6	3.7	5.3	5.9	2.9	61.3	4,308

Source : (CSO, 2011)

(CSO, 2011) grouped the population into two categories: labour force and inactive population[10]. The labour force for Lusaka Province comprised about 60%, of which 41% were in paid employment; 2.5% were unpaid family workers and 17% were unemployed (CSO, 2011). Unemployment rates for Lusaka Province were calculated at 28%, with females having higher unemployment rates (35%) than males (22%), (CSO, 2011).

The private sector is the next largest employer, employing 15% of men but only 5% of women, while the public sector accounts for 6.7% of employees with most of these working for the Central Government.

(CSO, 2013b) established that among the population of Lusaka District, about 40% are economically active. The employment status of the economically active population ranged from employers and employees to self-employed and unpaid family workers. There were a total of 1.9% employers and 60.9% employees, 35.3% were self-employed and unpaid family workers made up 1.9%.

[10] Paid workers, unpaid workers and the unemployed (as long as they are looking or available for the labour market) are all classified as economically active and are therefore part of the labour force. While others are termed economically inactive. they are neither working nor looking for work, and comprise students, retired people, homemakers, or are too ill or disabled to work (CSO, 2011).

Industrial sectors in Lusaka District are presented in the following figure. Most of the labour force is hired in the wholesale and trade sector (28%) followed by community, social and personnel services (26%).

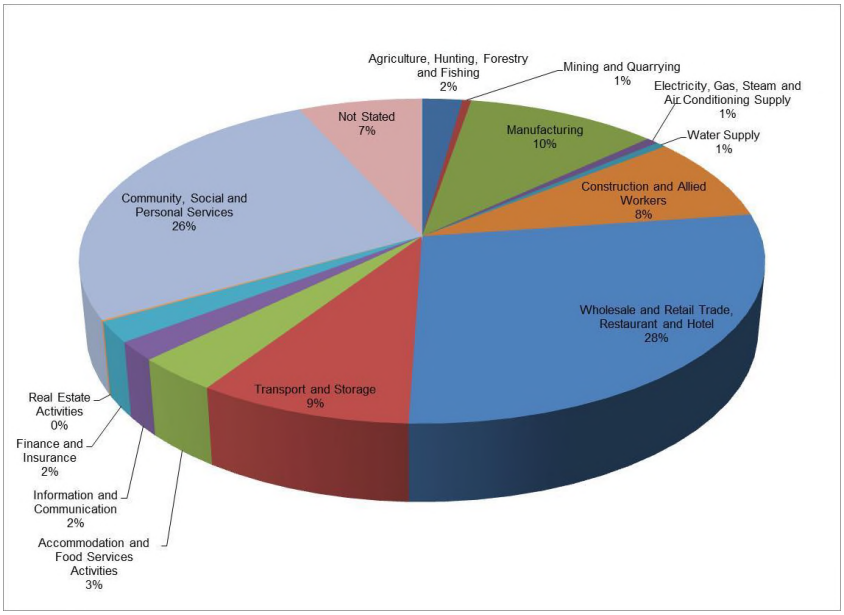


Figure 15 Distribution of working population by sectors in Lusaka District

Source : (CSO, 2013b)

5.5.7.2 In the Project AoI

The Project being predominantly in a low-density area is dominated by small retail shops and the selling of agricultural produce from the nearby farms of the Chunga area. Few if any of the households are able to meet all their needs through one activity, therefore the key characteristic of livelihood strategies is that of a combination of activities. People seek to balance the time, resources and risk allocated to various activities, so that, in total, the wide range of needs are met and this is done by prioritizing essential needs first. The strategies employed are dynamic and situational thus the main strategies used include small-scale business ventures with wage employment existing only in exceptional cases.

The largest business venture however is trading, with most of the goods coming from nearby farms and gardens. Other alternatives for livelihood in the area are pension money, renting out houses, selling pesticides to the farmers and working as a gardener in the big commercial farms surrounding the area.

In terms of employment, all PAPs that were interviewed in the Project AoI were not employed and they all ventured into personal businesses to raise money for daily basic needs. This indicates that the population that is in formal employment in Project AoI is very low. The table below shows the employment conditions.

Table 30 Employment conditions in the Project AoI

Economic parameter	Conditions
Unemployment %	95% according to ward councilor estimations
Main income sources	Self-employment approx. 90%

Source : (CES, 2017)

5.5.8 Water Supply Services

5.5.8.1 In Lusaka Province

Lusaka District has a total of 358,871 households and a population of 1,747,152 (CSO, 2013c). At least 85% of the district population has access to a safe water supply. Sources of safe water supply include individual household connections, protected boreholes, protected wells, communal pipes, water kiosks and piped water outside housing units but within stand/ plot.

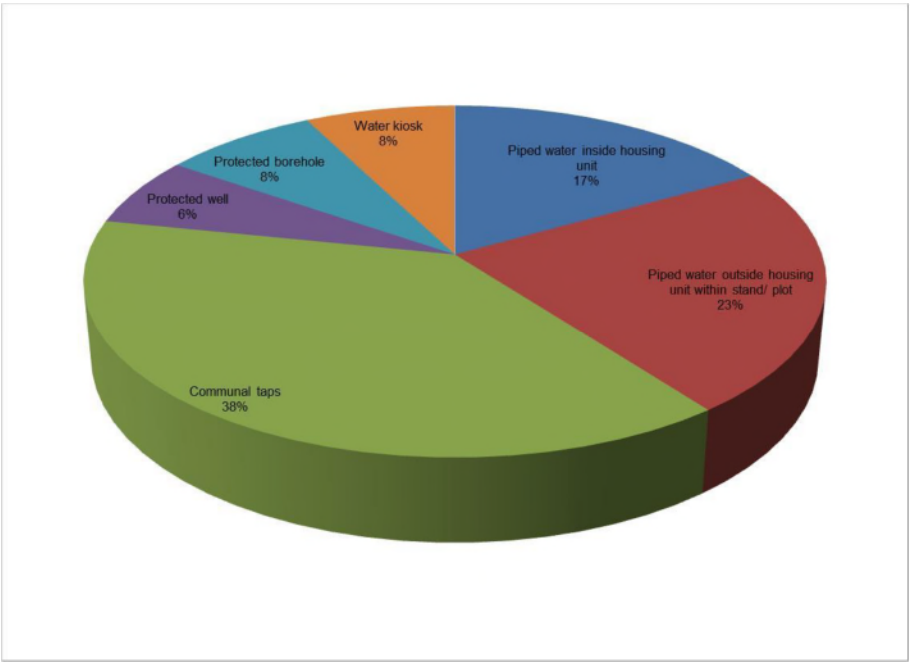


Figure 16 Population with safe water supply in Lusaka District

Source : (CSO, 2013c)

5.5.8.2 In the Project AoI

The majority of the population has quantitative access to drinking water. Around 65% of the population is equipped with in-house connections. However, this figure neither provides information on the water quality nor on the reliability of the water supply.

Table 31 Water Supply Infrastructure in the Project AoI

Water Supply Infrastructure	
In-house connection	approx. 65%
Tap in yards	approx. 20%
Public standpipes	approx. 15%
LWSC water tanks	1 (leaking)
Shallow wells	Several individual swells/boreholes. No exact data is available
Boreholes	

Source : (CES, 2017)

5.5.9 Sanitation Services

5.5.9.1 In Lusaka Province

70% of the households in the Lusaka District use pit latrines as the sanitation system. Only 23.1% of households use flush toilets, out of which only 16.8% are connected to the sewage network system

while 5.6% depend on septic tanks and soak-away systems (CSO, 2013c). the following figure shows the data.

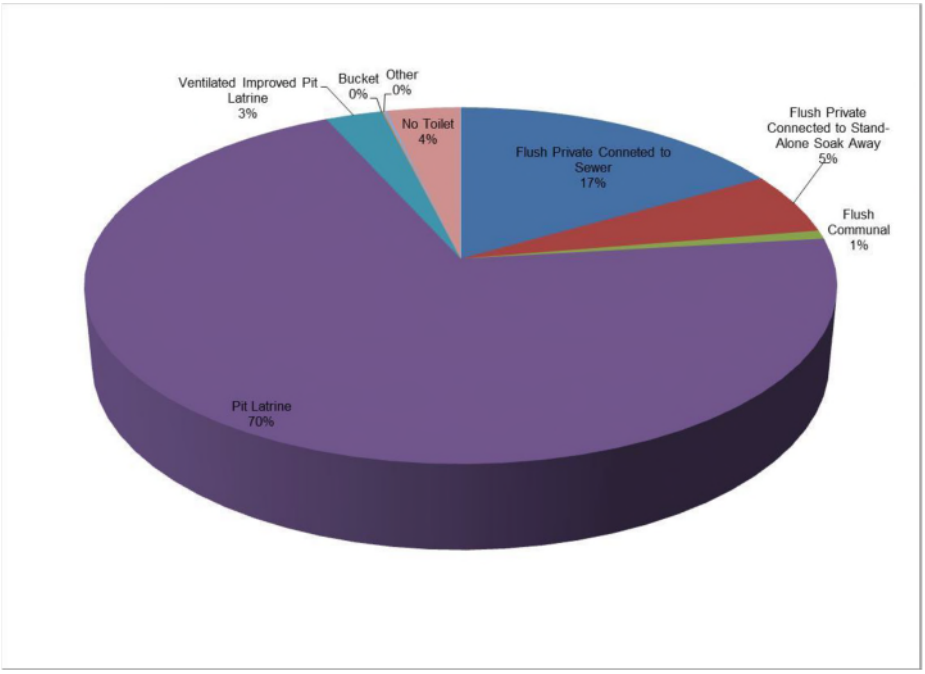


Figure 17 Distribution of wastewater treatment in Lusaka District

Source : (CSO, 2013c)

Lusaka's population growth has led to an increase in solid waste coming from the PUAa. Solid waste management has been a challenge for the Lusaka authorities due to the PUA's overpopulation. According to the LCC, the PUAs generate 70% of the city's solid waste, and half of it remains uncollected. Most of these areas are too big for effective collection of solid waste.

Chunga dumpsite sits on a 10-acre land, north of Lusaka City. Only a quarter of the land at Chunga dumpsite is being utilized.

5.5.9.2 In the Project AoI

Houses in Project AoI are all connected to the LWSC system for water provision, with over 60% of them also having sewer connections; hence many houses still have pit latrines. There is a steady reduction in the use of pit latrines due to sensitization programmes around Lusaka.

Table 32 Sanitation services in the Project AoI

Sanitation infrastructure	
Sewer connection	Approx. 65%
Pit latrines	Approx. 90%. Almost all hose holds have pit latrines as alternative toilet
Septic tanks	Approx. 20%

Source : (CES Consulting Engineers Salzgitter GmbH, 2017)

5.5.10 Human Health and Health Facilities

There are generally more cases of malaria in PUAs such as Chunga compared to other urban areas of Lusaka. This is mainly due to poor sanitary and environmental conditions. Limited access to health services contributes to the severity of any disease as in-time treatment is often not available. Waterborne diseases such as diarrhoea, cholera and dysentery are quite common in these areas and the project locations.

HIV/AIDS prevalence is a major problem in Zambia. The overall HIV prevalence among all women and men aged 15-49 tested in the 2013-14 ZDHS was 13% (CSO, MoH and ICF International, 2015). The

latest figures (CSO, MoH and ICF International, 2015) reported HIV/AIDS cases in Lusaka Province to be 16.3%, with 19.4% positive women and 13% HIV-positive men.

The health centre that services Project AoI is Chunga health centre and Matero Level 1 Hospital which offers both out-patient and in-patient facilities. The health centre had its maternity centre recently refurbished by the GRZ with aid from the EU through the Millennium Development Goal Initiative (MDGi).

Some households use water from shallow wells and boreholes for drinking purposes, likely to be contaminated by unsealed excreta pits. In Government Farms and Zanimuone East Compounds residents suspect that the wastewater from the WWTP that is untreated is infiltrating into their groundwater. These concerns were raised in the door-to-door interviews held between 1st and 9th July, 2021.

Specific data on waterborne diseases occurring in the neighbourhood of the WWTP system does not exist. However, residents reported that malaria and diarrhoea are the most common in their communities.

In terms of Malaria, more than 16 million people are at risk of Malaria in Zambia. It is estimated that in 2015, there were over 5 million malaria cases. Though significant achievements have been made in malaria control, the disease remains a significant cause of morbidity and mortality in Zambia. Reported Malaria deaths have dramatically decreased in Zambia over the past ten years, though more than 2,000 deaths are still reported annually (Zambia National Malaria Elimination Centre, 2015).

5.5.11 Land Use and Land Tenure

Zambia has six types of land tenure classes, i.e. Customary Land, Leasehold Land, Freehold Land, Stake Land and Public Land. The Chunga WWTP falls under the State Land type of land tenure which entails that the land is owned by the GRZ and can be used for public utilities, schools, hospitals, Government offices and other Government properties and projects.

The land use type of Project AoI is mainly that of agricultural practices but is slowly becoming a PUA setup with a lot of illegal settlers and irregular housing patterns.

There are residents who own the land they reside on and others were renting the pieces of land, but generally the land adjacent to the WWTP i.e. New Government Farms and Zanimuone East is owned by individuals under leasehold type of land tenure. During the scoping exercise there no property that was found to be on customary land.

A more detailed analysis of the ownership situation of the land neighboring the Chunga WWTP's land in the ownership of LWSC was conducted during the resettlement screening process and the findings have been highlighted in the RAP document which complements the ESIA.

5.5.12 Culture and Heritage

The City of Lusaka is named after a historical site where Chief Lusaka of the Soli people resided. Manda Hill area hosts the traditional graveyard of the first settlers. Other sites of cultural heritage and historical importance include the memorial site in Chilenje, where the first Republican President lived during the struggle for political independence; the presidential burial site at Embassy Park; and Football Heroes Burial Site.

The Consultant is not aware of any archaeological remains present within the Project AoI. Should there be any archaeological site found during the construction period, the teams will notify the National Heritage and Conservation Commission (NHCC).

The Chunga cemetery is located near the WWTP and to the immediate east side of the existing access road. It was noted that two graves are slightly within the alignment of the existing access road. Should there be any tombs found during the construction period, the teams will notify the National Heritage and Conservation Commission (NHCC) and follow the procedure in Annex 17 - Chance Find Procedure.

5.5.13 Transport, Communication and Site Accessibility

The City of Lusaka has a well-developed road network system linking the CBD to various parts of the City as well as to various towns and cities in the country. The main road network in Lusaka forms an urban area pattern along the Great North Road (GNR), Great East Road (GER), Kafue Road (T2), Mumba Road (M9) and Cairo Road. The T2 connects Zambia to countries in southern and eastern parts of Africa, and particularly the ports of Beira in Mozambique, Durban in South Africa, Dar-es-Salaam in Tanzania and Mombasa in Kenya.

The national North-South railway line divides the urban area into the western side and eastern side. The two airports in Lusaka, the City Airport and the Kenneth Kaunda International Airports (KKIA), are in operation although the City Airport is mainly used by the Zambia Air Force (ZAF). There are five bus stations located in the city centre; four of which are for local commuters (Soweto/ City Centre, Kulima Tower, Lumumba and Millennium bus stops), and one bus stop (Inter City Bust Terminus) is for inter-town and international travel. In addition, there is a railway station located in the CBD area for both passengers and goods.

The site is accessible either by using the Great North Road or by using the road network connecting the township of Matero to that of Chunga.

The road accessing leading to the WWTP is a small, unpaved road that is in poor condition with a total length of about 3,600 meters. This road is also the access road to the New Government Farms community in Mwembeshi Ward and runs along residential areas as shown in the figure below.

Figure 18 Access Road to Chunga WWTP from the Great North Road

5.5.14 Traffic

Zambia has a history of high traffic accident incidence. LCC states that Road Traffic Accidents have been ranked the third highest cause of death in Zambia after HIV/AIDS and Malaria and Lusaka Province counts for half the road accidents and a third of the fatalities.

Arising from the high population growth and increased socioeconomic activities, the City of Lusaka has been experiencing a tremendous increase in the volume of traffic especially during the last one and half decades. This increase is mainly attributed to the increased economic activities within the City and which has led to an influx of cheap used vehicles imported mainly from Japan as transport to support these economic activities. The assessment further established that congestion worsens during the morning, lunchtime and in the evening.

5.5.15 Telecommunication

The Project AoI has favourable radio and internet available to people with phones and other facilities which can be used for such communication. For the radio service, the coverage is uniform for most of the general stations especially the state-run radio and television networks. Mobile service providers Airtel, MTN and ZAMTEL are present in the project area. The network is along both the rail line and the roads.

5.5.16 Energy Services

Lusaka District is connected to the Zambian Electricity Supply Corporation (ZESCO) National Grid and most of the houses in the project area are connected to the Grid except for a few vulnerable households in the area. Houses that were not connected to the ZESCO lines either use solar or depend on candlelight at night and charcoal stoves for cooking their food.

5.5.17 Religious Practices and Rites

People in Project AoI are predominantly Christians and a number of churches including the Catholic, Jehovah's Witness and Seventh Day were found. Proportionally the majority of the people worship on Sundays than Saturdays. This is critical in determining the work calendar for the workforce as most people in the area observe Sunday and Saturday as religious days.

5.6 Sensitive Receptors

Considering the baseline study at the Project AoI, the key E&S sensitive receptors are as follows:

- No threatened or endangered species of fauna or flora were registered or known to exist.
- No sensitive or fragile habitats were noted in relation to the extent and magnitude of the works.
- No species of fauna or flora that could be exploited for commercial purposes were noted.
- The extent of the proposed Project AoI does not interfere with any protected area.
- There are no churches, hospitals or schools.
- The communities of Chunga and Matero.
- Farmers downstream the effluent discharge point that irrigates crops with the water from the receiving water body before the effluent is diluted into the Chunga River.

6 ENVIRONMENTAL AND SOCIAL IMPACT SCOPING

Possible E&S impacts are assessed in this chapter. Hereby the **preferred Option 5 is considered exclusively**, as explained in Chapter 4.2. These impacts will result from activities to be carried out during the construction and/or operation phases.

6.1 Specific considerations of key environmental impacts

The key environmental topics are described in more detail in this section. This includes:

- WWTP land requirements.
- Impacts on water resources (reduction of pollution loads).
- Sludge-to-energy options (biogas generation and recovery potential).
- Impacts on climate, atmosphere and proposed project structures (Climate Check).
- Future sewage sludge generation and disposal/reuse options.

6.1.1 WWTP land requirements

Facing the growing level of urbanisation in Lusaka City, land requirements for the WWTP extension or construction represents an essential factor. The next table provides an overview of the land requirement for the proposed Chunga WWTP.

The current Chunga WWTP covers an area of approximately 14 ha, all of which are under the ownership of LWSC. The existing WWTP will be replaced by a WWTP with CAS as the main treatment. The new WWTP will occupy an area of approximately 7 ha.

The change of technology from TF to CAS has reduced land requirements.

Table 33 Proposed Chunga WWTP land requirements (ha)

2022 (existing)	2030	2045
14	6.7	7.9

6.1.2 Impact on receiving water body

Considering that the WWTP at Chunga is not operating and that all the influent wastewater is bypassed into the River without receiving any treatment, it can be assumed that the concentration of the influents is the same as in the effluent.

The following table shows the organic load discharged at Chunga WWTP.

Table 34 Organic load discharged into the receiving water body

Parameter	Effluent (mg/l)	Treatment target ZEMA (mg/l)	Load Discharged (kg/d)
Av. dry weather flow (7,409 m^3 / d)			
BOD	3,356	50	24,865
COD	2,458	90	18,211

Source: (GIC - HYDROMENT - Bari Zambia, 2022)

It is estimated that the proposed Chunga WWTP influent flow and quality of wastewater will be as per Annex 3 - Proposed Chunga design flow and loads. The Chunga WWTP will be constructed to treat the wastewater to the effluent standard requirements shown in Table 16.

The proposed Chunga WWTP shall be constructed to cover the needs for the year 2030 flows and loads (phase A) with provision for a future extension to treat the wastewater produced in the year 2045 (phase B).

According to LWSC and financing bodies' decision, phase A works will have two options. A1 for fulfilling the requirements for carbon removal and nitrification and A2 for full nutrient removal (denitrification and phosphorus removal). As option A2 will lead to considerably higher CAPEX and OPEX, the option to be implemented will be decided based on the possibility of LWSC covering the costs offered by the construction works bidders during tendering.

The following table shows the estimated organic and nutrient load discharged of the proposed Chunga WWTP with Option A1, being the most unfavorable for the environment.

Table 35 Estimated future effluent quality and reduction of organic load in Option A1 (2030)

Parameter	Inffluent (mg/l)	Treatment target ZEMA (mg/l)	Effluent (mg/l)	Reduction rate (%)	Load Discharged (kg/d)
Av. dry weather flow (19,834 m^3 / d)					
BOD	456	25	25	95%	496
COD	913	90	90	90%	1,785
Suspended Solids, SS	462	35	35	92%	694
Total Nitrogen, TN	58	24	33	44%	645
Total Phosphorus TP	15	2	10	37%	188
Total coliforms (no./100 ml)	1.00E+07	20	20	99.9998%	

The effluent concentrations will be significantly reduced, and therefore, the quality and biodiversity of the receiving water body positively impacted.

The total coliforms will be almost eliminated. Regarding nutrients, some reduction will be achieved, however, as per the A1 option, this will not be enough to achieve the ZEMA effluent standards.

6.1.3 Impact on Groundwater

Currently, given the state of the WWTP, there is potential contamination of groundwater considering that the effluent is not properly treated and then discharged directly to the natural water bodies. Causing the heavy metals and contaminant chemicals from the industry to likely sink into the ground as the river flows, potentially reaching groundwater reservoirs.

Once the WWTP has been upgraded, the water will be properly treated before its release into the receiving water body, this will improve both the surface and groundwater quality.

6.1.4 Landscape and Visual Impacts

In this context, specific attention has to be paid to the community graveyard stretching along the access road to the Chunga WWTP compound. Today, the graveyard has already extended beyond its original border up until the fence of the existing WWTP. Some graves are placed immediately at the roadside. The graveyard is protected by old trees along the access road. A site inspection has shown that potential construction works (broadening of the access road, transfer pipelines, WWTP) are not likely to affect the graveyard. Nevertheless, planting trees at the WWTP site bordering the graveyard is recommended. The Lusaka City Council has also been engaged through the public health and civil engineering department on how to protect the graveyard. If there will be a need to move any graves, the rightful channels of engagement will be followed before any works are done. The promoter of the project is dedicated to preserving all cultural structures in the AoI, specifically the graveyard adjacent to the WWTP.

Table 36 Landscape and Visual impacts

Impact/effect	Impact significance
Effect on the preservation of scenic views and valued features	Moderate
Compatibility with surrounding areas	Moderate
Effect on the character of the area	Moderate
Visual impacts (features, removal of vegetation, etc.)	Major
Effects on natural heritage sites	No sites identified

6.1.5 Impacts on climate and atmosphere

In order to calculate the GHG emissions of the no-action alternative and the Project, the Energy Performance and Carbon Assessment and Monitoring Tool (ECAM) developed by WaCCliM[11] was utilized. For wastewater treatment, three major GHG are considered, those are; carbon dioxide (CO_2), methane (CH_4) and Nitrous Oxide (N_2O).

The main processes in a WWTP where GHG is emitted are presented in the following table.

Table 37 Main processes within the WWTP that emit GHG

Process	Emissions
Electricity (indirect)	CO_2: The electric energy demand in the different installations of the WWTP (e.g. blowers, pumps, lights, sludge dewatering unit…)
Treatment process	CH_4: The organic component removed from wastewater in the form of sludge. N_2O: The emission also plays an important role in WWTPs with aerobic treatment processes.
Biogas	CH_4: Any leaks in the systems shall be considered. The amount recovered to produce heat or electric energy, or flared in the anaerobic digestion shall not be counted.
Sludge Management	CH_4 and N_2O emissions may be released from the sludge depending on the type of management (e.g. storage, composting, landfilling…)
Discharged wastewater	CH_4 and N_2O emissions may be released from the discharged (un)treated wastewater into the environment.

The following assumptions have been made.

Table 38 Assumption for GHG emissions calculations

Parameter	Value	Unit	Reference
Population equivalent reference year 2030	146,171	p.e.	(GIC - HYDROMENT-Bari Zambia, 2022)
The average flow of wastewater in the dry season in 2030	18,714	m^3 / d	
Average BOD_5 load in 2030	8,770	kg / d	
Average TN load in 2030	1,127	kg / d	
CH_4 emission factor (treatment)	0.14	kg CH_4 / kg BOD	(Deborah Bartram (USA), 2019)

[11] WaCCliM – Driving a climate-smart and sustainable urban water sector

Parameter	Value	Unit	Reference
N_2O emission factor (treatment)	0.0004	kg N_2O-N / kg N	
CH_4 emission factor (discharge)	0.021	kg CH_4 / kg BOD	
N_2O emission factor (discharge)	0.005	kg N_2O-N / kg N	
Emission factor for grid electricity in Zambia	0.13	t CO_2 eq/ MWh	(EIB, 2020)

Further assumptions are considered:

- Power is exclusively sourced from the Zambian electricity grid (no off-grid power plants).
- For comparison purposes, the no-action alternative and the Project alternative for 2030 used the same basic data (e.g. population, inflow loads…).
- No-action alternative
- The wastewater is discharged into the receiving water body without receiving any treatment.
- Project
- The wastewater is discharged into the receiving water body with the quality indicated in Chapter 2.16.
- The recovered heat energy will be used in the treatment processes.
- The amount of produced CH_4 in the anaerobic digestion is transformed for heating of digesters or burned in the flare to CO_2.
- The sludge will be stored and used for land application.

For comparison of results, the **Global Warming Potential (GWP)** has to be considered. It is a measure of how much a given mass of GHG is estimated to contribute to global warming.

The following table shows the amount of CO_2 equivalent released into the atmosphere for the no-action alternative and the implementation of the Project.

Table 39 Total CO_2 equivalent emissions

CO_2 equivalent emission	Comment	No-action (t CO_2 eq/ y)	Project (t CO_2 eq/ y)
Electricity (indirect)	Conversion from MWh to t CO2eq using the emission factor for grid electricity in Zambia	0	506
Treatment process	GHG from the treatment process (CH_4+N_2O)	0	195
Biogas (anaerobic digestion of sludge)	The sum of emissions from biogas production (biogas flared, valorised and leaked)	0	406
Sludge Management	GHG emissions from sludge management operations (storing, composting, incineration, land application, landfilling, stockpiling and truck transport)	0	345

CO_2 equivalent emission	Comment	No-action ($t CO_2$ eq/ y)	Project ($t CO_2$ eq/ y)
Discharged water	GHG emissions from discharging untreated wastewater into the environment	3,249	673
Total		**3,249**	**2,126**

Besides avoiding the discharge of pollutants into the environment, the implementation of the Project will contribute to reducing GHG emissions. Energy recovery from biogas could still reduce those emissions in Phase B of the Project when a CHP is envisaged to generate electricity that would reduce the electricity demand of the WWTP.

