

Republic of Zimbabwe
Ministry of Environment, Water and Climate
Ministry of Local Government, Public Works and National Housing
Environment Management Agency

DATA COLLECTION SURVEY
ON
WATER SUPPLY AND SEWAGE SECTOR
IN
HARARE CITY AREA
IN
ZIMBABWE

FINAL REPORT

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ABBREVIATIONS

A-MDTF	Zimbabwe Analytical Multi Donor Trust Fund
A.T.C	Acting Town Clerk
AMCOW	African Minister's Council on Water
AWF	African Water Facility
AfDB	African Development Bank
BNR	Biological Nutrient Removal
BOD	Biochemical Oxygen Demand
CAPEX	Capital Expenditure
CSO2	Second round of Country Status Overviews
EMA	Environmental Management Agency
EOJ	Embassy of Japan
EPIRP	Emergency Power Infrastructure Rehabilitation Project
GC	Grid Chamber
GDP	Gross Domestic Product
I-PRSP	Zimbabwe Interim Poverty Reduction Strategy Paper
IE	Project Implementing Entity
IFRS	International Financial Reporting Standards
IPSAS	International Public Sector Accounting Standards
ISA	International Standards on Auditing
JICA	Japan International Cooperation Agency
JST	JICA Survey Team
M/P	Master Plan
MEWC	Ministry of Environment, Water and Climate
MFAIT	Ministry of Foreign Affairs and International Trade
MLGPWNH	Ministry of Local Government, Public Works and National Housing
MOFED	Ministry of Finance and Economic Development
MoWRDM	Ministry of Water Resources Development and Management
NAC	National Action Committee
NWP	National Water Policy
NWSSU	National Water Service and Sanitation Utility
PBB	Performance Based Budgeting
POC	Project Oversight Committee
PPP	Public Private Partnership
PSIP	Public Sector Investment Programme
SADC	South Africa Development Community
SPV	Special Purpose Vehicle
STP	Sewage Treatment Plant
TOR	Terms of Reference
UNICEF	United Nations Children Fund
USH	Urban Sanitation and Hygiene
UWSSRP	Urgent Water Supply and Sanitation Rehabilitation Project

VAT	Value Added Tax
WASH	Water, Sanitation and Hygiene
WB	World Bank
WHO	World Health Organization
WSP	Water and Sanitation Program
WSS	Water Supply and Sanitation
WWTN	Waste Water Treatment Works
ZIMSTAT	Zimbabwe National Statistics Agency
ZINWA	Zimbabwe National Water Authority
Zim Asset	Zimbabwe Agenda for Sustainable Socio-Economic Transformation
Zim-Fund	Zimbabwe Multi Donor Trust Fund

EXECUTIVE SUMMARY

1. General

1.1 Background

In the Harare metropolitan area, increasing volume of domestic waste water and industrial effluent surpassed the capacity of the treatment plant due to rapid urbanization, population growth and evolution of industry. Consequently, contamination of the water of Lake Manyame and Lake Chivero, which are the major water resources of the area, has been deteriorating from the late 1990s. Furthermore, dysfunction of the socio-economy after 2000 worsened the water, sanitation and hygiene condition in Chitungwiza municipality, a dormitory town of Harare city.

In order to improve this condition, “The project for Improvement of Sewage Facilities in the Municipality of Chitungwiza in the Republic of Zimbabwe” a grant aid project, was conducted and facilities delivered to Government of Zimbabwe (hereinafter referred to as GOZ) in 2000. However, rapid and intense aggravation of the economy of Zimbabwe in the period made it difficult to secure the necessary budget for development and operation of facilities for water, sanitation and solid waste disposal. As a result, operation and maintenance of sewage and hygiene facilities in Chitungwiza became difficult and dysfunctional.

Subsequently JICA conducted “Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality in the Republic of Zimbabwe” in 2011, for the collection and analysis of basic information for improvement of sanitation and hygiene conditions in Chitungwiza municipality. The result of the survey showed that the water supply as well as the sanitation and the solid waste management in the municipality were dysfunctional. Given the result of this survey, GOZ requested the implementation of “The Project for the Improvement of Water Supply, Sewage and Solid Waste Management in Chitungwiza in the Republic of Zimbabwe” for establishment of a Master Plan (M/P) and examination and clarification of improvement measures. In response to the request, JICA commenced the study in 2012, conducting Phase 1 for collection and analysis of information, and established the M/P in Phase 2. Nonetheless, the implementation of the study was suspended in July 2013 due to severe financial conditions in Chitungwiza municipality. Agreement was made between JICA and GOZ that the project would be resumed when the financial condition had improved.

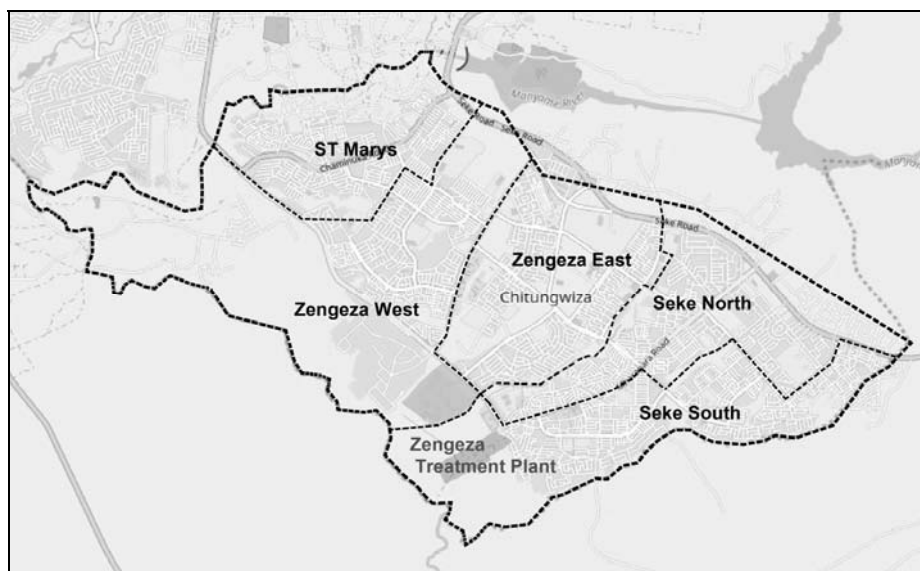
To date, improvement of the financial condition has not been observed. From 2017, examination of various reform measures is ongoing, and improvement in the financial condition is expected.

1.2 Objectives

This survey aims at collection of information on activities and plans by relevant organizations, the financial condition, organization structure of implementing agency and activities by donors regarding water supply and sanitation in Harare metropolitan area (City of Harare and Chitungwiza municipality). Additionally, by inspection on the condition of facilities and equipment of Zengeza treatment plant constructed by grant aid by the Japanese government, options for replacement of facilities and partial utilization of existing facilities will be analyzed. Based on the result of those surveys, issues and proposals for sustainable management of water supply and sanitation in Chitungwiza municipality will be scrutinized.

1.3 Survey Area

The principal survey area is Chitungwiza municipality. The City of Harare is included if integrated survey is required from facility aspect and institutional aspect.



Source: JST

Figure 1.3.1 Survey Area

2. Water Supply Works and Wastewater Works in the Greater Harare

2.1 Water Supply in Greater Harare

(1) City of Harare

Two purification plants are operating in the City of Harare, Prince Edward purification plant and Morton Jeffery purification plant. The quantity of water supply is 84ML/d by Prince Edward plant and 614ML/d by Morton Jeffery Plant, 700ML/d as a total. The planned capacity of water supply is 90ML/d by Prince Edward plant and 500ML/d by Morton Jeffery. Water demand in City of Harare is estimated as 800ML/d at present and 1300ML/d if areas currently without water supply are included, therefore present water supply is not sufficient for water demand. The water source for the Prince Edward plant is Seke Dam, the capacity of which is smaller than the purification capacity.

(2) Chitungwiza Municipality

Chitungwiza Municipality does not have its own water source including a water purification plant, and is purchasing the water produced at the Prince Edward water treatment plant in Harare. The management of water supply conducted by Chitungwiza is limited to water distribution facilities. Due to the leakage of water in the pipe connecting Harare and Chitungwiza, both cities have different recognition on the water charge levied to Chitungwiza. Caused by this difference, the amount charged by Harare is currently in dispute.

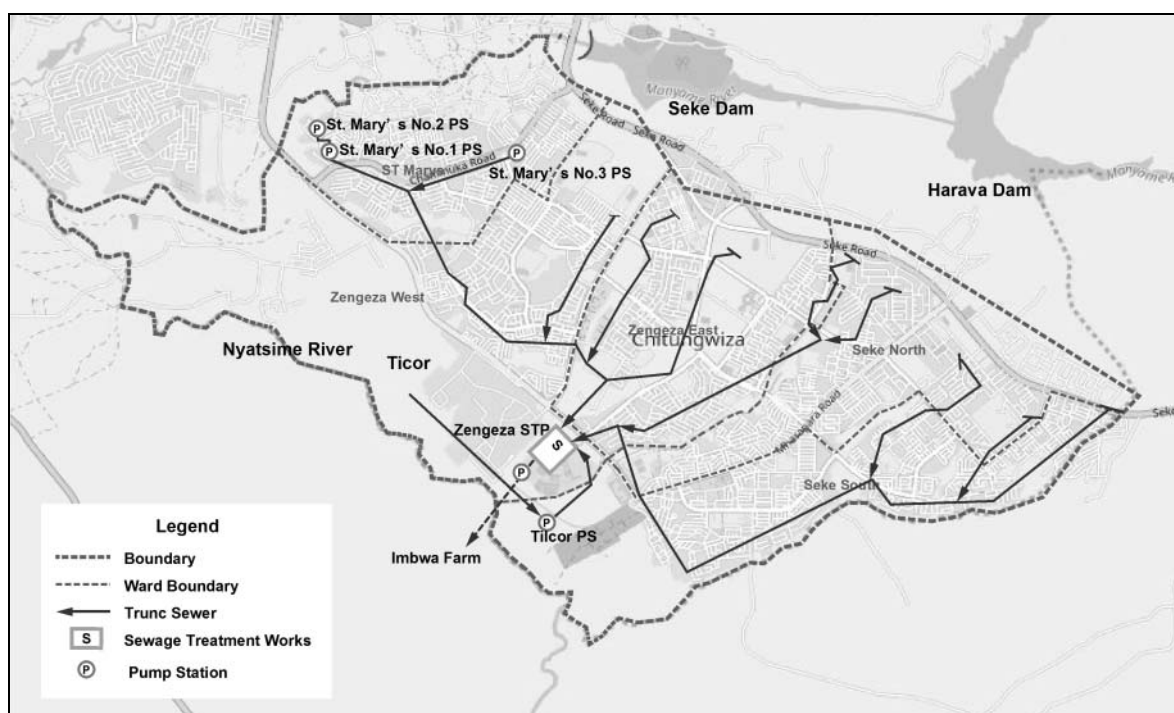
Among 334 days from January to November in 2017, water was delivered in 252 days and average delivery was 19ML/d and 26ML/d on delivered days.

2.2 Wastewater Works in Chitungwiza

The sewerage system of Chitungwiza city is as shown in Figure 2.2.1. The whole amount flows into Zengeza sewage treatment plant. The sewage from St. Mary area is pumped by three pumping stations; the Tilcor area supplied by one pumping station, and the remaining areas drained by gravity flow.

Out of the four pump stations, three pump stations have damaged pumps or broken pipe line, thus sewage from St. Mary No.3 pump station is solely sent to Zengeza treatment plant. In areas where the pumps are not functional or the sewage main is damaged, sewage overflows and adversely affects the living environment. Overflow of wastewater can also be observed in the Seke area due to pipe

breakage. As a result, the inflow area into Zengeza sewage treatment plant is approximately half of the planned area.



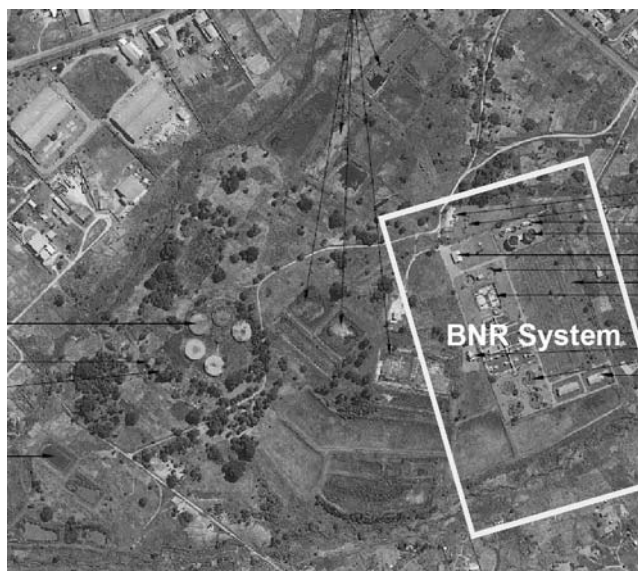
Source: JST

Figure 2.2.1 Sewerage Network in Chitungwiza Municipality

2.3 Present Condition of Zengeza Wastewater Treatment Plant

(1) General Condition

Two systems were constructed in Zengeza WWTP, the trickling filter system constructed in 1975 and the Biological Nutrient Removal (BNR) system constructed in 2000 under Japanese assistance. The trickling filter system is in operation whereas the BNR system is currently halted. Figure 2.3.1 shows the layout of Zengeza treatment plant. Trickling filter facility is renovated and operated with the support from ZIM Fund (over 4 million USD) in 2016. Only one out of five trickling filters is currently used because of a small sewage inflow.



Source: Urgent Water Supply and Sanitation Rehabilitation Project Volume 2 (2014 Gauff Ingenieure)

Figure 2.3.1 Zengeza Sewage Treatment Plant Layout

(2) Condition of Facilities

All mechanical and electrical equipment in BNR are out of service at present. The current state of the main facilities observed during the field survey is as shown in Table 2.3.1.

Table 2.3.1 Present Condition of BNR Facilities

Facility	Condition
GC (Grit Chamber)	The submergible pumps to pump up the sand and the pipe to transfer the sand are removed. Mud accumulates in the GC tank.
Primary Sedimentation Tank (PST)	Sludge collector has rusted and mud accumulates in the PST. The motor of the collector running at the round pond terminal has been broken and needs to be replaced.
Equalization basin	Mud accumulates in the basin. One out of four mixers is out of order.
Biological reactor	All the motors in the anoxic basin is out of order. All the pressure switches of the aerators which detect the normal condition of lubrication for the gearbox are out of order. The aerators cannot run due to an interlocking system.
Final Sedimentation Tank (FST)	FST is filled with mud and covered with weeds.
Return Activated Sludge pump (RAS), Waste Activated Sludge pump (WAS)	All the RAS and WAS are out of order.
Sludge thickener	All the sludge collectors in all four sludge thickeners are out of order.
Digester	Mud accumulates to half of the tank and weeds have grown thickly.
Sludge drying bed	The valves to control the flow of sludge to the bed have rusted and need to be overhauled or repaired.
Infiltration pit	All the infiltration pumps are broken.
Sludge storage yard	The roof of the yard is broken.
Maturation pond	Weeds have grown thickly.

Source: JST

(3) Pollution Load to Lake Chivero

Table 2.3.1 shows estimation of pollution load in Lake Chivero. The amount of untreated sewage is estimated by subtracting the amount of wastewater treatment at the existing sewage treatment plant from the amount of wastewater generated in 2012 in Harare city and Chitungwiza city, which is in the basin of Lake Chivero. The pollution load is estimated by multiplying the amount of untreated sewage by the BOD pollution loading unit (700 mg/L for unit raw water). This calculation shows that in the 9 years since 2009 when Zengeza WWTP was shut down, a pollution load of about 220,000 tons has accumulated in the basin

Table 2.3.2 Estimation of Pollution Load of Lake Chivero

		Estimated Pollution Load		Remarks
		Harare	Chitungwiza	
Population (persons): a		1,581,887	354,472	
Water use (L/day): b		80	60	
Sewage collection rate (%): c		65		
Amount of effluent (m ³ /day): A=a*b*c		82,258	13,824	
Treated water	Number of plants	5	1	
	Amount of treated water (m ³ /day): B	170.5	35*	*: Amount by Trickling Filter
Untreated sewage (m ³ /day): X=A-B		82,092	13,789	
Pollution load unit (BOD) (kg/ m ³ /day)		700		
Pollution load (BOD) (ton/year)		20,974	3,523	
Total amount of pollution load in the basin after 2009 when Zengeza WWTP was shut down (ton)		188,770	31,709	
		220,478		

Source: JST

2.4 Zimbabwe Multi-Donor Trust Fund (Zim-Fund) and Urgent Water Supply and Sanitation Rehabilitation Project (UWSSR)

(1) Zim-Fund

The African Development Bank was requested by a group of donors to establish and administer the Zimbabwe Multi-Donor Trust Fund (Zim-Fund). The Zim-Fund was established on 31st May 2010. The purpose of the Zim-Fund is to contribute to early recovery and development efforts in Zimbabwe by mobilizing donor resources and promoting donor coordination in Zimbabwe. The duration of the Zim-Fund was five years, from 2010-2015.

The thematic scope of the Zim-Fund focused initially on infrastructure investments (rehabilitation and/or construction works) in the areas of water & sanitation and energy.

(2) UWSSRP

UWSSRP project is divided into two phases. The first phase of the Project was implemented to support urgent rehabilitation works - restoration and stabilization of water supply and sanitation services in the Municipalities of Harare, Chitungwiza, Mutare, Chegutu, Masvingo and Kwekwe, targeting a total population of approximately 4.15 million people.

The second phase was formulated to further the benefits and impacts of the first phase of the Project and include aspects not included in the first phase of the Project. The second phase Project is implemented in Harare, Chitungwiza, Ruwa and Redcliff serving an estimated population of 1.9 million. The total Project cost is estimated at USD 35.99 million to be financed by Zim-Fund in two stages. The first stage (US\$ 19.84 million) focuses on Harare and preparatory activities for the three other towns. The infrastructure improvement in UWSSRP phase 2 is shown in Table 2.4.1.

Table 2.4.1 Infrastructure Improvement by UWSSRP Phase 2

Infrastructure Improvement	
•	Water supply rehabilitation of pumping stations and equipment, bulk and domestic metering, distribution system repairs and replacements, water supplies for vulnerable communities, and operation and maintenance equipment.
•	Sanitation rehabilitation of sewage pumping stations and equipment, rehabilitation of outfall and trunk sewers, rehabilitation/replacement of sewer lines, and operation and maintenance equipment.

Source: AfDB

Hereafter rehabilitation of pump stations and sewage pipes is expected in Chitungwiza, rehabilitation of wastewater treatment plant, however, is not planned. In the rehabilitation of Tigor pump station, 500 manholes and 5km of sewer pipes are planned. Location of the 5km sewage pipe is not clear.

2.5 Sewerage Charge

(1) Local Tax and Utility Charge

The local tax and various public utility charges are collected together by form of Rent Card, and not collected individually by each department. The residents are required to go to taxation office to pay the charges. Last year tax collection officers were appointed and collection rate was improved from previous 36% to 54%.

(2) Consideration on Deciding the Sewage Charge

The water and sewer charge in each city is included in the local tax and utility charge, and they are reviewed and renewed every year. The cost necessary for maintenance and the citizens' income level are considered in deciding the fee for each city. However, at the stage of approval by MLGPWNH, the budgets proposed by local government are rarely approved as it is.

(3) Sewer Charge in the Past

Transition of sewer charge over the last five years is shown in Table 2.5.1. The charge was raised in 2016.

Table 2.5.1 Sewer Charge in the Past Five Years

	2014	2015	2016	2017	2018
Sewer charge (USD/month)	4.51	4.51	7.6	7.6	7.6

Source: JST based on Budget Statement

2.6 PPP Project in Chitungwiza

Sesani, an engineering company in Chitungwiza, has issued a feasibility study report in July 2017, including water supply and sewerage PPP project.

(1) Scope of PPP Project

The scope of the PPP project consists of emergency repairs of the pipeline and metering, new transmission mains and water storage, Muda Dam and bulk supply transfer, offices and workshops.

The sewerage fee collection and maintenance are included in this PPP under the premise of using existing trickling filter system and the renovation of BNR is not included in the plan. If BNR is rehabilitated with funds other than PPP, the cost for maintenance and management of BNR will also be included in the PPP scheme. In this case, the entire plan including the financial plan will be altered.

(2) Operation by PPP Scheme

The PPP is assumed to adopt BOT, so the operation of water supply and sewerage service will be operated independently from municipal administration by establishing SPV (Special Purpose Vehicle). After constructing the assets of PPP, SPV will provide services using the assets which will be transferred to the city after 25 years of operation. The method to raise funds will be non-recourse loan. Services provision, interest payments and repayment of loan are done only by revenues raised from project schemes.

(3) Financial plan

The important points on PPP from the financial aspect are the expected yield of investors and the charge setting. The water and sewer charge, which is 11.13USD at present, is assumed as 12.26USD for fixed water fee, 1.65USD/m³ for water tariff and 0.42USD for sewer tariff in 2015.

3. Challenges in Sewerage Works in Chitungwiza

3.1 Challenges on Institution and Organization

(1) Water Supply and Sewerage Fee and Allocation

The current Chitungwiza city sewer system has massive parts to be repaired. The cost of repair, operation and maintenance should be fundamentally covered by water and sewerage charges. However the current charge determination system does not take these into consideration. Local taxes and various fees are received collectively, and the budget is not allocated in accordance with collection purpose. As a result, sewerage infrastructure is left unrepaired. Therefore there is a need for a system for properly setting the water and sewerage tariff levels and allocation of the sewerage budget.

(2) Reliable Fee Collection

The water supply and sewerage fee is received collectively with local taxes and other fees. The collection rate has remained 54% in December 2017. In principle, users are responsible for water supply and sewerage fees, and it is necessary to raise the collection rate from the viewpoint of fairness and securing financial resources. Payment by prepaid method is considered effective as can be seen in Sesani's proposal. However, it should be carefully planned as there are potential risks in the prepaid system itself.

(3) Securing the Necessary Personnel

There are currently 51 maintenance staffs in Zengeza sewage treatment plant for the maintenance of the trickling filter facility. In the case of BNR operation, 51 personnel are insufficient considering the size of the treatment facility. Hence it is also important to secure personnel and experts for sustainable maintenance and stable operation.

3.2 Technical Challenges

(1) Strengthening of the Planning Ability

Comprehensive inspection, updating or repair is needed for the aged sewerage infrastructure. It is necessary to clarify the projects to be implemented in the short, medium and long term as a program. It is prerequisite to prepare an integrated plan with the repair program of water supply infrastructure which is the source of sewage, and to coordinate with the activities by donors. Planning ability is required to make such a plan.

(2) Technology Improvement Related to Maintenance

Appropriate maintenance is essential for prolonging the life of the sewage system. Preventive maintenance type management is required as well as minimization of life cycle cost and optimization of the budget in order to prevent disruption of the sewage system. Preparation of manuals and training for that will be necessary. Likewise, improvement in technology related to operation and maintenance is an issue for the future.

(3) Improvement of Sewer Inspection Technology

In order to promote systematic rehabilitation, it is necessary to accurately grasp the current situation. It is required to acquire visual inspection techniques and to introduce inspection technology using TV cameras.

3.3 Challenges in Finance

(1) Low Reliability and Delays on Accounting Reports

Financial statements from Chitungwiza Municipality are not reliable, in regard to the stakeholders that evaluate the financial status. Further, the analysis with these financial statements might lead stakeholders to the wrong conclusion. Additionally, the issuance of financial statements delayed for more than a year to the mandated limit. Therefore, it is an urgent task to prepare financial statements with fair presentation including revenue by tax. Establishing the institutional arrangement is also important towards acquiring the understanding of the citizens.

(2) Deviation of Budget Record

From the comparison between the budget and the accrual basis, it can be said that; 1) the amount of cash collected was significantly different from the budget, and 2) all the expenditure could not be met due to the shortage of cash. This is because the income is not shown on a cash basis, whereas expenses are reported on a cash basis in the budgeting. Moreover, for this reason, the result on the budget was that a large amount of final profit came to be expected. As a result, achieving the budget goals, enabling each department to work corresponding to the budget, and increasing the effectiveness of the budget are challenges to be thought about even in sewerage projects.

3.4 Problems Related to Sewerage Projects

(1) Issues on the Financial Soundness of the City

Financial deficits occurred since 2012 and the cumulative loss was also expanding as of 2015. Although the city's financial situation is not quite sound, fiscal management using obtained city tax and fee collection as ceiling is the only possible way of fiscal management. Consequently, the risk of having extremely high financial leverage caused by excessive usage on external funds is low.

It is anticipated that the Chitungwiza Municipality should pay the controversial water charge to the City of Harare. In addition, the problem of unpaid salaries for officers in Chitungwiza Municipality may yet worsen. As a conclusion, it is a critical challenge that Chitungwiza Municipality shows a solution to increasing unpaid expenses.

(2) Issues Related to Soundness of Sewage Projects

Although it is a principle that sewerage service is run by the revenue of the sewerage works, it is not stipulated by the laws to bind sewer income to sewer expenditure. Therefore, there is a possibility that sewer revenue is used in other sectors when urgent large expenditure is required. In such cases, it would be difficult to stock necessary spare parts for sewerage projects. This might be a future risk of the facility's sustainability and management.

3.5 Issues Related to PPP

(1) Water Charge Setting

The water charge by PPP is considerably higher than the current level. In the explanation by Sesani, a survey on willingness to pay for PPP was conducted and the residents' reaction was that they have intention to pay if water is supplied appropriately even if it is a little expensive.

(2) Issues in Collection System

Management by smart meters and introduction of the prepaid method may cause risks that are not currently recognized (e.g. the lack of a method or system of collecting fees when a system error occurs over a long period of time). There should be a notice on the possibilities that this may lead to a financial influence that could break the premise of the core of SPV as a continuing company.

(3) Financial Feasibility

In this PPP, for example, in 2020 it was scheduled that tariffs would be collected by smart meters. This scheme anticipates USD 24,066,070 as the total revenue of water supply and sewerage, and USD 36,598,094 from 2022, when it starts the dam operation. However, from the financial statements of Harare Water, looking at the fiscal size in 2016, it was USD 84,132,196 on an accrual basis, although the amount was USD 31,657,550 on a cash basis. Considering that the population of the city of Harare is about six times that of Chitungwiza, and amount of revenue is almost the same as Harare on a cash basis, the feasibility of such a plan is questionable.

4. Direction of Improvement of Zengeza WWTP

4.1 Basic Approach

(1) Processing Capacity

Zengeza WWTP has two lines of facility with processing capacity of 10 ML/day each, totaling 20 ML/day processing capacity. The current amount of wastewater generation in Chitungwiza city is 20.8 ML/day, and about 50 % is leaked, which makes the influx amount 10 ML/day. Considering the expected increase in the inflow volume in the future, JST proposes a phased improvement with one line operation in short term and two line operation in mid-term.

(2) Critical Matters in Repair

1) Removal of Sand

One of the causes of failure of BNR facility is inflow of sand. It is therefore required to install facility to remove sand.

2) Extension of Service Life

Given breakdown began to occur at five years from the start of operation, extension of service life of the facility is required.

3) Easy Maintenance

One of the reasons for early failure was that the technical level of the staffs was low and maintenance was not done as specified. Installation of equipment using the latest technology that is easy to maintain is recommended.

4) Procurement of Spare Parts and Expendable Items

Machine failure occurs unexpectedly, and so it is necessary to provide spare parts and expendable items to minimize the down time due to failure.

4.2 Consideration of BNR Repair Options

BNR repair options are considered for both one line operation and two line operation for the staged improvement. Plan options for BNR improvement based on the present condition of facilities are shown in Table 4.2.1.

Table 4.2.1 BNR Repair Options and Their Costs (Unit: USD)

No	Option	Line	A	B	C	Remarks
1	Overhaul Utilize and repair the current mechanical and electrical equipment (asset management) e.g. Repair of machines, gear box overhaul, repair of motor, replacement of outdoor cable, piping repair, replacement of parts	1 line	726,050	726,050	726,050	Common to all options
		2 lines	1,034,350	1,034,350	1,034,350	
2	Change of GC specifications Change the specifications of GC and new installation (adopt air lift system and upgrade of capacity) (countermeasure for inflow of sand, extend service life)	1 line	303,500	303,500	303,500	Common to all options
		2 lines	586,500	586,500	586,500	
3	Change of mixer for anoxic tank Upgrade the capacity so as not to overload (Avoid capacity shortage, extend service life)	1 line		82,500	82,500	
		2 lines		165,000	165,000	
4	Change of aerator pressure switch Replace with aerator that does not use special pressure switch (Eliminate weakness of machine, extend service life)	1 line		274,100	274,100	
		2 lines		548,200	548,200	
5	Aerator soft start Start the aerator with soft starter unit (SSU). Add SSU to MCC. (Shock release at startup, extend service life)	1 line			110,000	
		2 lines			110,000	
6	Ground pump Design change of circulation pump for aerobic, Return Activated Sludge pump, and Waste Activated Sludge pump Replace submersible pump to ground pump (Improve maintainability by separation of pump and motor)	1 line			387,200	
		2 lines			759,400	
7	Secure financial and human resources, spare parts and expendable items		600,000	600,000	600,000	Common to all options

No	Option	Line	A	B	C	Remarks
8	Security enhancement (prevention of robbers)		50,000	50,000	50,000	Common to all options
9	Cleaning		61,400	61,400	61,400	Common to all options
Total Amount		1 line	1,740,950	2,097,550	2,594,750	
		2 lines	2,332,250	3,045,450	3,914,850	

Source: JST

4.3 Financial Analysis and Analysis on Financial Sustainability

Based on the analysis on (1) how much expenses will be incurred to maintain BNR (amount of contents), and (2) how much operation and maintenance expenses can be increased in the sewerage account of Chitungwiza Municipality (frame size), JST examines the overall financial sustainability.

- a) Regarding the size of cost for operating and maintaining BNR, it is not a level of monetary value that cannot be covered even by fully allocating the sewerage income generated.
- b) Among the additional expenses for BNR operation, when strictly estimating chemicals, increase in the collection rate of the charge to at least 70% or more, and further increase in allocation to BNR to at least 60% of the administrative and maintenance expenses should be required. Remaining 40% must maintain and manage the conventional treatment plant, pipe catcher and pump station. In order to reduce the allocation rate to BNR, it is necessary to raise the collection rate even more.
- c) It is necessary to raise the charge collection rate to about 50% and increase the allocation rate to BNR to 60% even if it is possible to lower the additional cost required when the operation of BNR is improved.
- d) In order to operate and maintain only one line of BNR, it is necessary to spend BNR of about 55% of the collection rate of 45% and general administrative expenses and repair/maintenance expenses.

4.4 Recommendations for Sustainable Water and Sewerage Services

(1) Status Variance from Past Points in Time

As an overall recommendation of JST, the rehabilitation of the facilities should consider the living condition in Chitungwiza. What is of concern in this case is that past outages will be repeated. Therefore, regarding the case where rehabilitation is done according to the proposal of JST, we summarized the change of various situations in the past and the situation assumed in the future as shown in Table 4.4.1.

Table 4.4.1 Changes in the Past and Circumstances Expected in the Future

Major risks	Situation from 2006 to 2009	After rehabilitation
1. Equipment damages caused by inflow sand volume exceeding treatment capacity	Equipment similar to Harare City, where the amount of sand is relatively small	Risk reduction is possible by increasing GC and increasing the amount of sand processing. (Increased effect by public awareness on sand use as technical cooperation)
2. Shortage of replacement parts for damaged equipment	Spare parts were not purchased and stored.	Risk avoidance is possible by continuously installing replacement parts in the warehouse on site. (Increase in effect due to appropriate operation and maintenance of lead time etc. as technical cooperation)
3. Foreign exchange (inflation) risk for parts purchased from overseas	Overseas parts became difficult to procure owing to the occurrence of hyperinflation and marked deterioration in the exchange rate.	Risk reduction is difficult (the same even by other rehabilitation methods)
4. City budget shortage to purchase parts	Economic turmoil made it impossible to collect fees that match market conditions.	Risk reduction is difficult (the same even by other rehabilitation methods)

Source: JST

The BNR system itself has been operating in Harare City even before 2000, which shows the sophistication of Zimbabwe compared to other African countries at the time. In addition, considering the impact of Harare city and the environmental burden, it seems reasonable that the Zengeza sewage treatment plant selected the same BNR system.