6.2 Objectives and Approach

The ESIA is an instrument that examines the risks and impacts of a project. The purpose of the ESIA is to provide the positive and negative E&S impacts caused by a project. It identifies potential impacts and plans safeguard measures to be followed during project implementation. More specifically, the ESIA will:

- Describe how the ESIA fits in with and supports relevant Zambian laws and policies and how gaps between international and national standards will be addressed. (see Chapter 2.15 Gap Analysis).
- Identify and assess the positive and negative E&S impacts that will be caused by the Project, including a specific focus on informal uses/seasonal uses and inclusion of vulnerable people and gender aspects.
- Describe the mitigation measures required to address the impacts (ESMP) and how they can be included in the Project documents and contracts.
- Describe appropriate measures to respect work standards (ILO) and Health & Safety (EHS) considerations (public safety/work safety).
- Lay out plans for stakeholder consultations and disclosure of documents on the impacts and proposed mitigation measures. (see Annex 15
- Develop a practical mechanism how to address complaints / Grievance Redress Mechanism (GRM). (see Annex 16).
- Develop suitable monitoring systems and reporting procedures to effectively manage the impacts and mitigation methods, (Environmental and Social Management and Monitoring Plan (ESMMP)). (see Chapter 0).
- Specify the roles and responsibilities of different institutions for managing the impacts caused.

The Project intends to improve the E&S conditions of Lusaka and in the downstream rivers where the WWTP effluent is discharged. Some of the benefits from WWTPs are safer and more stable aquatic ecosystems and lower levels of pollution in receiving water bodies. However, during the construction phase, there may be some negative impacts on the E&S.

The assessment of the issues has been conducted according to a synthesis of criteria required by the environmental management procedure defined in the table below, and as prescribed by ZEMA.

Table 40 E&S Impact Criterion

Impact Criterion	What it means
Nature of Impact	This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. Its description should include what is being affected and in what way.

Impact Criterion	What it means
Direct Impact	An impact that appears immediately as a result of an activity of the project, direct impacts would be experienced mainly during the construction and operational phases, and include effects on the physical environment, health and safety of the residents where the company operates.
Indirect Impact	An impact that is related to the project but that arises from the activity of the project at a secondary level. For example, a fully operational workshop may cause indirect impacts on the local economy of a community by increasing accessibility to other markets, and improved livelihoods. The indirect impacts are primarily socio-economic and extend beyond the project implementation. The indirect impacts include changes in economic activities and long-term changes, such as increased land degradation due to increased settlement and development in the area. Unlike the direct impacts, which occur in the immediate environment, the indirect impacts would be felt in the adjacent regions.
Spatial Extent	The physical and spatial size of the impact is a description of whether the impact would occur on a scale described as follows: • **Site**, the impact could affect the whole or measurable portion of the site. Whether it is limited to the immediate area of the proposed project; • **Local**, the impact could affect the extended area adjacent to the site perhaps a neighbourhood or small town. Whether it would affect the surrounding/environs up to 15km outside the immediate environment; • **Regional**, that impact could affect the area including the outlying areas of the city, the transport routes and adjoining towns; • **National,** the impact could be as far-reaching as international boundaries.
Frequency	Frequency is the incidence, occurrence, regularity, rate or rate of recurrence of the source of impact. This is measured by the number of times of occurrence of the source of impact due to the proposed development. • **Occurs once**, where the source of impact will either occur once and disappear with mitigation or will be mitigated through the natural process after occurring once due to the proposed development; • **Occurs twice**, where the source of impact will occur twice at any given phase of project implementation and thereafter it will be entirely negated; • **Occurs more than twice,** where the source of impact will continue or occur more than two times for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter
Duration	The lifetime of the impact. This is measured in the context of the lifetime of the proposed development. • **Short Term**, the impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the preparatory phase; • **Medium Term**, the impact will last for the period of the preparatory phase, thereafter it will be entirely negated; • **Long Term,** the impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter; • **Permanent:** the only class of impact which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Intensity	A description of whether or not the intensity (magnitude) of the impact would be high, medium, low or negligible (no impact). An attempt will be made to quantify the impacts on components of the affected environment to be described as

Impact Criterion	What it means
	follows: is the impact destructive, or benign? Does it destroy the impacted environment, alter its functioning, or slightly alter it? These are rated as follows:- • **Low**, where the impact will not have a significant influence on the environment, and this will not be required to be significantly accommodated in the project design or implementation; the impact alters the affected environment in such a way that natural processes of functions are not affected in any significant way; • **Moderate**, where it could have an adverse influence on the environment, which would require modification of the project design or alternative implementation schedules; the affected environment is altered, however, function and process continue, albeit in a modified way; • **High**: Where it could have a significant influence on the environment but cannot be mitigated or accommodated by the project environment by introducing alternative mitigation measures such as realignment at a particular point or adoption of different design measures. The function or process of the environment is disturbed to the extent that it temporarily or permanently ceases. This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Note that some impacts have a high intensity and a short duration with no permanent audio effects.
Severity	This describes whether the severity (harshness/gravity) of the impact would be high, medium, low or negligible (no impact). The severity of the impact will be qualitatively determined by the components of the environment to be affected by taking into consideration the following questions. Is the impact harsh, serious or dangerous? Does it degrade the impacted environment, alter its functioning, or slightly modify its natural state. These are rated as follows: • **Low** applies where the impact is very little and will not have a significant influence on the environment. This will not be required to be significantly accommodated in the project design or implementation and the impact changes the affected environment in such a way that natural processes of functions are not affected in any significant way; • **Moderate**, applies where the impact could have an adverse influence on the environment and would require some modification of the project design or alternative implementation schedules. In this regard, the affected environment is altered while the function and process continue, albeit in a modified way; • **High**, applies where the impact could have a significant influence on the environment but cannot be mitigated or be accommodated by the project environment by introducing alternative mitigation measures such as realignment at a particular stretch or adoption of different design measures. In this regard, the function or process of the environment is disturbed to the extent that it temporarily or permanently ceases.
Probability	This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows: • **Unlikely**, the probability of the impact occurring is very low, due to the circumstances, design, or experience, • **Possible**, the impact could possibly happen, and mitigation planning should be undertaken, • **Probable**, it is most likely that the impact will occur at some or other stage of the development. Plans must be drawn up before undertaking of activity, • **Definite**, the impact will take place regardless of any prevention plans, and only mitigatory actions or contingency plans can be relied on to contain the effect.

Impact Criterion	What it means
Sensitivity	The sensitivity of the element being impacted would be regarded as being high, medium, low or negligible (no impact). An effort will be made to determine the qualitative sensitivity of the element of the environmental components being impacted upon due to the proposed development. Is the reaction of the environmental component due to the impact acceptable or not? Does it destroy the impacted environmental component, alter its functioning, or slightly alter it? • **Low**, where the sensitivity of the element being impacted will not have a significant influence on the environmental component, and this will not be required to be significantly accommodated in the project design or implementation. The impact on the affected environment will be in such a way that natural processes of functions are not affected in any significant way; • **Moderate,** where the sensitivity of the element being impacted could have an adverse influence on the environmental component, which would require modification of the project design or alternative implementation schedules. The affected environment is altered while the function and process continue and albeit in a modified way; and • **High**: Where the sensitivity of the element being impacted could have a significant influence on the environmental component but cannot be mitigated or accommodated by the project environment by introducing alternative mitigation measures such as realignment at a particular stretch or adoption of different design measures. The function or process of the environment is disturbed to the extent that it temporarily or permanently ceases.

According to the above-mentioned criterion, finally, the Consultant assesses the significance of the impact. Significance is an indication of the importance of the impact in terms of the above mention criteria, and therefore indicates the level of mitigation required.

Table 41 Criteria for Impact Significance

Impact Significance	Definition
Major	• Very large or large magnitude of change in environmental or socio-economic conditions. • Impacts, both positive and negative, which are likely to manifest and be considered as important at a regional level or could result in breaches of legally enforceable mechanisms for the protection of the environment, social well-being and/or human rights. • Sensitive receptors will be affected.
Moderate	• An intermediate magnitude of change in environmental or socio-economic conditions • Impacts that are likely to manifest and be considered as important at a level of the municipality. • Sensitive receptors are unlikely to be affected.
Minor	• Small magnitude of change in environmental or socio-economic conditions. • Impacts manifest in the vicinities of project sites and may be raised as local issues but are unlikely to be of importance in the Project's permitting process. • Sensitive receptors will not be affected.
Negligible	• No discernible change in environmental or socio-economic conditions. • Impacts manifest within Project sites and are likely to have a negligible or neutral influence, irrespective of other impacts. • Sensitive receptors will not be affected.

Impact Significance	Definition
Positive	• Beneficial Impacts at the local and regional levels.

6.3 Impact Assessment and Mitigation Measures

The E&S impacts are separated into six categories in order to comply with the broader ESS structure:

(1) Physical Impacts (P)
(2) Biodiversity Impacts (B)
(3) Social Impacts (S)
(4) Impacts on Health & Safety (HS)
(5) Potential Cultural Heritage Impacts (CH)
(6) Climate Change Impacts (CC)

The following subchapters provide a breakdown of predicted impacts and an assessment of their potential significance, on the basis of a comparison of receptor sensitivity and impact magnitude. The assessment highlights where E&S risks might occur, and indicates where increased vigilance is necessary for addressing negative impacts. From there, relevant mitigation measures are taken into the ESMP.

Before assessing the Project E&S impacts, the following aspects of land requirements and impact on receiving water bodies are described.

6.3.1 Potential Physical Impacts (P)

Physical impacts concern the effects of the project on the land and natural resources. Risks of destroying landscapes, destruction of natural resources, depletion of soil nutrients, created erosion risks, water diversion, depletion and pollution and other resource pollution risks (e.g. air) are assessed in this category.

In the Project, physical impacts will arise through the construction of the WWTP and access roads.

Table 42 Potential Physical Impacts (P)

Impact on	Significance	Description of Impact / Risk
Soil	Major	• O: Risk of pollution with **heavy metals** through the sludge, in case industries do not pre-treat their effluents to remove heavy metals meeting the trade effluent requirements; and later sludge is used in agriculture or soil improvement. At Chunga there is higher significance the presence of heavy metals in the wastewater was observed (e.g. Chromium)
	Moderate	• C: Compaction, damage to **soil structure**. • C: Excavation creates **erosion risk** at the site and access road. • C&O: Pollution with **liquid and solid waste** (e.g. faecal, hazardous waste, oils).
	Positive	• O: **Stabilized and dewatered sludge** is a valuable agriculture fertilizer/soil improvement.
Water resources	Major	• O: Malfunctioning of the WWTP caused by: 1) **Inappropriate O&M** of the plant due to lack of resources. 2) If **industries do not pre-treat the effluents** before discharging them in the sewerage, high organic and/or heavy metals loads may affect the biological treatment of

Impact on	Significance	Description of Impact / Risk
		the WWTPs, leading to a decrease in the treatment efficiency.
	Moderate	• C&O: Pollution with **liquid and solid waste** (e.g. faecal, hazardous waste, oils). • O: Pollution through the sludge in case of leaching from **too high quantities of nutrients in the sludge** applied as sludge used in agriculture or soil improvement.
	Positive	• O: **Improved treatment** compared to the present dysfunctional WWTP that directly overflows into the River.
Air / Odour	Minor	• C&O: **Gas emissions** of vehicle/machinery sources. • C: **Dust emissions** of fugitive emissions of dust in the access road, transport of material, site preparation and excavation. • C&O: **Odour emissions** during cleaning/decommissioning of existing infrastructure and WWTP operation.
Noise	Minor	• C: Machinery is expected to cause **noise short-term disturbance**. • O: **Noise generated by pumps, blowers and generators**.
Waste generation	Moderate	• C: **Excavation Material.** Construction waste from existing sludge and contaminated soil. At Chunga, the existing sludge may be contaminated with heavy metals from industries. • C: **Demolition Material** from old replaced pipelines and structures to be dismantled. Chunga has a higher significance as there is electro-mechanical equipment and large structures.
	Minor	• C&O: **Domestic Waste** will increase from plastic from packaging etc. and domestic waste from workers. The volume can be estimated via the number of employees in the C&O phases. Solid waste generation may be 1.3 kg/cap-day. • C&O: **Liquid Waste.** The drinking water demand will be supplied by the public water supply system. Domestic wastewater will be generated by staff. The water usage can be assumed to be 130 l/person-day. • C&O: **Hazardous Waste.** Oil and air filters changed during the maintenance of machinery (e.g. excavator etc.), waste fabrics used in maintenance, empty paint and lubricant boxes, fluorescent lamps and wasted printer cartridges etc. • O: **Grit Material** from coarse and fine screenings.

C: Construction phase; O: Operation phase

Table 43 Recommended mitigation measures: potential physical impacts (P)

Pre-Construction
• Design of the WWTP in order to meet the effluent discharge standards. • Design of the WWTP in order to reduce heavy metals expected in the influent, e.g. Chromium. • Elaboration of a SMP. • Establish sound construction principles for contractors on soil stabilization requirements in the Works Contract (Employer's Requirements). • Establish environmental clauses for contractors on pollution prevention in the Works Contract (ESHS specifications, ESMP). • Establish performance guarantees on effluent discharge values for contractors in the bidding documents.

- Enforce the pre-treatment of the major industries' discharges into the sewerage prior to the commissioning of the new WWTP. In this regard, it is envisaged that Zamleather Industries Ltd. is the main contributor to Chromium in the Chunga sewer shed, and therefore, the efforts from LWSC to enforce the trade effluents standards should be put in this industry.

Construction

Training

- Training of works contractors, sub-contractors and workers for environmental good practices for construction works.
- Workers shall be trained to respond to emergency spills and taught how to clean up and manage leaks.

Soil

- Excavated material shall be temporarily stored and sorted onsite to maximize material reuse. The material not reused shall be transported offsite to a site agreed upon by LWSC. Stored material shall be stored safely in designated areas, not dumped into the river, or deposited on river slopes. Erosion prevention measures need to be implemented at all sites of earthworks.
- Avoid the use of a lot of heavy machinery in areas not designated for construction.
- Loosen the soils after completion of construction and plant vegetation around the campsite.
- Avoid digging in areas where construction is not intended. Protect / separate non-construction areas.
- Vegetate areas where there is no construction planned.
- Construction site to be restored and re-vegetated for slope stabilization immediately after the completion of construction.
- Avoidance of damage to private properties and minimize environmental damages (e.g. trees, etc.) during construction works.
- Rehabilitation of all damages.
- Design drainage and other disposal facilities to ensure soil stability and appropriate treatment.

Water resources

- Control contamination through bonding of storage areas, placing protective layers in areas where oil and other contaminates are handled and conducting continuous monitoring and maintenance of machines to prevent leakage.
- Plan emergency response measures in case of accidental oil spills.
- Ensure all used oils are stored in drums and disposed of with registered dealers with ZEMA.
- Spill kits shall be made available to workers.
- Exploitation of water sources for construction works shall be done after consulting the local authority and community.
- Construct water pans/dams to tap stormwater during the rainy season before the commencement of projects.
- Water abstraction permits should be obtained from WARMA.
- Good hygienic standards and proper management of sewage.
- Store materials in protected areas to reduce incidences of leakage
- Leftover construction material should be stored well and protected from elements of weather and erosion e.g. by bunding and covering the storage area
- All chemicals, hydrocarbons and other potentially polluting materials should be stored on an impermeable surface.
- Install proper siting of pit latrines away from water-logged areas.
- Monitor nearby sampling boreholes and shallow wells.

Air / Noise

- Enforcing works contractor maintenance of machines and transportation vehicles (minimization of air pollution). Avoidance of oil and fuel spills, and proper storage of oil and fuel barrels.

- Workers' H&S protection (noise protection equipment). Noise generation in habitation zones shall be limited to working hours. Ambient noise monitoring is not required.
- Engage a water bowser to be watering the premises and suppress the dust at least five times a day.
- Equipment used for processes that are likely to generate dust should be enclosed. This includes equipment such as gravel crushers, and gravel screeners.
- Adhere to ZEMA and international Regulations and Standards on air quality.
- Work within acceptable noise levels of 40 dB (A) during the night and 50 dB (A) during the day.
- The contractor shall use Best Management Practices (BMPs) for blasting, such as a chemical method to shatter the rocks and weaken rock formation, design and use of specific blasting plans, blasting mats, correct charging and micro delay detonations to minimise noise and vibrations.
- All workers will wear appropriate PPE at times including hearing protection.
- Noisy activities should be undertaken between 07-22hrs.
- Use of well-serviced machinery to minimize the sound produced.
- Plantations around the WWTP site.
- Pavement/widening of the access road to Chunga and Matero communities.
- Restrict vehicle speeds in/along residential areas.

Waste

- Detailed Waste Management Plan (WMP) is to be developed by the works contractor including specification of disposal sites for excavated materials and generated construction waste.
- Set up waste disposal bins in strategic areas on site.
- Put fines for any employees found discarding waste in undesignated areas.
- Engage an authorized and licensed garbage disposal unit.
- The sludge and soil from the WWTP, in case is contaminated and cannot be reused, needs to be disposed of safely.
- Hazardous wastes will be collected in a temporary hazardous waste storage area, which is surrounded by wire fences, bottom-sealed, and protected from precipitation. Materials from demolition could be hazardous and need to be disposed of safely.
- Non-hazardous waste generated at the plant will be regularly removed, temporarily collected and finally disposed of at the city solid waste landfill.
- Domestic wastewater generated to be discharged into the River.
- Close to the river no material deposits should be permitted and no re-fueling / lubrication of vehicles.
- Design (wastewater) drainage system to avoid run-off and spillage.

Operation

- Establish environmental clauses for operators on pollution prevention.

Soil

- Monitoring of sludge treatment and resource recovery as a soil amendment in agriculture => soil improvement / valuable agriculture input (EU requirements for monitoring of sludge used in agriculture).
- Develop periodic workshops and sensitization forums with the sludge potential users, focusing on sludge handling, appropriate personal protective equipment and procedures, and creating awareness of the risks associated with the eventual Chromium presence in the sludge.

Water resources

- Compliance with effluent standards to ensure that the status of the recipient water body does not deteriorate.
- Monitoring of the key performance parameters of the WWTP to promptly find out a possible industrial discharge affecting the treatment process.

- In case high concentrations of heavy metals are detected during commissioning, the addition of a treatment unit is required.
- Monitoring of the treated effluent at WWTP (targets on sewage treatment must be met). Effluent requirement for WWTP as per Chapter 2.16.
- Monitoring of the receiving water body quality upstream and downstream of the WWTP effluent discharge.
- Domestic wastewater generated to be treated in the WWTP.

Air / Noise

- Providing covers to equipment and containers that are likely to cause odour nuisance (sludge, waste, grit material).

Waste

- Hazardous waste shall be collected in temporary hazardous waste storage areas, which are surrounded by wire fences, bottom-sealed, and protected from precipitation. Hazardous waste will not be stored for more than 180 days. This stored waste will be given to the firms licensed for the collection of hazardous waste. Hazardous waste collected from the project site will be transferred to licensed intermediate storage areas, and then to hazardous waste landfills or incineration plants for final disposal.

  There are a total of about 10 companies licenced by ZEMA to handle hazardous waste. 60 % are involved in handling and transportation while 40% are involved in pre-treatment and treatment.
- Grit material is considered non-hazardous and shall be finally disposed of at the solid waste dump. Grease collected in the aerated grit chamber is usually considered hazardous and needs to be stored and disposed of according to consultations with ZEMA.

6.3.2 Potential Biodiversity Impacts (B)

Potential biodiversity impacts are related to the change of ecosystems through project activities. In the case of sanitation projects this concerns modification of flow volume through the discharge of treated effluent in surface water bodies thus potentially impacting aquatic and surrounding habitats.

For the project areas, landscape impacts, flora-and fauna (aquatic and terrestrial) and ecosystem services are relevant topics.

Table 44 Potential Biodiversity Impacts (B)

Impact on	Significance	Description of Impact / Risk
Landscape	Minor	• C: **Construction in a PUA**, semi-rural area. Similar structures to the ones to be constructed already exist.
Natural Habitats	Negligible	• C: The project site is **not in a natural habitat**.
Fauna and Flora	Minor	• C: **Loss of habitat** for birds and terrestrial insects. • C: **Loss of vegetation** when clearing the Site. • O: If WWTP operation fails, effluent impacts the **habitat of Chunga River**.
Ecosystem Services	Positive	• O: **Prevention of the degradation and/or improvement of the status of the water bodies** receiving treated effluent from WWTPs.

C: Construction phase; O: Operation phase

Table 45 Recommended mitigation measures: potential biodiversity impacts (B)

Pre-Construction
• Establish environmental clauses for contractors on landscape impact mitigation in the Works Contract (ESHS specifications).

• Establish performance guarantees on effluent discharge values for contractors in the bidding documents.
Construction
• Training of workers, monitoring and enforcement of good construction and environmental practices for access road construction, digging of trenches, pipe-laying and all metal and concrete works. • Avoid noise-generating activities and construction site lighting at night time to limit wildlife disturbance. • Stockpiling of removed topsoil for reinstating flora. • Any tree/plant harvested due to the project should be replanted. • Avoid cutting trees and clearing vegetation in areas that shall not be developed. • Planting trees and ornamental plants.
Operation
• Prevent pollution of water with chemicals. • Proper maintenance of all infrastructures including access roads.

6.3.3 Potential Social Impacts (S)

Potential social impacts are all impacts that positively or negatively influence the livelihood systems of the PAP, their land use practices, their access to resources, their social and economic relations, etc.

Risks to be considered are resettlement, changes in land use pattern, exclusion from social groups, or increase of vulnerability of impacted persons, including landless, old, weak, disabled persons, etc. (there are no groups of indigenous people in the Project AoI).

Table 46 Potential Social Impacts (S)

Impact on	Significance	Description of Impact / Risk
Land Acquisition and Resettlement	Negligible	• C: The WWTP fits within the land owned by LWSC. The CAS technology has reduced the total footprint of the plant. **No risk of physical displacement.**
Risk of exclusion of vulnerable people	Moderate	• C&O: Municipal compensation rates/practices not compliant with international standards. **Risk of arbitrary deviation** by the municipalities from international standards resulting in unfair compensation for the PAP. • O: **Tariff payment affordability risks** after increasing the tariff for covering the higher OPEX of the new WWTPs.
The influx of Outsiders (Construction Workers)	Minor	• C: **Vulnerable groups at risk** of experiencing harassment from construction workers. • C: Risk of **spread of contagious diseases.**
Access to improved Sanitation	Positive	• O: Access to **improved Sanitation**.
Income Generation and Employment	Positive	• C: **Employment creation**. • C&O: **Know-how transfer** on wastewater treatment technologies to local companies and specialists. • O: Potential indirect, future **income generation and employment effects through tourism** development. • O: **Resource recovery** from sludge as a soil amendment in agriculture will improve the fertility of the soil.

C: Construction phase; O: Operation phase

Table 47 Recommended mitigation measures: potential social impacts (S)

Pre-Construction
• Develop SEP in line with EIB/KfW and Zambian requirements. • Systematic inclusion of women in all stakeholder consultations, also at the beneficiary level. • Systematic information and invitation of the Gender Council to participate in SE meetings at the community level. • Establishment and Implementation of functional GRM at LWSC and documentation. • Awareness raising about the benefits of ecosystem services/resource efficiency. • Ensure that the Contractor is capable to plan and implement H&S measures by putting such requirements (qualifications, experience) in the Prequalification documents. • Establish H&S clauses for contractors on construction workers in the Works Contract (ESHS specifications).
Construction
• Implement SEP in line with EIB/KfW and Zambian requirements. • Reinstatement of damages and/or compensation for all construction damages with replacement value to be satisfactory for PAPs. • For works that require unskilled labour, a priority should be given to local residents (if available and applicable); • Good practices in signalization of work sites and respect for normal working hours. • Prepare an influx management plan to help mitigate the influx of migrant workers. • Maximise employment of the local labour force to reduce labour influx.
Operation
• Adequate tariffs for the planned improved sanitation services to be developed for all groups of customers (e.g. social tariffs). • Periodical consultation with residents. • Inclusion of gender equality provisions as same salaries for women as for men, preference for women with equal qualifications and inclusion in decision making.

6.3.4 Potential Impacts on Community and Worker Health & Safety (HS)

Potential H&S Impacts of the project can occur at the community level and/or the workers level. EIB ESS9 addresses the health, safety, and security risks and impacts on Project affected communities and the corresponding responsibility of financing agencies to avoid or minimize such risks and impacts, with particular attention to vulnerable people. EIB ESS9 addresses workers' safety concerns during the construction and operation of the project facilities.

Project-related H&S risks for residents/communities near work sites are mostly related to traffic of construction machines and work sites e.g. trenches etc. that are not signed, not fenced or otherwise not appropriately secured.

Worker's H&S risks are mainly related to work accidents when handling machines, lack of protective equipment, lack of maintenance of machines and the appropriate hygienic situation at the work sites.

Table 48 Potential Impacts on Community and Worker H&S (HS)

Impact on	Significance	Description of Impact / Risk
Community H&S	Moderate	• C&O: **Livelihood is affected** as small-scale farming within the Project site will lose income.

Impact on	Significance	Description of Impact / Risk
		• C&O: **Access closed** as the community currently walks through the land to access areas that lie to the south and west sides of the WSP. • O: Risk of **public health issues** in case of malfunctioning of the WWTP discharging large quantities of untreated wastewater used in irrigation downstream and odour generation.
	Minor	• C: Safety risks for the communities along the access road to the facility are related to a temporary **increase in traffic** on the road. • C: Temporary impact on ambient air quality in the areas along the access road to Chunga and Matero communities as a result of **emissions from mobile sources** and fugitive emissions of dust may pose a health risk. • C: **Children at risk** of suffering accidents with construction equipment. • C: **Malaria and HIV/AIDS spread.**
	Positive	• O: Improved quality of effluent discharged will **reduce exposure to waterborne diseases.**
Worker H&S	Moderate	• C: Risk of **occupational health effects** on workers due to fugitive dust, material handling, noise, mechanical or chemical contact. • C: Risk of **transport accidents**. • C: Risk of child labour, discrimination in professional life, freedom of association and **violation of labour rights**. • C&O: Risk of **accidents** while handling machines, heavy equipment, hazardous substances, including welding etc.
	Minor	• C: Negative **health impacts** due to lack of hygienic conditions/sanitation facilities for workers (availability of water points, soap, toilets, etc.).

C: Construction phase; O: Operation phase

Table 49 Recommended mitigation measures: community & worker H&S (HS)

Pre-Construction
• Ensure that the Contractor is capable to plan and implement H&S measures by adding such requirements (qualifications, experience) in the Prequalification documents. • Establish clauses for works contractors on community and construction workers H&S in the Works Contract (ESHS specifications). • Consider a gravel footway around the fence of the new WWTP. • Require the contractor to make safe or fence off all open excavations, manholes, chambers and sinkholes that exist within the vicinity of the existing WWTP.
Construction
Works contractor measures for Community H&S • Access road shall be paved. • Develop a Traffic Management Plan taking into account information on peak and off-peak hours on the access road to the Project site. • Instruct drivers for responsible driving and compliance with traffic regulations. • Put traffic signs, construction site signalization and fencing of construction sites.

- Put safe access bridges across trenches for pedestrians, especially at house entrances.
- At night-time, all barriers and signs will remain at sites, with lighting and/or fluorescent signs placed as required to warn both vehicular and pedestrian traffic.
- Use a relatively modern (not obsolete) fleet for the Project needs and implement regular vehicle maintenance and repair programs.
- Apply dust suppression measures during dry days.
- Use high-quality diesel for all Project related transportation.
- Locate diesel generators and other equipment away from sensitive residents (houses, schools, kindergartens, etc.), considering the wind direction.
- Notification of nearby neighbours of potential dust emissions before construction works begin.
- Enforce public health and safety regulations.
- In consultation with the local health centres, conduct a comprehensive health awareness campaign among the local community and project workers on the dangers of Malaria and the HIV/AIDS pandemic.
- Provide workers with information on the existence of anonymous VCT centres (Testing, pre-test, post counselling) through referrals.
- Promote H&S by supporting programmes that aim at reducing the spread of diseases.
- Sensitize schools and churches about the dangers of construction sites.
- Engage the victim support unit to have talks with the workers and community members on the negatives of GBV and Sexual and other forms of harassment at a place of work.
- Formulate and implement an employee's code of conduct, which should define, among others, guidelines and procedures for managing special situations such as GBV and Sexual and other forms of harassment. This should be adopted by all contractors during their activities within the project.
- Promote programs that will encourage the protection of women and children from sexual abuse.

Works contractor measures for Workers H&S

- Develop site-specific Construction and Operation H&S Management Plans.
- Ensure and monitor appropriate hygienic and sanitary situations for workers at work camps and work sites.
- Develop site-specific WMP, educate workers and sub-contractors, and enforce appropriate waste management measures for inert materials, recyclable materials including packaging, hazardous materials (if applicable) and other construction waste. Prohibit the burning of waste.
- Ensure appropriate traffic signage and construction site signalization and barriers.
- Enforce the wearing of PPE by workers and the respect Construction H&S plan and manual.
- Ensure adequate handling of machines and hazardous substances.
- Make firefighting equipment available on construction sites/machines, and conduct its regular maintenance.
- Develop an emergency preparedness and response plan for the Project component.
- Train all employees and contractors' workers on actions in case of emergency
- Develop a safety instructions for drivers, which will outline requirements to drivers and the technical conditions of the vehicles and instruct them accordingly. Prohibition of drunk driving, use of mobile phones while driving, mandatory use of safety belts and further provisions, as necessary, to be included.
- Provide 24-hour security of all project sites and enhance surrounding communities.
- Promote the respect of human rights through an employer's code of conduct.

Operation

- Establish and operate an early warning procedure for the event of water pollution (accidental pollution of the receiving water body by WWTP).
- Provide regular training for operators.

- Develop and implement inspection programs to maintain the mechanical integrity and operability of equipment.
- Provide specific PPE and training needed to respond to emergency situations.
- Workers will have a clean eating area, good lighting, fire precautions, a potable water supply and first aid kits.

6.3.5 Potential Cultural Heritage Impacts (CH)

Impacts on Cultural Heritage sites could be caused by physical works in the immediate vicinity of historic monuments, churches, mosques or cemeteries. These potential impacts need to be avoided. All works in a safety radius around cultural sites need to get clearance from the National Heritage Conservation Commission (NHCC) in Lusaka.

It is noted that a few graves on the western edge of the cemetery are within the confines of the existing access road. The reconstruction of the access road to the WWTP site will avoid traversing the individual graves and shall ensure the new road edge is at least 1.5m away from the graves. This can be achieved by narrowing the road at the points where graves protrude into the access road. The road narrowing will result in a single-lane road for short distances which provides the added benefit of providing a traffic calming measure. A clearance for all project works is needed if works are planned in the 5 m radius of graveyards.

Table 50 Potential Cultural Heritage Impacts (CH)

Project impact	Significance	Description of Impact / Risk
Physical disturbance/destruction of CH sites	Minor	C: Construction of the access road and WWTP travers graveyards within the boundaries of the plant or close to the access road.

Table 51 Recommended mitigation measures: potential cultural heritage impacts (CH)

Pre-Construction
• Design of WWTP and access road to avoid traversing graveyards.
Construction
• Access to graveyards to be guaranteed during construction works. • Chance Find Procedure, see Annex 17 - Chance Find Procedure => If a graveyard is discovered, enquire with stakeholders and make sure that the site is avoided.

6.3.6 Potential Climate Change Impacts (CC)

Project Impacts related to Climate Change (CC) need to be differentiated into:

a) impacts of the project which contribute to CC via emission of greenhouse gases (GHG) (CC1), and;
b) the exposure of the project to effects of CC as increased temperature, increased occurrence of extreme weather events (such as dry spells, flash floods, landslides, avalanches) and potentia changes in the water regime (CC2).

The study does not have the objective and means to measure and predict the effects of CC but draws attention to potential impacts and develops appropriate mitigation measures that are commensurate with the Project.

Table 52 Potential Climate Change Impacts (CC)

Impact on	Significance	Description of Impact / Risk
Climate	Minor	• C: **Emissions of construction vehicles** (see air pollution). • O: Emission through **additional energy/electricity consumption** e.g. pumping, blowers (operation). • O: Risk of **methane emissions** generated in the digester in case the biogas is not burned.
	Positive	• O: The **sludge resource recovery** in agriculture will reduce the need for industrial fertilizers, which have a high CO_2 footprint (particularly nitrogen production). The utilization will reduce the transport to larger and more centralized landfill or sludge resource recovery sites, thus reducing GHG emissions. • O: **Renewable energy** use in case of heat and electric energy generation from the biogas generated in the WWTP digesters.

C: Construction phase; O: Operation phase

Table 53 Recommended Mitigation Measures: Potential Climate Change Impacts (CC)

Pre-Construction
• WWTP is designed to save energy and resources, minimizing pumping needs and use of energy-efficient equipment and including biogas generation and energy recovery. • OPEX is considered in the criteria for tender evaluation. Employer´s requirements will require that the equipment will be energy efficient.
Construction
• Minimize emissions of construction vehicles (see air pollution) during construction phase (no unnecessary transports, turn off motors of machines when unused, use of well-maintained machines not obsolete vehicles and machines from the Soviet time). • Encourage environmentally friendly behaviour among workers.

7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The table below summarizes the impacts, their assessed risks, the required mitigation measures (as described in the Chapters above) and the responsibilities during the pre-construction, construction and operation phases. The general ESMP includes OHS and labour conditions management plan to manage and mitigate any potential negative impacts in compliance with national and international standards.

The specific ESMP will be part of the tender documentation to ensure that the works contractor complies with the regulations and implements the recommended mitigation measures, including an Occupational Health and Safety Management Plan, to be accepted by the Engineer before the start of construction (including mobilization).

Table 54 Identified impacts and proposed measures

Domain	Potential impact	Significance	Mitigation measure
Pre-construction			
Physical	Soil erosion and compaction	Moderate	• Establish sound construction principles for contractors on soil stabilization requirements in the bidding documents (Employer's Requirements).
	Water Resources (receiving water body) pollution	Major	• Design the WWTP to meet the effluent discharge standards. • Establish performance guarantees on effluent discharge values for contractors in the bidding documents.
			• Enforce the pre-treatment of the major industries' discharges into the sewerage prior to the commissioning of the new WWTP. In this regard, it is envisaged that Zamleather Industries Ltd. is the main contributor to Chromium in the Chunga sewer shed, and therefore, the efforts from LWSC to enforce the trade effluents standards should be put in this industry.
	Soil & Water Resources (receiving water body) pollution / Waste generation	Moderate	• Design of the WWTP in order to reduce heavy metals expected in the influent, e.g. Chromium. • Establish sound construction principles for contractors on pollution prevention in the bidding documents (ESHS specifications). • Engage a water bowser to be watering the premises at least five times a day. • Work within acceptable noise levels of 40 dB(A) during the night and 50 dB(A) during the day. • Undertake noisy activities only between 6 – 18 hrs. Such activities could be undertaken at night only under exceptional cases such as emergencies or similar. • Make sure all construction vehicles are maintained regularly so to minimize their emissions. • Provide covers to equipment and containers that are likely to cause odour nuisances (sludge, waste, grit material). • Adopt ZEMA and international regulations and standards on air quality. • Implement vegetation in perimetral areas of the WWTP site.
	Air / Noise pollution	Minor	
Biodiversity	Landscape deterioration	Moderate	• Establish environmental clauses for contractors on landscape impact mitigation in the Works Contract (ESHS specifications).

Domain	Potential impact	Significance	Mitigation measure
	Deterioration of Flora & Fauna / Habitats & Ecosystems	Minor	• Establish performance guarantees on effluent discharge values for contractors in the bidding documents.
Social	Risk of exclusion of vulnerable people	Moderate	• Develop SEP in line with EIB/KfW and Zambian requirements. • Raise awareness towards vulnerable people.
			• Include systematically women in all stakeholder consultations also at the beneficiary level. • Invite the Gender Council to participate in stakeholder engagement meetings at the community level. • Establish and implement a functional GRM.
	The influx of Outsiders (Construction Workers)	Minor	• Ensure that the Contractor is capable to plan and implement H&S measures by putting such requirements (qualifications, experience) in the Prequalification documents. • Establish H&S clauses for contractors on construction workers in the Works Contract (ESHS specifications).
Health & Safety	Community H&S	Minor	• Ensure that contractors are capable to plan and implement H&S measures. • Establish clauses for contractors on community and construction workers H&S.
	Workers H&S	Moderate	
Climate Change	Climate mitigation/adaptation	Minor	• WWTP is designed to save energy and resources, minimizing pumping needs and use energy-efficientent equipment and including biogas generation and energy recovery. • WWTP is designed to be resilient against increasing magnitude of flash floods due to CC.
Construction			
Physical	Soil erosion and compaction	Moderate	• Control contamination by isolating storage areas, and placing protective coatings in areas where oil and other contaminants are handled. • Perform ongoing machine monitoring and maintenance to prevent leaks. • Provide spill kits in all operative areas, especially where oil and other contaminants are handled. • Consult the local authority and community before any imminent exploitation of water sources during construction works. Water abstraction permits should be obtained from the Water Resources Management Authority (WARMA).

Domain	Potential impact	Significance	Mitigation measure
			• Construct water pans/dams to tap stormwater during the rainy season before the commencement of construction works. • Implement good hygienic standards and proper management of sewage. • Store materials in protected areas to reduce incidences of leakage. • Protect and store adequately leftover construction materials, e.g. by bunding and covering the storage areas. • Store on impermeable surfaces all chemicals, hydrocarbons, and other potentially polluting materials. • Install proper siting of pit latrines away from water-logged areas. • Maximize material reuse by temporarily storing and sorting onsite under proper conditions. The not reused material shall be transported offsite to a site agreed upon by LWSC. Stored material shall be handled safely in designated areas, not dumped into the river or deposited at river slopes. Erosion prevention measures need to be implemented at all earthwork sites. • Avoid the use of heavy machinery in areas not designated for construction. • Loose the soils after completion of construction and plant vegetation around the campsites. • Avoid digging in areas where construction is not intended. • Protect / separate non-construction areas. • Vegetate areas where there is no construction planned. • Restore and re-vegetate construction sites immediately after the completion of construction activities to enhance slope stabilization. • Avoid damages to private properties and minimize environmental negative effects (e.g. non-planned tree removal, etc.) during construction works. • Compensate all non-expected damages to private properties and the environment. • Design drainage and other disposal facilities to ensure soil stability and appropriate treatment.
	Soil & Water Resources (receiving water body) pollution / Waste generation	Moderate	• Require works contractors to develop and implement a detailed Waste Management Plan (WMP) including specification of disposal sites for excavated materials and generated construction wastes.

Domain	Potential impact	Significance	Mitigation measure
			• Set up waste disposal bins in strategic areas on site. • Put fines for any employees found discarding waste in undesignated areas. • Engage an authorized and licensed garbage disposal unit. • Avoid under any circumstance the reuse of sludge and soil when is contaminated. These should be disposed of safely. • Collect in a temporary hazardous waste storage area the hazardous wastes; This area should be surrounded by wire fences, bottom-sealed, and protected from precipitation. Materials from demolition could be hazardous and need to be disposed of safely. • Collect and remove regularly non-hazardous wastes generated at the plant. Dispose of these materials in the city's solid waste landfill. • Discharge the domestic wastewater generated in the running WSP. • Forbid to conduct activities close to the river such as re-fuelling or lubrication of vehicles, and material deposit, among other potentially risky activities for this water body. • Design a drainage system (wastewater) to avoid run-off and spillage.
	Air / Noise pollution	Minor	• Enforce works' contractors to the maintenance of machines and transportation vehicles (minimization of air pollution). • Avoid oil and fuel spills, by implementing proper storage of oil and fuel barrels. • Require the use of H&S personal protection equipment (incl. noise protection equipment). • Limit noise generation close to habitation zones only to working hours. Ambient noise monitoring is not required. • Engage a water bowser to be watering the premises and suppress the dust at least five times a day during dry seasons. • Enclosed equipment used for processes that are likely to generate dust. This includes equipment such as gravel crushers and gravel screeners. • Adopt ZEMA regulations and applicable international standards on air quality. • Work within acceptable noise levels of 40 dB (A) during the night and 50 dB (A) during the day.

Domain	Potential impact	Significance	Mitigation measure
			• Require contractors to use Best Management Practices (BMPs) for blasting, such as the chemical method to shatter the rocks and weaken rock formation, design and use of specific blasting plans, blasting mats, correct charging, and micro delay detonations to minimize noise and vibrations. • Require all workers to wear appropriate PPE every time, including hearing protection. • Undertake noisy activities only between 07-22hrs. • Use well-serviced machinery to minimize noise generation. • Implement vegetation in perimetral areas of the WWTP site. • Pave and widen the access road to Silvia Masebo Compound. • Restrict the project's vehicle speed in/along residential areas.
Biodiversity	Landscape deterioration	Moderate	• • Train workers in good environmental practices.
	Deterioration of Flora & Fauna / Habitats & Ecosystems	Minor	• Avoid noise-generating activities and construction site lighting at night time to limit wildlife disturbance. • Stockpile removed topsoil for further use of it in reinstating flora. • Replant trees/plants harvested during construction activities. • Avoid cutting trees and clearing vegetation in areas that shall not be developed.
Social	Risk of exclusion of vulnerable people	Moderate	• Implement SEP in line with EIB/KfW and Zambian requirements. • Reinstate damages and/or provide compensations for all construction damages with replacement value to be satisfactory for PAPs.
	The influx of Outsiders (Construction Workers)	Minor	• Give priority to local residents for jobs positions that require unskilled labour (if available and applicable). • Implement good practices in the signalization of work sites and respect for normal working hours. • Prepare an influx management plan to mitigate the influx of migrant workers. • Maximise employment of the local labour force to reduce labour influx.
	Community H&S	Minor	• Pave the access road.

Domain	Potential impact	Significance	Mitigation measure
Health & Safety			• Implement and update (if necessary) the Traffic Management Plan, considering information on peak and off-peak hours on the access road to the Project site. • Instruct drivers for responsible driving and compliance with traffic regulations. • Implement traffic signs in all construction sites and fencing for construction sites. • Place safe access bridges across trenches for pedestrians, especially at house entrances. • Keep all barriers and signs at sites during night-time, with lighting and /or fluorescent signs placed as required to warn both vehicular and pedestrian traffic. • Enforce public health and safety regulations. • Conduct a comprehensive health awareness campaign among the local community and project workers on the dangers of the Malaria and HIV/AIDS pandemic, in consultation with local health centres. • Provide workers with information on the existence of anonymous VCT centres (Testing, pre-test, post counseling) through referrals. • Promote H&S by supporting programs that aim to reduce the spread of diseases. • Sensitize schools and churches about the dangers of construction sites. • Engage the victim support unit to have talks with the workers and community members on the negatives of GBV and Sexual and other forms of harassment at a place of work. • Promote programs that will encourage the protection of women and children from sexual abuse.
	Workers H&S	Moderate Minor	• Develop site-specific Construction and Operation H&S Management Plans. • Ensure and monitor the appropriate hygienic and sanitary situation for workers at work camps and work sites. • Develop site-specific Waste Management Plans (WMP). • Educate workers and sub-contractors. • Enforce appropriate waste separation and management measures for inert materials, recyclable materials including packaging, hazardous materials (if applicable), and other construction waste. • Prohibit the burning of waste.

Domain	Potential impact	Significance	Mitigation measure
			• Ensure appropriate traffic signage, construction site signalization, and barriers. • Ensure adequate handling of machines and hazardous substances within operational and construction sites. • Make firefighting equipment available on construction sites and conduct its regular maintenance. • Develop an emergency preparedness and response plan for the Project component. • Train all employees and contractors' workers on actions in case of emergency. • Develop safety instruction guidelines for drivers, which will outline requirements for drivers and the technical conditions of the vehicles; and instruct them accordingly. • Prohibit drunk driving, use of mobile phones while driving, mandatory use of safety belts, and further provisions, as necessary, to be included. • Provide 24-hours security of all project sites and enhance surrounding communities. • Promote the respect of human rights through an employer's code of conduct.
Climate Change	Climate mitigation	Minor	• Minimize emissions from construction vehicles • Encourage environmentally friendly behaviour among workers.
Operation			
Physical	Soil pollution	Moderate	• Monitor the quality of treated sludge. • Implement a treatment unit for heavy metals if required. • Establish environmental clauses for the operator on pollution prevention.
	Water Resources (receiving water body) pollution	Major	• Establish environmental clauses for the operator on pollution prevention. • Comply with effluent standards. • Define ad monitor key performance parameters of the WWTP. • Monitor the treated effluent at WWTPs. • Monitor the water quality of the receiving water body.

Domain	Potential impact	Significance	Mitigation measure
Social	Risk of exclusion of vulnerable people	Moderate	• Develop adequate tariffs for all groups of customers within the planned improved sanitation services (e.g. social tariffs). • Perform periodical consultations with communities within the AoI. • Implement gender equality provisions and strategies such as equality in salaries among women and men, preference for women with equal qualifications, and inclusion in decision-making.
Health & Safety	Community H&S	Moderate	• Implementation of a functional GRM. • Develop early warning procedures for unwanted events such as river water pollution and train accordingly the respective stakeholders.
	Worker H&S	Moderate	• Implement periodical cleaning and maintenance procedures for the facilities. • Implement a Hazardous Materials Management Plan and training plan for workers • Develop and implement inspection programs for equipment. • Provide specific PPE and training needed to respond to emergency situations.

7.1 Environmental and Social Management Plan (ESMP) and Monitoring Plan (ESMMP)

Table 55 Environmental and Social Management Plan

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
Pre-construction									
Physical	Soil erosion and compaction	- Establish sound construction principles. - Implement WWTP design.	- Check if the required design is implemented.	- Soil stabilization measures. - International design standards.	Project site	After every review during pre-construction	LWSC	Approx.	500
	Water Resources (receiving water body) pollution	- Enforce the pre-treatment of the major industries' discharges.	- Introduce revised industrial effluent limit discharges. - Sample effluent from industries. - Apply penalties when necessary.	- Wastewater quality of the industrial effluent.	Project site	Monthly	LWSC	Sampling, transport, and laboratory costs Work hours of experts 4000 per month for 12 months 480 per month for 12 months	48,000
	Soil & Water Resources (receiving water body) pollution / Waste generation	- Plan the construction in phases so that it is going to be used the existing WSP to treat the wastewater partly during construction. - Establish sound construction principles for contractors on pollution prevention in the bidding documents (ESHS specifications).	- Introduce revised industrial effluent limit discharges. - Sample effluent industries from industries. - Apply penalties when necessary.	- Wastewater quality of the industrial effluent	Project site	Monthly	LWSC	Sampling, transport and laboratory costs Work hours of experts 4000 per month for 12 months 480 per month for 12 months	48,000
	Poor air quality from dust emissions and bad odors from the WWTP / Noise pollution	- Engage a water bowser to be watering the premises at least five times a day. - Work within acceptable noise levels of 40 dB(A) during the night and 50 dB(A) during the day. - Undertake noisy activities only between 6 – 18 hrs. Such activities could be undertaken at night only under exceptional cases such as emergencies or similar.	- Check noise levels at the site and around the site. - Monitor air quality. - Record the number of complaints every month and compare it with the next reporting month after carrying out mitigation measures.	- Air Quality - Sound levels	Project site	Weekly	LWSC	Engaging independent parties to sample air and sound levels on site	10,000

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Make sure all construction vehicles are maintained regularly so to minimize their emissions. - Provide covers to equipment and containers that are likely to cause odour nuisances (sludge, waste, grit material). - Adopt ZEMA and international regulations and standards on air quality. - Implement vegetation in perimetral areas of the WWTP site.							
Biodiversity	Land Degradation and Deterioration of flora and ecosystems	- Implement environmental clauses for contractors. - Establish performance guarantees on effluent discharges.	- Verify the implementation of the designs. - Check applicable clauses are included in tenders and contracts.	- Environmental clauses	Project site and Project area of Influence	Monthly	LWSC	Approx.	1000
Social	Risk of exclusion of vulnerable people	- Raise awareness towards vulnerable people. - Develop SEP in line with EIB/KfW and Zambian requirements. - Include systematically women in all stakeholder consultations also at the beneficiary level. - Invite the Gender Council to participate in stakeholder engagement meetings at the community level. - Establish and implement a functional GRM. - Seek systematic inclusion of women in stakeholder consultations and their permanent information and invitation to the Gender Council to participate in SE.	- Verify the implementation of awareness campaigns by the project. - Monitor gender equality and stakeholder consultation. - Monitor grievances and redress cases.	- No. of awareness campaigns performed. - No. of vulnerable people, women, and Gender Council representatives included.	Project area	Weekly	LWSC	Review of cases by LWSC safeguard expert, 240 per month for 12 months.	2,880 for Safeguard Expert/ Year

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
	The influx of Outsiders (Construction Workers)	- Ensure that contractors are capable to plan and implement H&S measures by putting such requirements (qualifications, experience) in the prequalification documents. - Establish H&S clauses for contractors on construction workers in the Works Contract (ESHS specifications).	- Check the contractor´s capabilities to plan and implement H&S measures	- Bidder's references and policies. - No. of grievances/law suites.	Project Site	Monthly	LWSC		
H&S	Livelihood affected Risk of public health and safety issues	- Ensure that contractors are capable to plan and implement H&S measures. - Establish clauses for contractors on community and construction workers H&S.		- Bidders' references and policies.	Project Site	Weekly	LWSC	Review of cases by LWSC safeguard expert 240 per month for 12 months	2,880 for Safeguard Expert/ Year
Climate Change	Impacts of climate on the project	- Implement climate-resilient design.	- Verify the implementation of the climate-resilient design.	- (Minimized) energy consumption. - No. of protection measures against flooding.	Project AoI	Annually	LWSC	Inspection hours of Env. Expert 12.5 days at 280 per day Included in the works contract tender	3,500/month
Construction									
Physical	Contamination of Soil and Water	- Control contamination by isolating storage areas, and placing protective coatings in areas where oil and other contaminants are handled. - Perform ongoing machine monitoring and maintenance to prevent leaks. - Provide spill kits in all operative areas, especially where oil and other contaminants are handled. - Consult the local authority and community before any imminent exploitation of water sources during	- Carry out water quality tests. - Record the Number of complaints in the GRM related to water contamination. - Carry out soil quality tests regularly. - Monitor nearby sampling boreholes and shallow wells.	- No. of non-compliance cases Water Quality Soil Quality.	The project area of influence	weekly	LWSC	Inspection hours of Env. Expert 12.5 days at 280 per day Included in the works contract tender	3,500/month

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		construction works. Water abstraction permits should be obtained from the Water Resources Management Authority (WARMA). - Construct water pans/dams to tap stormwater during the rainy season before the commencement of construction works. - Implement good hygienic standards and proper management of sewage. - Store materials in protected areas to reduce incidences of leakage. - Protect and store adequately leftover construction materials, e.g. by bunding and covering the storage areas. - Store on impermeable surfaces all chemicals, hydrocarbons, and other potentially polluting materials. - Install proper siting of pit latrines away from water-logged areas. - Maximize material reuse by temporarily storing and sorting onsite under proper conditions. The not reused material shall be transported offsite to a site agreed upon by LWSC. Stored material shall be handled safely in designated areas, not dumped into the river or deposited at river slopes. Erosion prevention measures need to be implemented at all earthwork sites. - Avoid the use of heavy machinery in areas not designated for construction.							

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Loose the soils after completion of construction and plant vegetation around the campsites. - Avoid digging in areas where construction is not intended. - Protect / separate non-construction areas. - Vegetate areas where there is no construction planned. - Restore and re-vegetate construction sites immediately after the completion of construction activities to enhance slope stabilization. - Avoid damages to private properties and minimize environmental negative effects (e.g. non-planned tree removal, etc.) during construction works. - Compensate all non-expected damages to private properties and the environment. - Design drainage and other disposal facilities to ensure soil stability and appropriate treatment.							
	Air/Noise	- Enforce works' contractors to the maintenance of machines and transportation vehicles (minimization of air pollution). - Avoid oil and fuel spills, by implementing proper storage of oil and fuel barrels. - Require the use of H&S personal protection equipment (incl. noise protection equipment).	- Carry out inspection campaigns on all construction sites. - Monitor air and environmental noise. - Register the number of complaints received related to air and noise.	- Decibels at the site and around the site. - Solid particulates in the air.	The project area of influence	weekly	LWSC	Inspection hours of Env. Expert included in above Included in the works contract tender	3,500/month

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Limit noise generation close to habitation zones only to working hours. Ambient noise monitoring is not required. - Engage a water bowser to be watering the premises and suppress the dust at least five times a day during dry seasons. - Enclosed equipment used for processes that are likely to generate dust. This includes equipment such as gravel crushers and gravel screeners. - Adopt ZEMA regulations and applicable international standards on air quality. - Work within acceptable noise levels of 40 dB (A) during the night and 50 dB (A) during the day. - Require contractors to use Best Management Practices (BMPs) for blasting, such as the chemical method to shatter the rocks and weaken rock formation, design and use of specific blasting plans, blasting mats, correct charging, and micro delay detonations to minimize noise and vibrations. - Require all workers to wear appropriate PPE every time, including hearing protection. - Undertake noisy activities only between 07-22hrs. - Use well-serviced machinery to minimize noise generation.							