(2) Tasks and Recommendations for Sustainable Water Supply and Sewage Works

At present, due to financial constraints and small inflow which is about 20% of the prescribed capacity, processing is carried out by the trickling filter system. However, the original role of sewage system is the preservation of water quality (advanced treatment for eutrophication and water pollution improvement) or the water shed management (water circulation, water environment) of public water bodies. Considering the impact on the environment from that viewpoint, some improvements are needed to improve living environment and public health. Table 4.4.1 shows tasks and recommendations for enabling sustainable water supply and sewage works for the future as a measure for that.

Table 4.4.2 Tasks and Recommendations for Sustainable Water Supply and Sewage Works

Task / Timing	Short Term	Mid/Long Term	Negative impact when measures are not taken	Remarks
■ Water quality improvement of public water and hygiene promotion				
Repair of broken pipeline and pump stations	X		Exacerbation of public health and spread of infectious diseases due to leakage of wastewater	
Improvement of BNR facilities	X		Water quality deterioration in public water bodies	
Stop discharging water to the farm and discharge the treated water satisfying the criteria to the river		X	Water quality deterioration in public water bodies and groundwater pollution	
■ Capacity development for water and Sewerage management				
Improve water supply rate (promotion of the dam project)	X		Stagnant of collection rate of sewere charge	
Capacity development for BNR operation and maintenance		X	Outage of the facility	In case BNR facility is rehabilitated
Capacity development for inventory controll of spare parts and chemicals for both systems		X	Outage of the facility	
■ Improvement of business management and financial capacity				
Improvement of the capacity for realistic cash-based budget formulation and appropriate preparation of financial statement	X		Unstable operation & management	
Improvement of management capacity using management index including fee collection rate	X		Unstable operation & management	
Improvement of pricing capacity based on general cost		X	Unstable operation & management	
Awareness raising of residents against use of sand at home		X	Decline in processing function or function stop	
Establishment of funding system at the central government for uragent occasion such as inflation		X	Turmoil in the inflation period	

Source: JST

CHAPTER 1 GENERAL

1.1 Background and Objectives of the Survey

1.1.1 Background

In the Harare metropolitan area, increasing volume of domestic waste water and industrial effluent surpassed the capacity of treatment plants due to rapid urbanization, population growth and evolution of industry. Consequently, water contamination at Lake Manyame and Lake Chivero, the major water resources of the area, has been a problem since the late 1990s. Furthermore, socio-economic dysfunction after the year 2000 worsened the water sanitation and hygiene condition in Chitungwiza municipality, a dormitory town of Harare city.

In order to improve the condition, “The project for Improvement of Sewage Facilities in the Municipality of Chitungwiza in the Republic of Zimbabwe”, a grant aid project, was conducted and facilities delivered to The Government of Zimbabwe (hereinafter referred to as GOZ) in 2000. However, rapid and intense aggravation of the economy in Zimbabwe in this period made it difficult to secure the appropriate budget for development and operation of facilities for water, sanitation and solid waste disposal. As a result, operation and maintenance of sewage and hygiene facilities in Chitungwiza became difficult and dysfunctional.

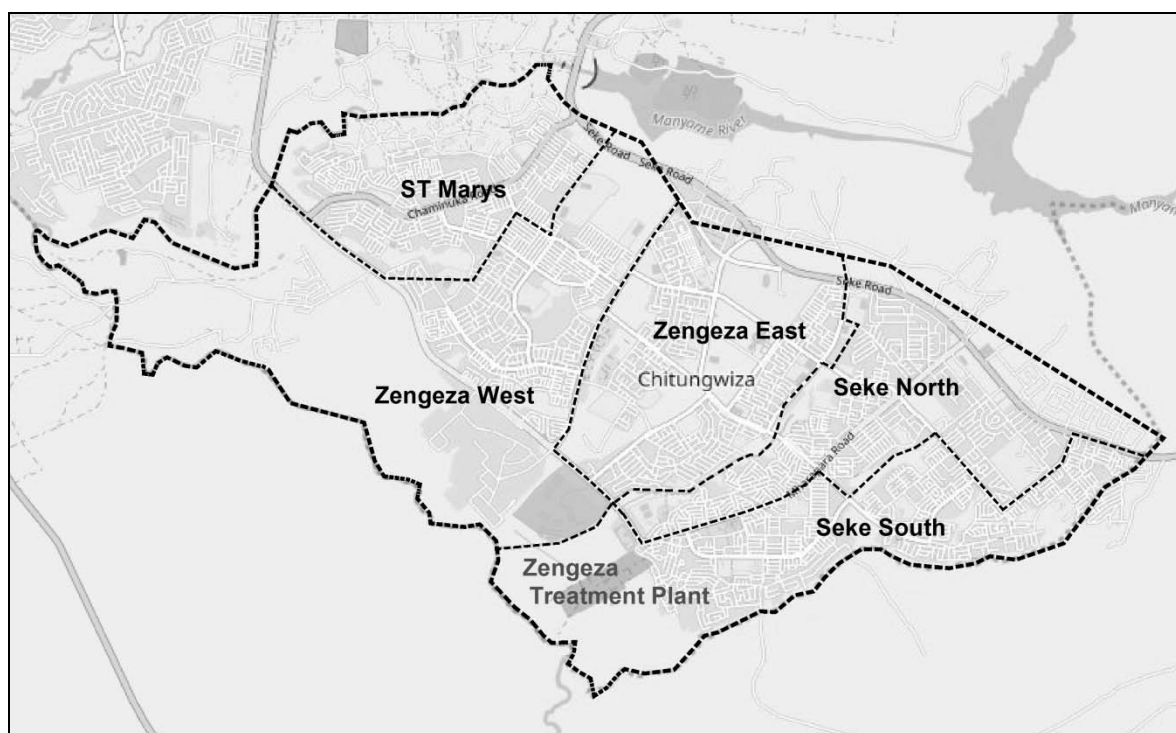
Subsequently JICA conducted “Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality in the Republic of Zimbabwe” in 2011, and collected and analyzed basic information for the improvement of sanitation and hygiene conditions in Chitungwiza municipality. The result of the survey showed that the water supply as well as the sanitation and the solid waste management was not functioning in the municipality. Given the result of the survey, GOZ requested the implementation of “The Project for the Improvement of Water Supply, Sewage and Solid Waste Management in Chitungwiza in the Republic of Zimbabwe” for the establishment of a Master Plan (M/P) and examination and clarification of improvement measures. In response to the request, JICA commenced the study in 2012, conducting Phase 1 which involved collection of information and analysis, and established the M/P in Phase 2. Nonetheless, the implementation of the study was suspended in July 2013 due to serious financial conditions in Chitungwiza municipality. Agreement was made between JICA and GOZ that the project would be resumed when the financial condition had been improved. To date, improvement of the financial condition has not been observed. From 2017, examination of various reform measures is ongoing and improvement in the financial condition is expected.

1.1.2 Objectives

This survey aims at collection of information on activities and plans by relevant organizations, the financial condition, organization structure of the implementing agency and activities by donors regarding water supply and sanitation in the Harare metropolitan area (City of Harare and Chitungwiza municipality). Additionally, by inspection on the condition of facilities and equipment of Zengeza treatment plant constructed under the Japanese grant aid, options for replacement of facilities and partial utilization of existing facilities will be analyzed. Based on the result of those surveys, issues and proposals for sustainable management of water supply and sanitation in Chitungwiza municipality will be scrutinized.

1.2 Survey Area

The principal survey area is Chitungwiza municipality. The City of Harare is included if integrated survey is required from the facilities and institutional aspects.



Source: JST

Figure 1.2.1 Survey Area

1.3 Survey Schedule and Survey Team

1.3.1 Survey Schedule in Zimbabwe

The following two surveys were conducted in Zimbabwe. Detailed schedules are shown in Table 1.3.1 and Table 1.3.2.

First Survey in Zimbabwe: From 1 Jan. 2018 to 7 Feb. 2018 (30 days)

Second Survey in Zimbabwe: From 9 Apr. 2018 to 15 Apr. 2018 (7 days)

Table 1.3.1 Survey Schedule of First Survey in Zimbabwe

			Tatsuo TOMIDOKORO	Natsuki SHIMEGI	Takaaki OGAWA	Erina KAN (1/9 - 1/20) Satoshi MIZUNO (1/29 - 2/4)
1/9	Tue		Dep. from Tokyo	Dep. from Tokyo	Dep. from Kansai	Dep. from Tokyo
1/10	Wed	AM	Arrive at Harare	Arrive at Harare	Arrive at Harare	Arrive at Harare
		PM	Office work	Office work	Office work	Office work
1/11	Thr	AM	JICA Zimbabwe Office EOJ	JICA Zimbabwe Office EOJ	JICA Zimbabwe Office EOJ	JICA Zimbabwe Office EOJ
		PM	Ministry of Environment, Water and Climate	Ministry of Environment, Water and Climate	Ministry of Environment, Water and Climate	Ministry of Environment, Water and Climate
1/12	Fri	AM	Ministry of Environment, Water and Climate	Ministry of Environment, Water and Climate	Chitungwiza Municipality Office	Ministry of Environment, Water and Climate
		PM	Harare Water Department	Harare Water Department	Zengeza Sewage Plant	Harare Water Department
1/13	Sat	AM	Field Survey (St. Mary PS1/2/3, Tilcor PS)	Field Survey (St. Mary PS1/2/3, Tilcor PS)	Field Survey (St. Mary PS1/2/3, Tilcor PS)	Field Survey (St. Mary PS1/2/3, Tilcor PS)
		PM	Field Survey (St. Mary PS1/2/3, Tilcor PS)	Field Survey (St. Mary PS1/2/3, Tilcor PS)	Field Survey (St. Mary PS1/2/3, Tilcor PS)	Field Survey (St. Mary PS1/2/3, Tilcor PS)
1/14	Sun	AM	Office work	Office work	Office work	Office work

*Data Collection Survey on Water Supply and Sewage Sector in Harare City Area in Zimbabwe
April 2018*

		PM	Office work	Office work	Office work	Office work
1/15	Mon	AM	Chitungwiza Municipality Office	Chitungwiza Municipality Office	Chitungwiza Municipality Office	Chitungwiza Municipality Office
		PM	Zengeza Sewage Plant	Zengeza Sewage Plant	Zengeza Sewage Plant	Zengeza Sewage Plant
1/16	Tue	AM	Environmental Management Agency	Environmental Management Agency	Chitungwiza Municipality Office	Environmental Management Agency
		PM	Ministry of Local Government, Public Works and National Housing	Ministry of Local Government, Public Works and National Housing	Zengeza Sewage Plant	Ministry of Local Government, Public Works and National Housing
1/17	Wed	AM	ZINWA	ZINWA	Zengeza Sewage Plant	ZINWA
		PM	Office work	Office work	Zengeza Sewage Plant	Office work
1/18	Thr	AM	JICA Zimbabwe Office	JICA Zimbabwe Office	JICA Zimbabwe Office	JICA Zimbabwe Office
		PM	The Harare Water Department	The Harare Water Department	The Harare Water Department	The Harare Water Department
1/19	Fri	AM	Chitungwiza Municipality Office	Chitungwiza Municipality Office	Chitungwiza Municipality Office	Chitungwiza Municipality Office
		PM	Field Survey (Tilcor, Unit M trunk line)	Field Survey (Tilcor, Unit M trunk line)	Field Survey (Tilcor, Unit M trunk line)	Field Survey (Tilcor, Unit M trunk line)
1/20	Sat	AM	Office work	Office work	Office work	Dep. from Harare
		PM	Office work	Office work	Office work	
1/21	Sun	AM	Office work	Office work	Office work	
		PM	Office work	Office work	Office work	
1/22	Mon	AM	AfDB (Zim Fund)	Chinese Embassy	AfDB (Zim Fund)	
		PM	Sesani (PPP) UNICEF	Sesani (PPP) UNICEF	Sesani (PPP) UNICEF	
1/23	Tue	AM	Finance Department, Chitungwiza Municipality	Finance Department, Chitungwiza Municipality	Finance Department, Chitungwiza Municipality	
		PM	Acting Town Clerk, Chitungwiza Municipality	Acting Town Clerk, Chitungwiza Municipality	Zengeza Sewage Plant	
1/24	Wed	AM	Office work	Office work	Office work	
		PM	Firle Sewage Plant	Firle Sewage Plant	Firle Sewage Plant	
1/25	Thr	AM	JICA Zimbabwe Office	JICA Zimbabwe Office	JICA Zimbabwe Office	
		PM	Ministry of Finance and Economic Planning	Ministry of Finance and Economic Planning	Ministry of Finance and Economic Planning	
1/26	Fri	AM	Crowborough Sewage Plant	Finance Department, Chitungwiza Municipality	Crowborough Sewage Plant	
		PM	Harare Water	Arrangement for survey	Harare Water	
1/27	Sat	AM	Morton Jeffry Plant and Lake Chivero	Survey for willingness to pay	Morton Jeffry Plant and Lake Chivero	
		PM	Morton Jeffry Plant and Lake Chivero	Survey for willingness to pay	Morton Jeffry Plant and Lake Chivero	
1/28	Sun	AM	Office work	Office work	Office work	
		PM	Office work	Office work	Office work	
1/29	Mon	AM	Environmental Management Agency	Office work	Harare Water	Harare water
		PM	Ministry of Finance and Economic Planning	Ministry of Finance and Economic Planning	Zengeza Sewage Plant	Zengeza Sewage Plant
1/30	Tue	AM	Report writing	Survey for willingness to pay	Report writing	Report writing
		PM	JICA Zimbabwe Office	Survey for willingness to pay JICA Zimbabwe Office	JICA Zimbabwe Office	JICA Zimbabwe Office
1/31	Wed	AM	EOJ	EOJ	EOJ	EOJ
		PM	Office work	Finance Division, Chitungwiza Municipality	Office work	Office work
2/1	Thr	AM	Water Division, Chitungwiza Municipality	Water Division, Chitungwiza Municipality	Environmental Management Agency	Environmental Management Agency
		PM	Finance Division, Chitungwiza Municipality Planning Division, Chitungwiza Municipality	Finance Division, Chitungwiza Municipality Planning Division, Chitungwiza Municipality	Finance Division, Chitungwiza Municipality Environmental Management Agency	Finance Division, Chitungwiza Municipality Environmental Management Agency

2/2	Fri	AM	Accounting Division, Harare Water Planning Division, City of Harare	Accounting Division, Harare Water Planning Division, City of Harare	Prince Edward Plant Zengeza Sewage Plant	Prince Edward Plant Zengeza Sewage Plant
		PM	Sesani (PPP)	Sesani (PPP)	Harare Water	Harare Water
2/3	Sat	AM	Office work	Survey for willingness to pay	Office work	Office work
		PM	Office work	Survey for willingness to pay	Office work	Office work
2/4	Sun	AM	Dep. from Harare	Dep. from Harare	Dep. from Harare	Office work
		PM	Arrive at Johannesburg	Arrive at Johannesburg	Arrive at Johannesburg	Dep. from Harare
2/5	Mon	AM	Survey in Johannesburg	Survey in Johannesburg	Survey in Johannesburg	
		PM	Survey in Johannesburg	Survey in Johannesburg	Survey in Johannesburg	
2/6	Tue	AM	JICA South Africa Office	JICA South Africa Office	JICA South Africa Office	
		PM	Dep. from Johannesburg	Dep. from Johannesburg	Dep. from Johannesburg	
2/7	Wed		Arrive at Tokyo	Arrive at Tokyo	Arrive at Kansai	

Source: JST

Table 1.3.2 Survey Schedule of Second Survey in Zimbabwe

		Tatsuo TOMIDOKORO		Natsuki SHIMEGI		Remark
4/9	Mon		Dep. From Tokyo		Dep. From Tokyo	
4/10	Tue		Arrive at Harare		Arrive at Harare	
4/11	Wed	AM	JICA Zimbabwe, AfDB, Ministry of Environment, Water and Climate	JICA Zimbabwe, AfDB, Ministry of Environment, Water and Climate		
		PM	Chitungwiza Municipality, Zengeza Sewage Plan	Chitungwiza Municipality, Zengeza Sewage Plan		
4/12	Thr	AM	Sesani, EOJ	Sesani, EOJ		
		PM	Ministry of Environment, Water and Climate	Ministry of Environment, Water and Climate		
4/13	Fri	AM	WorkShop	WorkShop		
		PM	Harare Water	Harare Water		
4/14	Sat	AM	Office work	Office work		
		PM	Dep. from Harare	Dep. from Harare		
4/15	Sun		Arrive at Tokyo	Arrive at Tokyo		

Source: JST

The outline of discussion in the workshop held 13 April is shown in 5.3.3. The Minutes of Meeting and material for meeting are shown in Appendix 4.

The outline of agenda and collected information are shown in Table 1.3.3.

Table 1.3.3 Agenda and Collected Information of Meetings

Organization	Agenda and Collected Information
Embassy of Japan	<ul style="list-style-type: none"> • Explanation on circumstances of Zengeza Sewage Plant and objectives of the survey by the JST • EOJ's expectations are grant aid through follow-up, repair through technical cooperation
Dep. Of Environment, Ministry of Environment, Water and Climate	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Organization structure and role of related organization - Relation with sewer policy and legislative system - Budget of the ministry
Dep. Of Water, Ministry of Environment, Water and Climate	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Organization structure - Legislation for water and sanitation - Relation with local government and its water and sanitation entity - Policy on water charge - Activities by donors and progress of PPP
Ministry of Local Government Public Works and National Housing	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Role of the Ministry and relation with local government - Financial system of local government - On-going project of water and sanitation

	<ul style="list-style-type: none"> - Intervention to water charge policy
Ministry of Finance and Economic Development	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - State of control for water and sanitation entity in local government - Financial statement
Zimbabwe National Water Authority (ZINWA)	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Institution for water and sanitation enterprise - Present state of water resource management and problems - Method of water charge levy
Environment Management Agency (EMA)	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Environmental regulation, quality standard - Administration of regulation, penalties - Relation with local government
Harare Water	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Budget allocation by Harare City - State of water charge levy - Relation with Chitungwiza municipality: disbursement by Chitungwiza municipality, water supply to Chitungwiza municipality
Chitungwiza Municipality	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Financial statements in last year, budget for this year - Accounting system of the municipality
Zengeza STP	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Past cooperation by Zim-Fund and Japan - Problems of BNR system and improvement method
AfDB	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Water and sanitation project by Zim-Fund - Improvement condition of Zengeza treatment plant and existing issues
Sesani	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Progress of transition to PPP and prospect - Government policy for PPP
Chinese Embassy	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Chinese aid system including loan - Recognition on current water and sanitation condition
UNICEF	<ul style="list-style-type: none"> • The following information was collected: <ul style="list-style-type: none"> - Activity in Zimbabwe - Planned activity

Source: JST

Table 1.3.4 Inspection Items in Site Visit

Site	Inspection item and result
Zengeza STP	<ul style="list-style-type: none"> • Operation condition • Detailed inspection on facilities for BNR system
Firle Sewage Plant Crouborough Sewage Plant	<ul style="list-style-type: none"> • Operation condition of BNR sewage plant • Condition of facilities of BNR sewage plant: Firle Sewage plant is working. Crouborough Sewage Plant is out of service for rehabilitation.
Morton Jeffry Water Plant	<ul style="list-style-type: none"> • Condition of facilities of purification plant
Lake Chivero	<ul style="list-style-type: none"> • Condition of Lake Chivero (headspring)
Pump Stations	<ul style="list-style-type: none"> • Status of pump station: One station is working. One station is out of service due to equipment shortage. One station is out of service due to problem in water pipe.
Discharge points	<ul style="list-style-type: none"> • Destination of treated water from Zengeza plant: Used for irrigation water. Not discharged to river.

Source: JST

1.3.2 Member of the Survey Team

The members of the Survey Team are shown in Table 1.3.5.

Table 1.3.5 Survey Team Members

Name	Organization	Position
Tatsuo TOMIDOKORO	EJEC	Team Leader/ Planning, Design, and Business Operation of Sewerage System
Natsuki SHIMEGI	EJEC	Financial and Institutional Analysis of Water and Sewerage Project
Takaaki OGAWA	EJEC	Mechanical and Electrical Equipment of Sewerage System
Satoshi MIZUNO	EJEC	Information Collection
Erina KAN	EJEC	Project Administrator /Environmental and Social Considerations

Source: JST

1.3.3 Interviewee of the Survey

The names of organization, the names of interviewee and their position are shown below:

Table 1.3.6 Interviewee of Government Organization

Organizations	Name	Position
Chitungwiza Municipality	Ms. Charity Maunga	Acting Town Clerk
	Mr. Emmanuel Mushata	Works Manager
	Mr. Witness Gowero	Sewerage Superintendent
	Mr. Kudakwashe Alexio Chirongwe	Acting Head Human Resources
	Mr. Bernard Bvoro	Acting Works Superintendent
	Conrad Muchesa	Director, Urban Planning Services
	Mr. Robert Nyikadzino	Finance Manager
Dep. of Environment, Ministry of Environment, Water and Climate (MEWC)	Mr. Joseph Shoko	Acting Director/Chief Environment Officer
	Ms. Pauline Dhlakama	Principal Environment Officer
	Mr. Beavan Ngoshi	Environment Officer
Dep. of Water, Ministry of Environment, Water and Climate (MEWC)	Mr. G. Mawere	Deputy Director - Water Resources Management
	Mr. Zvikomborero Manyangadze	Chief Hydrologist
	Mr. Ruzengwe Manatsa	Chief Ecologist
	Eng. Tatenda Mawokomatanda	Chief Engineer
Environmental Management Agency (EMA)	Mr. Chinogwenya	in charge of community related projects
	Mr. Union Mapxashike	Water & Effluent Specialist
EMA-Chitungwiza	Mr. Mudii	District Environmental Officer
Harare Water	Eng. T.R. Kunyadini	Acting Water Manager
	Eng. S.T. Muserere	Waste Water Manager
	Mr. G. Kusangaya	Finance Manager
Ministry of Local Government, Public Works and National Housing (MLGPWNH)	Ms. Erica Jones	Principal Director Urban Local Authorities
Zimbabwe National Water Authority	Mr. Jeffer K. Sakupwanya (PhD)	CEO
	Eng. W. Mandiziba	Chief Engineer
	Mr. F.G. Manzira	Head Clear Water Operations
	Ms. Nyaradzayi A. Mawango	Quality Assurance Manager
	Ms. Musiwa Debra	Hydrologist
Ministry of Finance and Economic Development (MOFED)	Mrs. Margireta Makuwaza	Director, international Cooperation
	Mr. Forbes Kanogwere	Principal Economist
	Mr. Yoshinari Kitamura	ODA Advisor
	Mr. Tendayi Munyoro	Accountant

	Mr.Peter Makore	Economist
	Mr.Stephen Nkomo	Economist
	Mr.Nimirod Mawindidze	Economist
	Mr. Edison Mutsvunguma	Economist
	Mr.John Mafarikwa	Head - Zimbabwe Public Debt Management Office
Joint Venture Unit, MOFED-	Mr.Johah Mushayi	Acting Director
	Mr.Moriseni Mutema	Acting Deputy Director
	Mr.Pardon Nyandoro	Principal Economist
	Mr.Wilbert Zimbiti	Principal Economist

Source: JST

Table 1.3.7 Interviewee of Donors and Private Company

Organizations	Name	Position
Donor		
African Development Bank Group	Mr. Emmanuel Nzabanita	Zim-Fund Manager
	Mr. Damon Kitabanita	Water Supply and Sanitation Specialist
	Mr.Damoni Kitabire	Country Manager
UNICEF	Mr. Arnold Cole	Water, Sanitation and Hygiene Manager
Private Company		
Sesani	Mr. Marshall Maphosa	Director
	Mr. Tafadzwa Mputa	Director
	Mr.Mike Peto	Managing Director
SSI	Mr.Michael Kubare	Senior Civil Engineer

Source: JST

Table 1.3.8 Embassy of Japan and JICA

Organizations	Name	Position
The Embassy of Japan in Zimbabwe	Mr.Toshiyuki Iwado	Ambassador Extraordinary and Plenipotentiary
	Mr. David Tsunakake	Deputy Head of Mission Counsellor
	Ms. Yumi Sakata	Second Secretary
JICA Zimbabwe Office	Mr. Shumon Yoshiara	Representative
	Mr. Sakae Kashihara	Project Formulation Advisor
	Mr. Takashi Shirata	Security Clerk
	Mr. Tachiwana NKOMO	Program Officer
	Mr. Tomohiro Seki	Chief Representative
	Mr. Kensuke Oshima	Senior Representative
	Ms.Yumiko Tsubota	Representative

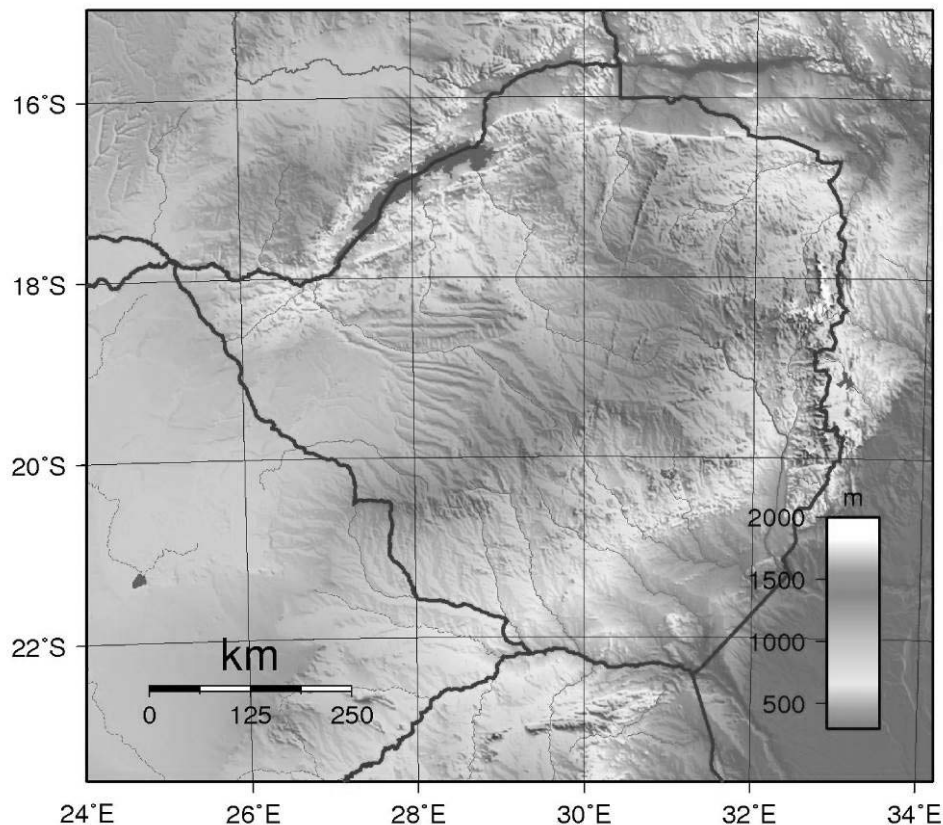
Source: JST

CHAPTER 2 GENERAL CONDITION AND SANITATION IN ZIMBABWE

2.1 Natural Condition

(1) Geography

Zimbabwe is a landlocked country in southern Africa, surrounded by Mozambique to the east, Zambia to the North, Botswana to the west and South Africa to the south. It lies between latitudes 15° and 23°S, and longitudes 25° and 34°E. The land area is 390,757 km², of which 3,910 km² (1%) is inland water. Altitude is highest towards the eastern border with Mozambique, at Mt. Iyangani (2,592m). The country inclines north-westwards and southwards, with the lowest point at the junction of the Runde River and Save River (162 m). Figure 2.1.1 shows the topography of Zimbabwe.



Source: Wikimedia Commons

Figure 2.1.1 Topographical Map of Zimbabwe

The River system in Zimbabwe is as shown in Figure 2.1.2. The City of Harare and Chitungwiza Municipality are in the basin of Hunyani River, a tributary of Zambezi River. In the upstream of Hunyani River, two man-made lakes, Lake Manyame and Lake Chivero, supply water to the City of Harare and Chitungwiza Municipality.



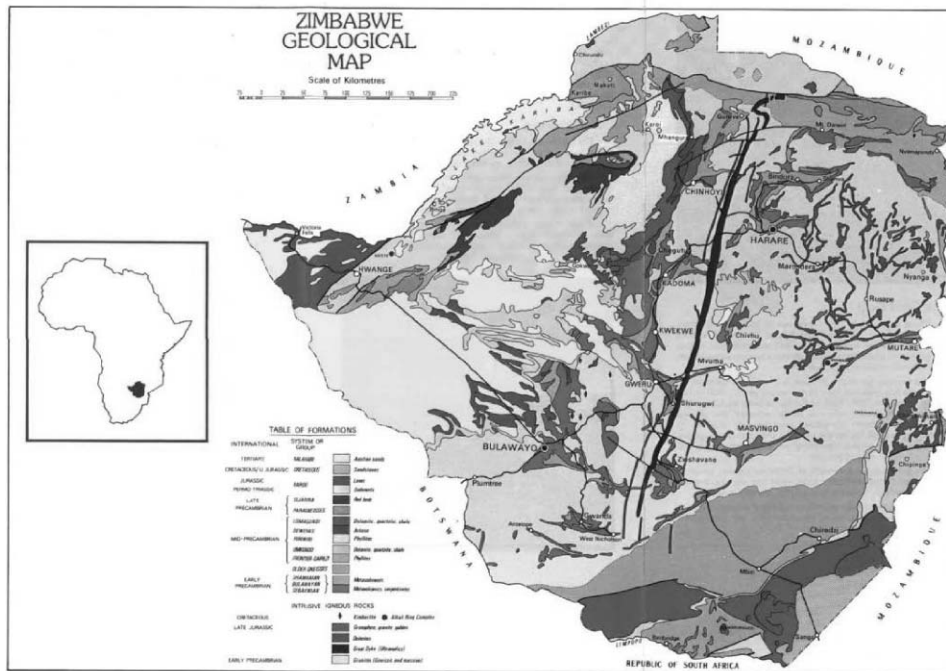
Source: www.mapsofworld.com

Figure 2.1.2 River System in Zimbabwe

The geology of Zimbabwe mainly consists of following three areas.

The northern area is comprised of the Precambrian gneisses named “Zambezi belt” which was formed by orogenic movement. The southern area comprises of Precambrian gneisses and massive granites named Kakahali Cratons. The western area is made up of the Jurassic basalt, upper carboniferous sedimentary rock named Karoo supergroup.

In addition, in the center of Zimbabwe, there is an ultramafic intrusive sheet named “great dyke” of Archaen which crosses the north and south of the country. Useful metallic ore deposits such as platinum and chromium are distributed almost entirely in this intrusive sheet. Those metallic ore deposits support the Zimbabwe economy.



Source: Overview of Zimbabwe's mineral resource potential, Forbes Mugumbate,

Figure 2.1.3 Geological Map of Zimbabwe

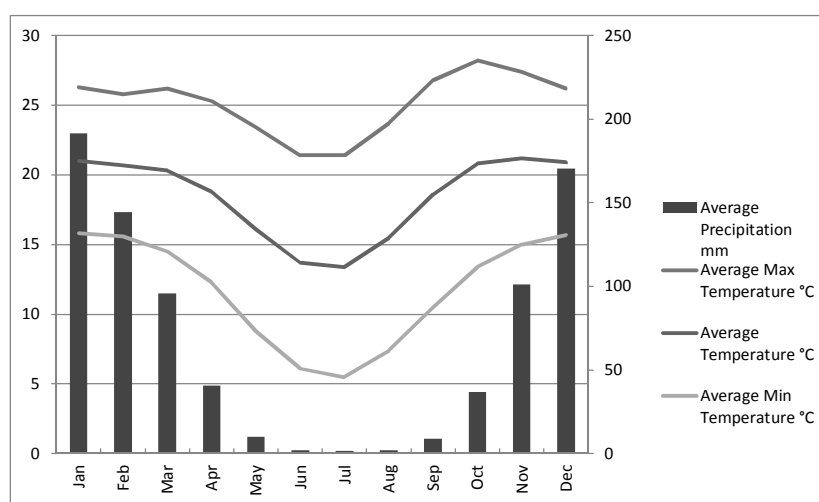
(2) Weather

Weather in Zimbabwe is mostly tropical. The southern areas are known for their heat and aridity and the Zambezi valley is also known for its extreme heat. The Eastern Highlands usually experience cool temperatures and the highest rainfall in the country. The rainy season generally spans from November to March. Table 2.1.1 and Figure 2.1.4 shows the weather in the City of Harare. Average temperature is 18.4°C and the highest temperature is 28.2°C in October. Total annual precipitation is around 800mm.

Table 2.1.1 Weather in Harare

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max Temperature °C	26.3	25.8	26.2	25.3	23.4	21.4	21.4	23.7	26.8	28.2	27.4	26.2	25.2
Average Temperature °C	21	20.7	20.3	18.8	16.1	13.7	13.4	15.5	18.6	20.8	21.2	20.9	18.4
Average Min Temperature °C	15.8	15.6	14.5	12.3	8.8	6.1	5.5	7.4	10.5	13.4	15	15.7	11.7
Average Precipitation mm	191.4	144.3	95.7	40.6	10	2.2	1.8	2	8.8	36.8	101.2	170.4	805.2

Source: ClimaTemps.com



Source: ClimaTemps.com, JST

Figure 2.1.4 Weather in Harare

2.2 Socio-economy

(1) Background

Chitungwiza is located at 30km south-east from Harare city center and approximately 10km from the Harare International Airport. Chitungwiza was formed as a dormitory town of Harare in 1978 with three townships, Seke, Zengeza, and St Marys. In early the 2000s another township named Manyame Park (New St Marys) was established, and consequently the number of townships is four at the present. In 1981, town council status was granted and in 1995, municipal status was granted.

(2) Population

Zimbabwe consists of 12 provinces and Chitungwiza municipality belongs to Harare Province. Table 2.2.1 shows the population of Zimbabwe and Harare Province as per the Censuses of 2002 and 2012. Population growth rate of Harare Province exceeds the overall growth rate of Zimbabwe.

Table 2.2.1 Population of Zimbabwe and Harare Province

	2002 (persons)	2012 (persons)	Growth rate 2001-2012 (%)
Zimbabwe	11,631,657	12,973,808	1.098
Harare Province	1,869,134	2,098,199	1.163
Proportion of Harare	16.1%	16.2%	

Source: CENSUS, Zimbabwe National Statistics Agency (ZIMSTAT)

Table 2.2.2 gives the population of the four districts in Harare Province. Chitungwiza had a population of 350 thousand in 2012. However due to densification of the residential area in Harare urban and Chitungwiza, the rate of increase of the population is slowing down.

Table 2.2.2 Population by District in Harare Province

District	2002 (persons)	2012 (persons)	Growth rate 2001-2012 (%)
Harare Urban	1,435,784	1,468,767	0.23
Harare Rural	23,023	113,120	17.26
Epworth	114,067	161,840	3.56
Chitungwiza	323,260	354,472	0.93

Harare Province Total	1,896,134	2,098,199	1.02
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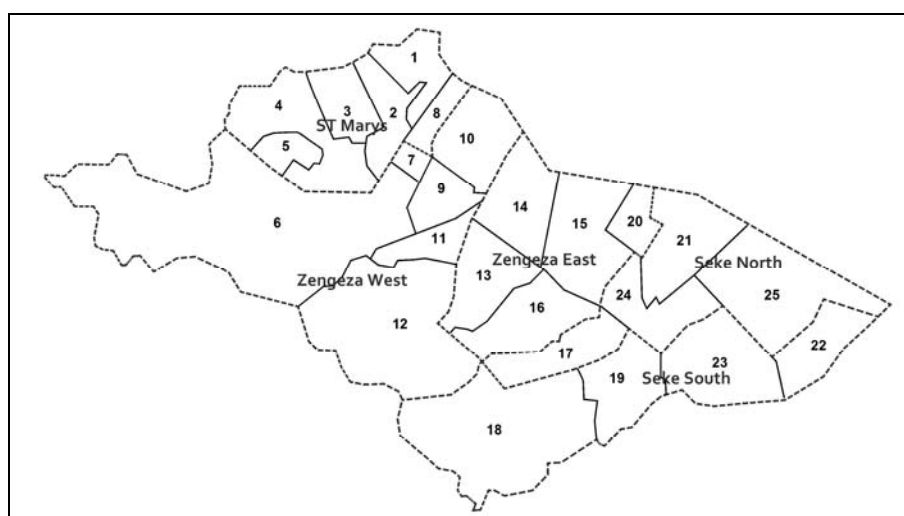
Source: CENSUS, Zimbabwe National Statistics Agency (ZIMSTAT)

Table 2.2.3 shows the population by ward in Chitungwiza. Ward No.23 in Seke South has the largest population. The ward map is given in Figure 2.2.1.

Table 2.2.3 Population by Ward in Chitungwiza in 2012

Ward No.	Population	Ward No.	Population	Ward No.	Population
1	8,286	12	15,111	24	20,700
2	11,024	Zengeza West Total	66,566	25	12,638
3	10,009			Citungwiza North Total	68,134
4	27,468	13	9,832		
5	10,730	14	15,467	19	16,658
8	10,023	15	13,485	22	15,254
St Mary Total	77,540	16	14,688	23	28,068
6	17,156	20	11,284	Chitungwiza South Total	77,476
7	7,946	Zengeza East Total	64,756		
9	8,181			17	16,163
10	8,793	21	18,633		
11	9,379				

Source: CENSUS, Zimbabwe National Statistics Agency (ZIMSTAT)



Source: Zimbabwe Electoral Commission

Figure 2.2.1 Ward Map in Chitungwiza

(3) Economy

Since economic statistics could not be obtained from the government, economic features are shown in reference to the indices by World Development Indicator (World Bank). Table 2.2.4 compares GDP in SADC (South Africa Development Community) countries. Among the 14 countries, GDP growth rate in Zimbabwe is lowest and in the period from 2000 to 2010, GDP declined.

Table 2.2.4 GDP in SADC Countries

Country Name	Index	2000	2005	2010	2015	2000-2015 Average
Angola	GDP	34.535	46.226	82.471	103.920	
	GDP growth	6.387	6.005	12.275	4.732	7.621

DRC	GDP	13.003	15.675	20.523	29.848	
	GDP growth	-3.916	3.808	5.538	7.779	5.696
Zambia	GDP	9.882	13.351	20.266	26.058	
	GDP growth	3.615	6.202	8.706	5.157	6.678
Zimbabwe	GDP	15.352	10.459	10.052	14.577	
	GDP growth	2.310	-7.388	-0.791	7.716	-0.345
Tanzania	GDP	16.511	23.383	31.408	43.728	
	GDP growth	4.309	7.207	6.079	6.843	6.708
Botswana	GDP	8.564	10.231	12.787	16.146	
	GDP growth	5.191	3.622	4.561	4.776	4.318
Mozambique	GDP	4.635	7.096	10.154	14.308	
	GDP growth	11.511	8.890	7.431	7.099	7.804
Lesotho	GDP	1.645	1.888	2.394	2.983	
	GDP growth	3.022	2.791	4.864	4.498	4.047
Mauritius	GDP	6.599	7.671	10.004	11.956	
	GDP growth	5.777	3.055	5.454	3.629	4.041
Malawi	GDP	4.376	4.867	6.960	8.499	
	GDP growth	3.908	2.148	7.416	4.077	4.525
Namibia	GDP	7.116	9.053	11.282	14.753	
	GDP growth	3.512	4.932	4.502	5.511	4.981
Swaziland	GDP	3.135	3.773	4.439	5.373	
	GDP growth	2.850	3.775	3.304	3.893	3.657
South Africa	GDP	266.993	322.228	375.349	418.388	
	GDP growth	2.787	3.832	3.099	2.195	3.040
Seychelles	GDP	0.794	0.783	0.970	1.265	
	GDP growth	5.659	-0.285	4.374	5.457	3.152

GDP: constant 2010 billion USD

GDP growth: annual %

Source: World development Indicator, World Bank

Table 2.2.5 compares GDP per capita in SADC countries. GDP per capita in Zimbabwe surpasses Tanzania, Mozambique, Malawi and DRC. However the growth rate is lowest among the SADC countries.

Table 2.2.5 GDP per Capita in SADC Countries

Country Name	Index	2000	2005	2010	2015	2000-2015 Average
Angola	GDP per capita	2,100.57	2,364.19	3,529.05	3,730.17	
	GDP per capita growth	3.42	2.39	8.34	1.11	3.90
DRC	GDP per capita	276.22	286.29	318.08	391.72	
	GDP per capita growth	-6.27	0.72	2.13	4.25	2.36
Zambia	GDP per capita	938.35	1,107.73	1,463.21	1,618.46	
	GDP per capita growth	0.71	3.37	5.72	2.04	3.70
Zimbabwe	GDP per capita	1,256.08	808.29	713.60	923.90	
	GDP per capita growth	0.75	-8.44	-2.46	5.30	-2.03
Tanzania	GDP per capita	497.20	610.82	701.60	835.97	
	GDP per capita growth	1.60	4.20	2.81	3.57	3.52
Botswana	GDP per capita	4,954.77	5,512.81	6,346.16	7,308.61	

	GDP per capita growth	3.18	2.16	2.86	2.86	2.63
Mozambique	GDP per capita	256.54	339.13	419.23	510.79	
	GDP per capita growth	8.50	5.74	4.33	4.03	4.70
Lesotho	GDP per capita	880.41	968.45	1,173.26	1,371.78	
	GDP per capita growth	1.81	1.92	3.91	3.18	3.00
Mauritius	GDP per capita	5,560.23	6,245.20	8,000.38	9,468.94	
	GDP per capita growth	4.60	2.35	5.08	3.43	3.61
Malawi	GDP per capita	384.68	373.23	458.87	483.63	
	GDP per capita growth	1.08	-0.60	4.22	1.06	1.54
Namibia	GDP per capita	3,746.71	4,454.63	5,191.58	6,082.33	
	GDP per capita growth	0.71	3.52	3.11	3.22	3.28
Swaziland	GDP per capita	2,953.23	3,411.67	3,690.24	4,073.21	
	GDP per capita growth	0.82	2.93	1.58	1.99	2.17
South Africa	GDP per capita	5,946.81	6,768.56	7,362.76	7,605.40	
	GDP per capita growth	1.15	2.62	1.70	0.65	1.65
Seychelles	GDP per capita	9,790.27	9,450.28	10,804.68	13,542.23	
	GDP per capita growth	4.10	-0.70	2.71	4.62	2.19

GDP per capita: constant 2010 USD

GDP per capita growth: annual %

Source: World development Indicator, World Bank

2.3 Policy on Sanitation in Zimbabwe

2.3.1 National Plan

2.3.1.1 I-PRSP, 2016

The latest national plan in Zimbabwe is the Zimbabwe Interim Poverty Reduction Strategy Paper (I-PRSP) 2016-2018 issued in September, 2016. The plan established seven pillars, in which water and sanitation are stipulated in Pillar II, Social Sectors.

In Chapter 2 titled Poverty Diagnostics, Inequality and Sectoral Performance Defining Poverty, the worsening condition of the Safe Water and Sanitation sector is described as follows:

158. Nationally, 76.6 percent of the households had access to safe drinking water³¹ in 2011/12. Access to safe water decreases with poverty, and this pattern is true in both rural and urban areas³².
159. Despite significant efforts to develop rural water, sanitation and hygiene (WASH) sector infrastructure, the imbalance between urban and rural services remains a distinctive feature of the sector.
160. The situation with regards to access to safe sanitation is worse than that of access to safe drinking water in both rural and urban areas. Nationally, 55.9 percent of the households have access to safe sanitation³³, in 2011/12.
161. Access to safe sanitation decreases with poverty, and this pattern is true in both rural and urban areas³⁴.

It is noted that access to safe sanitation is worse than that of access to safe drinking water in Zimbabwe. In Chapter 4 titled Poverty Reduction Strategies: 2016-18, strategy for Water and Sanitation is described in Pillar II, Social Sectors.

388. Despite the magnitude of initiatives by various sectors to halt the further deterioration of existing water, sanitation and hygiene (WASH) infrastructure and systems, a lot of work requires to be done to enable provision of WASH facilities to the entire population.

389. Challenges include highly fragmented WASH policy implementation; inadequate financial resources for infrastructure development, operation, and maintenance, and the pollution of water sources.

390. The wide disparity between urban and rural areas in access to water and sanitation continues, with rural areas being worse-off.

I-PRSP articulates that to implement the policy on water and sanitation, 87.05million USD is required in two years of which none is secured.

Table 2.3.1 I-PRSP Budget (USD million), 2017 - 2018

	Budget	Funding	Funding Gap
PILLAR II: SOCIAL SECTORS			
Water & Sanitation	87.05	-	87.05

Source: I-PRSP

2.3.1.2 Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset), 2013

(1) Objectives

The government of Zimbabwe drafted a blue print for five years between 2013 and 2018, termed “Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset)”, to guide national development.

Zim Asset is established for the following four clusters:

- Food Security and Nutrition
- Social Services and Poverty Eradication
- Infrastructure and Utilities
- Value Addition and Beneficiation

Water and sanitation is one of the programs in both Social Services and Poverty Eradication Cluster and Infrastructure and Utilities Cluster.

(2) Water and Sanitation Program

The situation regarding water and sanitation is described in Chapter 2 as follows:

2.17 As for water, sanitation and hygiene, high levels of pollution continue to affect urban drinking water. In rural and farming communities, some of the sources of clean water such as boreholes are now ageing or are dysfunctional, forcing people to utilize unprotected sources of drinking water.

2.18 The utilities and infrastructure sector has also not been spared, as roads, civil aviation and railway networks across the country have not seen major improvements and modernisation due to shortage of capital and long term investment opportunities. In the urban areas, capacity challenges exacerbated by the corruption of erstwhile councilors also affected the efficient operation of councils resulting in poor water and sewerage reticulation systems.

The measures for addressing this situation are shown as the Result Matrices indicating key result areas, outcomes, outputs, strategies and lead institution. Result matrices pertaining to water and sanitation are shown as follows:

1) Social Services and Poverty Eradication Cluster

Cluster Key Result Areas	Cluster Outcomes	Cluster Outputs	Strategies	Lead Institution
Social Service Delivery	<ul style="list-style-type: none"> Improved service delivery by local authorities. 	<ul style="list-style-type: none"> Public infrastructure (sewerage system, roads, health facilities, waste management, schools and social amenities) put in place and maintained in all local authorities; 	<ul style="list-style-type: none"> Undertake a national blitz to rehabilitate water supplies, sewerage systems, roads, health facilities, waste management, schools and social amenities in all local authorities; Strengthen Public Private Partnerships; 	<p>Office of the President and Cabinet</p> <p>Ministry responsible for Local Government</p>

Source: Zim Asset

2) Infrastructure and Utilities Cluster

Cluster Key Result Areas	Cluster Outcomes	Cluster Outputs	Strategies	Lead Institution
Construction of Urban Water Supply and Sanitation Projects	<ul style="list-style-type: none"> Improved water supplies and waste water disposal in towns and cities. 	<ul style="list-style-type: none"> Harare Water Supply Project Completed Harare water supply and waste water treatment plants rehabilitated. Masvingo, Chitungwiza, Kwekwe, Chegutu, Bindura, Chipinge, Chiredzi, Chivhu, Gokwe, Gwanda, Hwange, Karoi, Mutoko, Mvurwi, Plumtree, Rusape, Shurugwi, Zvishavane, Bulawayo, Gweru, Kadoma, Chinhoyi, Norton, Beitbridge and Kariba water supply and waste water treatment plants rehabilitated 	<ul style="list-style-type: none"> Transfer responsibility of service provision to local authorities. 	<p>Ministry responsible for Water Resources Development</p>

Source: Zim Asset

2.3.2 Development Plan for Sanitation

2.3.2.1 National Water Policy, 2012

Government of Zimbabwe, through the Ministry of Water Resources Development and Management (currently Ministry of Environment, Water and Climate) supported by the World Bank (WB) and United Nations Children Fund (UNICEF) reviewed the whole of the water sector and developed a new National Water Policy (NWP) in August 2012. The latest development policy on water sector is the National Water Policy.

(1) Current Status and Issues

The national policy describes the current condition of urban water supply and sanitation in Chapter 5. In this section, historical characteristics of the water sector in Zimbabwe is explained as follows:

Historically, Zimbabwe's Urban WSS (Water Supply and Sanitation) services development has been driven by principles of high service levels and standards, and universal access for all, making them unique in Africa. It was mandatory that construction and legal occupation of urban houses be preceded by the development of road, water supply and sewerage services. This approach ensured that service delivery kept pace with housing development. Cross-subsidies from wealthier sections

of urban areas to poorer sections advanced principles of universal access to all. However, like all other sectors of Zimbabwe's economy, urban water supply and sanitation services have faced serious challenges over time due to population pressure and economic challenges of the past decade. The challenges led to highly degraded services that pose a serious health threat to urban inhabitants. This has resulted in more than 4000 deaths related to cholera, inadequate and erratic water supply and sanitation, poor quality of water provided to residents and dire state of infrastructure.

The following are shown as the examples for deteriorated urban water supply and sanitation services in Zimbabwe:

- Access to urban water supply decreased from 97% in 1990 to 60% in 2008,
- Access to urban sanitation decreased from 99% in 1990 to 40% in 2008,
- Hourly availability of water dropped from 24hrs supply to between 6 and 12 hours per day, and
- Costs exceeded tariffs in 50% of urban local authorities as of 2012.

The reason for shortage of budget to operate and maintain water and sanitation services are described as follows:

Increasingly, revenues from water services have been used to cover the costs of a wide range of non-water services instead of being used to maintain water infrastructure, leading to a progressive collapse in water services. Cost recovery has dropped significantly due to billing and collection challenges, including faulty or non-existent meters and reduced willingness and ability to pay for unreliable and low quality services. Low revenues have resulted in large financial deficits in funding operation and maintenance, rehabilitation and the expansion of infrastructure.

In order to address this condition, the proposed policy change is as follows:

This situation has to be rectified as a matter of urgency. It calls for bold decisions on whether it is practicable to maintain the high standards of urban housing services while at the same time achieving universal access for all under the current economic circumstances. The evidence of the past decade indicates that it is not possible to simultaneously maintain high standards of delivery and universal access. The first option is to maintain high standards and call for a moratorium on new housing developments that do not meet existing standards, during the 5-year recovery period at the risk of failing to ensure universal access to all.

The second option is to prioritize universal access for all over high standards during the recovery period, followed by a full resumption of high standards during normal development phase.

(2) National Water Policy Details

Policy on urban water supply and sanitation comprises five subjects, roles of central government and local authorities, service authorities and service providers, targets, technical norms and standards, Recycling and re-use of water, and financing. The followings are the summary of detailed policy.

1) Roles of Central Government and Local Authorities

In 2005, Government shifted urban water supply from Urban Local Authorities (ULAs) to ZINWA (Zimbabwe National Water Authority). Central Government will now revert to supporting the delivery of services by ULAs as a devolved function. Central Government will play the role of regulator.

2) Service Authorities and Service Providers

Designation of ULAs as Water Service Authorities: In terms of this policy, Urban Authorities are designated as Water Services Authorities who have a duty to ensure efficient, affordable and sustainable access to water services for all their current and potential consumers.

Designation of Water Service Providers: The responsibility at operational level of providing water supply and sanitation services may be delegated by a ULA to a designated Water Services Provider which is a legal entity capable of carrying out water supply and sanitation services on behalf of the ULA. Service Authorities will have the power and authority, to enter into contractual agreements with Service Providers if they do not supply the services themselves. A Service Provider could be ZINWA/NWSSU (National Water Service and Sanitation Utility), a private sector company or any other legal entity.

3) Targets, Technical Norms and Standards of Urban WSS

In order to ensure universal access to water supply and sanitation services for all urban residents the normal high service standards will be temporarily relaxed during the recovery period. The relaxation will include permitting certain onsite sanitation technologies for plots of a minimum prescribed size to allow housing delivery to recover. This will be followed by a full resumption of high standards once the situation is normalized.

There will be no compromise on the quality of water provided for human consumption. Water quality which does not meet the World Health Organization Guidelines at the tap will not be accepted.

4) Recycling and Re-use of Water

The government will promote the exploitation of alternative sources of water such as rainwater harvesting, reuse of water, recycling and reclamation. Relevant research will be promoted as and where appropriate.

5) Financing

Water Service Authorities and Water Service Providers will be required to be transparent and legally accountable to consumers. Revenue derived from water sales will be applied to the costs of providing water services in order to maintain consumer confidence and not compromise cost recovery and the ‘user pays principle’. Tariffs will be set to achieve full cost recovery in the normalized phase. The long-term financial viability of service provision will depend largely on the financial well-being of consumers and their ability to pay in full for the services their use.

2.3.2.2 Results Based Strategic Plan 2017-2020, City of Harare

In order to correlate mid-term plan and yearly performance-based budget, mid-term plan including related sectors for local government is formulated in Zimbabwe. To this end, Results Based Strategic Plan (2017 – 2020) which contained water supply and sewerage was established in the City of Harare.

Targets of strategy for water supply is shown in “19. Goal” as follows:

Ref	Goals	Weight	Targets					Responsible Division/s
			Base	2017	2018	2019	2020	
G6	To increase access to potable water from the current 40% to 75% by Dec 2020	5%	40%	55%	65%	72%	75%	Water production

In “20. Strategy, Assumption and Risk” the following matrix is illustrated.

Period	Strategies	Assumptions	Risks
Key Result Area 1: SERVICE DELIVERY			
Goal 6 : To increase access to potable water from the current 40% to 75% by Dec 2020			
Objectives:			
1. To increase water production from the current 400ML/day to 580 ML/day by December 2017			
2. To reduce non-revenue water from the current 61% to 48% by December 2017			
Budget Year (2017)	3. Optimize water production systems (complete plant rehabilitation works-treatment units, pumping plant and equipment) 4. Develop and implement a rehabilitation plan	5. Adequate raw water available. 6. Plant and infrastructure available. 7. Resources available (financial, human, skills) 8. Availability of partners	9. Climate change and variability. 10. Obsolete plant and equipment. 11. Shortage of resources (financial, skills). 12. Polluted raw water sources. 13. Contractors non performance
	14. Optimise water transmission and distribution systems (study of water distribution network, replacement of aged pipes, pressure management and network zoning). 15. Develop a water distribution plan 16. Universal metering	17. Willing and capable partners available. 18. Captive market available – high and increasing demand for services. 19. Industry and commerce aware of sustainable environmental management. 20. Plant and equipment availability 21. Stakeholder cooperation	22. Unplanned settlements in water source catchments. 23. Illegal connections and water thefts. 24. Absence of research and development. 25. Technology deficit. 26. Resistant stakeholders
	27. Implementation water conservation programmes (water conservation campaigns, installation of flow limiters)	28. Water conservation policies and programs in place.	29. Non cooperating stakeholders.
	30. Engagement of stakeholders	31. Willing stakeholders.	32. stakeholders priorities
	33. Engage development partners (PPPs – funding) 34. Update customer base 35. Project investment plan for new water sources and infrastructure 36. Develop and implement a water supply infrastructure augmentation plan 37. Update of new developments	38. Enabling policies and environment. 39. Functional industry and commerce. 40. Technology available. 41. Economy performing well. 42. Customers willing to pay. 43. Updated customer base 44. New water source available 45. Stable currency	46. Inconsistent and unfavourable policies. 47. Bureaucracy. 48. Company closures 49. Customer resistance 50. Exorbitant costs 51. Non performing contractors
	52. Develop and implement a regulatory framework for water.	53. Policies available	54. Inconsistent policies
	55. 100% metering (metering state study, assessment, prepaid meters, pilot conventional meters, smart prepaid metering project.	56. Customers willing to pay. 57. Technology available 58. Funding available	59. Contractors' non-performance. 60. Industry and commerce polluting. customer priorities 61. funding shortages
	2018 -2020	62. Optimize water production systems	63. Raw water available. 64. Plant and infrastructure available. 65. Resources available (financial, human, skills)
70. Optimize water		71. Willing and capable	74. Unplanned settlements in

	transmission and distribution systems (replacement of aged pipes, pressure, management and network zoning, active leak detection)	partners available. 72. Captive market available – high and increasing demand for services. 73. Industry and commerce aware of sustainable environmental management.	water source catchments. 75. Illegal connections and water thefts. 76. Absence of research and development. 77. Technology deficit.
	78. Implement water conservation programmes	79. Water conservation policies and programs in place.	80. Non cooperating stakeholders.
	81. Reduction of non-revenue water	82. Willing stakeholders.	83. Unwilling stakeholders

2.3.3 Laws Relating to Sanitation and Hygiene in Zimbabwe

There are 16 laws pertinent to sanitation and hygiene in Zimbabwe as follows:

1. Constitution of Zimbabwe (2013)
2. The Water Act (Chapter 20:24)
3. The Rural District Councils Act (Chapter 29:13)
4. The Communal Lands Act (Chapter 20:04)
5. The Public Health Act (Chapter 15:09).
6. The Provincial Councils and Administration Act (Chapter 29:11).
7. The Environmental Management Act (Chapter 20:27).
8. Urban Councils Act (Chapter 29:15).
9. The Regional, Town and Country Planning Acts (Chapter 29:12).
10. The Traditional Leaders Act (Chapter 29:17).
11. The Zimbabwe National Water Authority Act (Chapter 20:25)
12. The Housing Standards Control Act (Chapter 29:08)
13. The Housing and Building Act (Chapter 29:07)
14. Older Persons Act (Chapter 17:11)
15. Disabled Persons Act (Chapter 17:01)
16. Civil Protection Act (Chapter 10:06)

Among these laws, The Water Act, The Environmental Management Act and the Zimbabwe National Water Authority Act are essential for water administration.

The Water Act	
Objectives	
<ul style="list-style-type: none"> • To provide for the development and utilisation of the water resources of Zimbabwe • To provide for the establishment, powers and procedures of catchment councils and subcatchment councils • To provide for the grant of permits for the use of water • To provide for the control of the use of water when water is in short supply • To provide for the acquisition of servitudes in respect of water • To provide for the protection of the environment and the prevention and control of water pollution • To provide for the approval of combined water schemes • To provide for matters relating to dam works 	
Contents	
Part I:	Preliminary
Part II:	Water resources planning and development
Part III:	Establishment, functions and procedures of catchment councils
Part IV:	Use of Water
Part V:	Water shortage areas
Part VI:	Water quality control and environment protection

Part VII:	Servitude in respect of water
Part VIII:	Combined water schemes
Part IX:	Safety of dams
Part X:	Appeals
Part XI:	General
Part XII:	Repeals and savings
The Environmental Management Act	
Objectives	
<ul style="list-style-type: none"> • To provide for the sustainable management of natural resources and protection of the environment • The prevention of pollution and environmental degradation • The preparation of a National Environmental Plan and other plans for the management and protection of the environment • The establishment of an Environmental Management Agency and an Environment Fund • To amend references to intensive conservation areas and committees and associated matters in various Acts 	
Contents	
Part I:	Preliminary
Part II:	Principles of environmental management and functions of minister
Part III:	National environmental council
Part IV:	Environmental management agency
Part V:	Environmental management board
Part VI:	Staff of agency
Part VII:	Financial provisions relating to agency
Part VIII:	Environment fund
Part IX:	Environment quality standards
Part X:	Environmental plans
Part XI:	Environmental impact assessments audit and monitoring of projects
Part XII:	Conservation and improvement of environment
Part XIII:	Control of invasive alien species
Part XIV:	Appeals
Part XV:	International obligations and commitments
Part XVI:	General
Zimbabwe National Water Authority Act	
Objectives	
<ul style="list-style-type: none"> • To establish the Zimbabwe National Water Authority and to provide for its functions • To provide for the appointment and functions of a board of the Authority • To provide for the raising of charges for the provision of water and other services by the Authority • To provide for the funds of the Authority • To provide for the imposition and collection of a water levy 	
Contents	
Part I:	Preliminary
Part II:	Zimbabwe National Water Authority
Part III:	Issue of shares and securities by authority
Part IV:	Financial provisions relating to authority
Part V:	Water fund
Part VI:	General

2.3.4 Activity of Donors and International Organization in the Sanitation Sector

2.3.4.1 African Development Bank (AfDB)

Assistance to Zimbabwe by AfDB is through African Water Facility (AWF) and Zimbabwe Multi-Donor Trust Fund (Zim-Fund). Table 2.3.2 shows the progress of assistance to Zimbabwe by AfDB.

Table 2.3.2 Progress of Assistance to Zimbabwe by AfDB

	Progress
Jan. 2010	Agreement for Emergency Rehabilitation of Water Supply and Sewage System in Chitungwiza between AWF and Government of Zimbabwe including Chitungwiza
May. 2010	Establishment of Zim-Fund
Apr. 2011	Approval by Zim-Fund for first stage of Urgent Water Supply and Sanitation Rehabilitation Project (UWSSRP)
Jan. 2013	Completion of Emergency Rehabilitation of Water Supply and Sewage System in Chitungwiza
Sept. 2018	Scheduled completion of Urgent Water Supply and Sanitation Rehabilitation Project (UWSSRP)

Source: JST based on the documents by AfDB

Remark: * Additional Financing Grant Proposal, Sept. 2015, AfDB

(1) Emergency Rehabilitation of Water Supply and Sewage System in Chitungwiza

1) African Water Facility (AWF)

The African Water Facility (AWF) is a multilateral fund that provides grants and technical assistance to enable governments, NGOs and private-public partnerships to secure investments and implement sustainable water projects throughout Africa.

Hosted by the AfDB, the AWF was created in May 2004 by the African Ministers' Council on Water (AMCOW) in response to the need to catalyse the development of the water sector, by increasing the number and the quality of sustainable water projects to meet water development goals throughout the continent.

A proposal from the Chitungwiza Municipality was submitted to the African Water Facility (AWF) to support its ailing water and sanitation systems. The AWF responded with a mission in May 2008 to follow up these proposals and to prepare and appraise a suitable project for AWF financing. Agreement was reached between AWF and the Zimbabwean authorities in Feb. 2010.

2) Purpose

The project was aimed at:

- (a) Stabilising the deterioration in the provision of water and sanitation services in the Municipality of Chitungwiza and
- (b) Enhancing institutional capacity for efficient and sustainable operation and management of the water supply and sanitation services.

3) Developed Facilities by the Project

The project consisted of the following components:

1. Pump Station No 1
2. Pump Station No 2:
3. Pump Station No 3
4. Trunk Sewers (sewers 2,6,7,8,9,10,11,12,13 and 14)
5. Water Pipes, Valves, Fittings, Meters
6. Boreholes
7. Equipment Supply

(2) Zimbabwe Multi-Donor Trust Fund (Zim-Fund) and Urgent Water Supply and Sanitation Rehabilitation Project (UWSSRP)

1) Zim-Fund

The African Development Bank was requested by a group of donors to establish and administer the (the “Zim-Fund”). The Bank was designated administrator of the Zim-Fund, with the endorsement of the Government and the Donor Community. The Zim-Fund was established on 31st May 2010. Negotiations between the Bank and Donors on the modalities to establish the Fund were concluded in July 2010.

2) Purpose

The purpose of the Zim-Fund is to contribute to early recovery and development efforts in Zimbabwe by mobilizing donor resources and promoting donor coordination in Zimbabwe. The current duration of the Zim-Fund is five years, over the period 2010-2015.

The thematic scope of the Zim-Fund will focus initially on infrastructure investments (rehabilitation and/or construction works) in the areas of water & sanitation and energy. Critical to the achievement of these goals are the following:

- (i) Financial and technical support to activities that are consistent with the recovery priorities of the Government.
- (ii) Mobilization of pooled donor resources based on a common understanding of the country’s recovery needs and linked to effective coordination and complementarity with other related activities funded outside the trust fund and.
- (iii) Efficient monitoring and evaluation of outputs and impact. In line with the evolving Government needs, the scope can be reviewed and adjusted by the Project Oversight Committee (POC).

3) Urgent Water Supply and Sanitation Rehabilitation Project (UWSSRP)

The first phase of the Urgent Water Supply and Sanitation Rehabilitation Project (UWSSR, US\$ 29.651 million) was approved to support urgent rehabilitation works - restoration and stabilization of water supply and sanitation services in the Municipalities of Harare, Chitungwiza, Mutare, Chegutu, Masvingo and Kwekwe, targeting a total population of approximately 4.15 million people.

A second phase of this Project was formulated to further the benefits and impacts of the first phase of the Project and include aspects not included in the first phase of the Project. The proposed second phase Project will be implemented in Harare, Chitungwiza, Ruwa and Redcliff serving an estimated population of 1.9 million. The total Project cost is estimated at USD 35.99 million to be financed by Zim-Fund in two stages. The first stage (US\$ 19.84 million) will focus on Harare and preparatory activities for the three other towns.