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Implement vegetation in perimetral areas of the WWTP site. - Pave and widen the access road to Silvia Masebo Compound. - Restrict the project's vehicle speed in/along residential areas.							
	Deterioration due to solid waste and Hazardous Waste	- Require works contractors to develop and implement a detailed Waste Management Plan (WMP) including specification of disposal sites for excavated materials and generated construction wastes. - Set up waste disposal bins in strategic areas on site. - Put fines for any employees found discarding waste in undesignated areas. - Engage an authorized and licensed garbage disposal unit. - Avoid under any circumstance the reuse of sludge and soil when is contaminated. These should be disposed of safely. - Collect in a temporary hazardous waste storage area the hazardous wastes; This area should be surrounded by wire fences, bottom-sealed, and protected from precipitation. Materials from demolition could be hazardous and need to be disposed of safely. - Collect and remove regularly non-hazardous wastes generated at the plant. Dispose of these materials in the city's solid waste landfill.	- Monitor the implementation of good practices and adequate construction methods	- No. of non-compliance cases.	The project area of influence	weekly	LWSC	Inspection hours of Env. Expert included in above	3,500/month

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Discharge the domestic wastewater generated in the running WSP. - Forbid to conduct activities close to the river such as re-fuelling or lubrication of vehicles, and material deposit, among other potentially risky activities for this water body. - Design a drainage system (wastewater) to avoid run-off and spillage.							
Biodiversity	Landscape deterioration	- Train workers in good environmental practices.	- Monitor the implementation of good practices and adequate construction methods	- No. of non-compliance cases	The project area of influence	weekly	LWSC	Inspection hours of Env. Expert included in above	3,500/month
	Deterioration of Flora & Fauna / Habitats & Ecosystems	- Avoid noise-generating activities and construction site lighting at night times to limit wildlife disturbance. - Stockpile removed topsoil for further use of it in reinstating flora. - Replant trees/plants harvested during construction activities. - Avoid cutting trees and clearing vegetation in areas that shall not be developed.	- Perform inspections on site.	- No. of trees planted. - No. of complaints.	The project area of influence	Monthly	LWSC	Inspection hours of Env. Expert included in above	3,500/month
Social	Risk of exclusion of vulnerable people	- Implement SEP in line with EIB/KfW and Zambian requirements. - Reinstate damages and/or provide compensations for all construction damages with replacement value to be satisfactory for PAPs.	- Monitor grievances and redress cases.	- No. of grievances/law suites	Project area	cont.	LWSC	Work hours of experts 5 days at 280 per day	1,400
	The influx of Outsiders (Construction Workers)	- Give priority to local residents for jobs positions that require unskilled labour (if available and applicable). - Implement good practices in the signalization of work sites and respect for normal working hours.	- Monitor grievances and redress cases	- No. of grievances/law suites.	Project area	Monthly	LWSC	240 per month for 24 months	5,760

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Prepare an influx management plan to mitigate the influx of migrant workers. - Maximise employment of local labour force to reduce labour influx.							
Community Health & Safety	Livelihood affected through loss of gardening land Risk of public health issues Access closed Children at risk of suffering accidents Malaria and HIV/AIDS spread.	- Pave the access road. - Implement and update (if necessary) the Traffic Management Plan, considering information on peak and off-peak hours on the access road to the Project site. - Instruct drivers for responsible driving and compliance with traffic regulations. - Implement traffic signs in all construction sites and fencing for construction sites. - Place safe access bridges across trenches for pedestrians, especially at house entrances. - Keep all barriers and signs at sites during night-time, with lighting and /or fluorescent signs placed as required to warn both vehicular and pedestrian traffic. - Enforce public health and safety regulations. - Conduct a comprehensive health awareness campaign among the local community and project workers on the dangers of the Malaria and HIV/AIDS pandemic, in consultation with local health centres. - Provide workers with information on the existence of anonymous VCT	- Record, monitor, observe.	- No. compliances, non-compliances with H&S standards. - No. of traffic accidents.	Project area/construction sites	weekly	LWSC	Inspection hours of Safeguards Expert	3,500/month

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		centres (Testing, pre-test, post counseling) through referrals. - Promote H&S by supporting programs that aim to reduce the spread of diseases. - Sensitize schools and churches about the dangers of construction sites. - Engage the victim support unit to have talks with the workers and community members on the negatives of GBV and Sexual and other forms of harassment at a place of work. - Promote programs that will encourage the protection of women and children from sexual abuse.							
Worker Health & Safety	Risk of occupational health effects Risk of accidents while handling machines	- Develop site-specific Construction and Operation H&S Management Plans. - Ensure and monitor the appropriate hygienic and sanitary situation for workers at work camps and work sites. - Develop site-specific Waste Management Plans (WMP). - Educate workers and sub-contractors. - Enforce appropriate waste separation and management measures for inert materials, recyclable materials including packaging, hazardous materials (if applicable), and other construction waste. - Prohibit the burning of waste.	- Record, monitor, observe.	- No. H&S Plan compliances, non-compliances. - No. of accidents recorded on site.	Project area/construction sites	weekly	LWSC	Inspection hours of Expert	3,500/month

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Ensure appropriate traffic signage, construction site signalization, and barriers. - Ensure adequate handling of machines and hazardous substances within operational and construction sites. - Make firefighting equipment available on construction sites and conduct its regular maintenance. - Develop an emergency preparedness and response plan for the Project component. - Train all employees and contractors' workers on actions in case of emergency. - Develop safety instruction guidelines for drivers, which will outline requirements for drivers and the technical conditions of the vehicles; and instruct them accordingly. - Prohibit drunk driving, use of mobile phones while driving, mandatory use of safety belts, and further provisions, as necessary, to be included. - Provide 24-hours security of all project sites and enhance surrounding communities. - Promote the respect of human rights through an employer's code of conduct.							
Climate Change	Emissions of construction vehicles	- Turn off the motors of machines when unused, to minimize emissions	- Record, monitor, observe. - Estimate the carbon footprint during this phase,	- No. of complaints. - Carbon footprint.	Project area/construction sites	weekly	LWSC	Inspection hours of Env. Expert	3,500/month

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
	Risk of methane emissions Flooding of the WWTP due to abnormally high rainfall and flows in the stream near the site.	of construction vehicles (see air pollution). - Use well-maintained equipment such as non-obsolete vehicles. - Avoid unnecessary transport. - Encourage environmentally friendly behaviour among workers.	using indirect parameters based on the number of vehicles (scope 1), and register the results.						
Operation									
Physical	Soil pollution	- Monitor the quality of treated sludge. - Implement periodic workshops and sensitization forums of sludge handling procedures. - Implement a treatment unit for heavy metals if required. - Establish environmental clauses for the operator on pollution prevention.	- Monitor the effluent and river. - Monitor the quality of treated sludge.	- Effluent standards (amounts of heavy metals and organic matter in the effluent). - Sludge standards.	Effluent discharge point	Daily/Monthly	LWSC	Sampling, transport and laboratory costs 250 per week,	13,000 per year
	Water Resources (receiving water body) pollution	- Establish environmental clauses for the operator on pollution prevention. - Comply with effluent standards and regulations. - Define ad monitor key performance parameters of the WWTP. - Monitor the treated effluent at WWTPs. - Monitor the water quality of the receiving water body.	- Monitor the effluent and river.	The quantity of sludge eliminated	WWTP	Daily	LWSC	Inspection hours of experts 19.73 per day, = 7200 per year	7,200 per year
Social	Risk of exclusion of vulnerable people	- Develop adequate tariffs for all groups of customers within the planned improved sanitation services (e.g. social tariffs). - Perform periodical consultations with communities within the AoI.	- Register opinions and concerns of communities within the AoI.	- Number of complaints regarding the operation of the WWTP.	The project area of influence	monthly	LWSC	Inspection hours of experts 60 per month for 12 months,	720 per year

Domain	Impact	Mitigation Measure	Monitoring Measure	Parameters to be monitored	Location	Frequency	Responsibilities	Cost estimate basis	Cost estimate (EUR - €)
		- Implement gender equality provisions and strategies such as equality in salaries among women and men, preference for women with equal qualifications, and inclusion in decision-making.							
	Air Pollution/Odours	- Provide covers to equipment and containers that are likely to cause odour nuisance (sludge, waste, grit material).	- Register opinions and concerns of communities within the AoI.	- Number of complaints regarding the operation of the WWTP.	The project area of influence	monthly	LWSC	Engaging independent parties to sample air and sound levels on site	10,000/ 6 months
Health & Safety	Pollution of receiving waters	- Implement a functional GRM. - Develop early warning procedures for unwanted events of river water pollution and train accordingly the workers.	- Monitor grievances and redress cases.	- No. of grievances/law suites. - No. of cases of accidental pollution of supplied water.	Project area	cont.	LWSC	Work hours of experts 60 per month for 12 months,	720 per year
Worker Health & Safety	Negative health impacts due to lack of hygienic conditions/sanitation facilities for workers	- Implement periodical cleaning and maintenance procedures for the facilities.	- Inspect facilities. - Register complaints from workers regarding the facilities.	- No. of cleaning and maintaining activities. - No. of complaints or non-compliance.	WWTP	Everyday	LWSC	Consultation 60 per month for 12 months,	720 per year
	Risk of accidents while handling machines, heavy equipment, hazardous substances	- Implement a Hazardous Materials Management Plan and training plan for workers.	- Register accidents or near-accidents events.	- No. of accidents or near-accidents events. - No. training sessions.	WWTP	Everyday	LWSC	Training hours of experts 120 per month for 12 months,	1440 per year

7.2 ESIA Schedule

Table 56 ESIA Schedule

Activity	Means	Responsible firms	Proposed dates
Public notification of scoping meetings	Use churches and local helpers to spread the word of public consultative meetings.	Consultant	1st July 2021 to 6th July, 2021
Identification of IAPs	Public Consultative meetings	Consultant	8th to 11th July 2021
Compilations of Scoping report and TORs	Discuss items related to the scoping exercise and propose terms of reference	Consultant	13th to 21st July 2021
Submission of TORs and Scoping Report	Submission of TORs to LWSC and await for comments	Consultant	23rd July 2021
Baseline study, identification, and evaluation of impacts	The study team for EIA will review the relevant literature necessary for the projects and gather primary data from the sites	Consultant	2 weeks after acceptance of the Terms of Reference and Scoping Report
Compilation of Draft EIA report	The study team conducts study in the proposed project location, and sampling	Consultant	1 week after the baseline study, identification and evaluation of impacts
Submission of the draft EIS report to ZEMA	Draft EIS is submitted to ZEMA for review	Consultant submits EIS to LWSC for onward submission to ZEMA	Within a month of the commencement of the draft report compilation
Comments and observations from LWSC and ZEMA are addressed	Amend the draft EIS as required by ZEMA and S3P	Consultant receives comments from ZEMA through LWSC	2 weeks after receipt of comments
Submission of final EIS to LWSC and ZEMA	Bari Zambia to submit 8 copies and a soft copy of the EIS to S3P	ZEMA approves the EIS	2 weeks after receipt of comments
Public Disclosure Meeting	Public Meeting about the contents of the EIA document	Consultant, ZEMA, LWSC, and other Stakeholders.	After approval of EIS by ZEMA

8 DECOMMISSIONING AND REHABILITATION PLAN

This phase will involve planning for the way to decommission the existing infrastructure, once the new WWTP is commissioned and operational. Permanent termination implies the removal of the entire infrastructure and disposal of such decommissioned materials at the designated sites approved by ZEMA. This will be followed by revegetating and landscaping the affected sites.

The closure will come at some point in the distant future when the WWTP is deemed no longer adequate to treat the volumes of sewage to the levels of treatment deemed necessary at that time, and a replacement WWTP is constructed at an alternative site. The expected lifespan of the WWTP from the time of construction to decommissioning is estimated at a minimum of 50 years of design lifespan. At closure, the site will require rehabilitation so, that some other sustainable land use other than WWTP is created.

To ensure this is achieved, progressive rehabilitation of the area will start on the commencement of the proposed operations of the new WWTP at the site. As an integral part of the activities of the plant. All disturbed areas will be progressively rehabilitated once operations cease in that particular area.

The other activities that shall be undertaken under this phase shall include:

- Demolition of temporary structures and sanitary facilities;
- Demolition of concrete infrastructure and levelling of the surface;
- Treatment of contaminated portions covering the project site and general site clean-up;
- Disposal of WWTP electromechanical equipment and solar panels through a licensed and fully authorized waste handling company;
- Objectives of the Decommissioning and Closure Plan.

It is imperative that once the design life of the infrastructure is attained, the infrastructure is decommissioned and replaced where necessary to ensure continued optimum performance. The main objectives will be:

- Ensure the safety of the site and workers within the project vicinity;
- Prevent potential environmental impact resulting from the decommissioned infrastructure;
- Return the land to previous conditions capable of supporting the former land use or an alternative land use if the former is not practical.

No.	Aspect	Impact	Mitigation	Frequency of Monitoring	Time Frame	Performance Indicator	Responsible person	Estimated Cost (ZMW)
1	Excavation of Decommissioned Pipes at the WWTP	• Soil Compaction at the WWTP • Soil Erosion at the WWTP • Contamination of the Soil by Hydrocarbons • Poor air quality from the dust being raised by the excavation machines • Destruction of vegetation and ecosystems built around the WWTP during the excavation	• Avoid areas that are not designated for demolition of structures (Pipes) • Spray water on the pathways of machines to avoid raising dust • Re-plant vegetation on the piece of land where the WWTP was. • Protect the decommissioned site from agents of soil erosion by putting up wind breakers and avoiding flooding in the zone of decommissioning.	Everyday	Decommissioning phase	Number of Complaints Received Number of hydrocarbons in the soil after the decommissioning phase	LWSC	1,000,000
2	Destruction of Structures at the WWTP	• Soil Compaction at the WWTP • Soil Erosion at the WWTP • Contamination of the Soil by Hydrocarbons	• Avoid areas that are not designated for demolition of structures (Pipes) • Spray water on the pathways of machines to avoid raising dust	Everyday	Decommissioning phase	Number of Complaints Received Number of hydrocarbons in the soil after the decommissioning phase	LWSC	5,000,000

No.	Aspect	Impact	Mitigation	Frequency of Monitoring	Time Frame	Performance Indicator	Responsible person	Estimated Cost (ZMW)
		• Poor air quality from the dust being raised by the excavation machines • Destruction of vegetation and ecosystems built around the WWTP during the excavation • Build-up of debris at the WWTP site • Accidents from the destruction activities • Spillages of left-over untreated sewer in the tanks • Noise pollution from the Machines	• Re-plant vegetation on the piece of land where the WWTP was. • Protect the decommissioned site from agents of soil erosion by putting up windbreakers and avoiding flooding in the zone of decommissioning. • Avoid demolition works after 5 pm and before 5 am • Make sure construction vehicles are up to date with their maintenance and servicing.					
3	Reinstatement of affected areas at the WWTP	• Noise from workers on site	• No mitigation Measure	Every day until restoration	N/A	No signs of the WWTP should remain	LWSC	2,000,000

No.	Aspect	Impact	Mitigation	Frequency of Monitoring	Time Frame	Performance Indicator	Responsible person	Estimated Cost (ZMW)
		• Dust from restoration activities such as bringing in fertile soil for planting vegetation		is complete				

9 BIBLIOGRAPHY

Baumle, R. (2012). *Groundwater Resources of the Mwembeshi and Chongwe catchments, including the Lusaka Region.*

Beilfuss, R. A. (2012). *Risk Climate for Southern African Hydro: Assessing Hydrological Risks and Consequences for Zambezi River Basin Dams.*

CES. (2017). *Lusaka Wastewater Project Environmental and Social Impact Assessment (ESIA), BMZ. No. 2099 14 656.*

CES Consulting Engineers Salzgitter GmbH. (2017). *Final ESIA Report.*

Christensen, J. H.-I.-C.-P. (2013). *Climate Phenomena and their Relevance for Future Regional Climate Change Supplementary Material.* T. F. Stocker, D. Qin, G.-K. Plattner, et al.

Climate Centre Project. (2015). *Future Climate for Africa by Red Cross/Red Crescent Climate Centre.* Climate Centre Project.

Climate Service Center. (2013). *Climate Fact Sheet Zambia. – Status: May 2013.*

Climate-data.org. (n.d.). Retrieved from https://en.climate-data.org/africa/zambia-192/

COWI. (2016). *Feasibility Study for the Rehabilitation and Upgrading of WWTPs and Wastewater Collection Systems in Lusaka – Flow Measurement and Sampling Report.*

CSO. (2011). *Living Condition Monitoring Survey Report 2006 and 2010.*

CSO. (2013a). *2010 Census of Population and Housing: Descriptive Tables, Series A, B, C and D, Lusaka Province, Central Statistics Office, Lusaka.*

CSO. (2013b). *2010 Census of Population and Housing: Descriptive Tables, Series E – Economic Tables, Lusaka Province, CSO, Lusaka.*

CSO. (2013c). *2010 Census of Population and Housing: Descriptive Tables, Series F, G, H and I, Lusaka Province, Central Statistics Office, Lusaka.*

CSO, MoH and ICF International. (2015). *Zambia Demographic and Health Survey 2013-14.*

Deborah Bartram (USA), M. D. (2019). *Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

EIB. (2020). *EIB Project Carbon Footprint Methodologies.*

European Investment Bank. (2018). *Environmental and Social Standards.*

European Union. (1986). Council Directive of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.

European Union. (1991). Council Directive of 21 May 1991 concerning urban waste water treatment.

European Union. (2011). Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment.

Fauchereau, N. S. (2003). *Rainfall variability and changes in southern Arica during the 20th century in the global warming context.* Natural Hazards, Vol. 29 (2), pp. 139-154.

Gauff. (2012). *Preparation of Feasibility Studies (30%) and Preliminary Design for Water and Sanita-tion Projects Lusaka, Zambia.*

Gauff. (2013). *ESIA for Water Supply and Sanitation, Millennium Challenge Corporation.*

GIC - Hydroment - Bari Zambia. (2021). *Inception Report - New Ngwerere and Chunga WWTPs in Lusaka Project.*

GIC - HYDROMENT - Bari Zambia. (2022). *Chunga WWTP - Functional Design Report.*

GIC - HYDROMENT - Bari Zambia. (2022). *Wastewater Quality Analysis Campaign.* Manchinchi WWTP.

GIC - HYDROMENT- Bari Zambia. (2022). *Ngwerere WWTP - Functional Design Report.*

(2017). *Global Water Partnership. Creating an Organisational Framework - Forms and functions.* Available from: https://www.gwp.org/en/learn/iwrm-toolbox/Institutional_Arrangements/Regulation_and_Compliance/.

GRZ. (2007). *The National Adaptation Programme of Action (NAPA).* Ministry of Tourism, Environ-ment and Natural Resources.

GRZ. (2011). *Zambia Strategic PPCR Programme.*

Humanitarian OpenStreetMap Team. (2021). Retrieved from https://www.hotosm.org/updates/mapping-solid-waste-zones-in-lusaka/

International Finance Corporation - World Bank Group. (2012). *Performance Standards on Enviromental and Social Sustainability.*

JICA. (2009). *The Study on Comprehensive Urban Development Plan for the City of Lusaka in the Republic of Zambia.*

KfW Development Bank. (2022). *Sustainability Guideline Assessment and management of Environmental, Social, and Climate Aspects: Principles and Procedures.*

Meteoblue. (2022). Retrieved from https://www.meteoblue.com/en/weather/week/lusaka_zambia_909137

Report, A. G. (2018). *Special Report of the Auditor General on the Accounts of Water and Sanitation Companies for the Financial Year Ended 31st December, 2018.*

S. Kang'onmbe. (2009). *Ministry of Energy and Water Development – Department of Water Affair.*

WARMA. (2019). *Lower Kafue River Basin Report Card.*

World Bank Group. (2007). *Environmental, Health and Safety (EHS) Guidelines.*

World Bank Group. (2007). *Environmental, Health and Safety Guidelines for Water and Sanitation.*

World Bank Group. (2017). *Environmental and Social Framework.*

World Bank Group. (2021). *Climate Change Knowledge Portal*. Retrieved from https://climateknowledgeportal.worldbank.org/country/zambia/climate-data-historical

World Health Organization. (2006). *Safe Use of Wastewater, Excreta and Greywater.*

World Meteorological Organization. (2020). *World Weather Information Service*. Retrieved from https://worldweather.wmo.int/en/country.html?countryCode=40

Zambia National Malaria Elimination Centre. (2015). Retrieved from https://www.nmec.org.zm/

Zambia Statistics Agency. (2022). *2022 Census of Pupulation and Housing - Preliminary Report.* Lusaka, Zambia.

Zambia Statistics Agency. (n.d.). *Zambia Data Portal*. Retrieved from https://zambia.opendataforafrica.org/apps/atlas/Lusaka

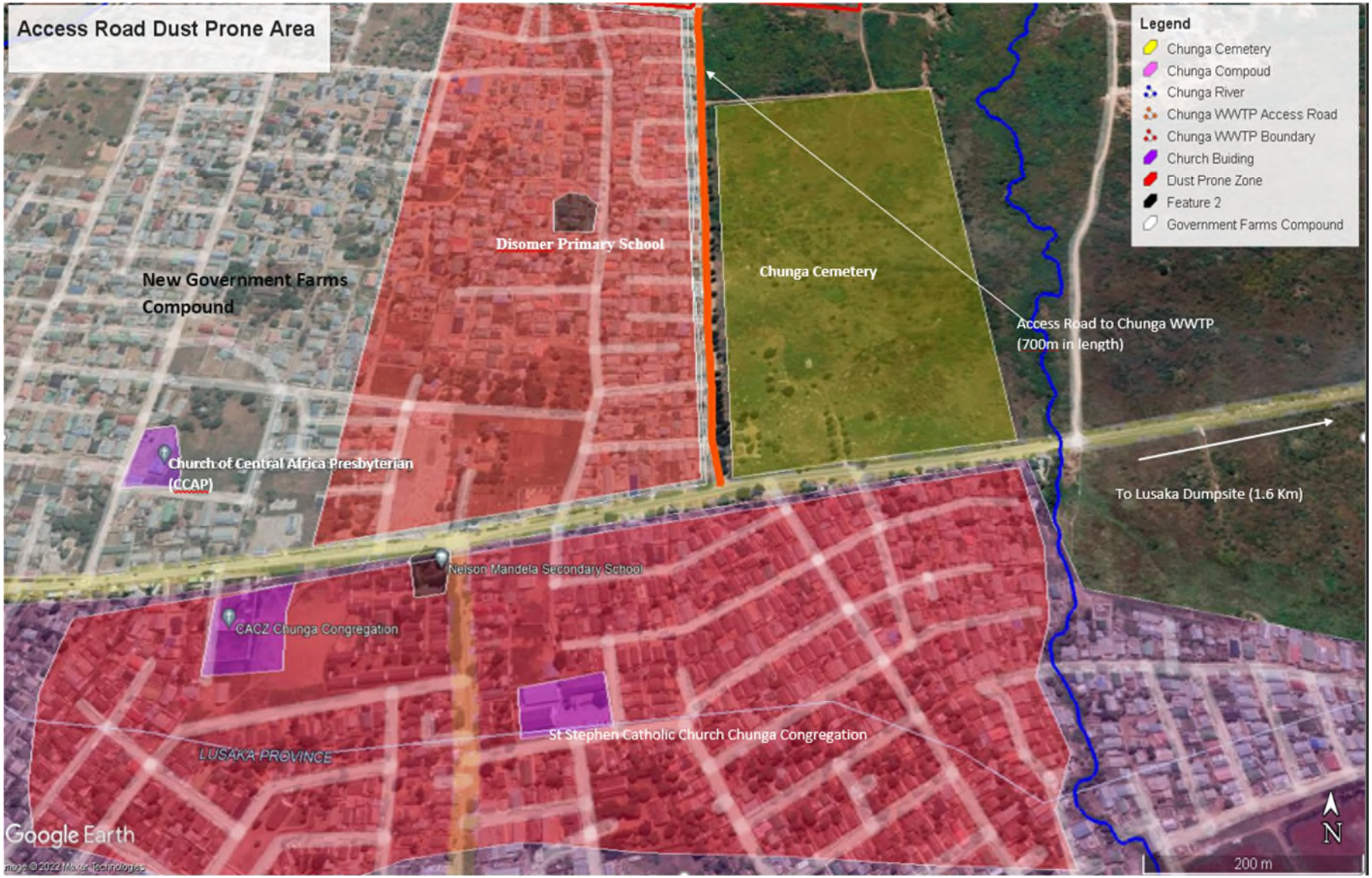
10 DECLARATION OF AUTHENTICITY OF REPORT CONTENTS

GITEC-IGIP GmbH, in association with ClaveOficina Consulting Engineers and Bari Zambia Limited, and in conjunction with Lusaka Water Supply and Sanitation Company (LWSC) hereby declare that the contents of this report are authentic and are a true reflection of what was observed on the ground during the scoping exercise carried out from 1st July, 2021 to 21st July 2021.

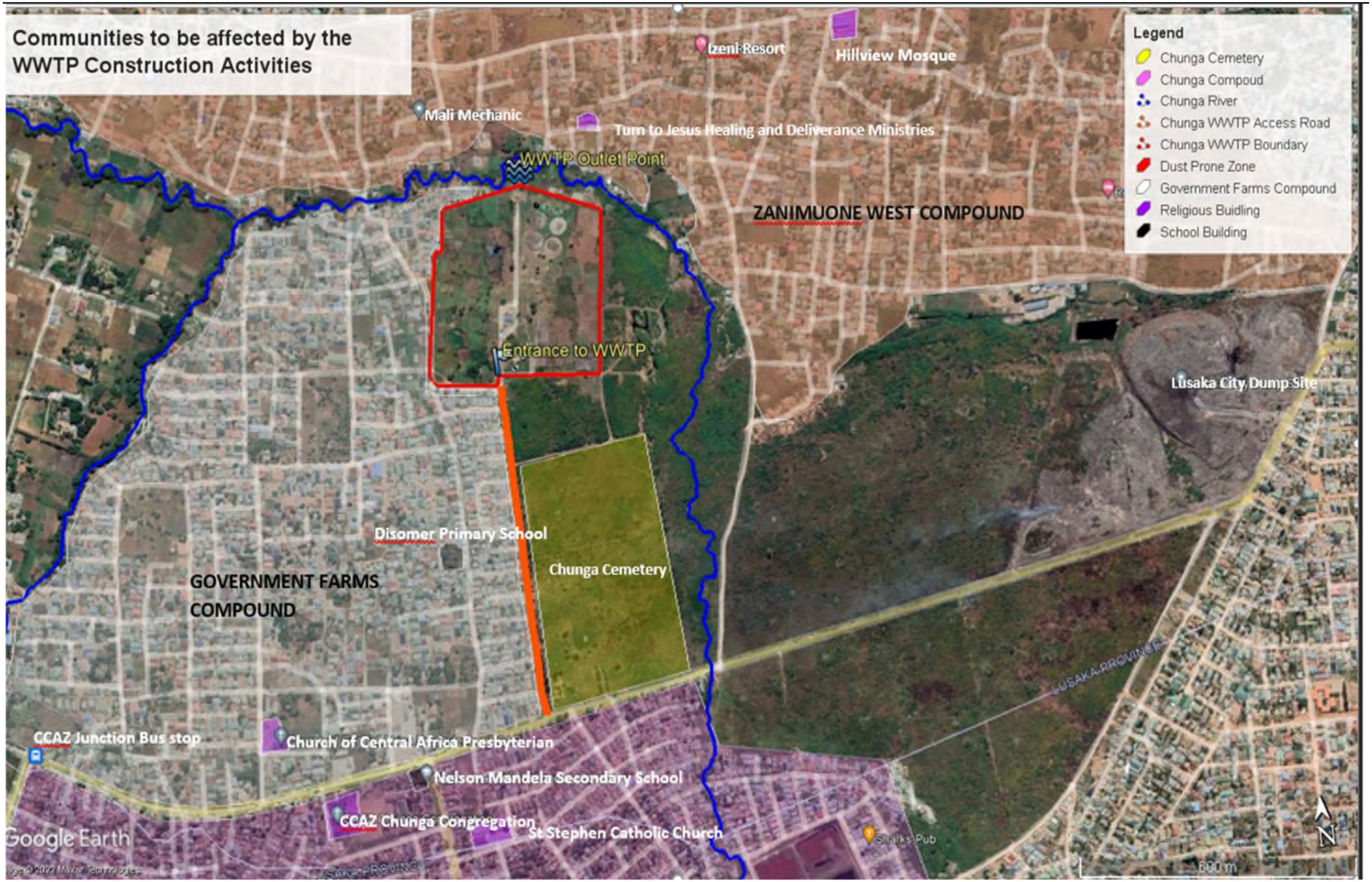
Mark Whippey

Consultant's Team Leader

Annex 1 Project AoI Maps



The figure above shows the settlements that will be affected by traffic during the construction of the WWTP. The red zones highlight the most affected parts of the communities around the Chunga WWTP. Some sensitive areas around these zones include Nelson Mandela Secondary School and Disomer Primary School.