The project consists of the following four components:

Component 1 - Water Supply and Sewerage: Water supply f pump stations and equipment, rehabilitation of bulk water and domestic metering, repair and replacement of distribution systems, water supplies for vulnerable communities, and operation and maintenance equipment.

Sewage pumping stations and equipment (Harare, Chitungwiza, Ruwa and Redcliff), rehabilitation of outfall and trunk sewers (Harare, Chitungwiza, Ruwa), rehabilitation/replacement of sewer lines (Harare, Chitungwiza, Ruwa and Redcliff), and operation and maintenance equipment.

Component 2 - Hygiene Promotion: This component will address the specific hygiene needs of vulnerable communities most affected by poor water and sanitation services.

Component 3 - Institutional Capacity Building: This component will carry out training that contributes to improvement of service delivery and streamline in the works packages and goods supply.

Component 4 - Project Management and Engineering Services: Under this component, the project will engage the services of Project Implementing Entity (IE). The IE will prepare the detailed scope of works/TORs for all components, supply the necessary details to the Procurement Agent for tendering, and supervise the implementation.

Chitungwiza Municipality engaged a contractor to rehabilitate and upgrade the town's sewer system in December, 2016 under the ZimFund Project Phase 2. The project duration was 12 months and the project included spot-rehabilitation and upgrade of water reticulation as well as rehabilitation and upgrade of the old sewers.

4) Achievement

The size of the Fund is determined by the willingness of development partners to contribute to it over time. To date, donors' commitments to the Zim-Fund, in various currencies, add up to an equivalent of USD 144.5 million, out of which an actual amount of about USD 140.80 million has been released to the Fund's account as at end November 2015. In line with Zim-Fund objectives, the amount mobilised has been allocated to finance the Urgent Water Supply and Sanitation Rehabilitation Project (UWSSRP) and Emergency Power Infrastructure Rehabilitation Project (EPIRP). Table 2.3.3 shows the amount of facilities improved in UWSSRP Phase 1.

Table 2.3.3 Improved Facilities by UWSSRP Phase 1

	Target	Achievement	Progress
Number of water treatment works rehabilitated	6	6	100%
Number of clean water pump units replaced (to distribution system)	12	12	100%
Number of raw water pumping units replaced	4	4	100%
Number of water reservoirs built	1	1	100%
Number of waste water treatment works rehabilitated/replaced	9	9	100%
Number of waste water effluent Pumping units rehabilitated/replaced	13	13	100%
Number of raw sewage pumping units rehabilitated/replaced	13	13	100%
Km of rehabilitated sewer line	5.16	5	103%
km of new trunk sewer constructed	12.5	12.5	100%

Source: Evaluation of Outcomes and Impact of Zim-Fund Phase I Urgent Water Supply and Sanitation Rehabilitation Project (UWSSRP) and Emergency Power Infrastructure Rehabilitation Project (EPIRP), 2017, AfDB

5) Development/improvement in Chitungwiza

Hereafter rehabilitation of pump stations and sewerage pipes is expected, although rehabilitation of the wastewater treatment plant is not planned. This rehabilitation is planned to cover Ticor pump station, 500 of manhole and 5km of sewer pipes. Location of the 5km sewage pipe is not clear.

2.3.4.2 World Bank (WB)

(1) Zimbabwe Analytical Multi Donor Trust Fund (A-MDTF)

The objectives of the Zimbabwe Analytical-Multi Donor Trust Fund (A-MDTF) were to improve the capacity and accountability of the Government of Zimbabwe, and to enable the World Bank and international donors to remain abreast of the development challenges in Zimbabwe. By achieving these objectives, the Fund donors aimed to facilitate dialogue and reform policies that would lead to increased economic growth and stability in Zimbabwe. To achieve its goals, A-MDTF funded analytical studies, technical assistance and expert placements, data and information management

system support, and knowledge exchanges for Government staff. Activities are carried out across three thematic areas, including economic management and governance, agriculture, and infrastructure. A-MDTF was approved in February 2008 and closed in 2014. The A-MDTF was initially supported by 12 donors¹ administered by the World Bank.

(2) Greater Harare Water and Sanitation Strategic Plan, 2014

1) Background

Under the UWSSRP, the Zim-Fund was financing consultancy services for the development of Medium to Long Term Water Supply and Sewerage Investment Plans in Harare, Chitungwiza, Mutare, Masvingo, Kwekwe and Chegutu.

On the other hand, The City of Harare requested the World Bank to support the development of a water supply and sanitation strategic plan for Greater Harare - the metropolitan area that includes Harare and the satellite towns of Chitungwiza, Epworth, Ruwa and Norton. The purpose of the strategic plan was to assess the infrastructure requirements for the Greater Harare area as a single water and wastewater infrastructure system that can be managed as one entity. The World Bank entrusted the development of the Greater Harare Water and Sanitation Investment Plan – a key input to the strategic plan - in parallel to the ongoing study financed by the Zim-Fund.

The Zim-Fund financed the study that generated the Harare and Chitungwiza input data, while the MDTF financed the additional investigations in Ruwa, Epworth and Norton and the development of the integrated water and sanitation investment plan for Greater Harare.

2) Water Demand and Wastewater Projection

In chapter 3 of the report, waste water flow by town is estimated for 2020 and 2030 as shown in Table 2.3.4. Table 2.3.5 shows the design capacity of existing wastewater treatment plants.

Table 2.3.4 Water Flow Projection in Greater Harare

City/Town	Present	2020	2030
Harare	182,354	191,270	242,468
Chitungwiza	37,872	40,985	55,328
Epworth	-	-	7934
Norton	3,805	8,743	13,266
Ruwa	9,221	18,416	25,801
Total	233,251	266,712	344,798

Unit: m³/day

Source: Greater Harare Water and Sanitation Strategic Plan, 2014

Table 2.3.5 Design Capacity of Existing Wastewater Treatment Plants

Plant	Type	Design Capacity (M ³ /day)
Harare		
Firle	Conventional+BNR	144,000
Crowborough	Conventional+BNR	54,000
Marlborough	Stabilisation ponds	2,000
Hatcliffe	BNR	5,000
Donnybrook	Stabilisation ponds	2,300
Harare Total		207,300
Chitungwiza	Conventional+BNR	55,000
Epworth	None	
Norton	Conventional	8,000
Ruwa	Stabilisation ponds	4,000

¹ AusAID, CIDA, DANIDA, DFID, DGIS, EU, FINNIDA, BMZ (GIZ), NORAD, SIDA, USAID & The World Bank

BNR: Biological Nutrient Removal
Source: Greater Harare Water and Sanitation Strategic Plan, 2014

3) Assessment of Existing Water and Sewerage Infrastructure

In Chapter 4, assessment of existing water and sewerage infrastructure was conducted. The following is the description on sewerage infrastructure in Chitungwiza:

The wastewater infrastructure in Chitungwiza consists of both on-site and off-site sanitation systems. Building and housing guidelines, by-laws and standards stipulate that Low Density properties depending on soil conditions are not connected to the sewerage system. They are provided with on-site septic tanks and soak-away pits. High and Medium density properties, on the other hand, are all connected to the sewerage system. The sewerage system in Chitungwiza consists of laterals, collector mains, pump stations and trunk mains that collectively convey wastewater to the Zengeza WWTW.

Result of assessment of sewerage infrastructure in Chitungwiza is summarised as Table 2.3.6.

Table 2.3.6 Sewerage Infrastructure Assessment in Chitungwiza

Sewerage Infrastructure	
	<ul style="list-style-type: none"> • Zengeza WWTW are in poor condition, the BNR plant is not operational. • Sewerage pump stations are in a poor state, AC sewer reticulation pipes are in fairly good condition; • Old concrete pipes are collapsing in some areas.

Source: Greater Harare Water and Sanitation Strategic Plan, 2014

4) Proposed Investment Measures

The report proposed measures for major rehabilitation investment are as shown in Table 2.3.7.

Table 2.3.7 Proposed Investment Measures for Sewerage in Chitungwiza

Chitungwiza	
Sewerage Service Improvement	<ul style="list-style-type: none"> • Rehabilitation of Zengeza WWTW modified conventional works • Rehabilitation of Zengeza WWTW- BNR System • Rehabilitation of Tilco sewage pump station • Replacement/upgrading of 2.1 km of existing sewer reticulation and transmission network
Extension of Sewerage Services	<ul style="list-style-type: none"> • Installation of 22 km of new sewer trunk mains • Extension of sewer reticulation system in new development areas (49 km of sewers and 5,800 service connections in the medium term; 222 km of sewers and 26,000 service connections in the long term).

Source: Greater Harare Water and Sanitation Strategic Plan, 2014

5) Investment Cost Estimates

For the investment, the study gave the priority to three categories:

- First priority: investment measures aimed at ensuring that the utility meets its basic public health and service obligations by getting the most out of the existing facilities.
- Second priority: measures that are essential for safeguarding the health of the population and the environment (wastewater treatment and disposal).
- Third priority: measures that will respond to the increasing demand for services due to population and economic growth.

Given above priority, projects for sewerage in Chitungwiza by priority is shown in Table 2.3.8.

Table 2.3.8 Projects for Sewerage in Chitungwiza by Priority

Priority 1	Priority 2	Priority 3
<ul style="list-style-type: none"> • Rehabilitation of storage tanks and pump stations • Accompanying measures and institutional support 	<ul style="list-style-type: none"> • Rehabilitation of Zengeza WWTW • Rehabilitation of sewage pump stations • Rehabilitation/replacement of existing sewer network 	<ul style="list-style-type: none"> • Connection to the Harare South WWTW • Expansion of services to new development areas

Source: Greater Harare Water and Sanitation Strategic Plan, 2014

(3) Zimbabwe National Water Project

The proposed project development objective is to improve access and efficiency in water services in selected growth centers and to strengthen planning and regulation capacity for the water and sanitation sector. The selected growth centers are: Guruve, Gutu, Lupane, Madziwa, Mataga, Nembudzia, and Zimunya. The project comprised of the following three components:

Component 1: Growth Center Water and Sanitation Improvements
<ul style="list-style-type: none"> • This component will finance investments in water supply and sanitation rehabilitation and upgrading in 7 growth centers. • Investments will include expansion and rehabilitation of water treatment works, boreholes, transmission mains, storage and service reservoirs, distribution system, connections and meter installation and replacement. • The works will also include minimal works to restore operation of the wastewater treatment systems in the project areas. • The works planned on wastewater treatment systems will include clearing and desludging, repairs of inlet works and fencing and operators facilities.
Component 2: Technical Assistance
<p>Sub-component 2.1: National Water Resources Master Plan This component aimed to develop a national water resources master plan. The Master Plan will build on the National Water Master Plan of the early 1990s and the subsequent Catchment Outline Plans developed in the mid-2000s.</p> <p>Sub-component 2.2: TA for a Water Services Regulator The Government has decided to set up a water and wastewater services regulatory authority and has approved a Cabinet Memorandum in April 2015 to this effect. Bank support will be made through the proposed Project and through TA from the Water and Sanitation Program.</p> <p>Sub-component 2.3: TA to Local Authorities (1) TA to facilitate agreement between Local Authorities and ZINWA in regard to water services (2) Promoting sanitation improvements in small towns.</p> <p>Sub-component 2.4: Institutional strengthening of ZINWA In 2014, at the request of ZINWA, the Bank financed a skills audit and strategic gap analysis to identify key areas to strengthen ZINWA.</p> <p>Sub-component 2.5: Training MEWC will develop a training plan, together with ZINWA and other relevant agencies, for support under the Project.</p>
Component 3: Project Management
ZINWA will set up a Project Implementation Unit (PIU) to manage the project. The PIU will be staffed with 5-7 staff, including a Project Manager and will include competence in engineering, procurement, financial management, safeguards and monitoring and evaluation.

2.3.4.3 African Minister's Council on Water (AMCOW)

The African Ministers' Council on Water (AMCOW) was formed in 2002 primarily to promote cooperation, security, social and economic development and poverty eradication among member states through the effective management of the continent's water resources and provision of water supply services. Member states are 53 African countries.

AMCOW issued a document titled "Water Supply and Sanitation in Zimbabwe" in 2011 which analyzed current status of water sector in Zimbabwe. With regard to urban sanitation and hygiene sector, the document summarises the current status as follows:

The urban sanitation subsector in Zimbabwe once had one of the highest coverage levels in Africa, including for networked sewerage. The economic collapse has led to a severe decline in services, reflected in both data sets, though the government estimates of coverage present a far more rapid deterioration. Lack of water flow causes frequent sewer blockages. Densification means that many more households use the same infrastructure. Many wastewater treatment plants are now dysfunctional.

CSO2 (The second round of Country Status Overviews) estimates show a massive capital investment gap of US\$273 million per year, relative to the US\$325 million per year required to meet national targets, requiring a six-fold CAPEX (Capital Expenditure) increase to rehabilitate neglected services. Current anticipated CAPEX has fallen to US\$51 million,

For the priority actions for urban sanitation and hygiene, the followings are proposed:

Alternatives to high-cost sewerage-only policy: A specific USH policy challenge facing Zimbabwe is whether it is realistic to have a goal of 100 percent sewerage coverage in urban areas. If not, policies on lower-cost approaches need to be considered. Lower-cost technologies would decrease investment costs for the local authority and the consumer, and provide services that are easier to manage, with less environmental risk when sewage treatment fails. In any case, the selection of wastewater treatment options should take sustainability and environmental impact more centrally into consideration. Also, at present some cities have by-laws prohibiting the construction of pit latrines in urban areas. Proposed policy changes would need consultation with consumers.

Financing strategy for urban sanitation: A review is needed of strategies to refinance the USH sector. Options such as specific sanitation levies or sale of wastewater for irrigation might be considered.

Enforcement of environmental and public health controls: Zimbabwe has the environmental and public health legislation in place to hold councils to account, although monitoring and enforcement is weak.

Specialist expertise: The USH sector has suffered from loss of skills. A specific capacity-building initiative is needed to attract back, or buy-in, the specialist engineering expertise needed to rehabilitate and manage sewerage and wastewater treatment facilities in Zimbabwe's cities and towns.

2.4 Institution for sewerage sector in Zimbabwe

2.4.1 Progress of Decentralization in sewerage sector

1) Legal aspect

a) Constitution

First, the Constitution in 2013 has some descriptions about governmental decentralization.
CHAPTER 14

PROVINCIAL AND LOCAL GOVERNMENT covers a specific content as below.

PREAMBLE

PART 1 PRELIMINARY

264. Devolution of governmental powers and responsibilities.

265. General principles of provincial and local government.

266. Conduct of employees of provincial and local governments.

PART 2 PROVINCES AND PROVINCIAL AND METROPOLITAN COUNCILS

267. Provinces and districts of Zimbabwe.

268. Provincial councils.

269. Metropolitan councils.

270. Functions of provincial and metropolitan councils.

271. Committees of provincial councils.

272. Chairpersons of provincial councils.

273. General provisions relating to provincial and metropolitan councils.

PART 3 LOCAL GOVERNMENT

274. Urban local authorities

275. Local authorities for rural areas.

276. Functions of local authorities.

277. Elections to local authorities.

278. Tenure of seats of members of local authorities.

279. Procedure of local authorities.

Article 276 especially is of high importance showing the role of the local government as this gives them permission to collect necessary fees to run the local authorities and the rights on power provision. The specific content is written as below.

276 Functions of local authorities

(1) Subject to this Constitution and any Act of Parliament, a local authority has the right to govern, on its own initiative, the local affairs of the people within the area for which it has been established, and has all the powers necessary for it to do so.

(2) An Act of Parliament may confer functions on local authorities, including—

(a) a power to make by-laws, regulations or rules for the effective administration of the areas for which they have been established;

(b) a power to levy rates and taxes and generally to raise sufficient revenue for them to carry out their objects and responsibilities.

In Part 2, Harare Metropolitan Province was established in Article 267 as the basic administrative unit for local administrative revenue management, and administrative services. Here, Provincial Councils, and the administrative management method based on the councils are clearly described. Chitungwiza Municipality would also be included in this state, and would be administered in accordance to this constitution. However, according to the interview with MoLG,

in practice, state-level management has not been implemented so far, and it was confirmed that Harare city, Chitungwiza Municipality is a unit of local administration.

Additionally, there are current preparations for a new law to switch some operations from the city to province management, and there is possibility that some operations may change from the city to the provincial administrative unit in the future.

b) Urban Councils Act (2008)

Details of contents and authority of residents' services in local governments mentioned in the Constitution are embodied in the Urban Council Act. In particular, the sewerage service is described in Chapter 12 and includes the following contents.

PART XII

SEWERAGE AND DRAINAGE

168. Powers of council in regard to sewerage and drainage.
169. Notice of work on public sewers or public drains.
170. Notice of construction of sewage works outside council area.
171. Objection to proposed sewage works.
172. Owners entitled to connect to public sewer.
173. Council may require connection to public sewer, provision of septic or conserving tank and treatment of trade effluent.
174. Construction, connection and extension of private sewers.
175. Combined private sewers.
176. Responsibility for septic or conserving tank, private sewer or combined private sewer.
177. Council may render services.
178. Council may finance water-borne sanitation and sanitary fittings.
179. Recovery of costs by instalments.
180. Protection of public sewers and public drains.
181. Control of public streams.
182. Saving of rights under contract or servitude.

2) Financial aspect

As mentioned above, the residents' services including the sewerage administration in Zimbabwe are decentralized by local governments under the Constitution. This is reflected in the financial aspect. According to the interview to MoLG, there are no grants, subsidies, etc. from the central government to the local government in the relationship between central and local finance. Therefore, local governments are required to operate with almost complete independent profit system including self-financing of financial resources. This could be confirmed by the fact that almost no financial transfer from the central government is written in the central government budget, and the financial statement of Chitungwiza Municipality as subsidies. The details of this is described in Chapter 3 of this report. Also, there is no prospect that this policy would change in future.

For these reasons, Chitungwiza Municipality needs to secure funding for sewage treatment plants, including facility renovation and maintenance. However, although capital budget may be

contributed in the form of loans from the Public Sector Investment Program (PSIP), expenses for operation and maintenance cannot be met by this loan.

According to the interview with the Ministry of Finance, there are no particular PSIP contribution requirements. Whether the loan will be provided or not will be individually and specifically studied depending on the availability and content of funds at the time of application. In addition, all conditions such as limit amount, interest rate, repayment period, etc. depend on consultation with local governments.

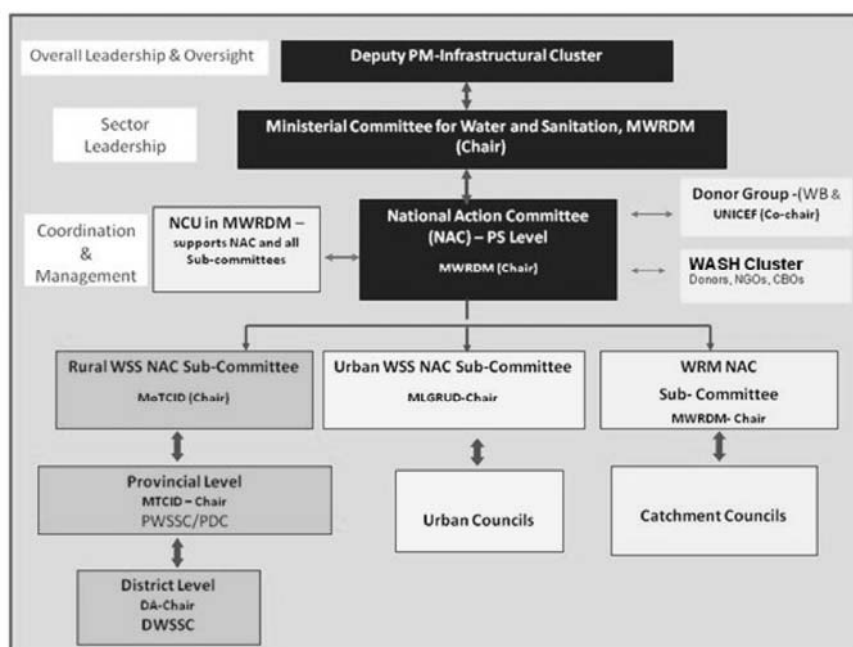
2.4.2 National Institutions for Sanitation and Hygiene Sector

2.4.2.1 National Action Committee (NAC)

Traditionally the National Action Committee (NAC) for Water, Sanitation and Hygiene's (WASH) domain and mandate had been limited to Rural WASH issues only. However, this has long since been expanded to cater for all the three WASH sub-sectors of Rural WASH, Urban WASH and Water Resources Management. This re-branded National Action Committee for the WASH Sector was born in October 2010.

The abovementioned new arrangement has provided for clearer sector leadership under Ministry of Water Resources Development and Management (MoWRDM) and has promoted effective coordination of all sector players and their interventions.

As an Inter-Ministerial steering body which brings together all relevant Ministries and Government Departments, NAC has a mandate to coordinate and oversee the development and management of Water, Sanitation and Hygiene activities in the country. The main NAC is made up of Permanent Secretaries from affiliated Ministries chaired by the Permanent Secretary in the Ministry of Water Resources Development and Management. The main NAC superintends over the three sub-sector committees of Rural WASH, Urban WASH, and Water Resources Management. The National Coordination Unit (NCU) is a full time secretariat of the NAC housed in the Ministry of Water Resources Development and Management. Figure 2.4.1 shows the organization structure of NAC.



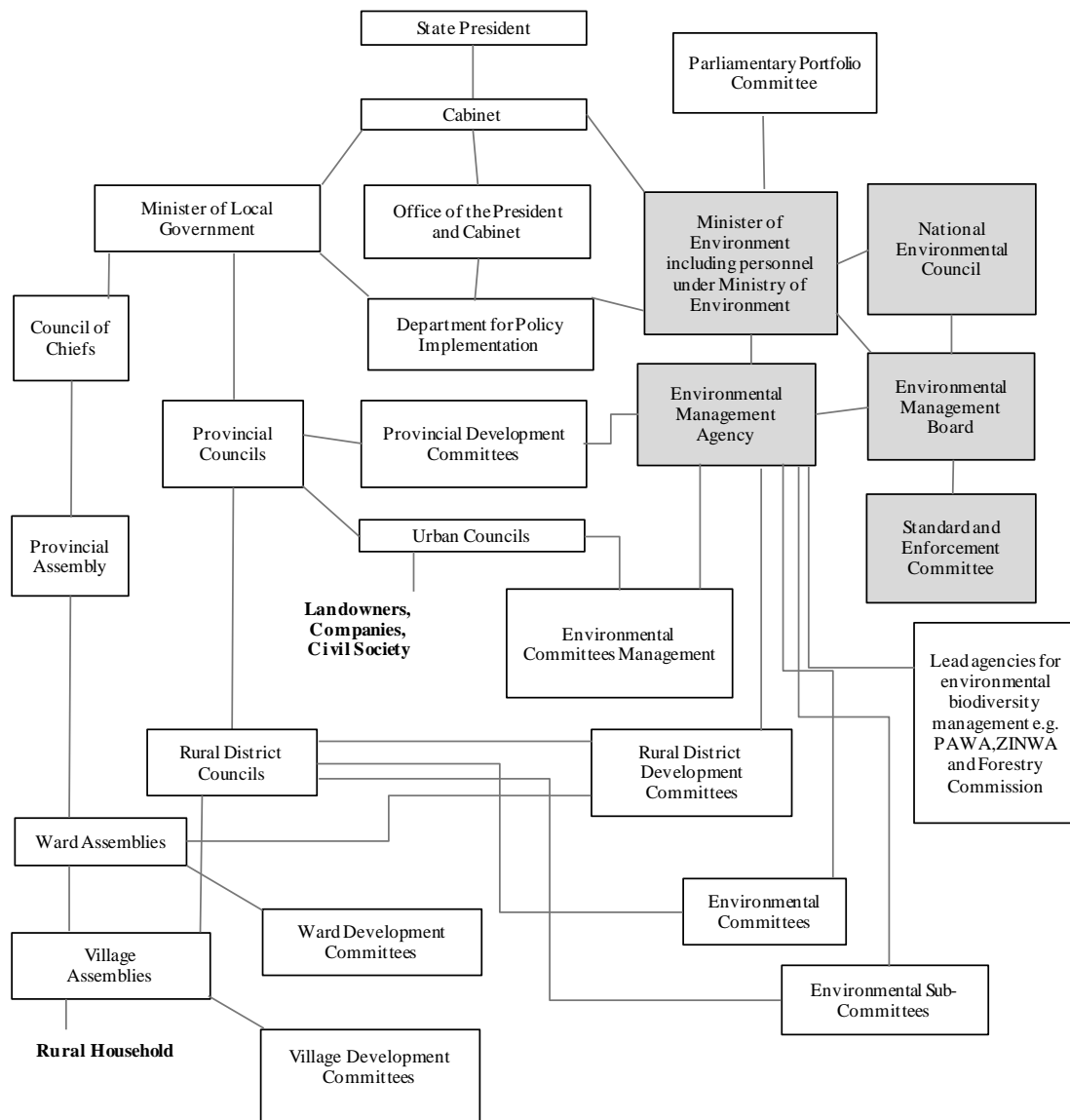
Source: NAC Website

Figure 2.4.1 Organization Chart of National Action Committee (NAC)

2.4.2.2 Ministry of Environment, Water and Climate (MoEWC)

The ministry's main responsibility is Environment and Natural Resources Management. The primary functions of the Ministry of Environment, Water and Climate are to:

- Develop, implement and monitor environment, water and climate polices and legislation for sustainable development.
- Coordinate and domesticate multilateral and regional protocols and agreements that Zimbabwe has ratified.
- Provide leadership in the advocacy and awareness of environmental, water and climate issues.
- Coordinate the resource mobilisation for government and other projects in the environment, water and climate sectors.
- Facilitate and coordinate capacity development in the areas of environment, water and climate.
- Ensure the proper use of all resources allocated/ raised by the Ministry.
- Ensure the proper management of all Parastatals and State Agencies under the Ministry.



Source: National Environmental policy and Strategies, June 2009

Figure 2.4.2 Administrative Chart of Ministry of Environment, Water and Climate

Administrative Chart of Ministry of Environment, Water and Climate is shown in Figure 2.4.2. Environmental Management Agency (EMA) is a sub-grain structure of the ministry. Environmental condition of sewage is controlled by each city.

2.4.2.3 Ministry of Local Government, Public Works and National Housing (MLGPWNH)

The Ministry is responsible for function and governance of local body as the supervisory authority, and is directing collection of sewerage charge.

2.4.2.4 Zimbabwe National Water Authority (ZINWA)

The Zimbabwe National Water Authority is a wholly Government-owned organisation that falls under the Ministry of Environment, Water and Climate. The Authority was formed in 2000 following the promulgation of the ZINWA Act and its functions and mandate are drawn from the same Act and the Water Act of 1998.

The Authority has a mandate to manage water for the State and to ensure sustainable development and equitable distribution of the country's water resources to all Zimbabweans at an affordable price. The major function provided by the Zimbabwe National Water Authority Act is as follows:

- (a) to advise the Minister on the formulation of national policies and standards on—
 - (i) water resources planning, management and development; and
 - (ii) water quality and pollution control and environmental protection; and
 - (iii) hydrology and hydrogeology; and
 - (iv) dam safety and borehole drilling; and
 - (v) water pricing;
- (b) subject to the Water Act [Chapter 20:24], to assist and participate in or advise on any matter pertaining to the planning of the development, exploitation, protection and conservation of water resources; and
- (c) to exploit, conserve and manage the water resources of Zimbabwe with the object of—
 - (i) securing equitable accessibility and efficient allocation, distribution, use and development; and
 - (ii) providing, in both the short and the long term, adequate water on a cost effective basis; and
 - (iii) taking appropriate measures to minimise the impacts of droughts, floods or other hazards;
- (d) to promote an equitable, efficient and sustainable allocation and distribution of water resources; and
- (e) to encourage and assist local authorities in the discharge of their functions under the Rural District Councils Act [Chapter 29:13] and the Urban Councils Act [Chapter 29:15] with regard to the development and management of water resources in areas under their jurisdiction and in particular, the provision of potable water and the disposal of waste water; and
- (f) to ensure that, catchment councils discharge their functions in accordance with the Water Act [Chapter 20:24]; and
- (g) to encourage and assist catchment councils to plan and co-ordinate the development and management of water resources in areas under their jurisdiction; and
- (h) to operate and maintain any water works owned or managed by the Authority and to sell any water therefrom, to dispose of waste water, to construct boreholes and to provide design and construction services; and

- (i) to provide, at such fee as the Authority may determine, all forms of assistance, including technical assistance, personnel, advisory and training, information and other services to the Government, local authorities and catchment councils in connection with the exploitation, development, management and distribution of water resources; and
- (j) to undertake research studies and develop a database on hydrological issues pertaining to or of interest to Zimbabwe and to publish the findings and any other data compiled by the Authority; and
- (k) to conduct hydrological and geographical surveys and to produce plans, maps or other information necessary in the planning, development and exploitation of water resources and to publish any such surveys, plans, maps or other information; and
- (l) to promote such mechanisms for the co-operative management of international water resources as the Minister may determine; and
- (m) to carry out any function that may be conferred or imposed on the Authority by or under this Act, the Water Act [Chapter 20:24], or any other enactment.

2.4.2.5 Environmental Management Agency (EMA)

(1) General

The Environmental Management Agency is a statutory body responsible for ensuring the sustainable management of natural resources and protection of the environment, prevention of pollution and environmental degradation, as well as preparation of Environmental Plans for the management and protection of the environment. It was established under the Environmental Management Act and enacted in 2002.

(2) Function

According to the Environmental Management Act, the function of the Agency is provided as follows:

- (a) To formulate quality standards on air, water, soil, noise, vibration, radiation and waste management;
- (b) To assist and participate in any matter pertaining to the management of the environments; and in particular,
 - (i) To develop guidelines for the preparation of the National Plan, environmental management plans and local environmental management action plans; and
 - (ii) To regulate and monitor the collection, disposal, treatment and recycling of waste; and
 - (iii) To regulate and monitor the discharge or emission of any pollutant or hazardous substance into the environment;
 - (iv) To keep records in the form of registers of all licenses and permits issued under this Act;
 - (v) To regulate and monitor the control of invasive alien species;
 - (vi) To regulate, monitor, review, and approve environmental impact assessments;
 - (vii) To regulate and monitor the management and utilisation of ecologically fragile ecosystems;
 - (viii) To make model by-laws and to establish measures for the management of the environment within the jurisdiction of the local authorities;
 - (x) To recommend to the Government the conventions which the country may join, and incorporate their provisions into national law;

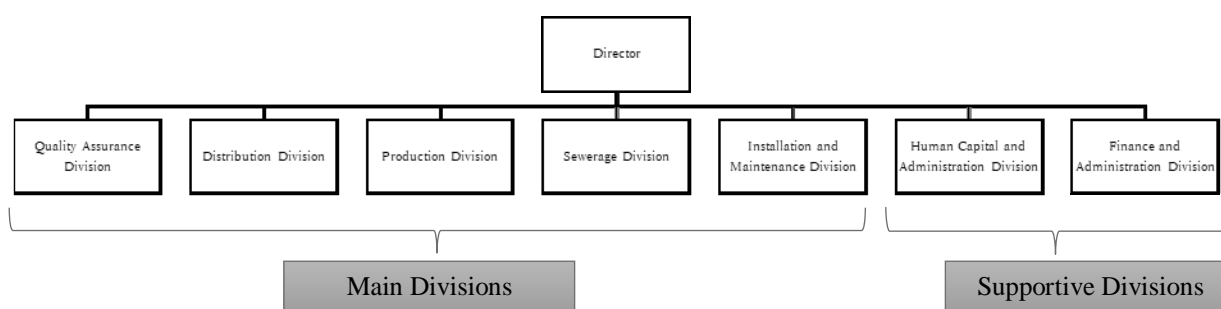
- (xi) To co-ordinate the production of a report on the state of the environment every five years;

2.4.3 Organization for Sewerage in Cities

The City of Harare names their sewerage department as Harare Water, which is not an independent organization. Chitungwiza Municipality arranges their sewerage department through directly connecting to the Town Clerk. The details of each city are as follows.

(1) Harare Water

According to the director of the Harare Water Accounting Director, the organizational chart of Harare Water is as shown in Figure 2.4.3. This has not changed since the last survey in 2012.



Source: Chitungwiza Municipality Collection and Confirmation Survey Report on Improvement of Sanitary Environment (2012)

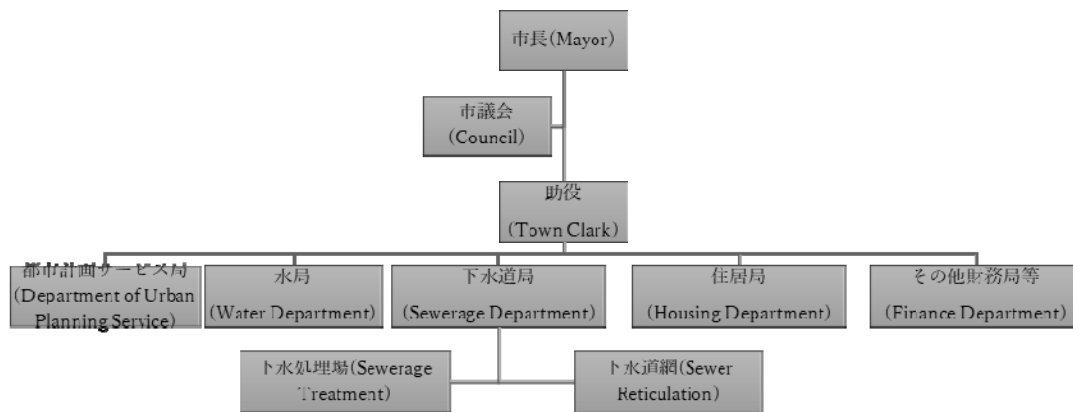
Figure 2.4.3 Organization Chart of Harare Water

Each main division plays the roles indicated below.

- 1) Quality Assurance Division : Voluntary water quality monitoring and recording (apart from EMA). Water quality laboratories are in both the supply and the sewer facilities
- 2) Distribution Division : Management of the pipeline system of tap water .
- 3) Production Division : Planning of water purification plant
- 4) Sewerage Division : Planning and maintenance of sewerage systems including treatment plants.
- 5) Installation and Maintenance Division : Management of general equipment and facility maintenance

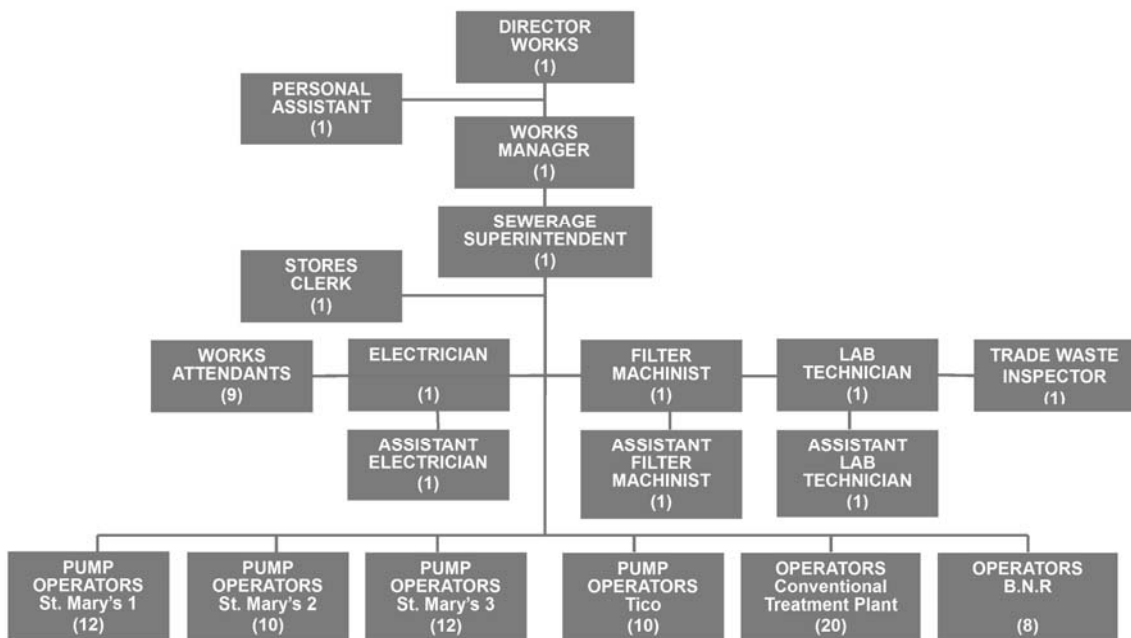
(2) Chitungwiza Municipality Sewerage Department

Organization chart of Chitungwiza Municipality is shown in Figure 2.4.4. Chitungwiza Municipality's sewerage department has two divisions: sewage treatment plants division, and sewerage piping division, shown in Figure 2.4.5 and Figure 2.4.6. Supervision of the technical field is the role of the Director of Works. Each technical staff is assigned under them. Pumping stations and sewerage pipes have concurrent positions although they have different directive systems. The sewerage fee is not collected by the sewerage department, but by the Financial Department.



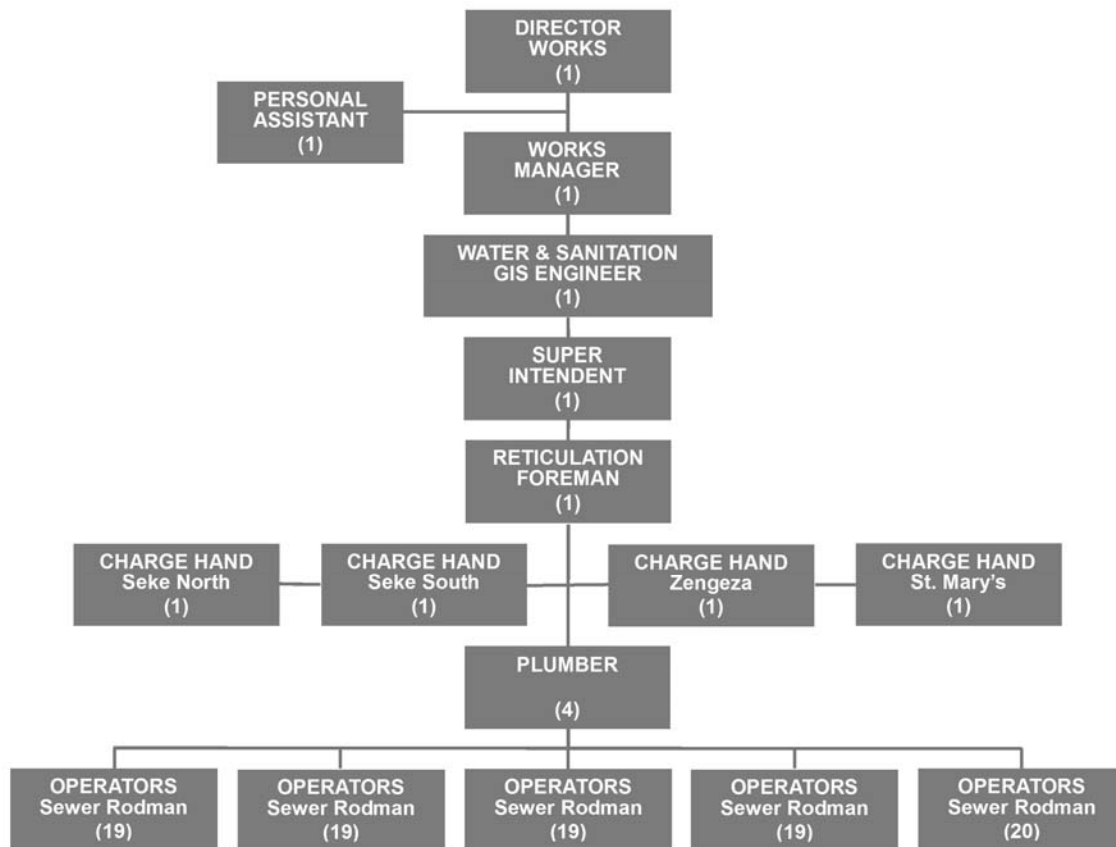
Source: Chitungwiza Municipality

Figure 2.4.4 Organization chart of Chitungwiza Municipality



Source: Chitungwiza Municipality

Figure 2.4.5 Organization Chart of Sewerage Treatment Plant Section, Sewerage Department, Chitungwiza Municipality



Source: Chitungwiza Municipality

Figure 2.4.6 Organization Chart of Sewer Section, Sewerage Department, Chitungwiza Municipality

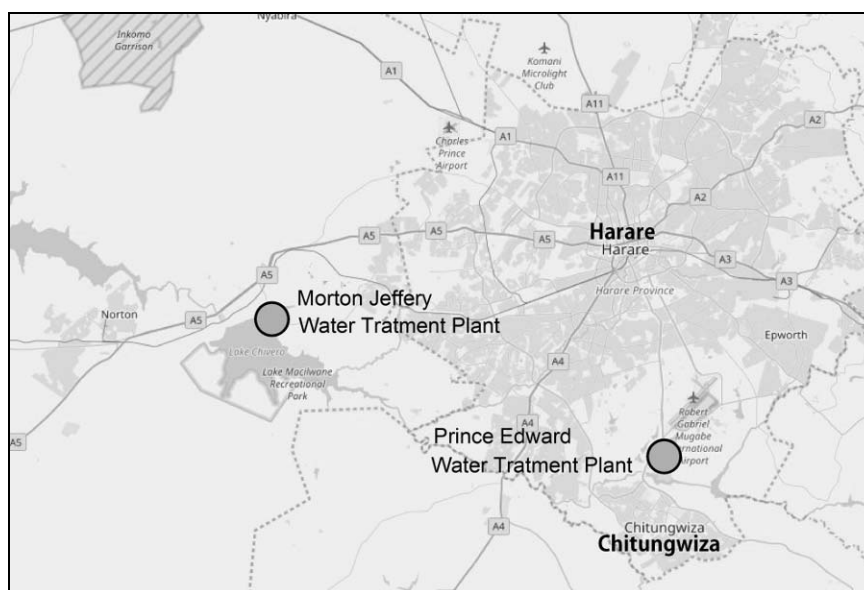
CHAPTER 3 WATER SUPPLY WORKS AND SEWERAGE WORKS IN THE GREATER HARARE

3.1 Water Supply in Greater Harare

Although the focus of this study lies mainly on the sewage system, it is important also to understand the condition of the water supply system as most of the water in daily use supplied by the supply system flows into the sewer system. Sewage and water supply have a close relationship which makes the amount of purified water supply the most related matter to sewage projects among other various water supply matters. On the other hand, the quality of drinking water, human resource, or organizational aspects has relatively weaker correlation with the sewerage system.

(1) City of Harare

Two purification plants are operating in the City of Harare, Prince Edward purification plant and Morton Jeffery purification plant. The quantity of water supply is 84ML/d by Prince Edward plant and 614ML/d by Morton Jeffery Plant, 700ML/d as a total. The planned capacity of water supply is 90ML/d by Prince Edward plant and 500ML/d by Morton Jeffery. Water demand in the City of Harare is estimated at 800ML/d at present and 1300ML/d when areas currently without water supply are included. The present capacity of water supply is therefore not sufficient for the demand. Water for the Chitungwiza Municipality is produced by the Prince Edward plant. The source of water for the Prince Edward Plant is Seke dam, the capacity of which is smaller than that of the purification plant.



Source: JST

Figure 3.1.1 Location of Purification Plant

Table 3.1.1 Outline of Water Purification Plant in City of Harare

	Unit	Morton Jeffery plant	Prince Edward plant
Quantity of water supply	ML/d	614	84
Population supplied	Million	2.5	2.5
Leacage rate	%	52	15

Source: JST based on the information from Harare Water

Prince Edward Purification plant was constructed in 1950, renovated and expanded in 1973. The facilities have since seen deterioration due to lack of appropriate maintenance except for rehabilitation by donors.

In dry seasons, water pollution in Lake Chivero and Lake Manyame aggravates to levels lower than the quality standard for drinking water. As a result, the water supply in Harare is insufficient at a supply rate merely around 40% as of 2017.

(2) Chitungwiza Municipality

Chitungwiza Municipality does not have its own water source including water purification plant, and is purchasing the water produced at the Prince Edward water treatment plant in Harare. The management of water supply conducted by Chitungwiza is limited to water distribution facilities. According to the information obtained from each organization, two issues are raised. The first point is two cities have different recognition about the volume of water purchased. This is due to leakage from the water pipe connecting the two cities. The second point is the unpaid tariff issue from Chitungwiza Municipality to the City of Harare. Although this is also related to the problem of the first point, Chitungwiza Municipality pays a monthly fee to Harare city, although the amount paid does not match the invoice amount from the City of Harare, and its cumulative accrued amount is large. As a result, City of Harare has filed a suit against Chitungwiza Municipality for unpaid claims. This is still in dispute. According to Harare Water, however, water supply has not stopped regardless of the ongoing lawsuit for the humanitarian reason.

Table 3.1.2 shows the monthly and daily water delivery in 2017.

Table 3.1.2 Daily Water Supply in Harare Municipality in 2017

Year	Month	Days of Month	Monthly Water Delivery (m ³)	Average Daily Delivery (m ³)	Water Supplied Days (days)	Not Supplied Days (days)
2017	Jan.	31	618,973	22,106	28	3
	Feb.	28	537,867	25,613	21	7
	Mar.	31	455,533	21,692	21	10
	Apr.	30	503,330	23,968	21	9
	May.	31	470,503	22,404	21	10
	Jun.	30	504,538	24,025	21	9
	Jul.	31	692,097	24,718	28	3
	Aug.	31	689,521	24,626	28	3
	Sep.	30	535,342	25,492	21	9
	Oct.	31	915,319	32,689	28	3
	Nov.	30	487,148	34,796	14	16

Source: JST based on the information from Chitungwiza Municipality

Table 3.1.3 shows the supply-demand balance when the per capita water demand is 60L/day. The average water supply volume of 19.2 ML/day shown in the table meets 75.5% of the total demand.

Table 3.1.3 Water Demand in Chitungwiza Municipality

Year	Population	Water Consumption per capita (L/d)	Water Demand (ML/d)	Average Water Supply (ML/d)	Demand/supply Ratio (%)
2017	422,547	60	25.4	19.2	75.5

Source: JST. Water consumption per capita of 60L/d is the value based on hearing from Chitungwiza city.

3.2 Wastewater Works in Chitungwiza

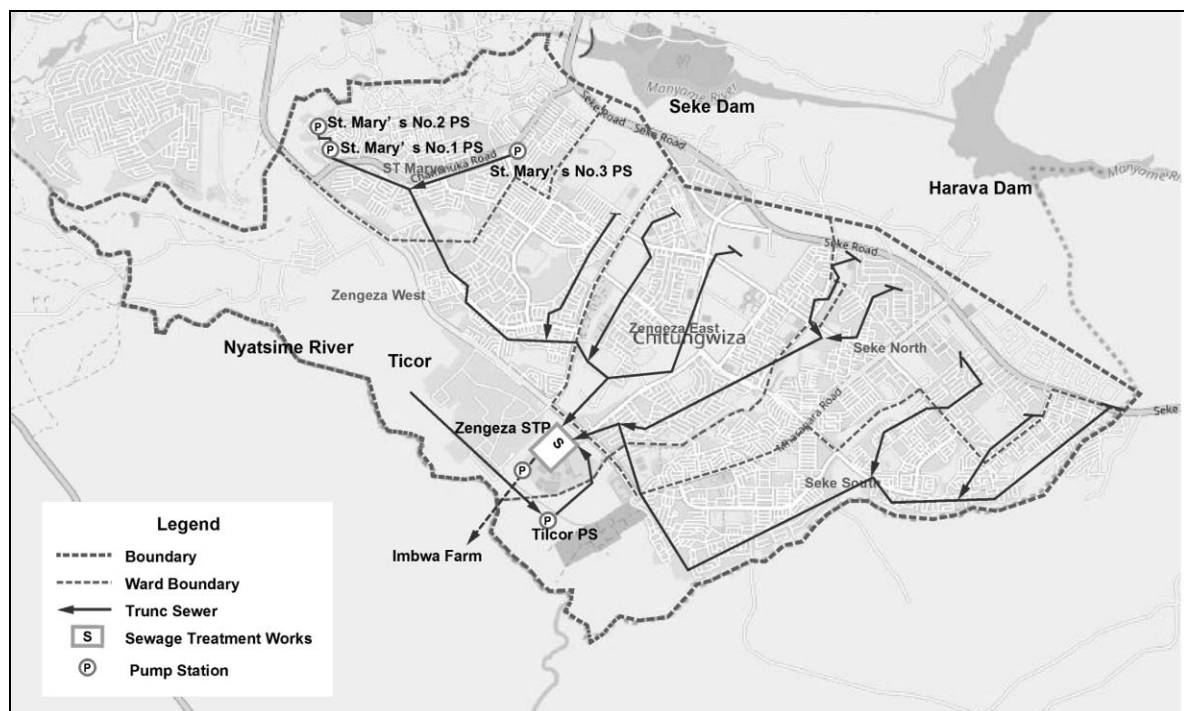
(1) Network

The sewerage system of Chitungwiza city is as shown in Figure 3.2.1. All sewage flows into the Zengeza sewage treatment plant. The sewage from St. Mary's area is pumped by three pumping

stations; with one pumping station supplying the Tilcor area, whereas the remaining areas are drained by gravity flow.

Firle sewage treatment plant in Harare city and Zengeza sewage treatment plant are higher in altitude than Lake Chivero, and treated water discharged from Firle sewage treatment plant to river flows into Lake Chivero. The water of Lake Chivero is treated at Morton Jeffrey water treatment plant and is supplied as drinking water to Harare city area.

Out of the four pump stations, Tilcor pump station and St. Mary's No.1 pump station are damaged, although the other two pumping stations are sound. However, St. Mary's No.2 pump station is out of function due to the damaged sewage main, and all the sewage from St. Mary's No.3 pump station is sent to the Zengeza treatment plant. In areas where the pumps are not functional or the sewage main is damaged, sewage overflows and adversely affects the living environment. Overflow of wastewater can also be observed in the Seke area due to pipe breakage. As a result, the inflow area into Zengeza sewage treatment plant is approximately half of the planned area.



Source: JST based on hearing results

Figure 3.2.1 Sewerage System in Chitungwiza

The cause of damage to these pumping stations and pipeline arises from sand which is predominantly used instead of detergents in home kitchens, but also from various kinds of garbage that flow into the system. Direct dumping of garbage into manholes is also common. As a result, the pipelines lack sufficient water permeability, and overflow easily occurs at clogged sections or when rainwater flows in. There is a need for raising awareness among the residents to prevent these.

According to the residents' consciousness survey in this study, about 30% of the households use the sand at home, more than half of the families are using it every day. The reason for using it is that households think sand to be more effective than detergents, and moreover, the proportion of families using it as a social habit is high. The detail of the survey results is in Appendix 3.

The city of Chitungwiza estimates that 0.01% of the inflow amount is sand. The amount of sand flowing into sewage per day is thus calculated as shown in Table 3.2.1.

Table 3.2.1 Amount of Sand Flowing into Sewage per day in Chitungwiza

Year	Sand % including in Wastewater	Incoming Wastewater at Zengeza ML/d	Sand L /Wastewater 10 ML/d	Sand gravity average kg/L	Sand kg /Wastewater 10 ML/d
2017	0.01	10	1000	2	2000

Source: JST

(2) Water Leakage Volume

Table 3.2.2 shows the amount of sewage generated when 80% of the water supply amount is to be sewage.

Table 3.2.2 Amount of Sewage Generated in Chitungwiza

Year	Population	Water Consumption per capita (L/d)	Population using septic tank	Population not using septic tank	Sewage Generation (ML/d)
2017	422,547	60	76,152	346,395	20.8

Note: The population of septic tank users is calculated from information on 3,173 regional group Chitungwiza city has, with 1 regional group as 4 families and 1 family as 6 members.

Source: JST

Since the sewage in the city flows into Zengeza treatment plant except for the septic tank users, the leakage rate from the sewer network is calculated as shown in Table 3.2.3, which is about 50%. This is consistent with the fact that sewage from about half of the area is not flowing into the treatment plant.

Table 3.2.3 Sewage Leakage Rate

Year	Sewage Generation (ML/d)	Inflow to Zengeza Treatment Plant (ML/d)	Sewage Leakage Rate (%)
2017	20.8	10	52

Note: Sewage inflow to Zengeza treatment plant is unknown because there is no flow meter, but it is set to 10 ML/d based on hearing from the staffs.

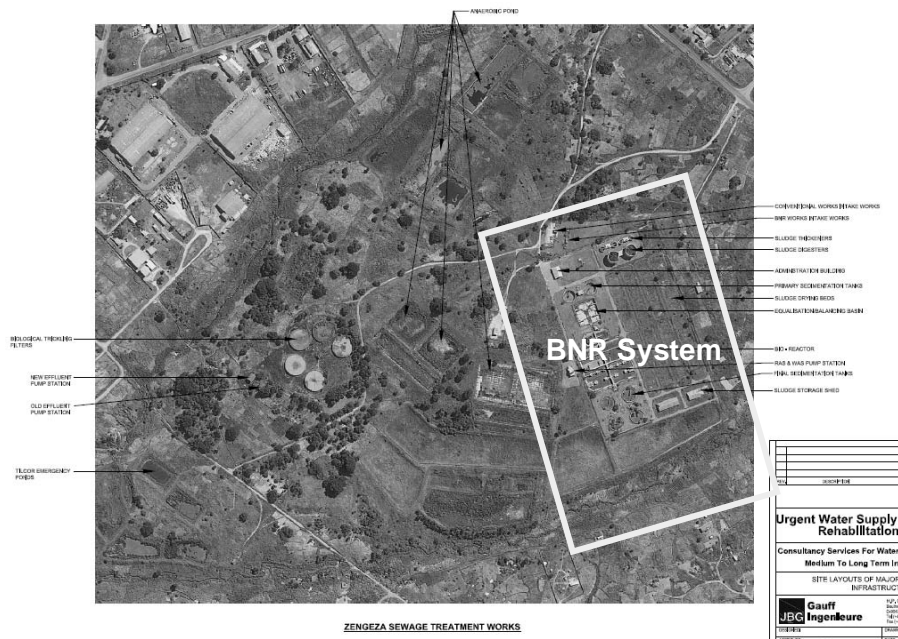
Source: JST

3.3 Present Condition of Zengeza Wastewater Treatment Plant

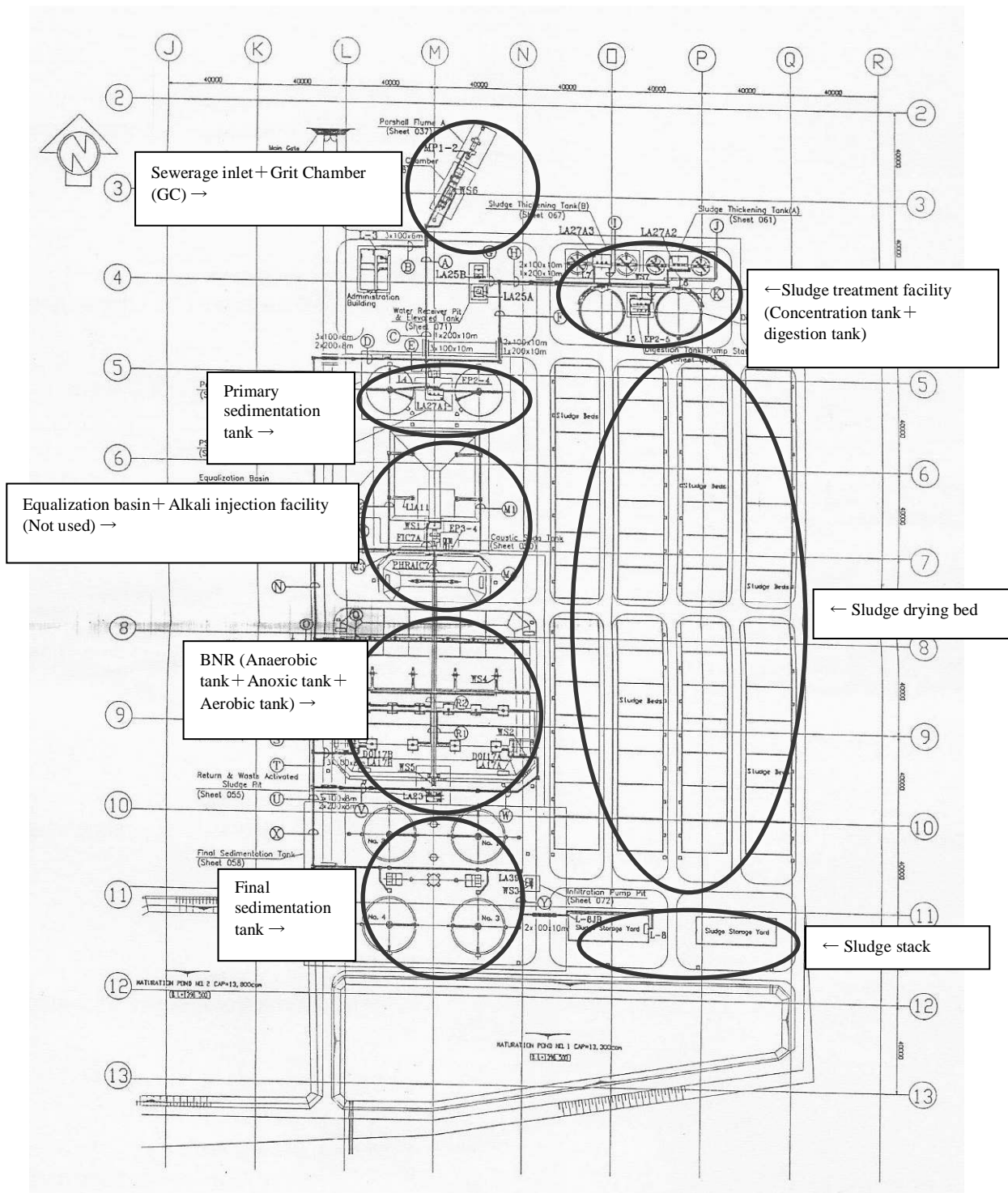
(1) Overview

Two systems were constructed in Zengeza WWTP, namely; the trickling filter system constructed in 1975 and the Biological nutrient removal (BNR) system constructed in 2000 under Japanese assistance.

Figure 3.3.1 shows the layout of Zengeza treatment plant and Figure 3.3.2 the overall layout of the facility. Trickling filter facility is renovated and operated with the support from ZIM Fund (over 4 million USD) in 2016. Only one out of five trickling filters is currently used because of a small sewage inflow.



Source: *Urgent Water Supply and Sanitation Rehabilitation Project Volume 2 (2014 Gauff Ingenieure)*
Figure 3.3.1 Zengeza Sewage Treatment Plant Layout



Source: As-built Drawing of Zengeza Treatment Plant

Figure 3.3.2 Overall Layout Drawing of Zengeza Treatment Plant Facility

Table 3.3.1 shows summary of mechanical equipment, equipment capacity and staffing of the trickling filter system and BNR system in Zengeza treatment plant.

Table 3.3.1 Summary of Trickling Filter System and BNR System in Zengeza

Item	Trickling Filter	BNR	Remarks
Sand removal method (GC system)	Air lift compressor 22kW (maintenance free)	Underwater pump 3kW*2 sets (need maintenance)	The air lift system is strong against sand and there is no mechanical deterioration since it is only a pipe.
No. of machines using power and equipment capacity	Compressor for GC Four compressors (including spares) Equipment capacity: 61kW	Primary sedimentation pond, mixer at each pond, aerator, circulation pump, final sedimentation pond, pump for sludge return, excess sludge, sludge transport etc 87 motors Equipment capacity: 564kW	The arm of the trickling filter system moves with the water head, and flows down to the terminal end by gravity.
Instrumentation	1 inlet flow meter	1 inlet flow meter 9 water level gauges 1 pH meter	
Manual machine	42 digestion tanks	31	
Water quality inspection equipment	14	14	
Spares	Compressor Pipe for the arm	23 kinds of machines 23 kinds of motors Pipe for digestion tank	
Operators	35	43	According to staffing table of Chitungwiza city
Manager, common workers, operators for pumping station 1&2 to the farm	27		According to staffing table of Chitungwiza city
Maintenance cost	Low	High	
Treatment performance	EMA Red class	EMA Blue class	
Treatment capacity	35 ML/day	20 ML/day	

Source: JST

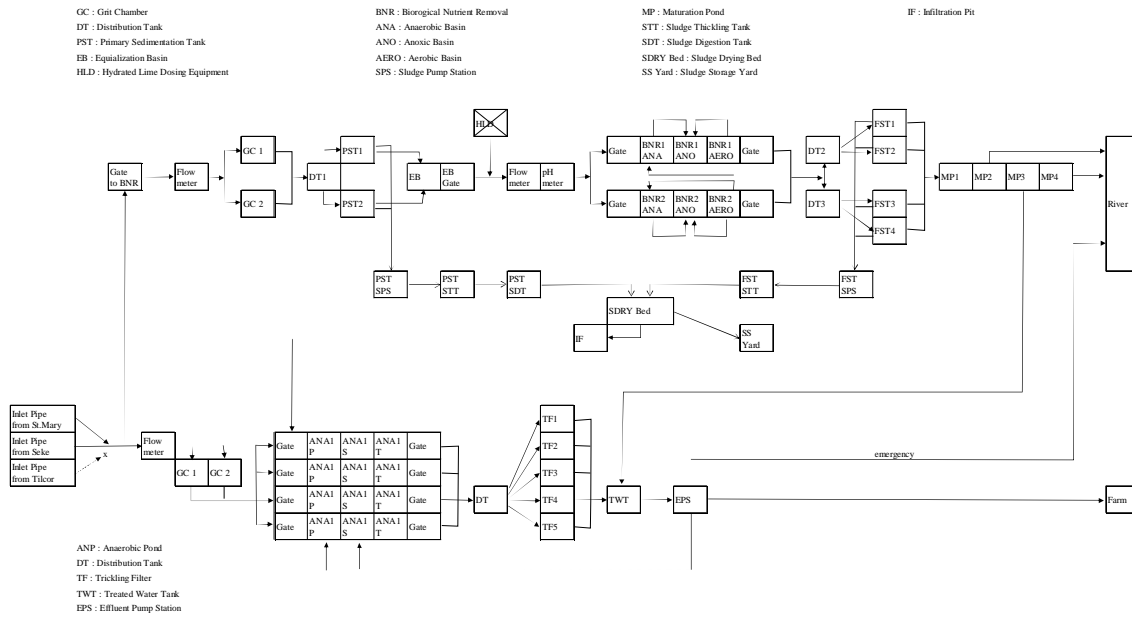
BNR has the higher risk of failure because of the large number of mechanical and electrical equipment whereas the trickling filter system requires little mechanical and electrical equipment. BNR therefore requires technical and financial resources for proper operation and maintenance.

(2) Condition of Facilities

The BNR facility started to be partially broken down from around 2005, five years after the start of operation. In 2009 it was completely shut down and has not been in operation since.

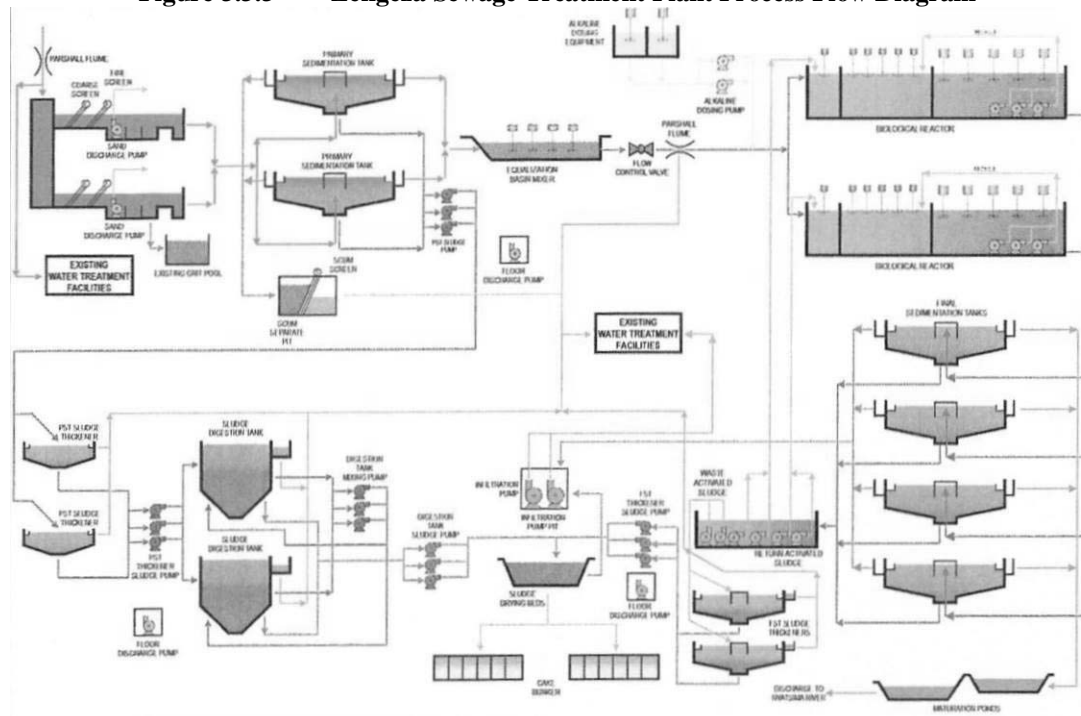
Figure 3.3.3 shows the process flow diagram of Zengeza sewage treatment plant and Figure 3.3.4 shows the process flow diagram of BNR facility.