Communities to be affected by the WWTP Construction Activities
Izeni Resort
Hillview Mosque
Mali Mechanic
Turn to Jesus Healing and Deliverance Ministries
WWTP Outlet Point
ZANIMUONE WEST COMPOUND
Entrance to WWTP
Lusaka City Dump Site
Disomer Primary School
Chunga Cemetery
GOVERNMENT FARMS COMPOUND
LUSAKA PROVINCE
CCAZ Junction Bus stop
Church of Central Africa Presbyterian
Nelson Mandela Secondary School
CCAZ Chunga Congregation
St Stephen Catholic Church
Sharks Pub
Google Earth
600 m
N
Legend
Chunga Cemetery
Chunga Compoud
Chunga River
Chunga WWTP Access Road
Chunga WWTP Boundary
Dust Prone Zone
Government Farms Compound
Religious Buidling
School Building

The figure above shows the areas that will be mainly affected by the Construction activities at the Chunga WWTP. These are Government Farms Compound, Zanimuone West and parts of Chunga Compound. The impacts and mitigation measures associated with this WWTP construction are well highlighted in the project's ESMP.


Chunga River Water Users within 3 Km Distance from the WWTP (Downstream)
Legend
Chunga WWTP Access Road
Chunga WWTP Boundary
Entrance to WWTP
Feature 2
Feature 3
Gardens
Izeni Resort
Lodge/Apartment
Religious Building
Shop
Water Body
WWTP Outlet Point
Zamnimuone West
Kabangwe
Users of Water from Chunga River
Users of Water from Chunga River
Barlastone Park
Chunga WWTP
Government Farms Compound
Hamz Apartments
Salem Apartments
Balastone Park Congregation
Breath Of Heaven Academy
CENTRAL PROVINCE
KONKWA
Google Earth
600 m
N

This map shows the users of water from the Chunga WWTP within 3km after the discharge point. Most of these are regular households that use the water for vegetable and maize growing. These products are usually for home consumption and selling to the markets in the CBD, the most common destination for these garden products is Soweto Market in the city's CBD.

As can be seen from the map, most of these are residents from Barlastone Park which is on the western side of the WWTP sharing a boundary with the Government Farms compound. Users of this water from the River have running tap water and thus it can be assumed that they do not use the water for domestic purposes such as cooking and washing. On the northern side of the River is a settlement known as Kabangwe, there were very gardens noticed on this side of the River as can also be seen from the image above. During the scoping exercise, few children and adult males and females were seen to be fishing along the shores of the River clearly indicating that the River is also a source of income and livelihood for the people living around the River.

Within this 3 km, there were no sensitive receptors noticed i.e. schools, hospitals, old people etc. The nearest school was Breath of Heaven Academy which has a borehole on its premises. It was also noticed that streams coming from the residential areas feed into the Chunga River, the source of water for these streams is usually runoff water from the rain and thus they can be considered seasonal streams.

Annex 2 Engineering Drawings

Annex 3 Proposed Chunga design flow and loads

Parameter	Units	2030 (Phase A)	2045 (Phase B)
Population equivalent (based on 60grBOD)	e.p.	146,171	396,606
Flows			
Average dry weather daily flow	m^3/d	18,714	44,541
	m^3/hr	780	1,856
	l/s	217	516
Wet weather flow	m^3/d	32,914	58,741
	m^3/hr	1,371	2,448
	l/s	381	680
Design peak hourly flow to the treatment	m^3/hr	2,151	3,747
	l/s	598	1,041
Pollutants			
Chemical Oxygen demand COD	kg/d	17,541	47,593
	mg/l	*937.3*	*1068.5*
Biological Oxygen demand BOD	kg/d	8,770	23,796
	mg/l	*468.6*	*534.3*
Suspended Solids, SS	kg/d	8,795	25,021
	mg/l	*470.0*	*561.7*
Total Nitrogen, TN	kg/d	1,127	3,433
	mg/l	*60.2*	*77.1*
Total Phosphorus TP	kg/d	294	925
	mg/l	*15.7*	*20.8*

Annex 4 ESHS Impact matrix

Domain	Impact	Nature	Direct / Indirect	Spatial Extent	Frequency	Duration	Intensity	Severity	Probability	Sensitivity
Physical										
Soil	Compaction, damage to structure	N	D	Site	Once	Long	Low	Low	Definite	Low
	Erosion risk	N	D	Site	+ Twice	Permanent	Low	Low	Possible	Low
	Pollution with liquid and solid waste	N	D	Local	+ Twice	Short	Low	Low	Unlikely	Low
	Pollution with heavy metals through sludge	N	I	Local	+ Twice	Medium	Moderate	Medium	Possible	Low
	Sludge as agriculture fertilizer/soil improvement	P	D	Local	+ Twice	Long	Moderate	Medium	Probable	Low
Water Resources	Risk of malfunctioning WWTP.	N	D	Regional	+ Twice	Medium	Moderate	Medium	Possible	Low
	Reduced treatment efficiency of existing WSP.	N	D	Regional	+ Twice	Medium	Moderate	Medium	Possible	Low
	Pollution with liquid and solid waste (e.g. faecal, hazardous).	N	D	Site	+ Twice	Short	Low	Low	Unlikely	Low
	Pollution from sludge used in agriculture or soil improvement.	N	I	Local	+ Twice	Medium	Moderate	Medium	Possible	Low
Air / Odour	Emissions from mobile sources and fugitive emissions of dust.	N	D	Site	+ Twice	Short	Low	Low	Definite	Low

Domain	Impact	Nature	Direct / Indirect	Spatial Extent	Frequency	Duration	Intensity	Severity	Probability	Sensitivity
	Odour during cleaning/decommissioning of existing infrastructure.	N	D	Local	Once	Short	Low	Low	Probable	Low
	Odour emissions WWTP operation.	N	D	Local	+ Twice	Short	Moderate	Low	Probable	Low
Noise	Machinery causes disturbance.	N	D	Local	+ Twice	Short	Moderate	Low	Definite	Low
	Created by pumps, blowers and generators.	N	D	Site	+ Twice	Long	Moderate	Low	Definite	Low
Waste Generation	Construction waste	N	D	Local	+ Twice	Short	Low	Low	Probable	Low
Landscape	New construction in a PUA, semi-rural area.	N	D	Local	Once	Permanent	Moderate	Moderate	Definite	Low
Fauna and Flora	Loss of habitat birds and terrestrial insects.	N	D	Local	Once	Permanent	Low	Low	Definite	Low
	Loss of vegetation when clearing the Site.	N	D	Local	Once	Permanent	Low	Low	Definite	Low
Ecosystem services	Prevention of the degradation and/or improvement of water bodies receiving effluent from WWTPs.	P	D	Regional	Once	Permanent	Moderate	Moderate	Definite	Low
Exclusion vulnerable	Unfair compensation for the PAP.	N	D	Local	Once	Permanent	Moderate	Low	Definite	Low
	Tariff payment affordability risks	N	D	Regional	Once	Permanent	Moderate	Moderate	Probable	Low

Domain	Impact	Nature	Direct / Indirect	Spatial Extent	Frequency	Duration	Intensity	Severity	Probability	Sensitivity
people										
Influx Outsiders	Vulnerable groups are at risk of experiencing harassment from construction workers.	N	D	Local	Once	Medium	Low	Low	Probable	Low
	Risk of spread of contagious diseases.	N	D	Local	+ Twice	Medium	Moderate	Moderate	Unlikely	Moderate
Improved Sanitation	Access to improved Sanitation	P	D	Regional	Once	Permanent	Moderate	Low	Probable	Low
Income Generation and Employment	Employment creation.	P	D	Regional	Once	Medium	Moderate	Moderate	Probable	Moderate
	Know-how transfer on wastewater treatment technologies.	P	D	Regional	Once	Long	Moderate	Moderate	Probable	Moderate
	Income generation and employment effects through tourism development.	P	I	Regional	Once	Long	Low	Low	Possible	Low
	Resource recovery from sludge as a soil amendment in agriculture will improve the fertility of soil.	P	I	Regional	Once	Long	Low	Low	Possible	Low
Community H&S	Small-scale farming loses income.	N	D	Local	Once	Long	Moderate	Moderate	Definite	Low
	Access is closed to the community.	N	D	Local	Once	Long	Moderate	Low	Definite	Low

Domain	Impact	Nature	Direct / Indirect	Spatial Extent	Frequency	Duration	Intensity	Severity	Probability	Sensitivity
	Risk of public health issues in case of malfunctioning of the WWTP.	N	I	Regional	+ Twice	Short	Moderate	Moderate	Possible	Moderate
	Increase in traffic on the road.	N	D	Local	+ Twice	Medium	Moderate	Low	Definite	Low
	Ambient air quality along the access road.	N	D	Local	+ Twice	Medium	Moderate	Low	Definite	Low
	Children are at risk of suffering accidents with construction equipment.	N	D	Local	+ Twice	Medium	Moderate	Low	Definite	Low
	Improved quality of effluent discharged will reduce exposure to waterborne diseases.	P	D	Local	Once	Permanent	Moderate	Low	Probable	Low
Worker H&S	Risk of occupational health effects.	N	D	Site	+ Twice	Medium	Moderate	Low	Definite	Low
	Risk of transport accidents.	N	D	Site	+ Twice	Medium	Moderate	Low	Definite	Low
	Risk of child labor, discrimination in professional life, for freedom of association and violation of labor rights.	N	D	Site	+ Twice	Medium	Moderate	Moderate	Definite	Low
	Risk of accidents while handling machines, heavy equipment,	N	D	Site	+ Twice	Medium	Moderate	Moderate	Definite	Low

Domain	Impact	Nature	Direct / Indirect	Spatial Extent	Frequency	Duration	Intensity	Severity	Probability	Sensitivity
	hazardous substances, including welding etc.									
	Health impacts due to lack of hygienic conditions/sanitation facilities for workers.	N	D	Site	+ Twice	Medium	Moderate	Moderate	Definite	Low
Climate (GHG emissions)	Emissions of construction vehicles.	N	D	Global	+ Twice	Short	Low	Moderate	Definite	Low
	Emission through additional energy/electricity.	N	D	Global	+ Twice	Long	Moderate	Moderate	Definite	Low
	Risk of methane emissions generated in the digester.	N	D	Global	+ Twice	Short	Moderate	Moderate	Possible	Low
	Sludge resource recovery in agriculture will reduce the need for industrial fertilizers, which have a high CO_2 footprint.	P	I	Global	+ Twice	Long	Moderate	Moderate	Possible	Low
	Renewable energy use in case of heat and electric energy generation from biogas.	P	D	Global	+ Twice	Long	Moderate	Moderate	Possible	Low

Annex 5 Sample of invitation letters

Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Proposed New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

GITEC CONSULT GMBH

HYDROMENT

Bari Zambia Limited
Multidisciplinary Consulting Engineers

GITEC-IGIP GmbH, Carlswerkstr. 13d, 51063 Cologne, Germany

The Permanent Secretary
Ministry of Energy
14th Floor Government Complex
P.O Box 36079
Lusaka, Zambia

Associated partners:
GITEC-IGIP GmbH, IGIP mbH,
Hydroment Consulting Engineers SA
Bari Zambia Limited

Phone: +260 (0)779767931
eMail:
whippey@gitec-consult.com

Date: 2021-07-29
Reference: 091/A/030

Subject: Administration of questionnaires to stakeholders in the scoping process of the Environmental and Social Impact Assessment

Dear Sir/Madam

With reference to the above, we would like to invite Stakeholders to take part in the Scoping process as part of the Environmental and Social Impact Assessment (ESIA) on the above project. The questionnaire will be administered by the Environmental Impact Assessment (EIA) team.

GITEC-IGIP GmbH, in association with IGIP, Hydroment Consulting Engineers and Bari Zambia Limited, has been engaged by the Government of the Republic of Zambia through Lusaka Water Supply and Sanitation Company to undertake consultancy services for preparation of functional designs, tendering and construction supervision for the proposed New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka under the contract No. LWSC/LSP/EIB/CS-001/2017. One of the main assignments the consultants will carry out is the Environmental and Social Impact Assessment (ESIA) to ascertain how the construction of the New Ngwerere and Chunga Wastewater Treatment Plants (WWTP) will impact the environment and livelihoods of people in the communities where the plants will be constructed.

In accordance with the ZEMA Environmental Management Act No. 12 of 2011 as read with the Environmental Impact Assessment Regulations No. 28 of 1997, and the EIB / KfW safeguard policies, all stakeholders and other Interested and Affected Parties (IAPs) must be provided with opportunities to participate in the EIA process and air their views on the developmental project.

It is in this regard that we request that you to take part in answering a questionnaire that has been designed for this purpose.

Yours faithfully,

Mark Whippey

Team Leader

GITEC

CC: Lusaka Water Supply and Sanitation Company

Encl: ESIA Questionnaire-July, 2021

Annex 6 Sample questionnaire

CONSULTANCY SERVICES FOR PREPARATION OF FUNCTIONAL DESIGNS, TENDERING AND CONSTRUCTION SUPERVISION FOR THE PROPOSED NEW NGWERERE CHUNGA WASTEWATER TREATMENT PLANTS IN LUSAKA

Questionnaire

Name of Participant: Newton Moyo

Name of Organisation / Area: ~~Cha~~ Chunga

1. Are you aware of the construction of the new Ngwerere and Chunga Wastewater Treatment Plant (WWTP) (√) (tick)

   YES ( ) **NO** (✓)

2. Tick (√) factors that would affect your environment and livelihood due to the project.

POSITIVE IMPACT	YES	NO
Improvement of people's health and welfare after construction	✓	
Increased employment opportunities during construction		✓
Improved Sanitation after construction	✓	
Less Odour after construction	✓	
Improved river quality after construction	✓	
NEGATIVE IMPACT	**YES**	**NO**
Displacement of crop fields during construction	✓	
Odours and air pollution during construction	✓	
Dust emissions during construction	✓	
Noise Pollution during construction	✓	
Increased incidences of HIV/AIDS due to migration of workers and change in behavior due to increased incomes	✓	

Others Land Noise pollution

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3. Propose ways of mitigating the negative impacts mentioned in 2

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4. Characterize the present land use where the proposed Wastewater Treatment Plant will be constructed

◯ Urban	◯ Industrial	◯ Agricultural
◯ Suburban	◯ Rural	(✓) Residential
◯ Forest	◯ Educational facilities	
◯ Other ...grave yard.....		

5. Will it improve your living standard? (tick)

YES ✓ **NO** ○

6. Do you foresee the project creating new opportunities for you or/and your organisation/village?

YES ✓ **NO** ○

7. State your other contributions/ comments on the project

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THANK YOU FOR YOUR PARTICIPATION

Annex 7 Attendance Register

Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

Ref No.	Name	Phone number	Area	Address	
01	ACKIM MONGA	0971-040163	ZANIMUONE WEST	ZANIMUONE WEST	MONGA
02	MARTIN KABWA	0974-785922	"	"	[illegible]
03	VERONICA M. NGOMA	0966-352792	"	"	[illegible]
04	SYDNEY TEMBO	0978-488174	"	"	[illegible]
05	LEVI K. MAYOWA	0977-448231	"	"	[illegible]
06	PATRICIA CHONDA	0977-674660	"	"	P. Chonda
07	ALICE LUNGU	0978-742960	"	"	A. Lungu
08	HAVWANA HENRY	0975-516814	"	"	[illegible]
09	PATRICK CHAMA	0955-951516	"	"	[illegible]
10	NESTER NABANA	0979-338900	"	"	[illegible]
11	ACKSON MULEBA	077-6526271	"	"	[illegible]
12	ROGER PHIRI	0978-784251	"	"	[illegible]
13	GIFT BANDA	0976-107586	"	"	Gift

Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

Ref No.	Name	Phone number	Area	Address	
01	MUKUMBUTA	096489670	Goternmeal Farm.		
62	E. DAKA	0975077769	11 11		
03.	AGNESS ZIMBA	0979662914.	GOVERMENT FARM.		
4.	ZELDAH SILAYWE	0960233293	GOVERMENT FARMS		
-5-	MULAKO TEMBO	0975971794	Government Farms		
16.	EMMANUEL-SIM	097-1272827	GOVERNMENT		
7	GIFT mumba	0770583946	Government Farms		
8	D. maamba	0976721651	government farms		
9.	m. Bwumba	0976 464406	11 11		
10	Emmanuel	0971622518	11 11	PLOT 124.	
11.	C. Maluza	0972422717	Goternmeal Farm		
12	MIKE MAYANDA		11 11		
13	GREENSON KULUNDA	0955896178	11 11		

Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

Ref No.	Name	Phone number	Area	Address	
14	MRS CHRISTINE	0972821304	ZANIMLIONE		
15	ANNIE NACHILONG	0960124635	"		
16	MR MARTIN	0965988424	ZANIMLIONE		
17	MRS RACHEL	0977 223232	"		

ultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

Name	Phone number	Area	Address	
TREVOR	0967 410627	GOVERMENT FARMS		
DAUL	0975105044	GOVERNMENT FARM		
SYLVIA ROSE	0970825556	" "		

onsultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

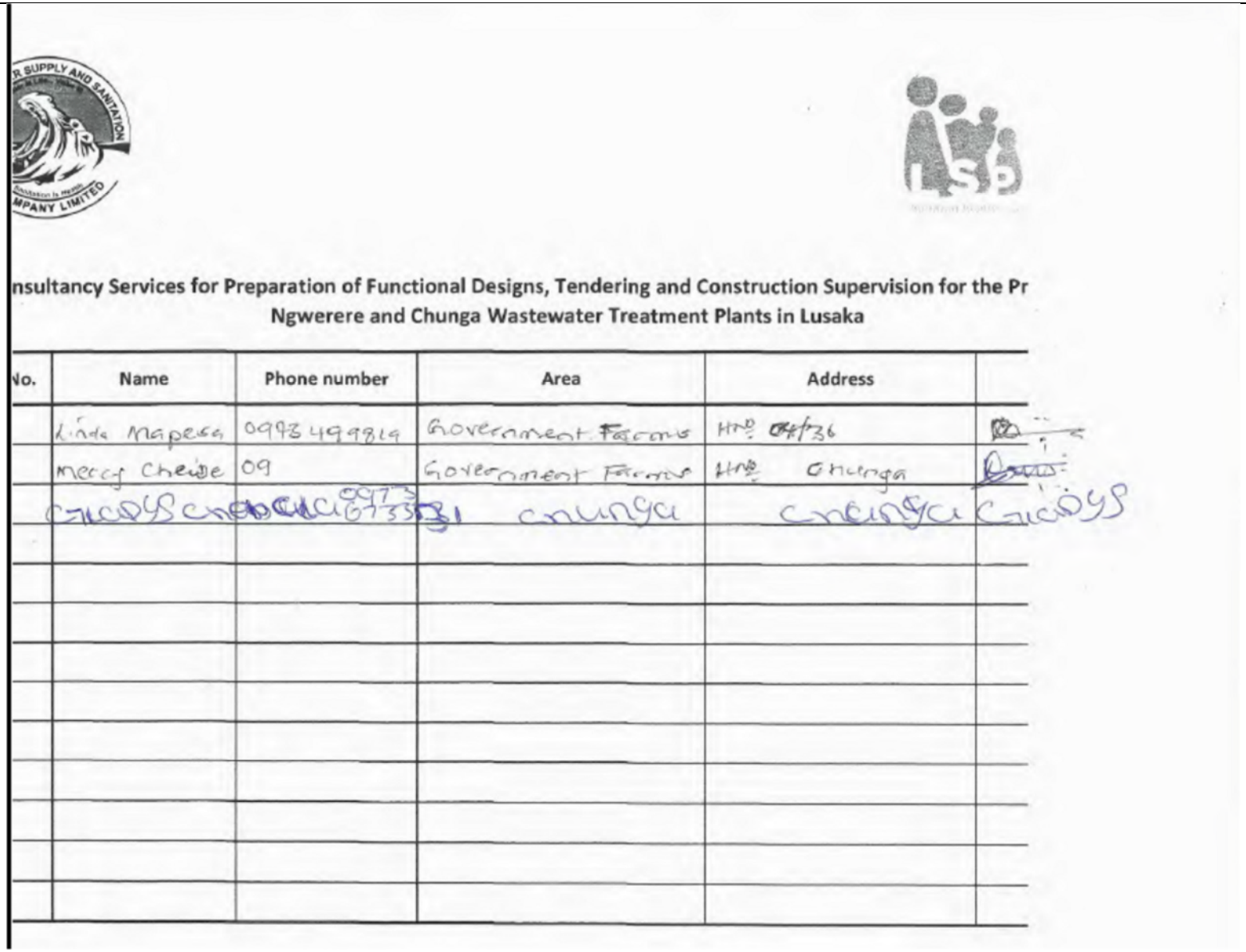
No.	Name	Phone number	Area	Address	
	GIFT [illegible]	0972-209269	[illegible]		

Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Proposed New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

ef No.	Name	Phone number	Area	Address	Signature
	Zanji Sicamo	0777195512	Chunga (government farm)	Chunga	
	Kondwani. M	0780876076	Chunga (Govt Farms)	Chunga	

Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Proposed New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

f No.	Name	Phone number	Area	Address	Signature
	C. Musonda	0977523834	Former Farms Government	House No. M/14	



nsultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

No.	Name	Phone number	Area	Address	
	Linda Mapesa	0973499814	Government Farms	HNº 04/36	
	Mercy Chembe	09	Government Farms	HNº Chunga	
			Chunga	Chunga	

nsultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Proposed New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

No.	Name	Phone number	Area	Address	Signature
1	Winner Sinkala	0977602568	Chunga	Box 50198	
2	BENJAMIN	0977930396	GOVERNMENT FARM		
3	ELIZABETH	"	GOVERNMENT FARM		
4	NATASHA	0940943649	Government Farm	Plot 232	
5	NAOMI KANYINJI	0962612199	GOVERNMENT FARM		N. Kanyinji
6	CHRISTINE SOKO	0979465258	GOVERNMENT Farms		
7	EDWARD CHIMA	0971161122	Chunga / GOVERNMENT Farms		
8	Simeon	0975682599	Government farms		
9	MRS ZULU	0977612997	Govt Farms		
10	SIMON MSOKI	0971622518	Chunga / Govt Farms	Plot 124 G	
11	Theresa Chewe	0940181944	Chunga		T Chewe
12	Steven Mutaunka	0976066599	Govt Farms / Chunga		S. Mutaunka
13	John K. Mwelwa	0965-558697	Govt Farms / Chunga	—	

WATER SUPPLY AND SANITATION COMPANY LIMITED

onsultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

No.	Name	Phone number	Area	Address	
	Emmie phiri	0977-196420	Chunga	Chunga	E phiri
	John .M	0979849308	Chunga	Chunga	[illegible]
	MARTHA Temba	0976 325459	CHunga	CHunga	[illegible]
	mary. Phiri	097807-6469	chunga	98/99	[illegible]
	cindy MBAO		Chunga		[illegible]
	Christopher	077[illegible]9858	Chunga	193	[illegible]
	RUTH KUNDA	0973080888	Chunga		
	Naomi Mbao	0974395771	Chunga	Chunga	[illegible]
	Dorcus yanda	0961556246	Chunga	chunga	D.yanda
	magret yanda	0779717558	Chunga	Chunga	M.yanda
	Mary Budya	0961556640	Chunga	Chunga	M.Budya
	[illegible] MFUNE	0960 370289	Chunga	02/43	Mfuhe
	SUWILANJI SUME	0975984107	Chunga	02/43	[illegible]

Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

f No.	Name	Phone number	Area	Address	
	Antine mwale	0962169280	Chunga	22/29	
	Natual Chisenga	0970 966242	Chunga	32/37	
	Lisa Kapiri	0973942413	Chunga	farms No 2110	[signature]
	Fared Phiri	0975656315	Chunga	Chunga	
	NKOSI MOYO	0779201905	Chunga	Chunga	D Moyo
	Newton	0972100743	Chunga	Chunga	N-Moyo
	Brighton Mumba	0970276877	Chunga	Chunga	[signature]
	Laymore Emmanuel		Chunga	Chunga	[signature]
	Grace Tembo	0970785519	Chunga	Chunga	
	Lameck	0979790741	Chunga	82/22	[signature]
	Amos Yanda	0972351317	Chunga	Chunga	
	James Banda	0973179379	Chunga	Chunga	[signature]
	Nkumbu Siame	0972452089	Chunga GOVT Farms	02/43	[signature]