Zengeza Wastewater Treatment Plant Process Flow Diagram



Source: JST

Figure 3.3.3 Zengeza Sewage Treatment Plant Process Flow Diagram



Source: Basic Study, The Sewage Facility in Chitungwiza, Zimbabwe, June 2006, JICA

Figure 3.3.4 Process Flow Diagram of BNR


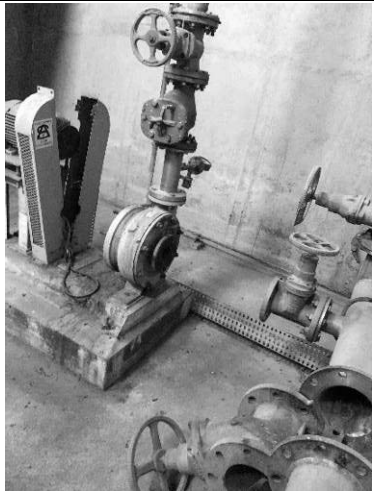

All mechanical and electrical equipment in BNR are out of service at present. The current state of the main facilities observed by field survey is as shown below:

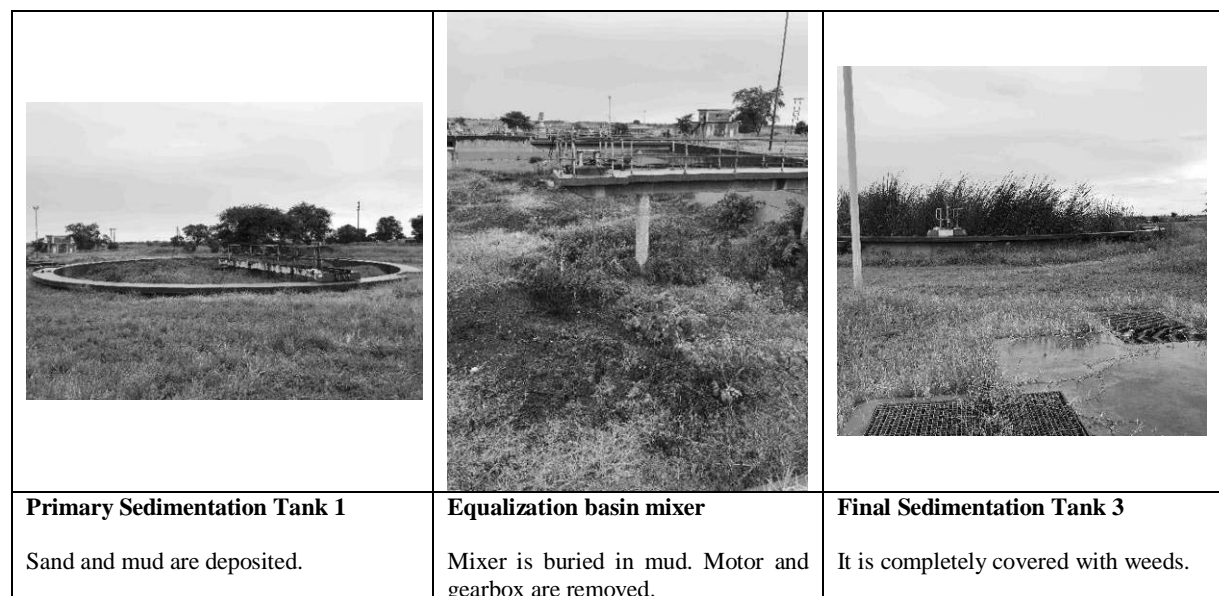
- GC (Grit Chamber): Although the GC is equipped with manual operation screens, the submersible pumps to pump up the sand and the pipe to transfer the sand are removed. As a result mud accumulates in the GC tank.
- Primary Sedimentation Tank (PST): Sludge collector has rusted and mud accumulates in the PST. The motor of the collector running at the round pond terminal has been broken and needs to be replaced.

- Equalization basin: Mud is accumulated in the basin. One out of four mixers is out of order.
- Biological reactor: All the motors in the anoxic basin are out of order. All the pressure switches of the aerators which detect the normal condition of lubrication for the gearbox are out of order. The aerators cannot run due to interlocking system.
- Final Sedimentation Tank (FST): FST is filled with mud and covered with weeds. It is totally devastated.
- Return Activated Sludge pump (RAS) / Waste Activated Sludge pump (WAS): All the RAS and WAS are out of order.
- Sludge thicker: All the sludge collectors in all four sludge thicker are out of order.
- Digester: Mud accumulates to half of the tank and weeds have grown thickly.
- Sludge drying bed: The valves to control the flow of sludge to the bed have rusted and need to be overhauled or repaired.
- Infiltration pit: All the infiltration pumps are broken.
- Sludge storage yard: The roof of the yard is broken.
- Maturation pond: Weeds have grown thickly.

Detailed inspection results are shown in Appendix 2. Other facilities than the above-mentioned have gone through operation tests in August 2017 and are operational according to interviews with the staffs.

Figure 3.3.5 shows the current status of the facilities.

		
<p>Grit Chamber</p> <p>All equipment such as underwater pump, sand transport pipe, chain block etc are removed.</p>	<p>Sludge pump 1, PST</p> <p>The piping of the pump is removed.</p>	<p>Circulation pump 1, 2, & 3 for digester</p> <p>They are removed.</p>



Source: JST

Figure 3.3.5 Facilities of BNR in Zengeza Sewage Treatment Plant

3.4 Water Quality

(1) Water Quality in Lakes and Rivers

In terms of environmental management, Environmental Management Agency (EMA) monitors the water quality of rivers and lakes where wastewater is flowing in. However quality data of Lake Manyame and Lake Chivero was not obtained in this survey.

The followings are extracts from Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality (2012).

Table 3.4.1 Raw Water Quality from Upper Manyame in 1996

Sampling point	pH	Total Alkalinity mg l ⁻¹ CaCO ₃	Dissolved Oxygen mg l ⁻¹	Ammonia mg/ NH ₃ -N	Phosphate mg l ⁻¹ P
Below Seke Dam	6,67	27	6,75	Traces	1,40
Zengeza Stream	6,50	27	6,70	0,14	5,00
Nyatsime Stream Above					
Zengeza Works	6,64	57*	7,80*	0,96	0,5
St. Marys Strem	6,79	137	Nil	0,17	7,90
Nyatsime Stream Below					
Works	6,85	100,8*	3,95*	1,79*	2,60
New Chitungwiza Road	6,59	27	5,45	Traces	3,80
At Skyline	6,62	37	5,95	Traces	9,10

Source: Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality, 2012, JICA

Table 3.4.2 Lake Chivero Raw Water Quality in 1996

Year	1988	1989	1990	1991	1992	1993	1994	1995
Total solids mg l ⁻¹	208,7	130,7	135,0	158,0	359,0	254	364,0	430
Dissolved solids mg l ⁻¹	207	129,2	132,4	153,6	356,4	251	359,4	420,0
Suspended solids mg l ⁻¹	1	0,8	2,6	4,4	32,6	3	4,6	10
Turbidity (NTU)	1,4	0,94	1,5	2,2				-
Total hardness mg l ⁻¹ CaCO ₃	58,0	50,0	62,0	75,0	87	94	116	132
BOD	0,8	0,7	0,9	1,5	3,8		6,1	5,5

Source: Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality, 2012, JICA

Table 3.4.3 Water Quality of Raw Sewage and Final Effluent of Firlse Sewage treatment Works in 1996

	Raw sewage	Final effluent	Permissible level
pH	6,8-9	7,18	6,5-8,0
COD (mg l ⁻¹)	906,0	219,0	60
TKN (mg l ⁻¹ N)	65,0	28,0	10
Total phosphates (mg l ⁻¹ P)	12	4,4	1,0
Suspended solids (mg l ⁻¹)	500	99,0	25,0
BOD (mg l ⁻¹)	400	164,0	25

Note: Average water quality from 4 January to 28 March in 1996

Source: Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality, 2012, JICA

Table 3.4.4 Chemical valuables in Lake Chivero and Other Lakes in 2010

	COD* (mg O·l ⁻¹)	NH ₄ ⁺ -N (mg·l ⁻¹)	NO ₃ ⁻ -N (mg·l ⁻¹)	PO ₄ ³⁻ -P (mg·l ⁻¹)	PC (mg·l ⁻¹)	PN (mg·l ⁻¹)
Lake Chivero						
Pelagic Stn. 0m	18	0.00	1.30	8.20	0.39	0.08
5m	19	1.70	1.25	5.85	0.23	0.07
10m	15	2.00	0.49	2.27	0.46	0.09

dam site 0m	14	1.30	1.60	2.05	0.14	0.06
10m	13	1.80	1.02	2.01	0.85	0.12
References						
1. Lake Victoria (littoral Nyakach) (Nyanza Gulf)**	6.0 --	< 0.05 --	< 0.20 0.10	0.15 0.06	7.49 --	1.34 --

2. Lake Kanyaboli	13	< 0.05	0.24	0.03	0.81	0.09

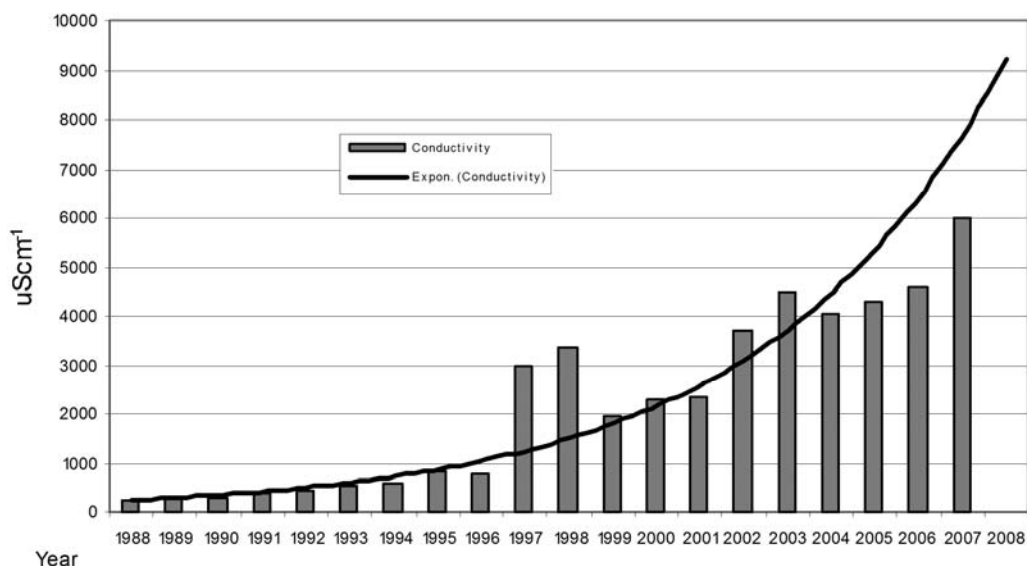
3. Lake Biwa	2.4	0.00-0.06	< 0.15	< 0.002	0.5-1.0	0.05-0.11

4. carp culturing pond	--	(NH ₄ ⁺ -N + NO ₃ ⁻ -N)		0.35	--	--
		1.27				

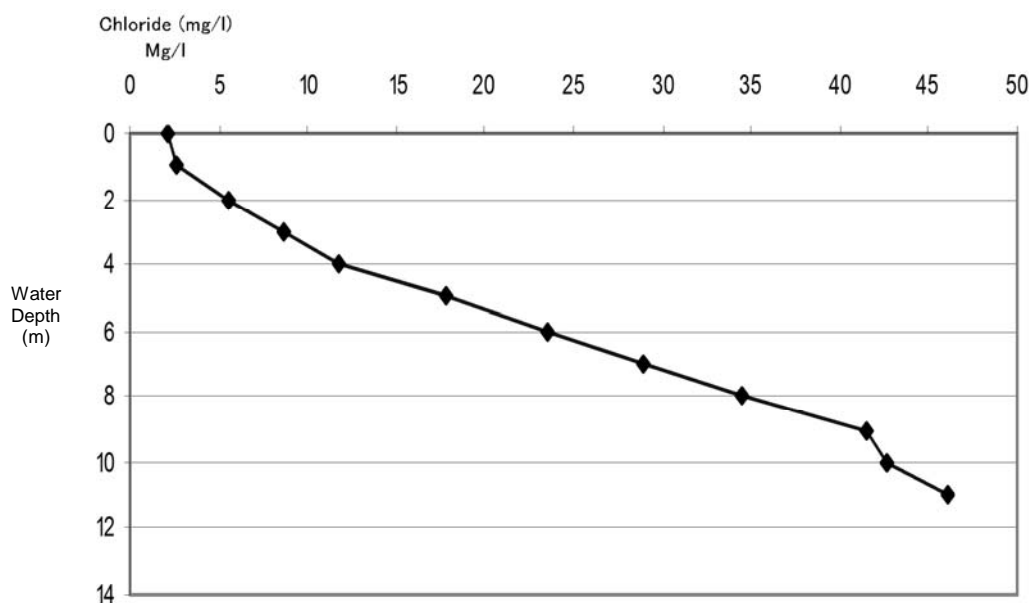
*COD in filtrates through Whatman GF/C filter preignited at 450°C for 4hs.

**L. Sitoki *et al.* (2010)

Source: Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality, 2012, JICA



Source: Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality, 2012, JICA
Figure 3.4.1 Record of Water Quality of Lake Chivero from 1988 to 2006



Source: Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality, 2012, JICA
Figure 3.4.2 Relation between Water Depth and Density of Chloride

Table 3.4.2, Table 3.4.3, and Figure 3.4.1 only show a part of the water quality status but the concentration levels of nitrogen and phosphorous are high, and BOD level also deteriorates towards the upstream of the sewerage line. Considering the above, it is assumed that the surface water quality in the area including Lake Chivero is not good as a tap water source. Since nitrogen and phosphorus cannot be removed by conventional treatment methods such as the trickling filter method, it is necessary to introduce advanced treatments that can remove them.

(2) Quality of Treated Effluent

Table 3.4.5 shows classes of effluent discharge and Table 3.4.6 shows the treated water quality of Zengeza treatment plant.

EMA has established effluent discharge standards and limits discharge of contaminated wastewater to the river. Environmental Management (Effluent and Solid Waste Disposal) Regulations, 2007 indicate the quality of effluent discharge in four classes (Blue, Green, Yellow, and Red), and stipulates a fine for each class when discharging to the river. The treated water of the trickling filter system in Zengeza

treatment plant is classified as Red, and the city of Chitungwiza disposes the treated water to farming land to avoid the fine.

Table 3.4.5 Classes of Effluent Discharge Licences

A blue license: Disposal is considered to be environmentally safe
A green license: Disposal is considered to present a low environmental hazard
A yellow license: Disposal is considered to present a medium environmental hazard
A red license: Disposal is considered to present a high environmental hazard.

Source: Ambient Water Quality Monitoring, Ema 2, 2014, EMA

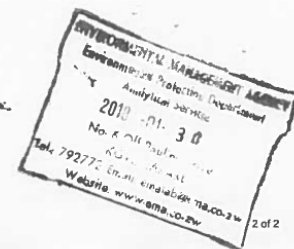
Table 3.4.6 Treated Water Quality of Zengeza WWTP

A SADCAS Accredited Testing Laboratory No Test-6 0005 Ref: 180470 EMA CONFIDENTIAL

Sewage				Chitungwiza Municipality	EMAL Effluent & Solid Waste Disposal Regulations 2007					
Customer Ref	Type of Sample	Sampling method/Plan	Lab ref number	Effluent	Blue Sensitive	Blue Normal	Green	Yellow	Red	
				180470						
				19/01/2018						
				19/01/2018						
Parameters	Units	Method	Status	Uncertainty of Measurement %						
Biological oxygen Demand	mg/l	Electrode SOP/CM03		TBA	31.13	≤15	≤30	≤50	≤100	≤120
Chloride	mg/l Cl	Titrimetric SOP/CM07	SA	1.9100	130	≤200	≤250	≤300	≤400	≤500
Dissolved oxygen	Saturation %	Electrode SOP/CM10		TBA	25.3	≥75	≥60	≥50	≥30	≥15
E. Conductivity	uS/cm	Electrode SOP/CM12		TBA	899	≤200	≤1000	≤2000	≤3000	≤3500
Iron	mg/l Fe	AAS Flame SOP/CM22	SA	0.1252	3.27	≤0.3	≤1.0	≤2.0	≤5.0	≤8.0
Manganese	mg/l Mn	AAS Flame SOP/CM22	SA	0.0051	0.10	≤0.1	≤0.1	≤0.3	≤0.4	≤0.5
Nitrates	mg/l N	Spectrophotometric SOP/CM23	SA	0.0286	1.19	≤10	≤10	≤20	≤30	≤50
pH		Electrode SOP/CM27		TBA	7.15	6.0-7.5	6.0-9.0	5-6-9-10	4-5-10-12	0-4-12-14
Oxygen absorbed(PV)	mg/l	Titrimetric SOP/CM25		TBA	11.83	≤5	≤10	≤15	≤25	≤40
Phosphates	mg/l P	Spectrophotometric SOP/CM28	SA	0.0131	14.04	≤0.5	≤0.5	≤1.5	≤3	≤5
Potassium	mg/l K	Flame Photometric SOP/CM31	SA	0.1199	29.42	*	*	*	*	≤500
Sodium	mg/l Na	Flame Photometric SOP/CM31	SA	0.1199	77.09	≤200	≤200	≤300	≤500	≤1000
Sulphate	mg/l SO4	Turbidimetric SOP/CM33		TBA	51	≤100	≤250	≤300	≤400	≤500
Total Dissolved Solids	mg/l	Gravimetric SOP/CM11		TBA	<1	≤100	≤500	≤1500	≤2000	≤3000
Total Suspended Solids	mg/l	Gravimetric SOP/CM33		TBA	<1	≤10	≤25	≤50	≤100	≤150
Total Hardness	mg/l CaCO ₃	Titrimetric SOP/CM36		TBA	186	*	*	*	*	*
Turbidity	NTU	Nephelometric SOP/CM39	SA	2.7833	6.59	≤5	≤5	*	*	*
Zinc	mg/l Zn	AAS Flame SOP/CM22	SA	0.0003	0.31	≤0.3	≤0.5	≤4.0	≤5.0	≤15.0
Band Class					Red					

NB. Conditions of sample(s). All samples were in good condition
This test report shall not be reproduced except in full, without written approval of the laboratory.
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Authorised by: Technical signatory; Name: S. MANUWA Signature: [Signature] Date: 21/01/2018



FMSB/QA/1 Revision No 7

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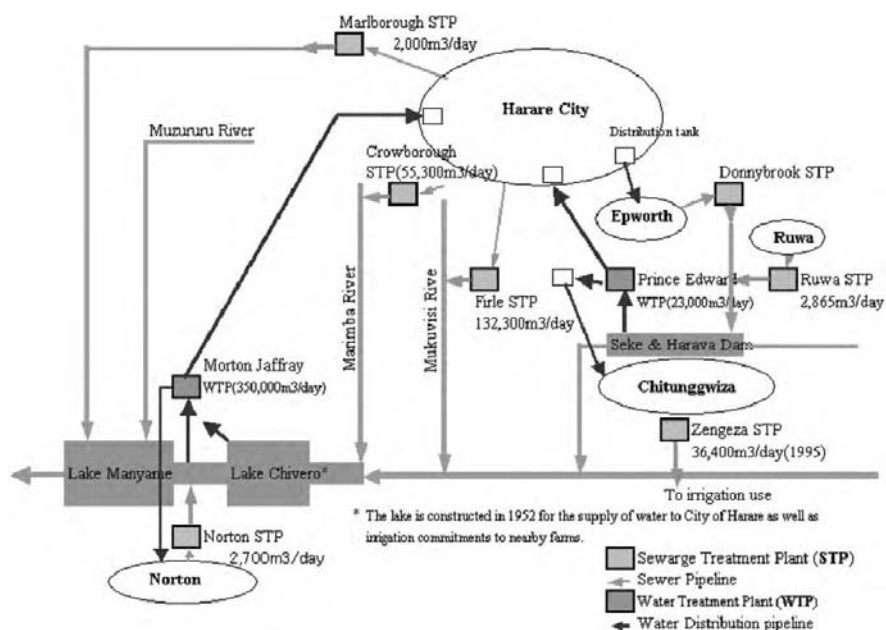
Source JST

(3) Estimation of Pollution Load

Although water quality data of Lake Chivero was not available during the survey, water pollution of the lake has progressed and becomes a severe environmental problem. Morton Jeffrey water treatment plant uses water from Lake Chivero as the water source and supplies 614 ML/day out of the total water supply of Harare city area of 700 ML/day. It is necessary to operate BNR system which removes not only BOD and SS which are indicators of water contamination, but also nitrogen and phosphorus in order to prevent eutrophication in discharged watersheds. As shown in Figure 3.4.3, the city of Chitungwiza is located on the upstream of Lake Chivero (Manyame river), and the treated water of Zengeza sewage treatment plant flows into Lake Chivero. Impact on the water quality of Lake Chivero and water supply in Harare city area is significant due to insufficient operation of sewage treatment plants in Chitungwiza city. Improvement of the processing capacity of Zengeza sewage treatment plant is crucial.

Table 3.4.7 shows estimation of pollution load in Lake Chivero. The amount of untreated sewage is estimated by subtracting the amount of wastewater treatment at the existing sewage treatment plant from the amount of wastewater generated in 2012 in Harare city and Chitungwiza city, which is the basin of Lake Chivero. The pollution load is estimated by multiplying the amount of untreated sewage by the BOD pollution loading rate (raw water quality: 700 mg/L). This calculation shows that in the 9

years since 2009 when Zengeza WWTP was shut down, a pollution load of about 220,000 tons has accumulated in the basin.



Source: Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality, 2012, JICA
Note: The amount in the figure is not the current one.

Figure 3.4.3 Schematic Drawing of Water Cycle in Harare City Area

Table 3.4.7 Estimation of Pollution Load of Lake Chivero

	Estimated Pollution Load		Remarks	
	Harare	Chitungwiza		
Population (person) : a	1,581,887	354,472		
Water use (L/day) : b	80	60		
Sewage collection rate (%) : c	65			
Amount of effluent (m ³ /day) : A	82,258	13,824	A=a*b*c	
Treatment capacity (m ³ /day)				
B : Firle WWTP (conventional+BNR)	128	/		
Treated water quality (BOD) (mg/L)	50			
C : Crowborough WWTP (BNR)	36			
Treated water quality (BOD) (mg/L)	75			
D : Hetcliff WWTP (BNR)	2.5			
Treated water quality (BOD) (mg/L)	30			
E : Doonybrook WWTP (stabilization pond)	4			
Treated water quality (BOD) (mg/L)	100			
F : Zengeza WWTP (conventional)			35	
Treated water quality (BOD) (mg/L)			31	
Untreated sewage (m ³ /day) : X	82,092		13,789	X=A-B-C-D-E-F
Pollution load unit (BOD) (kg/ m ³ /day)	57,464		9,653	
Pollution load (BOD) (ton/year)	20,974	3,523		
Total amount of pollution load in the basin after 2009 when Zengeza WWTP was shut down (ton)	188,770	31,709		
	220,478			

Source: JST

Note: 1) The population in Harare city and Chitungwiza city is that of 2012..

2) The quality of water inflow at each WWTP (BOD): 700 mg/L (estimated value in basic design)

3) The quality of discharged water at Zengeza WWTP (BOD): 31 mg/L (measured value on 18 January 2018)

3.5 Long and mid term planning, management accounting

3.5.1 Long and Mid-term Development Plan

(1) Long-term development plan

The Policy Document that currently states the comprehensive development plan of the City of Harare and the suburban cities is the Harare Integrated Master Plan. The development plan of Chitungwiza Municipality is also included in the plan. According to the explanation of the City of Harare, the master plan was initially formulated as a 20 years plan from 1989, but since the City of Harare hardly developed during the economic stagnation period, the Master Plan remains as the comprehensive mid-term development plan at present. The subsequent long-term development plan is yet to be written however, and as the standings are not aligned among the departments, it is unpredictable when the plan could be announced.

Statements on goals, aims, policies and proposals of the sewerage projects in the master plan can be found in section “2.3 Infrastructure and land development potential” on page 11. However, since this master plan is a comprehensive content covering a wide range of sectors, plans or other details for sewage treatment plants are not individually indicated.

(2) Mid-term development plan (Service level benchmark)

Aiming at the improvement of the administrative services of the city, local governments have created service level benchmarks based on the guidance of the World Bank. The benchmark sets several indicators for each administrative service and shows the achievement goal and the current situation, as well as the future action plan and financial resources for implementation, based on the situation.

Both the City of Harare and Chitungwiza Municipality have created the benchmark. In addition, Chitungwiza Municipality has prepared an improvement plan with the funding sources for its implementation based on the original data, which is called the SLB PIP. The sewerage budget allocation is basically linking to this.

The SLB PIP on sewerage project (sewage management) is shown in Appendix 1. It shows future improvement plans to challenges which were recognized through the original data. Additionally, the SLB PIP shows the funding source for its implementation. Performance indexes for sewerage service are as follows.

- Coverage of toilets, %
- Coverage of sewerage network services, %
- Efficiency in collection of sewage, %
- Adequacy of capacity for treatment of sewage, %
- Quality of sewage treatment, %
- Extent of recycling or reuse of sewage, %
- Efficiency in satisfactory response/reaction to customer complaints, %
- Efficiency of cost recovery in sewage management, %
- Efficiency in collection of sewage charges, %
- Maintenance Coverage ratio, %

3.5.2 Budget Formulation and Outlook

Explanation of the terms of the words used in this report

The words "income", "expenditure", "revenue", "cost" from this section are used in terms of budget and accounting terminology. "Income" and "expenditure" are generally used in budget and cash-based simple bookkeeping financial statements and are both basically cash basis. "Revenue" and "Cost" means double-entry bookkeeping accounting basis on accrual basis, and accounts receivable, uncollected income, accrued expenses, other than cash and are recorded as counterpart accounts. Therefore, even if "revenue" and "cost" are recorded, this does not mean that cash is

flowing in, but accounting in accounting principles is an appropriate accounting treatment .

(1) Overview of the National Budget

All budgets are basically prepared by government agencies under the guidance of the Ministry of Finance. The central ministry provides guidance and makes the overview for the agencies in their jurisdiction. Each ministry's goals, achievements, and indices for measuring the achievements are shown in the latest national budget document 2018. As to the budgeting method, Performance Based Budgeting (PBB) or Performance Informed Budgeting (PIB) is used for budget allocation.

As there are no subsidies from the central government to the local government, specific budget contents of each central government agencies are not verified in this report; however, to understand the size of the governmental finance, the budget overview related to the sewerage system is as follows.

First, approximately US \$ 6 billion is recorded in current expenditure and capital expenditure for the entire national budget. Second, for individual ministries and agencies related to water supply and sewerage projects, MoE has recorded US \$ 86 million, although the majority of US \$ 77 million is the resource of ZINWA as a capital transfer. MoLG has recorded US \$ 133 million, but since MoLG covers a wide range of areas, program budget is used in addition to PBB for budget management. The contents of each of these programs are as follows.

Programme 1: Policy & Administration

Programme 2: Spatial Planning

Programme 3: Local Governance

Programme 4: Construction, Maintenance & Management of Public Buildings

Programme 5: National Housing Delivery

Programme 6: Disaster Risk Management

The biggest budget allocated among the programs is US \$ 50 million in Program 3 followed by US \$ 47 million in Program 4. Also, by rebuilding the budget for each program into a regular categorical budget, Lending and Equity participation as capital expenditure is recorded at US \$ 56 million and Goods and services as current expenditure is recorded at US \$ 24 million.

Above information can be summarized as Table 3.5.1.

Table 3.5.1 Overview of budget allocation for the Ministries related to the sewerage system

National Budget: 5,021M illion USD (Ordinary and capital budget)					
Ministry of Environment, Water and Climate 86M illion USD		Minister of Local Government, Public Works and National Housing 133M illion USD			Other Ministries 4,802M illion USD
ZINWA 77M illion USD	Other budget for salary, projects, fixed assets, etc. 9M illion USD	Programme 3: Local Governance 50M illion USD	Programme 4: Construction, Maintenance & Management of Public Buildings 47M illion USD	Other Programmes 36M illion USD	
Expenses by accounting subjects : Lending and equity participation 56M illion USD , Goods and services 24M illion USD , etc.					

Source: JST material made from 2018 Budget Estimates

However, the allocated budget to the central ministries is for their officers' salary, or program budget for the executing agencies under the central ministries to enforce their works. Therefore, the budget is hardly allocated directly to the local governments.

Consequently, the budgets for Harare Water and Sewerage and Water Departments in Chitungwiza Municipality have to be financed by from the cities' own resources. The details are as shown in

Appendix 1. The city of Harare and Chitungwiza Municipality manage their respective budgets, and the budgets have to be eventually approved by MoLG.

(2) Local Government Budget around the Water Supply and Sewerage Projects

1) Harare Water

In Harare Water, the budget is divided into an ordinary budget and a capital budget. The budget that integrates both is shown in the last chapter of the current budget. The current budget consists of the individual budgets for each water supply and sewerage facility. Then, common expenses and income are added to it as the final budget. The 2017 budget of Firlle sewage treatment plant where is operated both the conventional system and BNR is shown in Appendix 1.

The Firlle Sewage Treatment Plant in 2017 operated two conventional systems and three BNRs, and the budget size is US \$ 4.8 million. Among these, the electricity expenditure budget is the largest, accounting for US \$ 0.9 million. Regarding of chemicals, only US \$ 0.08 million has been recorded, but within the overall budget of Harare Water, US \$ 17 million for water, and US \$ 0.2 million for sewage are recorded.

Although the budget book shows the budget of the previous year and the estimated amount of settlement, this settlement has a wide gap from the actual settlement. This point will be examined in Chapter 4.

2) Chitungwiza Municipality

Chitungwiza Municipality makes the city budget by integrating the budget of each sector. The sewerage system manages its individual budget plan. The sewerage budget of Chitungwiza municipality is shown in Appendix 1.

The first page shows the cost budget whereas the second page shows the total budget of the current account payment and the fund resource of income and capital expenditure added.

Among the trends in this budget, points to consider are as follows.

- The toll revenue budget has increased significantly from 2.6 million US dollars to 4.4 million US dollars in 2015-2016. This seems to reflect that the price rose significantly from 4.51 US dollars / household to 7.6 US dollars / household since 2016, as described below.
- About personnel expenses, the rehabilitation of the sprinkled-bed method was completed in 2016, and despite the fact that the sewage treatment plant had not been in operation until 2014, labor costs were halved between 2014 and 2015 are doing. Therefore, it is thought that until 2014 he was hiring surplus personnel. Also, in 2016, when the sprinkling filter bed system was in operation, the same amount as the personnel expenses in 2015 was accrued, which means that the staff worked efficiently, or by the operation of surplus personnel, personnel It can be thought that it could be maintained without increasing.
- Operating and maintenance expenses are posted from 2016. This is thought to reflect the fact that the sprinkling filter bed system was restarted in 2016.
- Although reimbursement by ZimFund is recorded as a revenue budget on the budget, the same amount is calculated as rehabilitation expenditure and can not be diverted between expense items. In this regard, according to an interview with the city of Chitunggiza, ZimFund pays directly to the merchant, so that cash etc. payment management of this part can not be done.
- Regarding the repair cost budget, it is newly added from 2016, and it is considered to correspond to the BNR restart of the same year. However, in 2017 it has halved.

As an overall consideration, the revenue in the budget is calculated on an accrual basis and the cost is calculated on a cash basis, so it becomes a calculation that generates a large residual income. Originally, in the present situation where accrued revenues are large, if the amount of cash proceeds is calculated and the expenditure corresponding to that amount is taken as the budget, such a

difference will not occur. Although the original budget document shows the previous year 's budget and the estimated settlement amount, the estimated closing amount differs from the actual settlement in a wide range, and this point will be discussed in Chapter 4.

3.5.3 Status of management of fixed assets and liabilities

(1) Management of fixed assets

Management of fixed assets in sewerage treatment plants is stated in URBAN COUNCILS ACT. Specifically, at the PART II ESTABLISHMENT OF MUNICIPALITIES, TOWN COUNCILS, LOCAL GOVERNMENT AREAS AND LOCAL BOARDS AND MATTERS INCIDENTAL THERETO, the following provisions exist, whereby the right to asset management, disposal etc. is authorized to local governments.

4 Provisions relating to establishment, alteration or abolition of municipalities, towns, councils and council areas

*(3) Where a municipality or town is abolished or the whole or any part of the area of a local authority is included in a council area or a separate council is established for that area, the President shall-
(a) make such transfer, disposal or apportionment of property, assets, rights and liabilities; and*

(2) Management of liabilities

In Zimbabwe, URBAN COUNCILS ACT also regulates the management of liabilities. Specifically, in PART XX FINANCIAL PROVISIONS, AUDIT, LOANS AND ACCOUNT, there are provisions as follows.

291 Short-term borrowing

293 Security for loans

294 Illegal borrowing

295 Repayment of loan

However, as will be described later, the city of Chitungwiza currently has little long-term external debt.

3.5.4 Tariff system

(1) Local tax (Rates) and usage fee

According to the interviews with related agencies, the local tax (Rates) and various public utility charges will require the approval of the Minister of MoLG at the end, but will basically be calculated in the process of organizing the budget for the next term at the municipality level. In addition, the local tax and various public utility charges are not collected individually by each department, but by the form of Rent Card. The residents go to the counter to pay the charges, and the taxes are not collected by visiting each household unless there is default of payment. There was no collector to demand the dunning until last year.

(2) Consideration on deciding the sewage fee

According to interviews with each city's water supply and sewerage department, the water supply and sewage fee at each city is included in the local tax and the usage fee, so it is reviewed and renewed every year. In the interview with Chitungwiza Municipality, the cost necessary for maintenance and citizen's income level were the two considered points stated as consideration in deciding the fee within the city. However, when it comes at the approval stage in MoLG, the proposed budgets are rarely approved as it is.

According to the interview with MoEW, opinions opposing MoLG approvals were heard. It was said that the approvals on water supply and sewerage matters should be made by other jurisdictions rather than MoLG who does not have expertise in the field. In addition, the Cabinet approved the

establishment of the Waste Water Regulate Authority in 2015, and the authority to approve the tariff is thought to be given away to this agency. On the other hand, this problem is very sensitive, and it has not been transferred to implementation as some people have different opinions.

(3) Changes of the Tariff in the past

Transitions of local taxes (Rates) and various utility charges are shown in each fiscal year budget and transition over the last five years are shown in Table 3.5.2 below.

Table 3.5.2 Taxes and Charges in Past Five Years in Chitungwiza

	2014	2015	2016	2017	2018
Development Levy	0.28	0.28	0.28	0.28	0.28
Refuse Residential	3.86	3.86	4.65	4.65	4.65
Sewer Charge	4.51	4.51	7.6	7.6	7.6
Adm in Charge	0.84	0.84	0.84	0.84	0.84
Insurance			0.28	0.28	0.28
Fixed Fire	0.28	0.28	0.28	0.28	0.28
Public Lighting	1	1	1	1	1
Fixed Water	3.9	3.9	3.53	3.53	3.53
Supplementary Charge	5.18	5.18	5.18	5.18	5.18
Roads Levy			0.5	0.5	0.5
Total	19.85	19.85	24.14	24.14	24.14

Source: JST based on the budget statement of Each Year

According to the chart, the sewerage fee was raised sharply in 2016, and it could be understood that the rise (approximately 4 USD) has a big influence on the overall increase (approximately 4 USD).

(4) Fee collection rate

Based on the interview with the Chitungwiza municipal accounting officer, the water supply and sewerage charges are basically included in the taxes and the utilities fees by the city and therefore the collection rate of the sewerage fee is equal to the collection rate of the charges. The collection rate of the collection by the city was 36% in November last year. However, as a result of placing the collecting officer in December, it was said that it improved up to 54%. The SLB Performance Improvement Plan of Chitungwiza Municipality (SLB PIP) and its original data CHITUNGWIZA MUNICIPALITY FINAL SLB REVIEWED QUESTIONNAIRE APRIL 12 shows this situation as shown in Table 3.5.3.

Table 3.5.3 Collection Rate of Sewerage Charge in Chitungwiza

	2012	2013	2014	2015	2016
SLB Performance Improvement Plan (Sewerage) (%)	128.3	3.12	46.4	47	
Original data (Sewerage) (%)	45	45	43	24	12

Source: SLB Performance Improvement Plan and CHITUNGWIZA MUNICIPALITY FINAL SLB REVIEWED QUESTIONNAIRE APRIL12 (Original data)

There is a discrepancy between these two data. This point will be discussed in Chapter 4. Also, the charge collection rate of tap water in this data is shown as Table 3.5.4.

Table 3.5.4 Collection Rate of Waterworks Charge in Chitungwiza

	2012	2013	2014	2015	2016
SLB Performance Improvement Plan (Water) (%)	64.9	35.3	55	57.6	
Original data (Water) (%)	35	35	44	24	23

Source: SLB Performance Improvement Plan and CHITUNGWIZA MUNICIPALITY FINAL SLB REVIEWED QUESTIONNAIRE APRIL12 (Original data)

According to the interview with Harare Water, the collection rate of City of Harare was about 50%, but SLB (Original data) of City of Harare shows the changes as in Table 3.5.5.

Table 3.5.5 Collection Rate of Waterworks and Sewage Charge in Harare

	2012	2013	2014	2015	2016
Efficiency in collection of sewage charges	58.7	52.6	31.6	47.9	33.3
Efficiency in collection of water supply-related charges	35.2	35.2	43.9	38.1	45.3

Source: Original data of SLB by City of Harare

3.6 Financial Situation

3.6.1 Financial accounting

3.6.1.1 Financial situation in Chitungwiza

(1) System, accounting standards, and process of preparing financial statements

The highest level of legislation stipulating the fiscal management, budget, and accounting of local governments including Chitungwiza Municipality is the Public Finance Management Act of 2009 (Cap. 22: 19 PUBLIC FINANCE MANAGEMENT). In this Act, the preparation of the financial statements is shown in Part 4 as below.

PART IV FINANCIAL STATEMENTS

- 32. Preparation and reporting of annual financial statements by Ministries.*
- 33. Preparation and reporting of quarterly financial statements.*
- 34. Preparation and reporting of monthly financial statements.*
- 35. Consolidation of annual financial statements.*
- 36. Content of financial statements.*
- 37. Financial statements and budgets to comply with generally accepted accounting practice.*
- 38. Publishing of reports on financial statements.*

Specific standards on the preparation based on the law above are adopted using accrual basis International Public Sector Accounting Standards (IPSAS) and International Financial Reporting Standards (IFRS).

According to interviews with the city's accounting officer and MoLG, the current accounting system used is one of three accounting systems that MoLG admits (SAGE Pastel: a system that is widespread in African countries). However, before this accounting system was introduced in 2013, accounting was done by Excel with manual input.

Preparing financial statements by these standards and the accounting system enabled the city to adopt double entry bookkeeping in accruals basis, and make three statements: Balance Sheet, Income Statement, Cash-flow Statement. In addition, on using this system, the journal entry process for the income, for example, became as follows: At first, when the right of collecting taxes occurs, both accrued income (balance sheet: current assets) and city tax revenue (income statement: revenue) should be recorded at the amount of the collected inherently before collecting them from residents. Then, when some of the actual accrued income has been collected in cash, some accrued income (balance sheet: current assets) will be transferred to cash deposit (balance sheet: current asset).

Such journal entry will be booked based on evidence every time a transaction occurs. However, the appropriateness of the financial statement itself will be described in the following section

(2) Reliability of financial statements

1) Policy on reliability on financial statements

In order to ensure the reliability of financial statements, the Public Financial Management Law stipulates internal audits, external audits and others in Chapter 8. This chapter structures as follows.

PART VIII AUDIT

80. Internal auditors.

81. External auditors.

82. Auditor's report on public entities.

83. Annual reports and audited financial statements.

84. Audit Committees.

According to the interview with the Accounting Director of the Ministry of Finance, Actual practice of audit is as follows. The appropriateness of the city's financial statements is supposed to be audited by the Auditor - General Office, but because of the lack of human resources in the board of audit, it is outsourced to a private audit corporation. As the auditor of Chitungwiza Municipality, UNICORP, which undertakes a lot of local government audits, has been selected. As for the standards for auditing, International Standards on Auditing (ISA) are used.

2) Independent Auditor's opinion

In the interview with UNICORP, adverse opinions (The independent auditor cannot guarantee as the financial statement are incorrect) were given for the financial statement from 2009 to 2013 of the Chitungwiza Municipality by the auditor. The major reason for this result is pointed out to be the problem of corruption which influenced all the financial statements incorrectly displayed. On the other hand, the report in 2014 was given qualified opinion (correctly indicated except for some exclusion items) as audit report, and improvements were seen. The report for 2015 is currently under audit. In the second dispatch, it was confirmed that the financial report on fiscal 2016 is currently still being prepared by the accounting department. It is scheduled to be audited after auditing the financial statements for 2015. Financial statements for 2017 are currently under completion. In this respect, the reporting situation of Chitungwiza Municipality is significantly delayed as financial statements are necessary to be composed within 90 days after the end of the fiscal year, and the audited financial statements should be handed in to MoLG.

The scope of the audit does not include the adequacy of the budget amount nor the comparison with the budget record.

(3) Financial statements for the past four years (Municipality level)

Financial statements of the Chitungwiza Municipality over the past four years with a comparable style for each fiscal year, the balance sheet, income statement and cash flow statement are presented in Appendix 1.

(4) Considerations to use financial statements (Municipality level)

1) How to use the financial statements (Municipality level)

One of the ultimate goals regarding the finance part of the study is to confirm that, if the BNR is restarted, it will be able to bear the appropriate operating and maintenance costs in the future. To that end, at least, it is necessary to verify the occurrence of expenses in situations where the conventional system is in operation and check the tariff collection status after a substantial rate increase in 2016. Then, it would be possible to consider the future financial margin.

However, in this study period, since only the financial statements up to 2015 were available in Chitungwiza Municipality, the financial statements in the situation of using the conventional system after 2016 and raising the tariff could not be confirmed. Therefore, it is quite difficult to make future projections based on past financial statements which were in significantly different management situations. There are three management and business contents in the sewerage service in Chitungwiza:

Step 1 Maintenance of sewer network only

Step 2 Maintenance of sewage pipe network and water spray type bed facility

Step 3 Maintenance of sewage pipe network, water spray filtration system equipment, BNR facilities

The study purpose and actual situation require estimation of the cost for step 3 by the financial statements of Step 1.

Furthermore, as mentioned above, adverse opinions were given for the financial statements for 2012 and 2013, and therefore the amounts in the financial statements are not reliable enough. These points are major restrictions on the study, and the indicators are calculated for the financial statements from 2012 to 2015. Therefore, even if other analysis methods such as simulation are used, useful analysis results cannot be derived from the above.

Consequently, from these comparative financial statements and the financial statements of the sewerage account, the analysis should be limitedly used to understand the financial size, the structural features of the financial statements, the trends of previous years' profit / loss / cash flow, the various accrued status, etc.

2) Features that can be read from financial statements (Municipality level)

a) Balance sheet (Assets)

- Total assets decreased significantly from USD 70 million to USD 41 million between 2012 and 2015.
- The fact that cumulative uncollected local tax or utility charges have halved has the greatest influence on the remarkable decrease in total assets. However, the decrease in uncollected city tax etc. is due to the provision for reserves for uncollected city tax etc. from 2014 and the amount on the balance sheet is the amount after deducting allowance. Therefore, the collection situation is not getting better.
- Calculating the ratio of cumulative uncollected city taxes / income city tax revenues, etc. is 1.60 for 2012 and 1.62 for 2015. This is considered to be an abnormal situation if it is a general private company because, for example, this situation is equivalent to a company with sales of 100USD, and with accounts receivable of 160USD.
- From this trend of total assets, it is expected that a large amount will be posted for (cumulative) uncollected city tax etc. In addition, it is considered necessary to monitor to what extent the coefficient of 2015 is decreasing in the future.
- In the financial statements of the entire city, Interfund Receivables should be eliminated by consolidating all sectors, but especially in 2012, a large outstanding balance is seen, which as well indicates that the financial statements were not properly prepared from this point.

b) Balance sheet (Debt and net assets)

- From 2012 to 2015 the largest amount of liabilities is the accrued expenses, which accounts for the majority of total liabilities (USD 67 million) in 2015 (USD 64 million).
- Accrued expenses are increasing year by year, and the situation has deteriorated in this part. However, the main accrued expenses comes from expenditure in the internal organization (accrued salary), and not for external debt. The breakdown of the accrued expenses in 2015 is as follows.

Table 3.6.1 Breakdown of the Accrued Expenses

Accounts payables	
Trade Payables	12,366,414
Payroll Payables	45,065,701
Other	3,140,663
VAT	3,545,690
	64,118,468

Source: JST based on the Balance Sheet of Chitungwiza Municipality

- There was information that unpaid salaries continue to pile during the investigation period. Therefore, when the financial statements after 2016 becomes available, it is necessary to confirm how much unpaid salary is increasing (decreasing).
- As for external debt, USD 0.68 million has been recorded as short-term borrowings from PSIP from 2013 to 2015, but long-term borrowings have not been financed since 2014.
- Among the net assets, there are no accounts corresponding to the capital of general private companies, and the valuation reserve for fixed assets is large.
- The cumulative loss is extremely large, and if it is a financial statement of a general private company, it is in a state of excessive debt. However, since the city has no capital, it is a situation different from general debt excess.
- From the above comprehensive point of view, if, for example the external debt and its interest expenses are large, it is expected that the Chitungwiza Municipality will suffer from future repayment. However, since the Chitungwiza Municipality has no external debt, it can only pay expenses within the profit earning capacity, and it is assumed that there is almost no possibility of bankruptcy due to external debt.

c) Profit and loss statement

- Revenues and expenses are fluctuating and there is no consistent trend.
- As a trend of the final loss, the final loss is recorded every year with a maximum of (29,748,208) of 2014. However, this is a year in which accruals for uncollected municipal taxes, which had not been recorded until 2014, have begun, and in other periods also accrued expenses have been increased. As mentioned above, this point is not a problem as it is not the final loss caused by increasing external debt and increasing payment, etc.

d) Cash flow statement

- Cash flow is normally expected to be positive but was negative in 2012, however it turned positive after 2013.
- Borrowing from and repayment from banks is presented for cash flows from financing activities, but there are few other funding sources.
- As a result of operating, investment, and financial cash flow, the balance of cash and cash equivalents has declined year by year. At the end of 2015, USD141,025 is outstanding. From 2016, it is necessary to perform various administrative services with annual cash inflow.

(5) Overview of Gains and Losses by Sector Account

The Chitungwiza Municipality's financial statements also presenting profit and loss calculations for each sector, and the sectoral profit and loss for FY 2015 are shown in Appendix 1.

Looking at the sectoral financial statements for 2015, it is clear that revenue sources, cost structures, etc. differ in each sector, and the final profit and loss situation is also different. For that reason, it seems that there was a change of funds with other sectors, but in an interview with Chitungwiza Municipal water director, because of use of separate bank accounts by sector from 2015, there is almost no trans-sectorial fund transfer.

In terms of profit, income from each sector is derived from each business. In terms of cost, protective clothing, fuel costs and repair costs are outstanding in sewerage accounts compared to other sectors. Protective clothing was against cholera that occurred in 2015.

3.6.1.2 Financial situation for sewerage service in Chitungwiza

(1) Financial statement over the past 5 years

The financial situation of Zengeza Sewage Treatment Plant is equivalent to the sewerage account of Chitungwiza Municipality. The income statement and balance sheet of the sewerage account with organizing in chronological order, and without unnecessary columns are shown in Appendix 1.

(2) Cash-basis Income statement

The most important thing to keep in mind when reading the financial statements of Chitungwiza Municipality including sewerage accounts is that these financial statements are prepared on an accrual basis. Although preparing financial statement based on accrual basis is an appropriate accounting from the global trend. On the other hand, the actual situation is difficult to understand if there are many credit transactions because income on a cash basis does not match revenues on the income statement. If the cash flow statement is made only for sewerage account, this problem will be solved to a certain extent. However, cash flows related to sales are calculated collectively from revenues and expenses in the cash flow statements, so it is impossible to determine how much each income and expenditure is occurring.

Coming back to the purpose of this report, the following calculation rebuilding accrual based revenue to rough cash based income is necessary to grasp the actual cash income and the spending on each item.

1) Sales

The cash flow on sales can be calculated by the following formula.

Cash collection amount related to sales = balance of account receivables at the end of previous fiscal year + accrual sales in the current fiscal year - balance of account receivables at the end of the current fiscal year

If this formula is applied to uncollected revenues and sales for each fiscal year, it can be calculated as follows.

2013: Cash collection on sales = 6,070,692 + 3, 137, 305 - 3, 575, 222 = 5, 632, 775

2014: Cash collection on sales = 3,575,222 + 2,342,872 - 6,361,431 = -443,337

2015: Cash collection on sales = 6,361,431 + 3,173,258 - 9,063,799 = 470,890

This calculation highlights that earnings on income statement based on accrual basis seems fine, but actually it was corroborated with much smaller cash and cash equivalents.

Among above results, 2014 is difficult to understand since it is negative amount; however, the sewerage account has lending, and borrowing with other sector accounts (Interfund Receivables). There was lending to other accounts in 2013 but then turned to borrowing from 2014. Therefore, in order to reflect the effect of increase or decrease of the sales account on the cash collection, it is necessary to add the following calculation.

Revised Sales Revenue = Interfund Receivables Balance of previous Fiscal Year End + Cash Collection Pertaining to Sales – Interfund Receivables Balance of Current Year End

Applying this calculation to each year, sales income is revised as follows.

2013: Revised cash collection amount on sales = 745, 901 + 5, 632, 775 - 1, 089, 064 = 5, 289, 612

2014: Revised cash collection amount on sales = 1,089,064 + (- 443,337) - (-1, 289,443) = 1,935,170

2015: Revised cash collection amount on sales = (- 1,289,443) +470,890 - (- 1,497,305) = 678,752

From this result, sales seems to decline sharply from 2013 to 2014 and flat in 2015 in the income statement based on accrual basis, but on a cash basis, it is understood that the income from 2013 is halved every year.

2) Salary

Accrued expense accounts including accrued salaries are increasing annually, although the breakdown is unknown. However, in sewerage accounts, payroll payable has not occurred, so the amount recorded in employee expense is considered to be equal to expenditure.

3) Other expenses

Trade payable on other expenses is decreasing annually. Actual expenditure is supposed to be bigger than the expenses. Unpaid VAT is increasing year by year, and the reason is thought to be VAT not being paid.

(3) Points to be noted in financial statements (sewerage account)

A large amount of final deficit was presented in 2014 on the income statement. This was due to the impact on provision and fixed asset depreciation, although there were no records on this subject until 2013, but started recording from 2014(4,870,295 USD in 2014, 3,068,060 in 2015 USD).

As a result, the final loss seems to be getting worse in 2014; however, it would have actually improved if the same accounting procedure (records without provision and depreciation) before 2013 are used in 2014 and 2015. In addition, the accounting system has also improved qualitatively as provision and depreciation are necessary in double entry bookkeeping,

3.6.1.3 Financial statements in related organizations

1) Water supply and sewerage financial situation of the City of Harare

The water supply and sewerage financial statement of the City of Harare is managed by Harare Water, but unlike the budget, the water supply and sewage systems are not classified. It is reported as one account to the City of Harare. Therefore, the calculation of the cost of sewerage alone is not possible, although according to the interview with Harare Water, the policy allocates the budget of 45% for water, 55% for other sectors.

2) Financial status of other organizations

The financial source of the expenditure on Zengeza Sewage Treatment Plant is only tariff income and donors' contribution in the past 5 years. As there are no plans of grants and subsidies from the central government to the local government in the future, financial statements are not obtained from any central government agencies. In addition, Zengeza Sewage Treatment Plant cannot spend expenses by themselves as they don't own cash. Thus, financial management is not operated in Zengeza, and the city's accounting officer is in charge of recording accounts including the sewerage account.

3.7 Public-Private Partnership, Privatization, and Corporation

3.7.1 Overview

According to the interview to the Ministry of Finance, the most important movement in recent Public-Private Partnership (PPP) movement is the JOINT VENTURES ACT. Joint Venture department is placed in the Ministry of Finance to promote this Act. Before this act was made, PPP was done on the basis of "PPP Guideline 2004"; however, no department was placed in charge for PPP.

The past major PPP projects in Zimbabwe are; Limpopo Toll Bridge, Beitbridge, Bulawayo Railway, and Mutare-Plumtree Highway. The methodology of these were Build-Operation-Transfer(BOT), though Build Transfer(BT) was used for the Toll Bridge project. There are few small PPP other than these examples, but none are done in the sewage sector in Zimbabwe so far.

The most PPP related sewage business in Chitungwiza is the Chitungwiza Sewage PPP Project promoted by Sesani inc., an engineering company in Zimbabwe. If this PPP happens, the sewage system would be operated by the SPV within PPP. The details of the project will be written in the next chapter.

Regarding privatization or other reform, there were several discussions or rumors that were spoken in MoLG, MoF, or Chitungwiza Municipality; however, there were no established plans. The sewage sector has no simple privatization plans in particular. According to MoLG's explanation, there are sectors which match their character to privatization, and sewage sector was said to be a sector which shouldn't be privatized in the content of counter measure for small income households.

3.7.2 Potential PPP project in Chitungwiza

Sesani has issued a feasibility study report in July 2017, including the exhaustive content of Sesani's water supply and sewerage PPP project. Based on the report and interview, this section will show (a) the scope of the project included in PPP, (b) operation by the PPP scheme, and (c) financial plan, mainly focusing on sewage treatment plants, especially BNR. Although Sesani has no experience of similar PPP in the past in Zimbabwe, the main members have work experience at a major UK construction company (Balfour Beatty and others) and the project is designed based on their PPP experience there.

1) Scope of projects included in PPP

In the PPP proposed by Sesani, the following repairs and constructions on the facilities are included.

Project 1 - PE and emergency repairs and metering

Project 3 - New transmission mains and water storage

Project 5 - Muda Dam and Pipeline, plus Bulk Supply transfer

Project 6 - Offices and Workshops

Approximately \$ 176 million (excluding interest on assets inclusion) is expected as invested capital to conduct these activities.

The largest amount of funds required among the components is the construction of Muda dam and the pipeline construction to the Prince Edward water treatment plant, estimating USD 128 million. Muda dam was designed back in 1995, but was a concept that didn't happen for the lack of funds. Chitungwiza Municipality will be able to have its own water source if Muda dam is constructed, and the environment of the water supply will be significantly improved.

However, the construction of water purification plants is not included in this PPP. Therefore, even if Mudadam is constructed, the raw water of the dam is assumed to be sold, and sent to the Prince Edward water treatment plant, and then purchased, and sent to Chitungwiza Municipality after processed.

Although the sewerage fee collection and maintenance are included in this PPP, the plans are formulated under the premise of using conventional plant system. Therefore, the renovation of BNR is not included in the plan. However, if BNR is rehabilitated with funds other than PPP, maintenance and management, and fee collection of BNR will also be included in the PPP scheme. All Plans including a part of the financial plan will be changed if this happens.

2) Operation by PPP scheme

The PPP is assumed to adopt BOT, so the operation of water supply and sewerage service will be run separately from municipal administration by establishing SPV (Chitungwiza water company). After constructing the assets intended to be PPP, SPV will provide services using the assets, and will be transferred to the city after 25 years of operation. The services of existing water supply and sewerage facilities is provided and maintained with using the assets, but the possession of the assets themselves will not change from the municipality and the related liabilities will not be transferred. The method to raise funds will be non-recourse loan. Providing services, making interest payments, and repaying loan are done only by revenues rose from project schemes.

The role of Chitungwiza Municipality during PPP implementation is as follows.

- Setting policy
- Provision on existing water and sanitation facilities.
- Transfer of skilled and experienced workforce from existing water and sanitation division.
- Provision of customer database.

3) Financial plan

The important points on PPP from the financial point of view is the expected yield of investors and the charge setting. As for the expected yields of investors, the loan portion is set as 8%, the stock portion as mezzanine, and the non-voting preferred stock as 15%.

The fee setting is calculated as shown in Table 3.7.1.

Table 3.7.1 Initial Tariff Settings under Chitungwiza PPP

\$ per m3 of water	Current Tariff (June 2016)	Short term measures only Tariff starts in 2020 Year 1	Short term measures and Construction of Muda Dam and pipeline to P E Waterworks Tariff in 2025 Year 6
Fixed water fee	\$3.53	\$10.00	\$12.46
Water Tariff (First 3m3 per month is free)	\$0.83 per m3	\$1.32 per m3	\$1.65 per m3
Sewerage Tariff	\$6.61 (fixed charge)	\$0.33 per m3	\$0.42per m3

Source: CHITUNGWIZA WATER COMPANY - SPV FEASIBILITY STUDY, Sesani, 2017)

The tariff collection rate is expected to be 100% due to the prepaid system. Also, although VAT needs to be paid, corporate tax will be tax exempted.

Various grounds for calculations performed by Sesani, detailed financial plans including assumptions, calculation processes, etc., and financial schedule are included in Appendix 1.

CHAPTER 4 CHALLENGES IN SEWERAGE WORKS IN CHITUNGWIZA

4.1 Challenges on Institution and Organization

1) Water Supply and Sewerage Fees and Allocation

The current Chitungwiza city sewer system has massive parts to be repaired, such as damage to pumping stations, rupture of pipelines, shutdown of treatment plants etc.

The cost of repair, operation and maintenance should be fundamentally covered by water and sewerage charges, although the current charge determination system does not take these into consideration. If the users cannot bear the necessary expenses, it is necessary to supplement with local taxes. However, local taxes and various fees are received collectively, and the budget is not allocated in accordance with collection purpose. As a result, sewerage infrastructure is left unrepaired. Therefore, there is a need for a system to properly set the water and sewerage tariff levels and to properly allocate the sewerage budget.

2) Reliable Fee Collection

As mentioned above, the water supply and sewerage fee is received collectively with local taxes and other fees. The collection rate has remained 54% in December 2017 although this is an improvement from 40% before November 2017, thanks to debt collectors. In principle, users are responsible for water supply and sewerage fees, and it is necessary to raise the collection rate from the viewpoint of fairness and securing financial resources. Prepaid meters have already been introduced for electricity supply, and this mode of payment is considered effective as can be seen in Sesani's proposal. However, it should be carefully planned as there are potential risks in the prepaid system itself as described later in this chapter.

3) Securing the Necessary Personnel

The implementing agency is the sewerage department of Chitungwiza city. It has 72 staff in sewer network maintenance and 93 staffs in the sewage treatment plant.

There are currently 51 maintenance staffs in Zengeza sewage treatment plant, of which 38 operators work in four shifts. These 51 staffs are personnel for the maintenance of the trickling filter facility that is currently running. In the case of BNR operation, 51 personnel is insufficient considering the size of the treatment facility. Hence it is also important to secure personnel and experts for sustainable maintenance and stable operation.

4.2 Technical Challenges

1) Strengthening of the Planning Ability

As the sewage infrastructure has been in place for nearly 50 years since construction, comprehensive inspection, updating or repair is required. It is necessary to clarify the projects to be implemented in the short, medium and long terms based on the current and future population and to present them as a program. As a prerequisite, it is necessary to prepare an integrated plan with the repair program of water supply infrastructure which is the source of sewage, and also to coordinate with the activities by donors. Planning ability is required to make such a plan.

2) Technology Improvement Related to Maintenance

Appropriate maintenance is essential for prolonging the life of the sewage system. Preventive maintenance type management is required as well as minimization of life cycle cost and optimization of budget in order to prevent disruption of the sewage system. Manual preparation and training for this maintenance is necessary. In addition, it is also necessary to build a maintenance database covering the current situation of sewerage facilities, history of accidents, and repair

history in light of stock management. Improvement in technology related to operation and maintenance is a challenge for the future.

3) Improvement of Sewer Inspection Technology

In order to promote systematic rehabilitation, it is necessary to accurately grasp the current situation. It is required to acquire visual inspection techniques and to introduce inspection technology using TV cameras.

4.3 Challenges in Finance

1) Adequateness and delays on accounting reports

As mentioned in Chapter 3, the financial statements of Chitungwiza city have not received an unqualified opinion yet from independent auditors. In addition, adverse opinions were given for past financial statements. Consequently, stakeholders cannot rely on these financial statements. Further, this situation might lead stakeholders to the wrong conclusion based on the analysis with these financial statements.

The legislation mandates the accounting reports to be submitted within 90 days after the end of the accounting year at the latest, but currently delayed for more than a year. Therefore, it is an urgent task to prepare financial statements with fair presentation including revenue by tax, and charges brought into Chitungwiza city. Establishing the institutional arrangement for this, is also important towards achieving the understanding of the citizens.

2) Deviation of Budget Record

Table 4.3.1 shows the budget and actual results for the revenue and the expenses of Chitungwiza city in 2015.

Table 4.3.1 Comparison of Budget and Actual Result of Revenue and Expenses in Chitungwiza

DETAILS	Annual Estimates 2015 (12 Months)	F/S (generation)	F/S (actual)
Sewerage Charges	2,586,871		
Maintenance Charges	0		
Effluent Charges	0		
Sewer Connection Fees	343,154		
TOTAL ESTIMATED INCOME	2,930,025	3,173,258	678,752
LESS: Revenue Expenditure			
Personnel Costs	622,991	921,680	921,680
General Expenses	582,363	141,884	141,884
Maintenance			
Repairs	750,000	62,503	62,503
Capital Charges	0		
Others (RCCO)	2,000		
GROSS EXPENDITURE	1,957,354	1,126,066	1,126,066

Source: JST

From the comparison between the budget and the accrual basis, it can be said that; 1) the generated revenue was slightly larger than the budget, and 2) the cost was considerably less than the budget. However, by comparing the budget and the cash basis, the actual situation is presumed to be; (1) the amount of cash collected was significantly different from the budget, and (2) all the expenditure could not be met due to the small amount of cash. This is because the income is not shown on a cash basis, whereas expenses are reported on a cash basis in the budgeting. Moreover, for this reason, the result on the budget was that a large amount of final profit came to be expected. As a result, achieving the budget goals, enabling each department to work corresponding to the budget, and increasing the effectiveness of the budget are challenges to be thought about even in sewerage projects.

3) Numerical inconsistency among financial accounting, management accounting, and management accounting data

In general financial accounting and management accounting, the same event is presented in financial statements or indicators in different departments. All data should be consistent, although there may be slight differences among data. However, the sewerage account of Chitungwiza city has a remarkable gap between the two when numerical values should be basically consistent. The collection rate from the financial statements is calculated through dividing the cash-based charge collection fee as shown in Chapter 3 by accrual basis sales. As indicators calculated for the management accounting, the collection rate as management accounting is shown in the SLB PIP and also in the original data of SLB. The following table shows each rate in a comparable form.

Table 4.3.2 Comparison of Financial Statement and SLB Data for Sewage Charge Collection Rate

	2013	2014	2015
Cash collection	5,289,612	1,935,170	678,752
Norminal revenue	3,175,819	2,352,835	3,173,258
Collection rate based on F/S	166.6%	82.2%	21.4%
Collection rate on SLB Performance Improvement Plan	3.1%	46.4%	47.0%
Collection rate on SLB (Original data)	45.0%	43.0%	24.0%

Source: JST

Since all three fee collection rates are for the same event, they are supposed to be the same value. However there is a big difference between the value taken from financial statements and the management accounting data. Also, the SLB Performance Improvement Plan is created by quoting the original data, and so these values should be equal; however, big differences among the management accounting data can be seen. Developing a proper data management system and coordinating values is an improvement needed in the future.