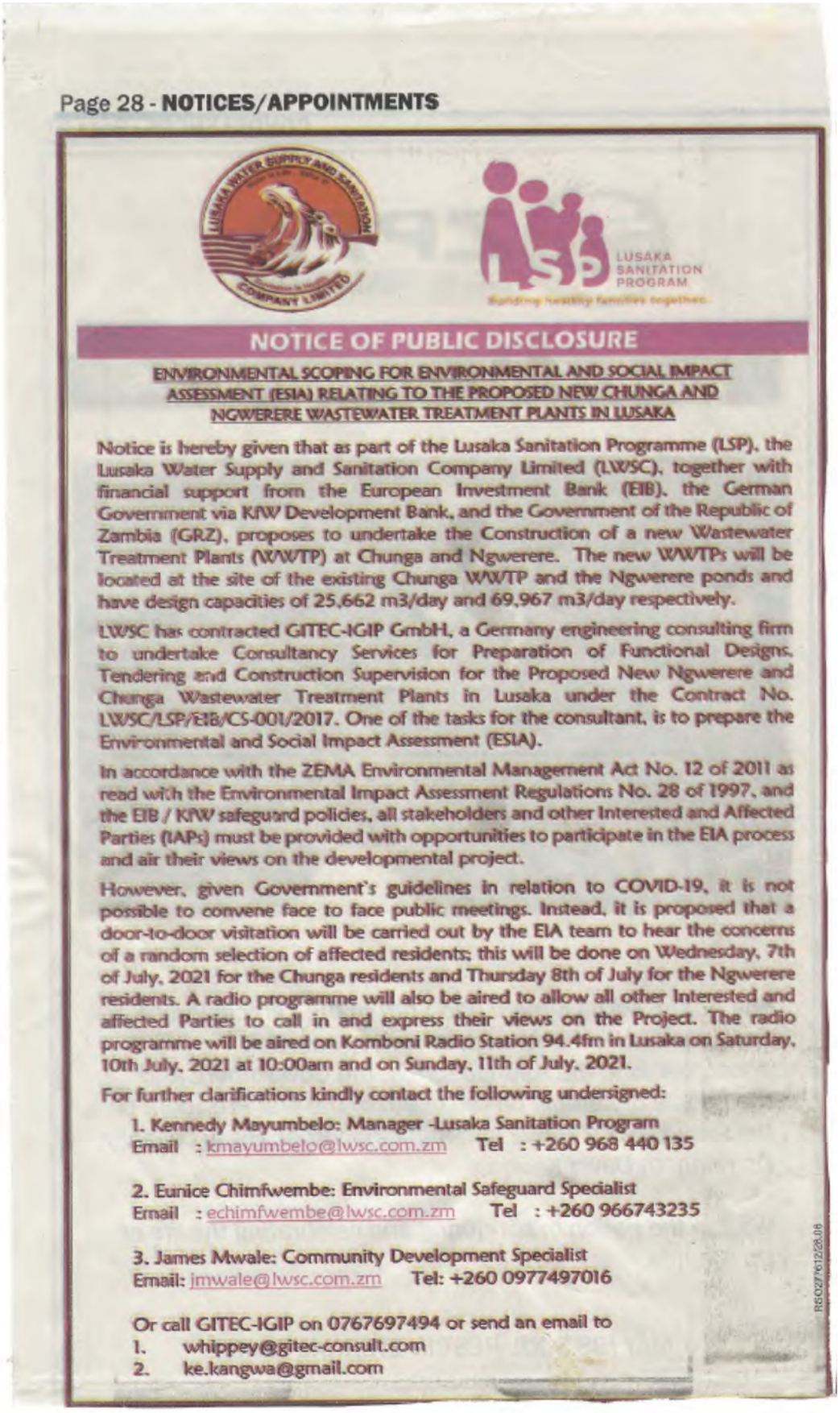
Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

ef No.	Name	Phone number	Area	Address	
1	Mr B. PHIRI	0973500660	ZANIMWONE WEST		
2	Mr B MUYAUKA	0977761584	ZANIMWONE WEST		
3	Mr G MUBANGA	0975091452	ZANIMWONE WEST		
4	Mr P Sichilimo	0977300969	ZANIMWONE WEST		
5	Mr J MUTAFI	09	"		
6	Mr M. Bwalya	0975379677	"		
7	MRS V. CHANDA	0976164217	"		V. CHANDA
8	MRS KAYONGO	0979733331	"		A. Phiri
9	MR MWANZA	0977780908	"		
10	MR LAZAROUS	0977B98894	"		
11	MR PHILI SANA	0977223061	"		P. SANA
12	MR HUMPHREY	0978608292	"		
13	MR KAYONGO	0978342478	"		

nsultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Pr
Ngwerere and Chunga Wastewater Treatment Plants in Lusaka

No.	Name	Phone number	Area	Address	
1.	GIFT [illegible]	0972-209269	ZANIMUONE WEST		[illegible]
2	LUKE NGHIMUNYA	0977803423	EMMASDALE – LSK	Box 37486, LSK	[illegible]
3	James Kale	0974436785	Buseko Market Kabanana	Kabanana	[illegible]
4	JOSEPH	0976558261	BUSEKO	MATERO	[illegible]
5	Cloud Ndiyondiko	0976173021	Garden/chilulu	Garden/chilulu	[illegible]
	Dorothy	0971161198	Garden/chilulu		[illegible]

Annex 8 Scoping Exercise Advertisement



Page 28 - **NOTICES/APPOINTMENTS**

LUSAKA WATER SUPPLY AND SANITATION COMPANY LIMITED

LSP LUSAKA SANITATION PROGRAM

Building healthy families together

NOTICE OF PUBLIC DISCLOSURE

ENVIRONMENTAL SCOPING FOR ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) RELATING TO THE PROPOSED NEW CHUNGA AND NGWERERE WASTEWATER TREATMENT PLANTS IN LUSAKA

Notice is hereby given that as part of the Lusaka Sanitation Programme (LSP), the Lusaka Water Supply and Sanitation Company Limited (LWSC), together with financial support from the European Investment Bank (EIB), the German Government via KfW Development Bank, and the Government of the Republic of Zambia (GRZ), proposes to undertake the Construction of a new Wastewater Treatment Plants (WWTP) at Chunga and Ngwerere. The new WWTPs will be located at the site of the existing Chunga WWTP and the Ngwerere ponds and have design capacities of 25,662 m3/day and 69,967 m3/day respectively.

LWSC has contracted GITEC-IGIP GmbH, a Germany engineering consulting firm to undertake Consultancy Services for Preparation of Functional Designs, Tendering and Construction Supervision for the Proposed New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka under the Contract No. LWSC/LSP/EIB/CS-001/2017. One of the tasks for the consultant, is to prepare the Environmental and Social Impact Assessment (ESIA).

In accordance with the ZEMA Environmental Management Act No. 12 of 2011 as read with the Environmental Impact Assessment Regulations No. 28 of 1997, and the EIB / KfW safeguard policies, all stakeholders and other Interested and Affected Parties (IAPs) must be provided with opportunities to participate in the EIA process and air their views on the developmental project.

However, given Government's guidelines in relation to COVID-19, it is not possible to convene face to face public meetings. Instead, it is proposed that a door-to-door visitation will be carried out by the EIA team to hear the concerns of a random selection of affected residents; this will be done on Wednesday, 7th of July, 2021 for the Chunga residents and Thursday 8th of July for the Ngwerere residents. A radio programme will also be aired to allow all other Interested and affected Parties to call in and express their views on the Project. The radio programme will be aired on Komboni Radio Station 94.4fm in Lusaka on Saturday, 10th July, 2021 at 10:00am and on Sunday, 11th of July, 2021.

For further clarifications kindly contact the following undersigned:

1. Kennedy Mayumbelo: Manager -Lusaka Sanitation Program
Email : kmayumbelo@lwsc.com.zm Tel : +260 968 440 135

2. Eunice Chimfwembe: Environmental Safeguard Specialist
Email : echimfwembe@lwsc.com.zm Tel : +260 966743235

3. James Mwale: Community Development Specialist
Email: jmwale@lwsc.com.zm Tel: +260 0977497016

Or call GITEC-IGIP on 0767697494 or send an email to
1. whippey@gitec-consult.com
2. ke.kangwa@gmail.com

Annex 9 ZEMA Effluent Standards

FIRST SCHEDULE

(Regulation 4)

TABLE OF STANDARDS FOR TRADE AND OTHER EFFLUENTS

Column 1 SUBSTANCE	Column 2 TRADE EFFLUENT INTO PUBLIC SEWER	Column 3 SEWAGE AND OTHER EFFLUENT
A. PHYSICAL		
1.Temperature	60°C. After mixing of the waters, the temperature should not exceed 40°C	40°C at the point of entry
(Thermometer)		
2.Colour Hazen (Spectrophotometer)	The treatment plant ensure discolouration dyestuffs in the waste water	Must not cause any colouration of the receiving water
3.Odour and Taste (Threshold odour Number)	The odour must not cause any nuisance	Must not cause any deterioration in taste or odour as compared with the natural state
4.Total suspended solids (Gravimetric method)	1,200 mg/L (Avoid blockage of sewer, effect free flow)	50 mg/L. Must not cause formation of sludge or scum in receiving waters
5.Settleable matter sedimentation ml/L (Imhoff funnel)	1.0 ml/L in 2 hours (Avoid blockage of sewer, effect free flow)	0.5 ml/L in 2 hours. Must not cause formation of sludge in receiving water
6.Salinity/Residue mg/L (Evaporation and Gravimetric method)	7,500 mg/L. The salinity must not affect the discharge and treatment or	3,000 mg/L. The salinity of waste water must not adversely affect surface

	installations or their functioning	water
B. CHEMICAL		
7.pH (0-14 scale) (Electrometric method)	6-10	6-9
8.Dissolved Oxygen mg oxygen/L (Modified Winkler method and Membrane-electrode method)	No requirements	After complete mixing, the oxygen content must not be less than 5 mg/L. Extreme temperature may result in lower values
9.Chemical Oxygen Demand (COD) (Dichromate method)	1,800 mg/L	COD based on the limiting values for organic carbon 60-90 mg 0 2 /L average for 24 hours
10.Biochemical Oxygen Demand (BOD) (Modified Winkler method and Membrane Electrode method)	1,200 mg/L	50 mg 0 2 /L (mean value over a 24 hours period). According to circumstances in relation to the self-cleaning capacity of the waters
11.Nitrates (NO 3 as introgen (Spectrophotometric method and Electrometric method)	80 mg/L	The nitrates burden must be reduced as far as possible according to circumstances: Watercourses <50 mg/L; Lakes <20 mg/L
12.Nitrite (NO 2 as nitrogen/L) (Spectrophotometric sulfanilamide)	10.0 mg NO 2 as N/L	1.0 mg NO 2 as N/L
Column 1 SUBSTANCE	Column 2 TRADE EFFLUENT INTO PUBLIC SEWER	Column 3 SEWAGE AND OTHER EFFLUENT
C. METALS		
13.Organic Nitrogen (Spectrophotometric method N-Kjeldhal) (*the % of nutrient elements for degradation of BOD should be 0.4-1% for phosphorous (different for processes using algae))	300 mg N/L*	5.0 mg/L mean*
14.Ammonia and Ammonium (Total) (NH 3	50 mg/L	The burden of ammonium salts must be reduced as far

as N/L) Nesslerization method and Electrometric method)		as 10 mg/L (depending upon temperature, pH and salinity)
15.Cyanides (Spectrophotometric method)	0.5 mg/L	0.1 mg/L
16.Phosphorous (Total) (PO4 as P/L) (Colorimetric method)	45 mg/L	Treatment installation located in the catchment area of lakes: 1 mg/L; located outside the catchment area: reduce the load of P as low as possible (PO4<6 mg/L)
17.Sulphates (Turbidimetric method)	500 mg/L	The sulphate burden must be reduced as low as possible
18.Sulfite (Iodometric method	10 mg/L	1 mg/L (presence of oxygen changes SO3 to SO4)
19.Sulphide (Iodometric and Electrometric method)	1 mg/L	0.1 mg/L (depending on temperature, pH and dissolved 02)
20.Chlorides Cl/L (Silver nitrate and Mercuric nitrate)	1,000 mg/L	Chloride levels must be as low as possible as < (800 mg/L)
21.Active chloride Cl2/L (Iodometric method)	(0.5-3.0 mg/L)	0.5 mg/L
22.Active Bromine (Br2/L) (Iodometric method)	(0.5-3.0 mg/L)	0.1 mg/L
23.Fluorides F/L (Electrometric method and Colorimetric method with distillation)	(<30 mg/L)	10 mg/L
24.Aluminium compounds (Atomic Absorption method)	<20 mg/L	<10 mg/L
25.Antimony (Atomic Absorption method)	0.5 mg/L (inhibition of oxidation)	0.5 mg/L
26.Arsenic compounds (Atomic Absorption method)	1.0 mg/L	1.0 mg/L
27.Barium compounds (water soluble concentration) (Atomic Absorption method)	1.0 mg/L	0.5 mg/L

28.Beryllium salts and compounds (Atomic Absorption method)	0.5 mg/L (inhibition of oxidation)	0.1-0.5 mg/L (according to circumstances)
Column 1 SUBSTANCE	Column 2 TRADE EFFLUENT INTO PUBLIC SEWER	Column 3 SEWAGE AND OTHER EFFLUENT
29.Boron compounds (Spectrophotometric method-Curcumin method)	<50 mg/L	<10 mg/L
30.Cadmium compounds (Atomic Absorption method)	1.5 mg/L	0.5 mg/L
31.Chromium Hexavalent Trivalent (Atomic Absorption method)	5.0 mg/L	0.1 mg/L
32.Cobalt compounds (Atomic Absorption method)	0.5 mg/L	0.5 mg/L
33.Copper compounds (Atomic Absorption method)	3.0 mg/L	1.0 mg/L
34.Iron compounds (Atomic Absorption method)	15.0 mg/L	<2 mg/L
35.Lead compounds (Atomic Absorption method)	1.5 mg/L	1.5 mg/L
36.Magnesium (Atomic Absorption method and Flame photometric method)	<1,000 mg/L	<500.0 mg/L
37.Manganese (Atomic Absorption method)	10.0 mg/L	<3.0 mg/L
38.Mercury (Atomic Absorption method)	0.01 mg/L	0.001 mg/L
39.Molybdenum (Atomic Absorption method)	5.0 mg/L	0.5-5.0 mg/L
40.Nickel (Atomic Absorption method)	2.0 mg/L	2.0 mg/L
41.Selenium (Atomic Absorption method)	<1.0 mg/L	<0.05 mg/L

42.Silver (Atomic Absorption method)	0.1 (inhibition of oxidation)	0.1 mg/L
43.Thallium mg (Atomic Absorption method)	1.0 mg/L	<0.5 mg/L
44.Tin compounds (Atomic Absorption method)	2.0 mg/L	2.0 mg/L
45.Vanadium compounds (Atomic Absorption method)	1.0 mg/L	1.0 mg/L
46.Zinc compounds (Atomic Absorption method)	25.0 mg/L	10.0 mg/L
D. ORGANICS		
47.Total hydrocarbons (Chromatographic method)	10.0 mg/L	20.0 mg/L
48.Oils (Mineral and Crude) (Chromatographic method and Gravimetric method)	100.0 mg/L (after installation of oil separators) 20.0 mg/L (after installation of demulsifier)	1-2 mg/L
49.Phenols (steam distillable) (Non-steam distilled) (Colorimetric method)	5.0 mg/L 1.0 mg/L	0.2 mg/L 0.05 mg/L

Column 1 SUBSTANCE	Column 2 TRADE EFFLUENT INTO PUBLIC SEWER	Column 3 SEWAGE AND OTHER EFFLUENT
50.Fats and saponifiable oils (Gravimetric method and Chromatographic method)	No requirement but installation of oil and fat separators	20.0 mg/L
51.Detergents (Anionic) (Atomic Absorption Spectrophotometric)	10.0 mg/L Alkybenzene sulfonate not permitted	2.0 mg/L (Detergents should contain at least biodegradable compounds)
52.*Pesticides and PCBs (Total) (Chromatographic method)	1.0 mg/L	0.5 mg/L (Reduce to a minimum)
53.Trihaloforms (Chromatographic method)	1.0 mg/L	0.5 mg/L (Reduce to a minimum)
E. RADIOACTIVE MATERIALS		

54.Radioactive materials as specified by IAEA	No discharge accepted	Not permitted

* There are approximately 4,000 pesticides, herbicides and PCBs. The normal practices as per the works of reference hereinafter mentioned shall be used in respect thereof.

References:

1. Environmental Protection Agency-Code of Federal Regulations-Protection of Environment Parts 1 to 399. US Government Printing Office, Washington USA (1979).
2. Environment Canada-Environmental Protection Service (EPS-1) Water Pollution Control Directorate Regulations, Codes and Protocols.
3. Kratel, R., Draft Water Pollution Control Act, Lusaka, Zambia (1981).
4. Lund, H. F., "Industrial Pollution Control Handbook" McGraw-Hill Book Company (1971).
5. APHA, AWWA, WPCF, "Standard Methods for the Examination of Water and Wastewater 15th Edition (1980)"

Annex 10 Photographs

[12]

[12] Consultant's team interviewing people in Chunga township and on Komboni radio. Source: Consultant

Annex 11 Minutes of Consultative Meetings

GITEC-IGIP HYDROMENT BARI ZAMBIA	LUSAKA WATER SUPPLY AND SANITATION COMPANY New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka Contract N°: LWSC/LSP/EIB/CS-003/2017	Date: Place:	03/09/2021 CHUNGA
	Minutes of Meeting No. 16 : Chunga Community Consultative/Engagement	Page:	1/4

N°	Company	Name	Function	Presence		
				P	A	D
1.	LWSC	James Mwale (JM)	Community Development Specialist	x		x
2.	BARI ZAMBIA	Patrick Phiri (PP)	RAP Consultant	x		x
3.	BARI ZAMBIA	Ethel Kangwa (EK)	Social Expert	x		x
4.	CHUNGA	Alice Namfukwe (AN)	Resident	x		
5.	CHUNGA	Besnart Mumba (BM)	Resident	x		
6.	CHUNGA	Beatrice Phiri (BP)	Resident	x		
7.	CHUNGA	M Daka(MD)	Resident	x		
8.	CHUNGA	Nathan Silumbwe(NS)	Resident	x		
9.	CHUNGA	Gabriel Njamba(GN)	Resident	x		
10.	CHIBOMBO	Stephen Phiri(SP)	Surveyor	x		
11.	CHUNGA	Mirriam Njobvu(MN)	Resident	x		
12.	CHUNGA	Mpande Kumuyu(MK)	Resident	x		
13.	CHUNGA	Carol Chongo(CC)	Resident	x		
14.	CHUNGA	Margaret K. Soko(MS)	Resident	x		
15.	CHUNGA	Given Chishimba(GC)	Resident	x		
16.	CHUNGA	Catherine Musonda(CM)	Resident	x		
17.	CHUNGA	Molia Tembo(MT)	Resident	x		
18.	CHUNGA	Malama(M)	Resident	x		
19.	CHUNGA	Belinda Chungu(BC)	Resident	x		

GITEC-IGIP HYDROMENT BARI ZAMBIA	LUSAKA WATER SUPPLY AND SANITATION COMPANY New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka Contract N°: LWSC/LSP/EIB/CS-003/2017	Date: Place:	03/09/2021 CHUNGA
	Minutes of Meeting No. 16 : Chunga Community Consultative/Engagement	Page:	2/4

20.	BARI ZAMBIA	Evans Simusokwe(ES)	Driver			

P: Present; A: Absent; D: Distribution

N°	Topic	Action	Person in charge	Deadline
	Resettlement Action Plan-Community Engagement/Consultative Meeting at LWSC premises			
	The meeting started at 09:30am with 20 people in attendance. It began with an opening prayer from one of the residents followed by self-introductions. **JM:** Gave a brief summary of the project. **PP:** The RAP consultant made the presentation in which he spoke about the positive and negative impacts of the project and their mitigations which was followed by a question and answer session. Among the negatives, he talked about the loss of crop cultivation fields resulting in loss of income to the farmers using Lusaka Water land. He also talked about a possibility of dust and noise during the construction. To help mitigate for the loss of income on the displaced farmers, he said that priority for employment opportunities during the construction phase will be given to the affected local people within the project area. On the dust the consultant assured the residents that construction works that may be noise will be restricted to the day shift to allow for a peaceful noise-free night. On the dust pollution, he indicated that the ground for construction site will be kept wet to trap the dust. On the positive side, he told the residents that in addition to employment opportunities, the upgraded treatment plant will take away the bad smell that was evidently felt even during the meeting. He observed and commended the residents because no one had a structure on Lusaka water land. He ended by inviting for questions from the audience.			
	BM: Should we stop farming right away? **JM:** I would advise you not to plant crops that are dependent on rains but rather settle for irrigation based crops in order not be inconvenienced when the construction starts in March 2022. **MK:** Can we plant maize in the meantime? **JM:** I would advise against it because the maize would not have been ready by the time works commence. **MD:** Is it possible to extend the cut-off date maybe to February or March to allow for the harvest since we harvest fresh maize. **JM:** It is not possible because projects have specific fix time frame and preparation could start even in January.			

GITEC-IGIP HYDROMENT BARI ZAMBIA	LUSAKA WATER SUPPLY AND SANITATION COMPANY New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka Contract N°: LWSC/LSP/EIB/CS-003/2017	Date: Place:	03/09/2021 CHUNGA
	Minutes of Meeting No. 16 : Chunga Community Consultative/Engagement	Page:	3/4

N°	Topic	Action	Person in charge	Deadline
	MZ: My garden is down the stream away from where the works will be taking place, should I plant anything right now? **JM:** That is still LWSC land **MK:** I have a pump can I go ahead and grow my crops since I do not depend on the rains? **JM:** You can go ahead and grow your crops as long as you clear by January or February **BP:** If I have early maturing seed of maize can I plant. **JM:** Only for Vegetables like Bondwe, Chibwabwa, but I would advise that you don't plant anything that is rain dependant to avoid the risk of having the crops removed. **GN:** Is it possible to talk to the people who have built right outside the LWSC boundary as we have had issues with them in the past **JM:** That is not LWSC land so we have no jurisdiction over it. **CM:** You have killed our livelihoods most of us are widows and we depend on gardening. Lusaka Water should give us jobs. **JM:** One of the positive impacts as earlier presented is that the project will present opportunities for employment for the locals, especially the able-bodied men and women and youths. **CM:** Our children are not old enough to work so what will remain of us? And when are we going to know when the works start? **PP:** Child labour is not legal in Zambia. We would be found wanting by the law if we employed anyone below the legal age. **JM:** This is not the last meeting we are having we will call for another one to inform you when exactly the works will commence. **PP:** We need to form a Grievance Redress committee to ensure that should there be any grievances, they are communicated and addressed effectively. **JM:** There is already a Grievance Redress committee for Chunga. *Some people present were not aware of such a committee because they lived in another part of Chunga called Government Farms so a recommendation was made for them to be part of the committee. **GC:** We need empowerment from you for chasing us from your land. **GN:** Let us all spread the information here to all the other community members who did not make it to today's meeting. After the closing prayer meeting ended at 10:26			

GITEC-IGIP HYDROMENT BARI ZAMBIA	LUSAKA WATER SUPPLY AND SANITATION COMPANY New Ngwerere and Chunga Wastewater Treatment Plants in Lusaka Contract N°: LWSC/LSP/EIB/CS-003/2017	Date: Place:	03/09/2021 CHUNGA
	Minutes of Meeting No. 16 : Chunga Community Consultative/Engagement	Page:	4/4

N°	Topic	Action	Person in charge	Deadline
	Signatures of the Meeting Minutes			
	The Client : LWSC			
	The Project Implementation Consultant :			
	The Consultant for Component A : Consortium GITEC-IGIP/HYDROMENT/BARI ZAMBIA			

Annex 12 Water test results from Chunga WWTP

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : GITECH Consulting Group
Lusaka
Sampled by : Client
Sampling date : 19.08.2021
Report date : 25.08.2021

Laboratory Results

Parameter	Chunga Upstream	ZEMA Limits
pH	6.67	6.0 – 9.0
Temperature (°C)	26.4	40
Electrode Potential (mV)	-22.7	-
Conductivity (µs/cm)	1689	4300
Total Dissolved Solids (mg/l)	845	3000
Total hardness (as mg $CaCO_3$/l)	486	-
Bicarbonates (as mg $CaCO_3$/l)	480	-
Alkalinity (as mg $CaCO_3$/l)	482	-
Iron (mg/l)	1.24	2.0
Zinc (mg/l)	0.400	1.0
Ammonia (as NH_4-Nmg/l)	15.10	10
Lead (mg/l)	<0.01	0.5
Sulphates (mg/l)	69.90	1500
Cadmium (mg/l)	<0.002	0.5
Chlorides (mg/l)	166.0	800
Chromium (mg/l)	0.090	0.1
Nitrates (as NO_3 –N mg/l)	<0.01	50
Total phosphates (mg/l)	5.00	6.0
Magnesium (mg/l)	68.68	500
Calcium (mg/l)	80.0	-
Manganese (mg/l)	0.070	1.0
Dissolved Oxygen (as mg O_2/l)	2.8	5
Biochemical Oxygen Demand (as mg O_2/l)	84	50
Chemical Oxygen Demand (as mg O_2/l)	290	90
Fats (mg/l)	0.098	20
Bacteriological Results		
Total coliforms (#/100ml)	1,900	5000
Feacal coliforms (#/100ml)	1,600	2500

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

UNIVERSITY OF ZAMBIA SCHOOL OF ENGINEERING 25 AUG 2021 DEPT. OF CIVIL ENGINEERING P.O. BOX 32379 LUSAKA

Tested by: E. Mutati ..... Checked & Approved by: Joshua Liyungu.....
Lab. Technician Lab. Manager /Co-ordinator

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : GITECH Consulting Group
Lusaka
Sampled by : Client
Sampling date : 19.08.2021
Report date : 25.08.2021

Laboratory Results

Parameter	Chunga Downstream	ZEMA Limits
pH	6.79	6.0 – 9.0
Temperature (°C)	26.5	40
Electrode Potential (mV)	-29.5	-
Conductivity (µs/cm)	1835	4300
Total Dissolved Solids (mg/l)	917	3000
Total hardness (as mg $CaCO_3$/l)	500	-
Bicarbonates (as mg $CaCO_3$/l)	490	-
Alkalinity (as mg $CaCO_3$/l)	496	-
Iron (mg/l)	1.18	2.0
Zinc (mg/l)	0.360	1.0
Ammonia (as NH_4-Nmg/l)	*10.20*	*10*
Lead (mg/l)	<0.01	0.5
Sulphates (mg/l)	28.10	1500
Cadmium (mg/l)	<0.002	0.5
Chlorides (mg/l)	174.0	800
Chromium (mg/l)	0.840	0.1
Nitrates (as NO_3 –N mg/l)	<0.01	50
Total phosphates (mg/l)	5.10	6.0
Magnesium (mg/l)	76.80	500
Calcium (mg/l)	76.0	-
Manganese (mg/l)	0.080	1.0
Dissolved Oxygen (as mg O_2/l)	2.4	5
Biochemical Oxygen Demand (as mg O_2/l)	72	50
Chemical Oxygen Demand (as mg O_2/l)	184	90
Fats (mg/l)	0.064	20
Bacteriological Results		
Total coliforms (#/100ml)	6,700	5000
Feacal coliforms (#/100ml)	4,500	2500

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

25 AUG 2021

Tested by: E. Mutati ..... Checked & Approved by: Joshua Liyungu.....
Lab. Technician Lab. Manager /Co-ordinator

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P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : GITECH Consulting Group
Lusaka
Sampled by : Client
Sampling date : 19.08.2021
Report date : 25.08.2021

Laboratory Results

Parameter	Chunga Wastewater	ZEMA Limits
pH	6.49	6.0 – 9.0
Temperature (°C)	26.6	40
Electrode Potential (mV)	-12.3	-
Conductivity (µs/cm)	1921	4300
Total Dissolved Solids (mg/l)	961	3000
Total hardness (as mg $CaCO_3$/l)	450	-
Bicarbonates (as mg $CaCO_3$/l)	442	-
Alkalinity (as mg $CaCO_3$/l)	448	-
Iron (mg/l)	1.05	2.0
Zinc (mg/l)	0.700	1.0
Ammonia (as NH_4-Nmg/l)	16.70	10
Lead (mg/l)	<0.01	0.5
Sulphates (mg/l)	62.90	1500
Cadmium (mg/l)	<0.002	0.5
Chlorides (mg/l)	181.0	800
Chromium (mg/l)	1.30	0.1
Nitrates (as NO_3 –N mg/l)	<0.01	50
Total phosphates (mg/l)	11.60	6.0
Magnesium (mg/l)	50.40	500
Calcium (mg/l)	98.4	-
Manganese (mg/l)	0.070	1.0
Dissolved Oxygen (as mg O_2/l)	1.9	5
Biochemical Oxygen Demand (as mg O_2/l)	160	50
Chemical Oxygen Demand (as mg O_2/l)	3400	90
Fats (mg/l)	1.940	20
Bacteriological Results		
Total coliforms (#/100ml)	480,000	5000
Feacal coliforms (#/100ml)	390,000	2500

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

25 AUG 2021

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PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : GITECH Consulting Group
Lusaka
Sampled by : Client
Sampling date : 19.08.2021
Report date : 25.08.2021

Laboratory Results

Parameter	**Chunga Borehole**	WHO Guideline (Maximum Permissible value for drinking water
pH	6.89	6.5 – 8.5
Temperature (°C)	26.2	-
Electrode Potential (mV)	-33.6	-
Conductivity (µs/cm)	1216	1500
Total Dissolved Solids (mg/l)	609	1000
Total hardness (as mg $CaCO_3$/l)	632	500
Bicarbonates (as mg $CaCO_3$/l)	610	500
Alkalinity (as mg $CaCO_3$/l)	613	500
Iron (mg/l)	<0.01	0.3
Zinc (mg/l)	<0.005	3.0
Ammonia (as NH_4-Nmg/l)	<0.01	1.5
Lead (mg/l)	<0.01	0.01
Sulphates (mg/l)	98.00	400
Cadmium (mg/l)	<0.002	0.003
Chlorides (mg/l)	130.0	250
Chromium (mg/l)	<0.01	0.05
Nitrates (as NO_3 –N mg/l)	25.00	10
Total phosphates (mg/l)	0.90	5.0
Magnesium (mg/l)	69.12	-
Calcium (mg/l)	137.6	200
Manganese (mg/l)	<0.01	0.50
Dissolved Oxygen (as mg O_2/l)	5.9	-
Biochemical Oxygen Demand (as mg O_2/l)	2	-
Chemical Oxygen Demand (as mg O_2/l)	6	-
Fats (mg/l)	<0.005	-
Bacteriological Results		
Total coliforms (#/100ml)	0	0
Feacal coliforms (#/100ml)	0	0

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

UNIVERSITY OF ZAMBIA SCHOOL OF ENGINEERING 25 AUG 2021 DEPT. OF CIVIL ENGINEERING P.O. BOX 32379 LUSAKA

Tested by: E. Mutati..... Checked & Approved by: Joshua Liyungu.....
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P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : GITECH Consulting Group
Lusaka
Sampled by : Client
Sampling date : 19.08.2021
Report date : 25.08.2021

Laboratory Results

Parameter	**Chunga Borehole 2**	WHO Guideline (Maximum Permissible value for drinking water
pH	7.16	6.5 – 8.5
Temperature (°C)	26.4	-
Electrode Potential (mV)	-50.5	-
Conductivity (µs/cm)	1056	1500
Total Dissolved Solids (mg/l)	528	1000
Total hardness (as mg $CaCO_3$/l)	560	500
Bicarbonates (as mg $CaCO_3$/l)	442	500
Alkalinity (as mg $CaCO_3$/l)	490	500
Iron (mg/l)	<0.01	0.3
Zinc (mg/l)	<0.005	3.0
Ammonia (as NH_4-Nmg/l)	<0.01	1.5
Lead (mg/l)	<0.01	0.01
Sulphates (mg/l)	48.30	400
Cadmium (mg/l)	<0.002	0.003
Chlorides (mg/l)	118.0	250
Chromium (mg/l)	<0.01	0.05
Nitrates (as NO_3 –N mg/l)	18.60	10
Total phosphates (mg/l)	<0.01	5.0
Magnesium (mg/l)	47.04	-
Calcium (mg/l)	105.6	200
Manganese (mg/l)	<0.01	0.50
Dissolved Oxygen (as mg O_2/l)	6.0	-
Biochemical Oxygen Demand (as mg O_2/l)	2	-
Chemical Oxygen Demand (as mg O_2/l)	7	-
Fats (mg/l)	<0.005	-
Bacteriological Results		
Total coliforms (#/100ml)	0	0
Feacal coliforms (#/100ml)	0	0

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

UNIVERSITY OF ZAMBIA SCHOOL OF ENGINEERING 25 AUG 2021 DEPT. OF CIVIL ENGINEERING P.O. BOX 32379 LUSAKA

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Annex 13 Soil Results

Annex 14 Air Quality Analysis Results

Annex 15 Stakeholder Engagement Plan (SEP)

15.1 Introduction and Objective

This chapter summarizes the consultation activities related to E&S Studies. In accordance with the Environmental Management Act No.12 of 2011 and EIB ESS 10, stakeholder engagement is understood as an inclusive process designed and implemented in order to support the development of strong, constructive and responsive relationships that are important for the successful management of a project's E&S risks.

In line with the EIB ESS 10, the objective of this SEP is to provide:

- Establish and maintain a constructive dialogue between the promoter, the affected communities and other interested parties throughout the project life cycle;
- Ensure that all stakeholders are properly identified and engaged;
- Engage stakeholders in the disclosure process, engagement and consultations in an appropriate and effective manner throughout the project lifecycle, in line with the principles of public participation, non-discrimination and transparency;
- Ensure that the relevant stakeholders, including commonly marginalized groups on account of gender, poverty, educational profile and other elements of social vulnerability, are given equal opportunity and possibility to voice their opinions and concerns, and that these are accounted for in the project decision-making; and,
- Duly verify and assess that the quality and process of engagement undertaken by third parties on the project conform to the provisions included in the present standard.

The stakeholder consultation and engagement process, as outlined in the figure below, will be continued at all project stages. The SEP will be updated taking into consideration any relevant changes that might have occurred after the ESIA scoping.

Figure 19 Stakeholder Engagement and Consultation Process

15.2 Stakeholder Identification

Stakeholders are understood in line with the definition given in the EIB ESS 10 as individuals or groups who:

- are affected or likely to be affected by the project directly or indirectly, PAP;
- may have an interest in the project (other interested parties).

Considering that this is a water and sanitation project, IAPs came from a lot of different sectors of the society since the majority, if not all of the sectors in a socio-economic set-up, require clean water and sanitation to function properly. Key players in the safeguarding of the environment were also considered

when identifying the stakeholders under this project. In as much as the water and sanitation aspect was being improved, the environment needs to be protected.

Key policymakers in Government and Quasi Government organizations were considered key stakeholders considering that they make policies that govern the management of such facilities such as the Wastewater Treatment Plant. Private organizations and individuals affected by the project were also considered as key stakeholders as they represent the community and users of the WWTP and would raise concerns about how this would affect them in the short and long term. Among the private organizations considered were Schools, industries, Churches and households surrounding the WWTPs and those that are connected to the WWTPs.

Table 57 Stakeholder Profiling

Stakeholder	Agenda Strategic Goals and Interests	Area of Activity Scope of Influence	Relationships with Other Actors	Date/ Period	Location	Method of Engagement
ZEMA	Environmental Management and Regulation	Environment and social well-being	Management of E&S matters	1st to 5th June, 2021	ZEMA Head Office	Physical Meeting with the Managing Director and his officers
LWSC	Establishment and smooth running of the WWTP	Monitoring, operation and maintenance of the infrastructure	Closely cooperates and coordinates with the relevant municipality	Throughout project length	Various	Physical meeting with the Project Manager and his officers
Lusaka City Council	One of the Major Shareholders in LWSC Infrastructure Development and Adaptation	Lusaka municipality	N/A	Throughout project length	LCC Offices (Civic Center)	Questionnaires
Industrial Players	Serviced by the WWTP	Industrial wastewater heading into the WWTP	Use of the same WWTP	1st to 31st July, 2021	Various industrial head offices	Questionnaires
Ministry of Lands and Natural Resources	Overseers of Land Management	WWTP premises	Issuance of title deeds and management of natural resources	5th July, 2021	Mulungushi House, Ministry of Lands Headquarters	Questionnaires
EIB and KfW	Financiers Program results	Providing the loan	Involved in Project progress	Throughout Project Lifespan	Virtual meetings and correspondence	Virtual Meetings
National Water and Sanitation Council	Responsible for the regulation of water and sanitation service providers	All Water Utility Companies	Regulation of all water utilities	Throughout Project Lifespan	NWASCO Offices	Questionnaires
Ministry of Local Government	Oversees Local Governance including the	Municipalities	Overseeing functions of	20th to 31st July, 2021	Lusaka and Chongwe Council Offices	Questionnaires

Stakeholder	Agenda Strategic Goals and Interests	Area of Activity Scope of Influence	Relationships with Other Actors	Date/ Period	Location	Method of Engagement
and Rural Development	operation of Local Councils		the local council			
Water Resources Management Agency	Management and Regulation of Water Resources	Water bodies receiving waste from the WWTP	N/A	July, 2021	WARMA head office	Questionnaires
ZESCO	Responsible for the generation and transmission of power	Power distribution lines in the WWTP	Power generation and supply	July, 2021	ZESCO Head Office	Questionnaires
Other Interested and Affected Parties	Key stakeholders	Project area	N/A	10th and 11th July, 2021	Komboni Radio Station	Questionnaires

15.3 Disclosure of Information

In line with EIB ESS 10, the following information was disclosed at a minimum:

- The purpose, nature, and objectives of the project;
- The duration of proposed project activities;
- Potential risks and impacts of the project on local communities, and the proposals for mitigating these, highlighting potential risks and impacts that might disproportionately affect vulnerable and disadvantaged groups;
- The proposed mitigation plan and associated budget;
- The available grievance mechanism;
- Any added value and opportunities for benefit-sharing;
- The envisaged consultation process, if any, and opportunities and ways in which the public can participate and;
- Time and venue of any envisaged public meetings, and the processes in which meetings are notified, summarized and reported.

15.3.1 List of Public Domain Information/ Documents

The following information and documents were made available to the public domain:

- Functional designs;
- Environmental screening application and decision;
- ESIA;
- ESMP;
- Contact information for grievance redress;
- Time and venue of any proposed public consultation meetings;
- Information on the beginning of construction works and construction schedule, potential road closure and other information of public relevance.

15.3.2 Notification and Communication Channels

The following notification and communication channels were used during the stakeholder engagement process:

Table 58 Notification and Communication Channels

Channel	Most Appropriate Application
Information Boards	Establishment of information boards in each project area community, municipal offices
Correspondence by phone/email/SMS	Distribution of project information to government officials, organizations, agencies and companies; Inviting stakeholders to meetings
Official written correspondence: email/letter	Communication with the authorities and regulatory bodies
Print media and radio announcements	Dissemination of project information to large audiences and illiterate stakeholders; Inform stakeholders about consultation meetings
Social media (Facebook and Instagram)	Public announcements, PR campaigns, awareness raising, sharing of contact information

15.4 Methods of Engagement

During the period the stakeholders were to be engaged (scoping period), there were a lot of restrictions on meeting and engaging with people on a personal level. These restrictions arose due to the outbreak of the Covid-19 virus in Zambia. The cases escalated rapidly in the period from June to December 2021. The Government of the Republic of Zambia had banned all physical meetings and interactions. The Presidential election date was also scheduled within 3 months from the date of the scoping exercise, the social atmosphere was volatile and posed a threat to the ESIA scoping team as was advised by the Zambia Police when trying to get a permit for the scoping exercise.

The Zambia Environmental Management Agency was engaged by the consultant to seek guidance on how to proceed with the stakeholder engagement considering the restrictions that were in place. It was agreed that the stakeholders would be engaged using questionnaires and a radio phone programme on one of the common radio stations in Lusaka.

During the phone radio programme, the consultant's number was shared for those who felt like discussing their issues off-air. An email and physical address of the consultant were also shared to try and encourage more people to participate in the scoping process.

Key stakeholders were further engaged during a functional design workshop that was organized by the consultant and held in May 2022 at the Sarova Hotel in Lusaka. Various topics were discussed during this workshop including the Environmental and Social findings from the scoping exercise. The key stakeholders which included ZEMA, Local Councils and other government institutions were allowed to ask questions and make contributions to the findings later to be added to the final ESIA document.

- The following was considered during the selection of stakeholders to engage. :The extent of the impact of the Project on the stakeholder group;
- The extent of influence of the stakeholder group on the project; and
- The culturally acceptable engagement and information dissemination methods.

The following engagement methods have been applied:

Table 59 Overview of Applied Engagement Methods

Engagement Method	Most Appropriate Application
One-on-one interviews	Solicit views and opinions; Enable stakeholders to speak freely and confidentially about controversial and sensitive issues; Build personal relationships
Formal meetings	Present project information to a group of stakeholders; Allow the group of stakeholders to provide their views and opinions; Build impersonal relations with high-level stakeholders; Distribute technical documents.
Workshops	Present project information to a group of stakeholders; Allow the group of stakeholders to provide their views and opinions; Use participatory exercises to facilitate group discussions, brainstorm issues, analyses information, and develop recommendations and strategies.
Radio Phone in the programme	Gather opinions and views from individual stakeholders via a Radio Phone in Programme.

15.4.1 Measures to Remove Obstacles to Participation

Additional consultations are envisioned, in order to remove potential obstacles to participation for vulnerable groups and ensure that their outlook is taken into consideration:

Table 60 Consultation methods for vulnerable groups

Group	Consultation Method
Elderly	Assisted transport to meetings, telephone consultations
Women	Additional focus group discussion
Minorities	Additional focus group discussion; translation services
Wheelchair users	Telephone consultations

15.4.2 Approach to Include Commonly Marginalized Groups in Society

15.4.2.1 Gender Sensitive Approach

Considering the central role of women in domestic water-related activities, activities within the framework of the SEP are to be carried out with a gender-sensitive perspective, which considers the following aspects:

- Women and men use water resources in a different manner. Most water-related domestic tasks (cooking, washing, cleaning, bathing children) are traditionally performed by women.
- Women's domestic and economic roles can limit their availability and willingness to participate in decision-making tasks in society.
- Communication outreach might need tailoring to reach both women/men/boys and girls with messages related to environmental behaviour.

- Women, generally and as a group (with exemptions) are not included in public decision-making to the same extent as men, which can affect their access to information, input to solutions as well as possibilities to influence. Equal access can potentially contribute to better solutions, as well as a higher willingness to pay for services.
- Women's participation may be limited or completely restricted in male-dominated societies that do not allow them to have a voice in the community or to make decisions. This can cause conflict in communities if not managed appropriately.

The following approach to facilitate gender mainstreaming within the Program will be implemented:

Table 61 Gender mainstreaming activities within the Program

#	Program phase	Activity
1	Inception phase	**Analysis of the social baseline with a focus on the gender aspects:** Obtaining gender-disaggregated data, where possible, to understand the context and factors that influence gender differences as well as women's participation in water-related activities and community decision-making.
2	ESIA	**Gender consideration in E&S impact scoring** Incorporation of the feedback obtained during stakeholder engagement in the evaluation of E&S impacts
3	Starting before work commence, ongoing	**GRM** Establishment of a Project level GRM; Informing the local female population of the purpose and application of the GRM

15.4.2.2 Poverty

There is a strong correlation between income and access, for both water and sanitation. Affordability is an essential part of improving access to water, sanitation and hygiene (WaSH) products and services. The cost of access, whether that is a monthly bill or an investment in household infrastructure, is sometimes the largest barrier to improved access. 13

Access to affordable water and sanitation services is crucial for the realization of human rights to water and sanitation. However, there are certain barriers that population groups and households face in access to water and sanitation services. People may not be able to afford access or face unfair pricing, an insurmountable time burden, or inadequate services. Below is a breakdown of ways that affordability impacts access to water, sanitation, and hygiene.

- **Poor people are more likely to spend a lot more of their income on accessing WaSH services**: The cost of access, whether it is a monthly bill or an investment in household infrastructure, can be a significant barrier to accessing WASH services that meet national standards. Household budgets may be insufficient, meaning that their water sources may be far from the home, at risk of contamination, or provide an insufficient quantity; and they may not be able to cover the investment costs of a toilet that is connected to the national sewerage systems with a handwashing station and regular soap supplies.
- **Lower levels of WaSH services do not always cost less, especially for the poor and vulnerable households:** WASH services that do not meet the basic level of service do not always cost less

[13] Assessing the Affordability of Water, Sanitation and Hygiene: Zambia Country Case Study. UNICEF and WHO, May 2021

than services that do**.** The use of a pit latrine and the unavailability of Water Treatment Plants does not mean there will be a low cost for households seeking WaSH services. This risk associated with the lack of standard WaSH services can cost higher especially where health is concerned. Diseases associated with poor sanitation and water supply can have a serious toll on households and the nation at large, diseases like cholera and dysentery can cause mass deaths in communities affecting households, local economic activity as well as the nation at large.

15.4.2.3 Educational Attainment

Without proper water and sanitation services, children are prone to the contagion of waterborne diseases. Waterborne diseases promote absentism from school by school-going children, which in turn affects their academic performance. On the other hand, good sanitation services promote good health and if these services are extended to schools, enrollment rates can rise and access to education for community members will improve.

15.4.2.4 Other

According to a study carried out in Ethiopia, Ghana, India and Tanzania, Water supply and sanitation projects have impacts on people's lives which extend far beyond the expected improvements to health and reduction in time spent collecting water. The study shows that impacts can also include significant improvements in household income levels and security of livelihoods. Increased school attendance occurs along with better child care, and social and cultural benefits such as reductions in stress levels, increased status and self-esteem, better family and community relations, and increased ability to observe religious rites and customs. The table below summarizes how water and sanitation projects improved socio-economic livelihoods in these communities:

Table 62 Aspects improved by sanitation projects

Aspect	Impact
Health:	Incidence of stomach pain/diarrhoea reduced Incidence of water-linked diseases reduced Water used for washing body, clothing and utensils increased from between 26% and 33% to 52% of total consumption Bathing using soap increased from less than once per week to between daily and weekly Household utensils were cleaned more regularly Time for observance of religious rites Reduced fatigue for women Changed workload for women Quantities of water for domestic duties increased from
Economic Status:	The livelihood of the community improved Housing structures improved The income of households improved
School attendance:	Increase in the number of students attending school regularly Hours spent on school-related activities increased to between seven and nine hours/day Students have time for studying
Social	Time spent collecting water reduced from an average of six to eight hours to five to twenty minutes More time spent with family Social/community interaction increased More time devoted to children, elders, social gatherings
Psychological	Reduced tension

15.4.2.5 Decision-Making Process

The SEP will help the decision-makers take into account the concerns of the people in the communities around the WWTP as well as other stakeholders and how they will be affected by the construction. It is of utmost importance that the vulnerable in society are considered during the decision-making process i.e. women, school-going children, low-income earners and the elderly. Data was collected during the scoping exercise that helps in understanding what type of stakeholders will be affected by this proposed project. This should form a socio-economic baseline that will help the developers of the project understand how the project can best benefit the intended recipients of the development.

However, due to the constraints that were faced during the scoping period i.e. restricted movement due to Covid-19, restricted movement and meetings due to the tense pre-election atmosphere, further studies of the socio-economic baseline of the project AoI will be required. This information will be collected before and during the ESIA disclosure period, this will be important to bridge the gaps in information that was collected during the scoping period had a lot of restrictions.

15.5 Engagement Plan

Table 63 Stakeholder Engagement Plan

No.	WHAT Information Disclosure and Request	WHOM Receivers of communication	WHY Reason for needed action	HOW Means of communication	WHO Overall responsible person	WHEN Timeframe / Frequency	Indicators or means of verification
Pre-construction phase							
1	Program Kick-off	Various Stakeholders and PAPs.	Presenting of the initially collected data	Meeting Presentations Handouts	LWSC	At project start	Photo Documentation and signed minutes
2	Progress update	Various Stakeholders and PAPs.	Information on current activities and progress of the Consultant	Reports	LWSC	Monthly	Reports submission
3	Program introduction	Various Stakeholders and PAP.	Discuss and get acquainted with the existing wastewater systems; Present information about FD, program details and its potential	Meetings	LWSC	After completion of the FD	Photo documentation; Received filled-in applications
4	Local workshops	Local Community and PAPs	Discuss the current situation, problems, perceptions and expectations; Introduce Program concept	Presentation; Workshop	LWSC	During project implementation	Attendance list; Photo documentation

No.	WHAT Information Disclosure and Request	WHOM Receivers of communication	WHY Reason for needed action	HOW Means of communication	WHO Overall responsible person	WHEN Timeframe / Frequency	Indicators or means of verification
5	Public consultations	Various Stakeholders and PAP.	Public participation/stakeholder involvement, transparency of project approach and ESHS mitigation measures	Public meeting, presentation of the detailed project concept, ESIA / ESMP in each community	LWSC	Upon availability of the final design and ESIA / ESMP, before the start of construction	Minutes of Meeting; Attendance list; Photo documentation
6	Permit issuing	Regulatory bodies	Confirmation of permit and license application procedures and of applicable standards	Meetings	LWSC	During the ESIA preparation phase	Minutes of meetings
7	Inception Workshop	Various Stakeholders and PAPs	Inform about the progress made in the inception phase of the Program	Presentations	LWSC	After the submission of the Inception Report	Photo and video documentation;
8	Public grievance mechanism	PAP	Communication on the establishment and means of the implemented mechanism	Meetings, printed handouts	LWSC	Upon establishment of the GRM	Public announcement
Construction phase							
1	Impacts of the construction phase on everyday activities	Local population	Informing the population about increased traffic with heavy machinery, potential noise nuisance, potential road closure, the timing of works, etc.	Meetings, municipal bulletin board	LWSC	Before the start of construction works	Public announcement

No.	WHAT Information Disclosure and Request	WHOM Receivers of communication	WHY Reason for needed action	HOW Means of communication	WHO Overall responsible person	WHEN Timeframe / Frequency	Indicators or means of verification
2	Worker grievance	Construction workers	Informing the workers about their rights and the setup of the grievance mechanism	Meetings, printed handouts	LWSC	Before the start of construction works	Handouts

15.6 Monitoring of Stakeholder Engagement

Monitoring of stakeholder engagement involves collecting data, assessing the level of engagement and using insights from the data collection to adjust strategies and tactics for engaging effectively with stakeholders. The monitoring measures and procedures are designed to ensure the effective and timely implementation of the SEP.

Stakeholder engagement during the scoping exercise for the Chunga WWTP treatment was not conducted as per expectation and usual procedure (physical meetings with stakeholders), this was due to many restrictions among them, the banning of physical meetings due to the Covid-19 pandemic and the pre-election tense atmosphere. ZEMA was informed by the consultant about these constraints and how they would affect the collection of adequate information to highlight details of both the socio-economic and environmental baseline. Both parties (ZEMA and Consultant) agreed that stakeholder engagements would have to be conducted via a radio programme and distribution of questionnaires to selected stakeholders.

However, even with these solutions in place, it was still problematic to get to key stakeholders, especially community members as most of them feared letting the ESIA team in their homes due to health and security fears. The radio programme also recorded low participation from the members of the public during the two days it ran.

The SEP will be updated every year and during the implementation of the project. The Monthly Progress Report will also include a chapter about the status of E&S Impacts and items related to Stakeholder Engagement. The table below will be essential in monitoring of the stakeholder engagement process throughout the project phases and will be updated after every meeting with the stakeholders and community committees.

Table 64 Stakeholder Monitoring Matrix

Stakeholder	Impact (High, Medium, Low)	Scope of Influence (High, Medium, Low)	What is important to the stakeholder	Grievance reported?	What is the grievance?	Remedy	Frequency of engagement	Responsible Person
ZEMA	High	High	Successful Implementation while protecting the environment	No			Monthly	Consultant and Contractor's Environmental and Social Unit
LWSC	High	High	Successful Implementation of the project	No			Monthly	Consultant and Contractor's Environmental and Social Unit
Lusaka City Council	High	High	Successful Implementation of the project	No			Every 6 months	Consultant and Contractor's Environmental and Social Unit
Industrial Players	High	Low	Successful Implementation of the project and management of toxic waste in the WWTP influents	No			Monthly	Consultant and Contractor's Environmental and Social Unit
Ministry of Lands and Natural Resources	High	Medium	Protection of the land and avoiding land encroachment	No			Every 6 months	Consultant and Contractor's Environmental and Social Unit
EIB and KfW	High	High	Successful Implementation of the project while protecting the environment and people	No			Monthly	Consultant Environmental and Social Unit
National Water and Sanitation Council	High	High	Successful Implementation of the project	No			Monthly	Consultant Environmental and Social Unit

Stakeholder	Impact (High, Medium, Low)	Scope of Influence (High, Medium, Low)	What is important to the stakeholder	Grievance reported?	What is the grievance?	Remedy	Frequency of engagement	Responsible Person
Ministry of Local Government and Rural Development	High	Medium	Successful Implementation of the project	No			Every 6 months	Consultant Environmental and Social Unit
Water Resources Management Agency	High	High	Successful Implementation of the project and protection of all water bodies in the country	Yes	Pollution of water bodies from untreated effluent	Treatment of effluent before it is discharged into the receiving water bodies	Monthly	Consultant Environmental and Social Unit
ZESCO	Low	Low	Power generation and supply to the WWTP	No	Disruption and disturbance to power lines during construction	Engage ZESCO when powerlines need to be moved or if they pose a potential risk to works on site	Monthly	Consultant Environmental and Social Unit
Community Members and PAPs Committee	High	Low	Successful implementation of the project and improvement of their livelihood	Yes	Loss of vegetable gardens and effect on general livelihood	Develop a livelihood restoration plan and compensate affected individuals.	Monthly	Consultant and Contractor's Environmental and Social Unit

15.7 Stakeholder Engagement Plan Updates

It has to be considered that the SEP and associated documents are not static. The stakeholders identified and their associated information will be reviewed and updated every year to ensure that the plan is meeting project expectations and to make modifications if required.

Annex 16 Grievance Redress Mechanism

It is a requirement by the EIB and KfW that all projects funded by them have a Grievance Redress Mechanism (GRM) or complaint-handling policy in place. Feedback and GRM are essential for the successful implementation of projects. The GRM will ensure that community members or any stakeholders are able to raise their concerns regarding project-related activities, including the application of relevant E&S safeguards and mitigation measures. The GRM, once fully functional, will give LWSC a method of effectively collecting and responding to key stakeholders' inquiries, suggestions, concerns, and complaints that, if left unresolved, may result in the derailment of the whole project.

Effectively addressing grievances from people impacted by the project is a core component of managing operational risk and improving a project result. The GRM can be an effective tool for early identification, assessment, and resolution of complaints on projects.

16.1 Objectives

This Grievance Redress Mechanism will be applied to stakeholder complaints and grievances, perceived or actual, which relate to the activities of the LWSC and its contractors in relation to the Project components. Objectives of the grievance redress process are:

- To be responsive to the needs of the beneficiaries by providing a channel for feedback and resolving grievances and disputes at the various levels in the project area;
- To provide PAPs with accessible procedures for resolving perceived or actual harm done to their well-being or their belongings as a result of Project activities, and for the settlement of disputes, including the possibility of third-party adjudication;
- To provide an opportunity for the aggrieved party and the project developer to resolve disputes in a short time before they escalate to big problems;
- To identify and implement appropriate and mutually acceptable corrective actions to address complaints;
- To provide an opportunity for the aggrieved party and the project implementers to resolve disputes in a short time before they escalate to big problems;
- To enhance the project's legitimacy among stakeholders by promoting transparency and accountability, and deterring fraud and corruption;
- To provide a platform to ensure compliance with the provisions of the laws, regulations, and cultural and traditional rules in the project area; and
- To avoid, wherever possible, the need to resort to judicial proceedings.

16.2 Guiding Principles

This GRM shall be guided by the following principles:

(a) Equity: no complaint is too big or small. All complaints received shall be treated with the urgency and the attention they deserve. All Aggrieved Parties regardless of their social standing, gender, political affiliation, or religious affiliation shall be given the opportunity to be heard by the responsible officers without prejudice.
(b) Accountability: the project outcomes should benefit the people in the targeted communities and as such the Project Management is accountable to the people in the communities they operate in. The project should be responsive to the needs of the community including their complaints and grievances.
(c) Transparency: members of the community or aggrieved parties have the right to information on the grievance mechanism, how to access it, who is responsible for handling their complaints and the potential outcome of the processes.

(d) Accessibility: all people in the target communities must have unrestricted and free access to the GRM. The project shall publicize the GRM to all those who may wish to access it and provide adequate assistance for aggrieved parties who may face barriers to access, including language, literacy, awareness, finance, distance, or fear of reprisal. The Aggrieved Party shall be kept informed at each stage of the process.
(e) Anonymity: the GRM will not disclose the identity(s) of the complainant by name or otherwise to maintain confidentiality
(f) Timely Response: this GRM will function promptly and speedily. Prompt action is not only desirable from the complainant's point of view, but also from the LWSC's point of view. Since delay causes frustration and tempers may rise, it is necessary that grievances should be dealt with speedily. It is a common saying that justice delayed is justice denied. However, any 'unnecessary delay constitutes another grievance. Settlement of grievances "in the shortest possible time and at the lowest level possible," is the ideal one. Some of these cases and incidences might require reporting to RDA and possibly to WB Team immediately.
(g) Confidentiality: Grievances will be treated confidentially. The complainant's names and personally identifiable information will be kept in the strictest confidence.
(h) Building on existing informal and formal dispute resolution flows: the GRM will build on existing structures of informal and formal dispute resolution to enhance cost-effectiveness. The GRM will rely on two existing systems: informal dispute resolution practices (through the existing traditional conflict resolution flows) and formal resolution practices (through existing administrative and judicial flows by arbitration and courts of law). By doing this, the mechanism can easily become acceptable as the majority of stakeholders are already familiar with it.

16.3 Types of Grievances and Disputes

The following types of grievances are anticipated in this project implementation:

- Complaints about survey activities;
- Complaints about scope/lack of information provided by the Project; and
- Claims of unfair exclusion from engagement activities.
- Entitlement processing:
- Misidentification of the occupier of a particular garden;
- Complaints about income restoration assistance; and
- Complaints about the entitlement policy.
- Livelihood restoration:
- Complaints about the allocation of livelihood opportunities; and
- Complaints about Project training, employment and recruitment opportunities and procedures.

16.4 Grievance Management Process & Resolution Mechanisms

Implementation of the Grievance Redress Mechanism for the Chunga Wastewater Treatment Plant project will be the responsibility of the Grievance Officer (GM) with support from a wider team including the LWSC Social Safeguards team and the Grievance Committee. Upon receipt of a grievance, the GO will confer with the complainant to verify that this is the first time that this grievance has been submitted by this complainant. If the grievance is related to a previous submission, the GO will inform the complainant of the status of that grievance and record that the grievance has been re-submitted.

A register of all grievances submitted, identifying who received the grievance, and the status of the grievance will be present on-site at all times. If the grievance is new, the GO will fill in a grievance form, and create an entry in the Grievance Database. This form will track how the grievance is dealt with from submission through to resolution.

Open grievances will be reviewed weekly. Those that are not being resolved in a timely fashion or have been assessed at a higher level of severity, will be referred to management. People who submit grievances but feel

unsatisfied by the process retain their rights to refer their grievances to the court system as a formal judicial action.

16.4.1 Roles and Responsibilities

Grievance Officer (GO) and LWSC Safeguards Team: To seek to resolve the grievance, in a transparent and impartial manner. They meet with the complainant to understand the basis for the grievance and the resolution sought. They will conduct any investigation required, including meeting with the Respondent. If the person lodging the grievance is unable to write, the grievance and relevant personal information will be recorded on their behalf and read back to the complainant for their approval. Once the description of the grievance has been approved by the claimant, they will mark the document with their thumbprint. The Grievance Officer shall coordinate the grievance resolution process, track grievances as they emerge and prepare relevant reports, the grievance process and how to access it will be widely communicated to Project-affected communities.

Grievance Committee: This plays a crucial role in ensuring that the project developer respects the rights and interests of the affected communities and stakeholders and that any grievances are addressed in a fair and transparent manner. This committee will investigate the unresolved grievances from the previous instances, verifying the facts related to the complaints. Also, will facilitate the dialogue and negotiation between the project developer and the affected parties for unresolved grievances. The Grievance Committee should provide a platform for PAPs to voice their concerns and suggestions for project implementation. Also, it will monitor the implementation of grievance resolution and ensue compliance with relevant laws and regulations; and supervise the reporting on the status of grievances and the effectiveness of the grievance mechanism to relevant authorities and stakeholders. When required, the Grievance Committee will provide recommendations for improving the project's social and environmental performance based on lessons learned from grievance resolution.

The committee will be composed of a traditional leader from the local community, a representative from the local authorities, a representative from ZEMA, a delegate from the top management of the LWSC, an active member of the PAP Committee[14] and the Grievance Manager. Decisions made by the committee must be reached by a consensus of no less than 70% of the votes. A constitutional document will be created to establish the committee, and will be updated whenever is a change of its members, and it will hold meetings at least twice a year or whenever an important issue needs to be resolved. The Grievance Manager is responsible for documenting each meeting and recording its results in the minutes.

16.4.2 Resources

The following resources will also need to be in place:

- An auditable system for receipt, recording and tracking of the process (for example a grievance log, database etc.) shall be in place.
- Dedicated budget for resourcing management of Grievance Redress Mechanism and addressing grievances through financial or in-kind compensation as and when needed.

16.4.3 Grievance Process

The GRM has been designed to provide a timely, responsive and effective system of resolving community groups' or individual's grievances in the areas the project is implementing activities. It is a multi-stage process that ensures that all stakeholders from the community-level structures to the National Office are involved in finding solutions to the grievances raised by the communities the project is targeting.

[14] The PAP Committee is an organizational structure defined in the Resettlement Actin Plan (RAP) for representing the interests of the community members who will be affected by the economic displacement caused by the project.

All complainants will be informed of their rights to raise grievances pertaining to the Project. Mechanisms will be put in place to ensure that grievances are recorded and considered fairly and appropriately. Project management will issue and publicize a grievance redress policy that clearly states that management embraces grievance reports and views them as opportunities for project improvement. The policy will identify guiding principles; define the scope and types of grievances to be addressed; set out a user-friendly procedure for lodging grievances; outline a grievance redress structure; describe performance standards; and spell grievance review mechanisms.

The GRM Process is divided into six key steps as follows:

1) **Receive and log grievances**: A register of grievances will be held by the Grievance Officer (GO), an LWSC Safeguard Team member, or any other appointed person by the project. The complainant must register their grievances with the GO.
   To register the grievance, the complainant will provide information to the GO to be captured in the Grievances Registration Form. The GRM will accept complaints from the complainants submitted verbally, by email, by phone, by meeting or letter to the office of the GO, in English or any local language spoken in that region or district. The focal point persons handling grievances will transcribe verbal submissions. Receipt of grievances shall be acknowledged as soon as possible, by letter or by verbal means.
   When a complaint is made, i.e., when somebody asks to submit a grievance or upon receipt of a grievance (i.e., by mail, grievance form, orally or email), the GO opens the case and begins the preliminary investigation. This may begin immediately if the grievance is submitted in person or may require the GO to locate the complainant. As above, the name of the complainant and their contact details are recorded, as well as the details of the grievance. Complainants will be presented with a standardized written acknowledgment that the grievance has been received. Once the grievance is logged and acknowledged, the significance is assessed, based on the criteria described in Table 65 of the GRM. For second, third and fourth level grievances, higher levels of management will need to be informed and involved in the grievance process.
2) **Acknowledge grievance**: The GO will acknowledge receipt of a complaint in a communication that outlines the grievance process; provides contact details and, if possible, the name of the person who is responsible for handling the grievance; and notes how long it is likely to take to resolve the grievance. Complainants will receive periodic updates on the status of their grievances.
3) **Assess and Investigate**: This step involves gathering information about the grievance to determine its validity and resolve the grievance. The merit of grievances will be judged objectively against clearly defined standards.
   Grievances that are straightforward (such as queries and suggestions) will be resolved quickly by contacting the complainant.
   Having received and registered a complaint, the next step in the complaint-handling process is for the focal points to establish the eligibility of the complaint received. The GO who is the Grievances Registration Officer once a complaint or grievance is registered, shall within 7 days assess the registered complaint or grievances to determine its validity and relevance i.e. is it within the scope of the GRM as defined in this document. The following criteria can be used to assess and verify eligibility:
   - The complainant is affected by the project;
   - The complaint has a direct relationship to the project;
   - The issues raised in the complaint fall within the scope of the issues that the GRM is mandated to address.

   Having completed the complaint assessment, a response can be formulated on how to proceed with the complaint. This response will be communicated to the complainant. The response will include the following elements:
   - Acceptance or rejection of the complaint

- Reasons for acceptance or rejection
- Next steps – where to forward the complaint
- If accepted, further documents and evidence required for investigation e.g. field investigations

Once the registered grievance or complaint has been determined as falling within the scope of this GRM, the GO – or the Grievance Committee when applicable – shall investigate the complaint. Investigation of the complaint will include the following:

- On-site visit and verification;
- Focus Group discussions and interviews with key informers;
- Review of secondary records (books, reports, public records); and
- Consultations with local government and traditional authorities.

The GO – or the Grievance Committee when applicable – will ensure a neutral investigation, with an impartial outcome. At the end of the field investigation, the GO shall compile a Grievance Investigation Report (GIR) using a standard template on the outcomes of the investigations and the specific recommendation to resolve the grievance or complaint.

4) **Grievance Resolution**: After the investigations, the (GM) shall inform the complainant of the outcome of the investigations and the recommended remedies if any. The complainant shall be provided with a written response clearly outlining the course of action the project shall undertake to redress the grievances and the specific terminal date by which the recommended remedies shall be completed. Potential actions will include responding to a query or comment, providing users with a status update, imposing sanctions, or referring the grievance to another level of the system for further action. The project will take some action on every grievance.
   The complainant shall provide a response agreeing or disagreeing with the proposed course of action within a minimum reasonable period after receiving the recommended actions.
5) **Sign-off on grievance**: In the event that the complainant is satisfied with the decision made, the GO will document the pleasing determination, in an interview with the complainant. In cases where there have been major dangers, impacts and/or negative reputations, the project will incorporate composed documentation from the complainant showing fulfilment with the reaction.
6) **Monitor**: Monitoring and Evaluation will be carried out to avoid certain impacts and grievances in the future and also to learn from the processes in the past.

Table 65: Grievance Significance Levels

Significance Level	Type of Grievance	Responsible Party
Level 1	A grievance that is isolated or 'one-off' and essentially local in nature and restricted to one complainant. Note: Some one-off grievances may be significant enough to be assessed as a Level 4 grievance e.g., when a national or international law is broken (see Level 4 below)	Grievance Officer
Level 2	A grievance that extends to the local community or region and has occurred more than once, which is judged to have the potential to generate negative comments from local media or other local stakeholders	Grievance Committee
Level 3	A grievance that is widespread and repeated or has resulted in long-term damage and/or has led to negative comments from local media or is judged to have the potential to generate negative media and local stakeholder comments.	Grievance Committee and LWSC Management Team

Level 4	A one-off complaint, or one which is widespread or repeated and, in addition, has resulted in a serious breach of LWSC policies, Zambian or International Law and/or has led to negative national/international media attention, or is judged to have the potential to generate negative comment from the media or other key stakeholders (e.g. failure to pay compensation where appropriate)	Grievance Committee, LWSC Management Team, legal counsel

The Project proponent commits to recording, assessing and acknowledging receipt of the grievance, within seven days. All grievances submitted will be investigated fully, and will involve other departments, contractors and senior management as required to fully understand the circumstances that led to the grievance being raised. The grievance process will aim to resolve any grievances within 30 days from the date that it was initially received. This timeframe can be extended to 60 days for more complex grievances (i.e., level 3 or 4 grievances), if required.

The grievance resolution process includes the following steps:

- Obtain as much information as possible from the person who received the complaint, as well as from the complainant to gain a first-hand understanding of the grievance.
- Undertake a site visit, if required, to clarify the parties and issues involved. Gather the views of other stakeholders including LWSC employees, if necessary, and identify initial options for settlement that parties have considered.
- Determine whether the grievance is eligible or ineligible, and determine the more appropriate vehicle for addressing the issue, a full explanation as to the reasons for its ineligibility will be given to the complainant and recorded in the Grievance Database. If the grievance is eligible, we will determine its severity level using the significance criteria in Table 65. This will help to determine whether the grievance can be resolved immediately or requires further investigation and whether senior management will need to be informed of the grievance and who specifically. If the grievance concerns physical damage, (e.g., crop, house, community asset) we will take a photograph of the damage and record the exact location as accurately as possible.
- Inform the complainant of the expected timeframe for resolution of the grievance.
- Enter the findings of the investigation in the Grievance Database.

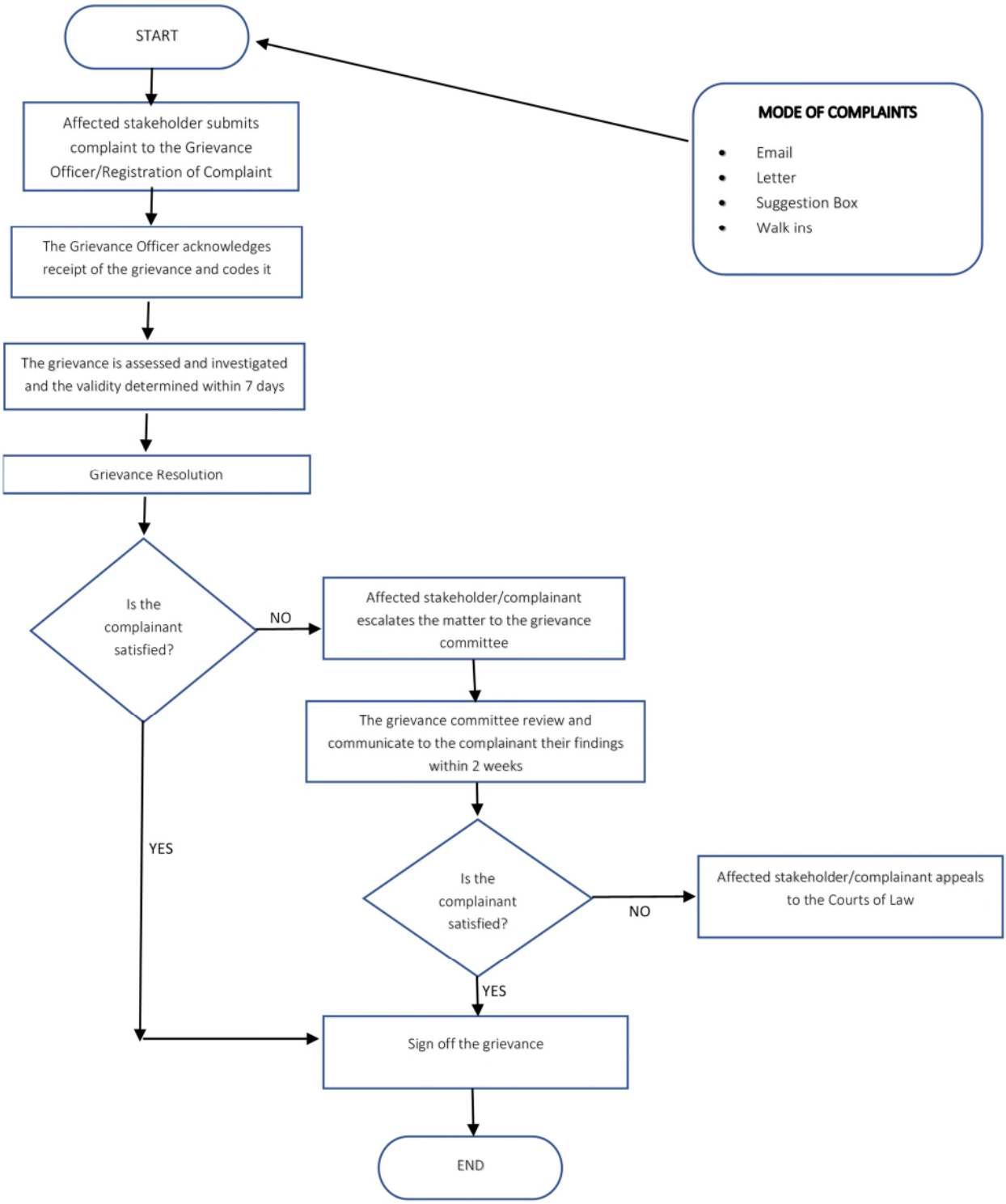

Figure 20 Grievance Redress Flow Chart

16.4.4 Grievance Settlement and Resolution Approach

All grievances will be addressed on a case-by-case basis. The proposed resolution should be respectful and thoughtful, including the reasoning and any data used to develop it. If broader consultation is required, grievances will be referred to the Grievances Committee.

The recommendations made by the Grievances Committee must be well-regarded and agreed upon by both the project developer and the affected parties. If further arbitration is necessary, appropriate legal or government involvement will be sought.

16.5 Monitoring and Reporting

Grievances will be monitored routinely as part of the broader management of the Project. This entails good record keeping of complaints raised throughout the life of the construction and operation of the Project. On receipt of grievances, electronic notification to management will be distributed. Grievance records shall be always made available to management, and the appropriate protocols established and followed for high-level grievances.

Monthly internal reports will be compiled by the Grievance Officer and distributed to the management team. These grievance reports will include:

- The number of grievances logged in the preceding period by level and type.
- The number of stakeholders that have come back after 30 days stating they are not satisfied with the resolution.
- The number of grievances unresolved after 60 days by level and type.
- The number of grievances resolved between LWSC and complainant, without accessing legal or third-party mediators, by level and type.
- The number of grievances of the same or similar issue.
- LWSC's responses to the concerns raised by the various stakeholders.
- The measures taken to incorporate these responses into project design and implementation.
- These reports and other records will be made available for external review if required.

The grievance database will allow for the relative success of the grievance resolution process outlined above to be regularly monitored and evaluated. Internally, grievance resolution timeframes will be monitored through weekly meetings between the GM and LWSC team. Open grievances will be reviewed, and emergent and recurring issues discussed. Where grievances remain open beyond the established timeframe, the GO will be responsible for providing the complainants with an explanation and an assurance that their grievance has not been lost or forgotten.

Lastly, reporting on grievances will be provided to external auditors as a component of the regular evaluations that will be conducted for the resettlement process overall.

16.6 Recourse to the Judicial System

Although it is hoped that all grievances will be resolved internally and through the aforementioned process, it will be communicated to stakeholders that at any time during the grievance resolution process, they retain their rights to refer their grievance to the appropriate arbitrative or legal body within the Zambian judicial system.

In the event that a grievance becomes a case presented by the claimant's legal counsel, the Project's Legal Advisor will be directly responsible for responding to the claim.

Annex 17 Chance Find Procedure

17.1 Purpose of the Chance Find Procedure

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly those of cultural and archaeological importance to the Country, are encountered during project construction or operation. A Chance Find Procedure, is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

17.2 Scope of the Chance Find Procedure

This procedure is applicable to all activities conducted by the personnel, including contractors, that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. The procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

17.3 Induction/Training

All personnel, especially those working on earth movements and excavations, will be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

17.4 Chance Find Procedure

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

(1) Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;

(2) Immediately notify a foreman. The foreman will then notify the Construction Manager and the Environment Officer /Environmental Manager;

(3) Record details in the Incident Report and take photos of the find;

(4) Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;

(5) Preliminary evaluation of the findings by relevant authorities. The authorities must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;

(6) Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the social specialist on-site, thus causing minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the Ministry/Agency, once completed.

(7) In case of a significant find the Agency/Ministry (Agency for Protection of National Heritage or Archaeological Research Centre, hereinafter referred to as Heritage team) should be informed immediately and in writing within 7 days from the find.

(8) The onsite social specialist provides the Heritage team with photos, and other information as relevant for identification and assessment of the significance of heritage items.

(9) The Ministry in charge must investigate the fact within 2 weeks from the date of notification and provide a response in writing.

(10) Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;

(11) Construction works should resume only after permission is granted from the responsible authorities.

(12) In case no response is received within the 2 weeks period mentioned above, this is considered as authorization to proceed with suspended construction works. One of the main requirements of the procedure is record keeping. All finds must be registered. Photolog, copies of communication with decision-making authorities, conclusions and recommendations/guidance, implementation reports - kept.

17.5 Additional Information

17.5.1 Management Options for Archaeological Sites

- **Site avoidance.** If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option)
- **Mitigation.** If it is not feasible to avoid the site through redesign, it will be necessary to sample it using a data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option)
- **Site Protection.** It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high-visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site-specific.

17.6 Management of replicable and non-replicable heritage

Different approaches for the finds apply to replicable and non-replicable heritage.

Replicable heritage Where tangible cultural heritage that is replicable[15] and not critical is encountered, mitigation measures will be applied. The mitigation hierarchy is as follows:

- Avoidance;
- Minimization of adverse impacts and implementation of restoration measures, in situ;
- Restoration of the functionality of the cultural heritage, in a different location;
- Permanent removal of historical and archaeological artefacts and structures ;
- Compensation of loss - where minimization of adverse impacts and restoration is not feasible.

17.7 Non-replicable heritage

15 Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.

Most cultural heritage is best protected by in situ preservation since removal is likely to result in irreparable damage or even destruction of the cultural heritage. Nonreplicable cultural heritage [16] must not be removed unless all of the following conditions are met:

- There are no technically or financially feasible alternatives to removal;
- The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and
- Any removal of cultural heritage must be conducted using the best available technique advised by the relevant authority and supervised by an archaeologist/Cultural specialist.

17.8 Human Remains Management Options

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above.

There are two possible courses of action:

- **Avoid.** The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.
- **Exhumate**. Exhumation of the remains in a manner considered appropriate by decision-makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can recommence in the area of the discovery.

17.9 Emergency Contacts

Ministry of Arts and Tourism
Address: Kwacha House, Cha Cha Cha Road, Lusaka
Phone: +260 211 223930
Web: www.mota.gov.zm

16 Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site. Examples of non-replicable cultural heritage may include an ancient city or temple, or a site unique in the period that it represents.

Annex 18 Traffic Management Plan

18.1 Brief

The management of traffic will be essential during the construction phase and will require specific mitigation measures as described below to ensure that the impact on residents, businesses and access road users is kept to a minimum.

18.2 Objective

- To ensure that traffic impacts as a result of construction activities are minimised
- To ensure that pedestrians are accommodated safely at all times where existing pedestrian walkways are affected by the construction activities
- To use existing road infrastructure to access construction sites

18.3 Targets

- No construction vehicles exceeding defined speed limits.
- Provision of detours or diversions.
- No replacement walkways for pedestrians that are directly exposed to vehicle movements
- Use of existing roads must be maximised.
- Avoid collisions.

18.4 Method Statement

- The contractor will prepare a Traffic Management Plan that provides traffic management measures during construction.
- Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include:
    - Emphasizing safety aspects among drivers.
    - Improving driving skills and requiring licensing of drivers.
    - Adopting limits for trip duration and arranging driver rosters to avoid overtiredness.
    - Avoiding dangerous routes and times of day to reduce the risk of accidents.
    - Use of speed control devices (governors) on trucks, and remote monitoring of driver actions.
- Location of access roads/diversions shall be done in consultation with the community and Monitoring Consultant.
- Construction vehicles shall not exceed 40 km/h for heavy vehicles and plants. On public roads the specified speed limit would be applicable.
- Appropriate traffic safety signage will be provided to warn the public of construction traffic and flagmen will be on duty where traffic merges with normal road traffic.
- Regular route monitoring on all routes utilised by construction traffic will be done by the construction foreman to ensure that any material that has fallen from construction vehicles be removed immediately to prevent traffic congestion and safety hazards.
- Construction vehicles shall be limited on any road in the vicinity between 7:00 to 18:00, Monday to Friday.
- Pedestrians should not be allowed to cross construction areas.

- Construction of temporary access roads will be minimised. Roads used will be cleared regularly of any dust and mud resulting from the use of construction vehicles. Dust and noise will be minimised, and accident risk reduced by strict monitoring of speed limits.
- All access roads will be watered regularly to control dust pollution (minimum 3 times per day in settled areas and twice in other areas). Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions.
- Appropriate traffic safety signage will be provided to warn the public of construction traffic and flagmen will be on duty where traffic merges with normal road traffic.
- Projects should have procedures in place that ensure compliance with local laws and international requirements applicable to the transport of hazardous materials.

18.5 Monitoring

Random checks will be done on the routes on the construction sites to ensure traffic control measures are in place and working. The speed of construction vehicles will be checked by following a construction vehicle to ensure that these vehicles only drive on the agreed roads. This should be done by following a vehicle from the construction site to its destination and vice-versa. For example, dump trucks will be followed from the construction site to the dump site and back to the construction site.

The routes followed must be checked at least once a month for all construction sites. The registration plate of the truck, the route followed, and the time and day will be recorded.

Annex 19 Feasibility study for the rehabilitation and upgrading of Wastewater Treatment Plants and Wastewater Collection Systems in Lusaka

[PLEASE REFER TO SEPARATE REPORT – DIGITAL COPY AVAILABLE AS ATTACHMENT TO THIS REPORT]

Annex 20 Approved terms of reference for the project