4.3.2 Problems related to Sewerage projects

1) Issues on the financial soundness of the city

Regarding the financial soundness of the city, deficits had occurred since 2012 and the cumulative loss has also been expanding as of 2015. However, in terms of how serious the expansion of cumulative loss is, the criterion of being good or bad in the public sector is different from that in the private sector. In other words, private enterprises are judged to be in a critical situation by calling excessive debts if cumulative loss exceeds the capital occurs in general, but local governments including Chitungwiza Municipality do not have capitals in the first place. Therefore, the criterion of the financial situation is different. In addition, through interviews with stakeholders, the situation of fiscal bankruptcy was not confirmed.

As presented in Chapter 3, the majority of liabilities occurred by accrued expenses, particularly accrued salaries, not by expenses financed from external funds with local bonds or any others. Although the city's financial situation is not quite sound, fiscal management using obtained city tax and fee collection as ceiling is the only possible way of fiscal management. Consequently, the risk of having extremely high financial leverage caused by excessive usage on external funds is low. However, since the data collection of financial statements was only available up to 2015, the situation after 2016 remains unknown. As shown in Chapter 3, there is a lawsuit between the City of Harare, and Chitungwiza Municipality. It might be possible that Chitungwiza Municipality need to pay for penalty from other sectors' revenues if it loses in court. In addition, it has been reported in several media that the problem of unpaid salaries for officers in Chitungwiza Municipality may yet worsen. As a conclusion, it is a critical challenge that Chitungwiza Municipality shows a solution to increasing unpaid expenses.

2) Issues related to soundness of sewage projects

The sewerage service is not operated by an independent public entity, and the soundness of the sewerage service follows to the soundness of the city. Although it is a principle that sewerage service is run by the income of the sewerage projects, it is not stipulated by the laws to bind sewer income to sewer expenditure. Therefore, there is a possibility of sewer revenues being used in other sectors when urgent large expenditure is required there. In such cases, it would be difficult to stock necessary spare parts for sewerage projects. This might be a future risk of the facility's sustainability and management.

4.4 Issues related to PPP

Although Zim-fund Phase2 is planned for the sewerage project in Chitungwiza City, the support is not planned for the BNR treatment plant, but is planned to be used for the repairment of the sewer pipe. From the interview with sewerage treatment plants, related facilities, and multiple stakeholders, the tasks are summarized as follows.

(1) Challenges from the present to the start of operation

1) Process of approval

In the case of local government implementing PPP in Zimbabwe, there are four stages (city council, MoLG, MoF, Cabinet) of approvals as administrative procedures. The procedural progress of the PPP advanced by Chitungwiza Municipality, and Sesani is in the final stage, and need to submit the necessary supporting documents to get the final Cabinet approval.

2) Credit guarantor

On the other hand, there is a big problem in terms of finance that the credit guarantor has not yet been found. In other words, in order for this PPP to be established, 80% of the total financial resources as a loan, and 20% of total financial resources needs to be actually disbursed. There is no particular problem in the paid-in capital part as it will be undertaken by Chitungwiza Municipality, the Pension Fund, and the National Social Security Agency. On the other hand, the loan part holds a problem. The standard bank, whose head office is located in South Africa, usually carries out a loan up to 5 years. To complement the market gap to get a 25 years loan, a guarantor is essential; however, such a guarantor has not yet been found. Therefore, PPP cannot be implemented in the future other than finding an appropriate guarantor.

3) Loan and construction period

Three years is set as the grace period; however, the bank side requires this to be two years. Although this is still being negotiated, there is also a need to shorten the construction period and to hurry monetization in order to pass the request of the bank side.

(2) Issues for sustainable operation in the future

1) Expected tasks in the scheme

Although it was not recognized as a big problem in the interview with stakeholders, it seems that there are some problems with introduction of prepaid smart meters and the fee structure. The first problem is the high price of water charges. As aforementioned, the water charge by PPP is considerably higher than the current level. In the explanation by Sesani, a survey on willingness to pay for PPP was conducted and the residents' reaction was that they have intention to pay if water is supplied appropriately even if it is a little expensive.

However, in the residents' consciousness survey in this study, it is necessary to review the point that the residents' willingness to pay is considerably lower than the fee assumed by PPP, and whether the income according to the financial plan will be feasible. The detailed result on willingness to pay is in Appendix 3.

2) Issues in Collection System

The second problem in operation will be the IT systematic risks. There are concerns that preliminary verification is difficult for system errors under the situation with the large amount of non-revenue water.

In addition, management by smart meters and introduction of the prepaid method may cause risks that are not currently recognized (e.g. the lack of a method or system of collecting fees when a system error occurs over a long period of time). There should be a notice on the possibilities that this may lead to a financial influence that could break the premise of the core of SPV as a continuing company.

3) Financial Feasibility

Finally, from the overall financial aspect of this PPP, there seems to be a problem in feasibility. In addition, there seems to be a necessity of reviewing individual assumptions and premises in order to examine it.

Specifically, in this PPP, for example, in 2020 it was scheduled that tariffs would be collected by smart meters. This scheme anticipates USD 24,066,070 as the total revenue of water supply and sewerage, and USD 36,598,094 from 2022, when it starts the dam operation. However, from the financial statements of Harare Water, looking at the fiscal size in 2016, it was USD 84,132,196 on an accrual basis, although the amount was USD 31,657,550 on a cash basis. Therefore, considering that the population of the city of Harare is about six times that of Chitungwiza, although the same level of revenue as planned for Harare city on a cash basis is planned, the feasibility of such a plan is questionable.

However, it is difficult to point out what assumptions are questionable. This is because the PPP financial plan is created on many assumptions, as shown in Appendix 1. Each hypothesis / premise and numerical value or indicator is specifically examined and cited from external resources, and the overall financial plan is the final result. Therefore, it cannot be pointed out which of the individual assumptions or premises are decisively in error, although, still, the feasibility of each should be reconsidered in terms of overall size of the project.

CHAPTER 5 ACHIEVEMENT AND DIRECTION OF JAPANESE COOPERATION IN SANITATION AND HYGIENE SECTOR

5.1 Achievement and of Japanese Cooperation in Hygiene and Sanitation Sector

The following four projects were conducted by JICA for the improvement of sanitation and the condition of solid waste in Chitungwiza.

- The Project for the Improvement of Sanity Condition in the Municipality of Chitungwiza in the Republic of Zimbabwe
- The project for Improvement of Sewage Facilities in the Municipality of Chitungwiza in the Republic of Zimbabwe
- Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality in the Republic of Zimbabwe (Provisional English title)
- The Project for the Improvement of Water Supply, Sewage and Solid Waste Management in Chitungwiza in the Republic of Zimbabwe

The summary of the projects is shown below.

(1) The Project for the Improvement of Sanity Condition in the Municipality of Chitungwiza in the Republic of Zimbabwe

Project title	The Project for the Improvement of Sanity Condition in the Municipality of Chitungwiza in the Republic of Zimbabwe
Project completion	March, 1997
Objective	To improve the solid waste condition by procuring currently lacking solid waste collection and disposal equipment and maintenance tools.
Contents of basic design	<ul style="list-style-type: none"> • Garbage collection trucks: 6 • Detachable container trucks: 8 • Containers: 18 • Dump trucks: 3 • Bulldozer: 1 • Wheel loader: 1 • Motor grader: 1 • Workshop tools • Trailer truck: 1 • Work trucks: 2
Cost estimates	Machinery and equipment: 3.35 million USD Design and supervision: 0.28 million USD Total: 3.63 million USD

(2) The project for Improvement of Sewage Facilities in the Municipality of Chitungwiza in the Republic of Zimbabwe

Project title	The project for Improvement of Sewage Facilities in the Municipality of Chitungwiza in the Republic of Zimbabwe
Project completion	January, 1998
Objective	To decrease the pollution load of Nyatsme River by improvement and expansion of Zengeza treatment plant and by replacement of decrepit mechanical and electric facilities of pump stations.
Contents of basic design	<ul style="list-style-type: none"> • Construction of new waste water treatment facilities: Sewage treatment facility with capacity 20,000m³/d

	<p>Sludge treatment facility</p> <ul style="list-style-type: none"> • Accompanying facilities for new treatment plant: Reconstruction of inlet sewer Anaerobic pond Installation of treated water distribution pipe • Rehabilitation of three pump stations: Replacement of existing pump Replacement of electrical equipment Replacement of level detector Installation of new magnetic flowmeters • Procurement and supply of equipment: Mechanical and electrical facilities for sewage treatment and sludge treatment Maintenance vehicle Water analysis equipment
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(3) Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality in the Republic of Zimbabwe (Provisional English title)

Project title	Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality in the Republic of Zimbabwe (Provisional English title)
Project completion	April 2012
Objective	The project aimed at collection and analysis of necessary basic information on the current condition of sewerage and solid waste management, and the activities and capacity of relevant organizations, for the improvement of sanitation and hygiene conditions in Chitungwiza.
Candidate improvement measure	The report shows improvement options with combination of improvement measures for sewage reticulation, pump station and treatment plant. The report shows rehabilitation options for sewage reticulation, pump station and treatment plant. Options for anticipated studies for improvement of hygiene conditions are shown.
Proposals for improvement measures	<ul style="list-style-type: none"> • Rehabilitation of existing BNR treatment plant Rehabilitation by a method capable of easy operation and maintenance such as conventional activated sludge method. • Rehabilitation of oxidation pond and filter bed Rehabilitation and expansion to 20,000m³ by the same method. • Rehabilitation of sewage reticulation and pump station To complement the rehabilitation by AfDB project.

(4) The Project for the Improvement of Water Supply, Sewage and Solid Waste Management in Chitungwiza in the Republic of Zimbabwe

Project title	The Project for the Improvement of Water Supply, Sewage and Solid Waste Management in Chitungwiza in the Republic of Zimbabwe
Project completion	September, 2013
Objective	To prepare the Master Plan and the Feasibility Studies for water supply, sewerage and solid waste management in Chitungwiza Municipality. In the F/S, the high priority projects will be selected and studied from the projects in the M/P. At the same time, the study will benefit the local counterparts in Zimbabwe by building their capacity for future development planning.
Major Contents of	<ul style="list-style-type: none"> • Sewage rehabilitation

Master Plan for sewage	<p>Urgent Phase City of Harare: Rehabilitation of Crowborough STP (Sewage Treatment Plant) and Firle STP and Sewers Chitungwiza: Rehabilitation of Zengeza STP and Pump Stations/Sewers</p> <p>Mid-Term Augmentation of facilities: City of Harare: Crowborough STP and Firle STP Chitungwiza: Zengeza STP</p> <ul style="list-style-type: none"> • Development of Ward 1 in Chitungwiza
Cost Estimates for sanitation/sewage facilities	<ul style="list-style-type: none"> • Zengeza STP improvement <ul style="list-style-type: none"> Option 1: New stabilization pond: 128,619 thousand USD Option 2: Existing trickling filter and Oxidation Ditch 20,121 thousand USD Option 3: Rehabilitation of existing BNR and usage of existing trickling filter 15,377 thousand USD • Pump station 2,592 thousand USD • Development of Tilcor Industrial area 384 thousand USD

5.2 Improvement of Zengeza WWTP

5.2.1 Basic Approach

The basic approach toward rehabilitation of Zengeza WWTP is summarized in this section.

(1) Processing Capacity

Zengeza WWTP has two lines of facility with processing capacity of 10 ML/day each, totaling 20 ML/day processing capacity. The current amount of wastewater generation in Chitungwiza city is 20.8 ML/day, but about 50 % is leaked, which makes the influx amount 10 ML/day. Considering the expected future increase in the inflow, JST proposes an improvement proposal including one line operation plan out of the two lines.

(2) Critical Matters in Repair

1) Removal of Sand

One of the causes of failure of BNR facility is the inflow of sand. It is therefore required to install facilities to remove sand.

2) Extension of Service Life

Given breakdown began to occur in five years from the start of operation, extension of service life of the facility is required.

3) Easy Maintenance

One of the reasons for failure early was that the technical level of the staffs was inadequate and maintenance was not done as specified. Installation of equipment using the latest technology that is easy to maintain is recommended.

4) Procurement of Spare Parts and Expendable Items

Machine failure occurs unexpectedly, so it is necessary to provide spare parts and expendable items to minimize the down time due to failure.

5.2.2 Consideration of BNR Repair Options

As already mentioned, one of the causes of shutdown of BNR facility is the inflow of sand. It is therefore recommended to change not only the mechanical and electrical equipment but also the specification of the facility.

Table 5.2.1 shows the repair proposals of each BNR facility.

Table 5.2.1 BNR Repair Proposals

No.	Proposal Name	Repair / Improvement Proposal for Each Facility
1	Overhaul	As machines that are considered to be operable have been left for 10 years, overhaul by machine manufacturers as well as the necessary repairs should be carried out. Nonfunctional motors need replacement of coil. Damaged outdoor cables and pipes should be replaced. Motor control center (MCC) containing the motor-driven electric circuit performs commissioning and replaces defective parts. Unrepairable machines should be replaced. Spare parts for all machines should be procured. There are 83 machines and 23 kinds of machine types for BNR.
2	Change of Grit Chamber (GC)	Since the current GC cannot deal with the problem of sand, the design of GC should be changed. Air lift system should be adopted as it works in several sewage treatment plants in Harare city and engineers at Zengeza WWTP also recommend this system. It is better to design GC residence time longer than usual since the amount of sand is large. Given the elevation of the facility (utilizing gravity flow), new GC should be constructed at the current GC position.
3	Change of mixer for anoxic tank	The motor of the mixer of the anoxic tank has a possibility of overload and needs design change. The specification should be upgraded to the machines of one rank or higher not to overload.
4	Change of aerator pressure switch	Even when the main body does not have a problem, if the pressure switch fails, the aerator stops operation. Manufacturers should be carefully selected to avoid procuring special pressure switches and pressure switches that frequently break down. Specifications of the aerator should be changed to an aerator equipped with a general-purpose pressure switch that is readily available at low cost.
5	Aerator soft start	Aerator is an important facility in BNR. A direct start-up of a motor with a maximum of 132 kW is adopted, but a soft start device using a semiconductor should be introduced in order to reduce the influence of rush current and voltage surge at the time of starting. Equipment is equipped one for each capacity, and an electric circuit that can be used only at the time of starting should be designed. This also works for extending service life of aerator.
6	Variable speed aerator	The current aerator is a 2 rated capacity motor. The large size is 90/132 kW and the small size is 30/45kW. There are two rotation speeds according to the change of the slip of the electric motor. The injection of air (oxygen) into water is performed separately by adjusting the mutual position between the aerobic tank water surface and the aerator, but the aerobic tank in Zengeza is equipped with a more complicated device which changes the aerator's turning degree change. Changing the rotation speed of the aerator requires a motor with special specifications, and the spare parts are also special. If speed change of the aerator is effective for inserting air, there is also a way to introduce a variable speed gear (VVVF) and change the motor to a single speed normal motor. Since the VVVF output voltage waveform is not a sine waveform, it should be changed to a motor for VVVF. (The motor for VVVF is not specially designed but is generally produced as a variable speed motor.)
7	Ground pump	Sand deals much damage to submersible motors. Since the motor and the

		pump are integrated in the submersible motor, if either one breaks down, the whole stops operation. It can have the same function as submersible pump to disconnect the motor and the pump, and instal it on the ground and dropping the suction pipe into the tank. Or the pump and the motor can be installed separately by disposing the pump outside the treatment tank and piercing the pipe wall through the wall of the tank. All pumps and motors are installed on the ground so that maintenance is easy. However, it is necessary to preliminarily design and construct a pedestal for installing pumps and motors. It is required to change the main submersible pumps to ground pumps in order to reduce the effect of sand.
8	Secure financial and human resources	Securing financial resources is a top priority in order to ensure replenishment of expendables and spare parts. It is also important to secure personnel for stable operation and maintenance. There are personnel and experts in Zimbabwe for BNR.
9	Security enhancement	Mechanical and electrical equipment have been vandalized in Zengeza WWTP, which causes stoppage of the facility. Enhancement of security is also important.

Source: JST

Table 5.2.2 shows combination of improvement proposals.

Table 5.2.2 Combination of Improvement Proposals

Option	Combination
A	Overhaul + GC + secure financial and human resources + security enhancement
B	Overhaul + GC + secure financial and human resources + security enhancement + Change of mixer for anoxic tank + Change of aerator pressure switch
C	Overhaul + GC + secure financial and human resources + security enhancement + Change of mixer for anoxic tank + Change of aerator pressure switch + aerator soft start + ground pump

Source: JST

Option A consists of required items for sustainable operation including anti-theft measures and sand removal. If sand is successfully removed, it is expected that failure of mixer in anoxic tank and failure of submersible pump will be reduced.

Option B aims at suppressing the failure frequency of the BNR system. Even if the mixer in the anoxic tank fails, the BNR does not move as expected. The aerator also fails to operate due to the failure of one small pressure switch, and the BNR stop operation.

Option C includes an alternative to submersible pump. As the submersible pump sucks sand directly by the impeller, sand and impeller rub against each other and the impeller wears out. Interviews with staffs at Zengeza WWTP confirmed that the submersible pump is weak against sand. Since the motor and the pump are integrated in the submersible motor, if either one breaks down, it is necessary to replace the submersible pump. On the other hand, the pump and the motor can be maintained separately in a system in which a suction pipe is placed in a well with a combination of ground pump and ground motor. However, it is necessary to preliminarily design and construct a pedestal for installing pumps and motors.

Table 5.2.3 Comparison Table of BNR Improvement Options

No	Option	A	B	C
1	Overhaul Utilize and repair the current mechanical and electrical equipment (asset management) e.g. Repair of machines, gear box overhaul, repair of motor, replacement of outdoor cable, piping repair, replacement of parts	X	X	X
2	Change of GC specifications Change the specifications of GC and new installation (adopt air lift system and upgrade of capacity) (countermeasure for inflow of sand, extend service life)	X	X	X

3	Change of mixer for anoxic tank Upgrade the capacity so as not to overload (Avoid capacity shortage, extend service life)		X	X
4	Change of aerator pressure switch Replace with aerator that does not use special pressure switch (Eliminate weakness of machine, extend service life)		X	X
5	Aerator soft start Start the aerator with soft starter unit (SSU). Add SSU to MCC. (Shock release at startup, extend service life)			X
6	Ground pump Design change of circulation pump for aerobic, Return Activated Sludge pump, and Waste Activated Sludge pump Replace submersible pump to ground pump (Improve maintainability by separation of pump and motor)			X
7	Secure financial and human resources, spare parts and expendable items	X	X	X
8	Security enhancement (prevention of robbers)	X	X	X

Source: JST

5.2.3 Cost Estimates of BNR Repair Options

The approximate cost is calculated based on rough estimation of mechanical and electrical equipment obtained from BATEMAN WATER in the Bulawayo city of Zimbabwe who constructed and installed BNR equipment in 2000. This approximate cost is the initial investment cost of FY2017 in Zimbabwe, which is converted to USD.

Table 5.2.4 Approximate Cost Estimation of BNR Repair Options (Unit: USD)

No	Option	Line	A	B	C	Remarks
1	Overhaul Utilize and repair the current mechanical and electrical equipment (asset management) e.g. Repair of machines, gear box overhaul, repair of motor, replacement of outdoor cable, piping repair, replacement of parts	1 line	726,050	726,050	726,050	Common to all options
		2 lines	1,034,350	1,034,350	1,034,350	
2	Change of GC specifications Change the specifications of GC and new installation (adopt air lift system and upgrade of capacity) (countermeasure for inflow of sand, extend service life)	1 line	303,500	303,500	303,500	Common to all options
		2 lines	586,500	586,500	586,500	
3	Change of mixer for anoxic tank Upgrade the capacity so as not to overload	1 line		82,500	82,500	

No	Option	Line	A	B	C	Remarks
	(Avoid capacity shortage, extend service life)	2 lines		165,000	165,000	
4	Change of aerator pressure switch Replace with aerator that does not use special pressure switch (Eliminate weakness of machine, extend service life)	1 line		274,100	274,100	
		2lines		548,200	548,200	
5	Aerator soft start Start the aerator with soft starter unit (SSU). Add SSU to MCC. (Shock release at startup, extend service life)	1 line			110,000	
		2 lines			110,000	
6	Ground pump Design change of circulation pump for aerobic, Return Activated Sludge pump, and Waste Activated Sludge pump Replace submersible pump to ground pump (Improve maintainability by separation of pump and motor)	1 line			387,200	
		2 lines			759,400	
7	Secure financial and human resources, spare parts and expendable items		600,000	600,000	600,000	Common to all options
8	Security enhancement (prevention of robbers)		50,000	50,000	50,000	Common to all options
9	Cleaning		61,400	61,400	61,400	Common to all options
Total Amount		1 line	1,740,950	2,097,550	2,594,750	
		2 lines	2,332,250	3,045,450	3,914,850	

Source: JST

5.2.4 Consideration of financial analysis and financial sustainability after rehabilitation

In this section, we will conduct financial analysis and finance sustainability toward utilization of the Zengeza sewage treatment plant. To do so, we will analyze them in terms of: (a) how much expenses will be incurred to maintain BNR, and (b) how much maintenance and maintenance expenses can be increased in the sewerage account of Chitungwiza City (fiscal place or volume of necessary fund).

As the assumptions of the above discussion, it is necessary to pay attention to the following concerning (1) inflation rate · interest rate handling, (2) maintenance and maintenance expenses, repair cost, (3) calculations for the combined use of the conventional system and BNR, and (4) personnel expenses.

(1) Treatment of Inflation Rate and Interest Rate

In considering financial analysis and financial sustainability, as a prerequisite for each calculation, increase of maintenance cost brought by inflation is not considered due to the stable situation of average inflation rate in recent years. However, Sesani's PPP financial plan assumes an inflation rate of 2.5%. The average inflation rate for the past five years is shown in Table 5.2.5.

Table 5.2.5 Inflation rate over the past 5 years

Year	2013	2014	2015	2016	2017	Average
Inflation rate	1.6%	-0.2%	-2.4%	-1.6%	2.5%	-0.1%

Source: World Bank WDI, and IMF Economic Outlook created by the study team

In addition, since external debt is hardly financed, and it is supposed to maintain and repair by self-finance or grant aid, interest rates are not taken into consideration.

(2) Definition of Maintenance and Repair Expenses

As to either cost estimation for operation and maintenance of BNR or prediction of the upper limit of maintenance cost that can be secured by the sewerage service in Chitungwa City, the scope of "cost for operation and maintenance of BNR" for this analysis purpose is different from Maintenance and maintenance expenses and repair expenses in the profit and loss statement in the financial statements, and is wider than that for budget / accounting.

Specifically, in terms of accounting, as detailed items of general expenses, diverse accounting subjects (such as Advertising, Audit fees and expenses, Bank charges, Discount, Chemicals, Electricity, Irrecoverable Debts, Legal and Professional expenses, Postage and Telephones, Protective clothing, Subscriptions and Donations, Transport-Fuel, Staff Welfare, Teas and refreshments, Printing and stationery, Plant Hire, Interest Charges, Tools) are included. Although some subjects like Chemicals, Electricity and Tools directly relate to the operation and maintenance of BNR, they are unable to be allocated to each facility directly due to the nature of the account subjects.

In addition, in the accounting subject, "Repairs and maintenance costs," there are two detailed subjects, "Repair expense" and "Maintenance expense", although other expenses might be spent for the same purpose. In accounting, expenses spent for repairing fixed assets which increase the value of fixed assets will be recorded as fixed assets (which is capital expenditures on budget). This also causes a difference from the costs for BNR operation and maintenance. Therefore, in this section, in order to calculate the upper limit of maintenance and maintenance expenses that can be secured by the sewerage service in Chitungwiza Municipality, we define "allocation ratio to BNR in total general expenses and repair costs". With this regard, we are trying to correct from accounting account items to analysis purpose. The image diagram related to the above explanation is as shown in Figure 5.2.1.

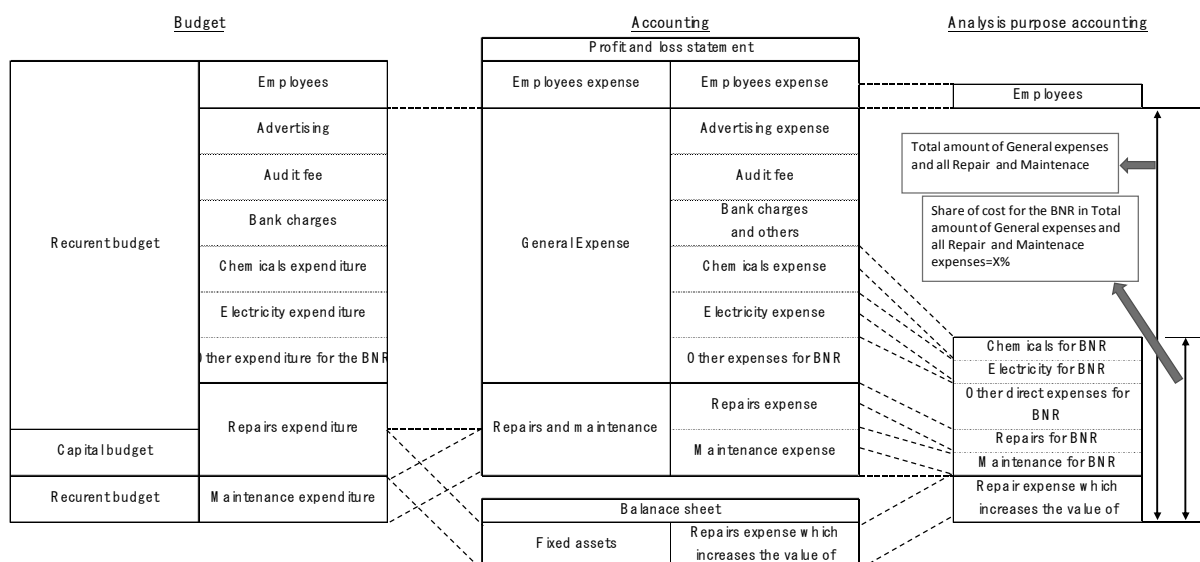


Figure 5.2.1 Image of Operation and Maintenance Cost of BNR

(3) Personnel Expenses

Based on past financial statements and budget, it is considered that surplus personnel were assigned in the sewerage service. That is, while USD 1.2 million was allocated as a personnel expenditure budget around 2012 when the conventional treatment plant was not in operation, 0.6 million dollars was allocated in 2016 after the conventional treatment plant was rehabilitated. Therefore, since the personnel system and salary level that are actually required in the sewerage project are unknown, in this section, personnel expenses are considered as fixed expenses as follows. (a) Personnel expenses necessary for maintaining current spraying filtration facility facilities, pump stations, sewage pipes, etc. are 622,991USD, which is included in the budget for 2018, (b) Personnel expenses necessary for operating BNR are 144,000 USD.

5.2.4.1 Cost Forecast to Maintain the BNR

(1) Forecast based on the Replacement of Fixed Assets and Life Cycle Cost

Through the forecast based on the replacement of fixed assets life cycle cost, the total of operating and maintenance expenses is calculated individually as expenses incurred each year except for personnel expenses. First, concerning the expendable items of the facility itself, the oil fee, etc., by the option C shown in 5.2.3 cost estimate of the support option of the Zengeza sewage disposal plant, the cost of equipment was 2,694,300 USD for the machinery requiring. Regarding this amount, if annual operation and maintenance expenses of 5% are estimated, annual expenses will be $2,694,300 * 5\% = 134,725$ USD. In addition, from Shimizu Corporation that built this BNR, we obtained cost estimation for maintaining and maintaining the same type of BNR in Japan, and electricity and chemicals are large in this. When such estimates are converted in Zimbabwe's unit price / currency, it is as shown in Table 5.2.6.

Table 5.2.6 Cost Estimation for Chemicals and Electricity

Chemicals	PAC(10%)	58.26	116.53	g/m3	0.454545 USD/kg	0.053 USD/m3	
	Sodium hypochlorite (12%)	33.61	67.23	g/m3	0.454545 USD/kg	0.031 USD/m3	
	Polymer	10.6	21.14	g/m3	6.363636 USD/kg	0.134 USD/m3	
					Chemicals used in Japan (FX rate: 1USD=110)		
				Total		0.2 USD/m3	1,591,544 USD/Year
Electricity	11,709 kWh/d				0.098 USD/kWh	1,147 USD/Day	418,831 USD/Year
				Unit cost in Zimbabwe is used			
						Total	2,010,375 USD/Year

Source: JST

If we assume (1) the whole function will be maintained by replacing parts sequentially in the next 20 years, and (2) expenses will cost double progressively within having intervals of 5 years in the next 20 years from the facility's life cycle, the calculation of repair cost in the next 5 years would be as follows.

$$0 - 5 \text{ years: } 2,694,300 * 1 / (5 * 1 + 5 * 2 + 5 * 4 + 5 * 8) = 35,924 / \text{year}$$

$$6 - 10 \text{ years: } 2,694,300 * 2 / (5 * 1 + 5 * 2 + 5 * 4 + 5 * 8) = 71,848 / \text{year}$$

$$11 - 15 \text{ years: } 2,694,300 * 4 / (5 * 1 + 5 * 2 + 5 * 4 + 5 * 8) = 143,696 / \text{year}$$

$$16\text{th} - 20\text{th} \text{ year: } 2,694,300 * 8 / (5 * 1 + 5 * 2 + 5 * 4 + 5 * 8) = 287,392 / \text{year}$$

From this result, for the first year, estimated operation and maintenance cost would be

$$134,725 + 418,831 + 1,591,544 + 35,924 = 2,181,024 \text{ (USD).}$$

(2) Forecast based on Operation and Maintenance Cost of Average Sewage Treatment Plant in Japan

In the analysis report on the sewerage entities in Japan by the Ministry of Land, Infrastructure, Transport and Tourism of Japan, 13,000 yen / m³ day is calculated as the average annual operation and maintenance cost of sewage treatment plants. In addition, the ratio of maintenance cost to capital cost is shown as 65.8: 82.3. If these figures are used for the BNR capacity (20 m³) at the Zengeza plant and converted into year / US dollar (1 USD = 110 yen), the total cost is calculated as follows.

$$\text{Operation and maintenance cost} = 13,000 * 20 * 365 / 110 = 862,727 \text{ (USD)}$$

$$\text{Capital cost} = 862,727 / 65.8 * 82.3 = 1,079,064 \text{ (USD)}$$

$$\text{Total amount} = 862,727 + 1,079,064 = 1,941,792 \text{ (USD)}$$

The total amount also includes personnel expenses, and the various costs are Japanese based. Furthermore, since various sorts of methods are mixed in Japan's sewage treatment plant, it cannot be said that it is a cost corresponding to BNR. However, the cost ratio of personnel expenses in sewage treatment plant operating and maintenance costs is over 10% in Japan, and despite being a conservative calculation (based on cost of Japan), this is lower than the cost estimation result.

(3) Cost Estimation by PPP

As to the calculation sheet of Sesani, the sewer fee was estimated with multiplying the water supply amount by the targeted expense unit price. That is, a water supply amount of 37,584 m³ / day is expected in the project start year. Then, 31,946 m³ / day of sewerage inflow is calculated based on it. This is the daily maintenance cost, which is multiplied by 0.35 USD / m³, and the result of calculating 365 days is estimated to be 4,081,125 USD as annual maintenance cost on financial statements. Also, from the following year after starting business, the first year's amount is multiplied by the inflation rate of 2.5%. In addition to this, if the common indirect cost of water supply and sewerage is allocated to the sewerage plant by some cost driver, the total maintenance cost will increase.

However, the above-mentioned amount is the cost estimate for maintaining the conventional plant. In the interview with Sesani about the rise in maintenance and maintenance expenses when BNR was rehabilitated, it is necessary to consider the income generated by treated water supply from Zengeza plant to the Prince Edward water treatment plant. It is possible to circulate and resell wastewater from BNR. In other words, by sending water from BNR to the Prince Edward Water Treatment Plant, 0.25 USD / m³ will be resale / increase income, so if the cost increase is less than 0.25 USD / m³, it can be absorbed. Yet, according to Sesani, it was mentioned that the cost of about 3 times the current estimate would be imposed because the electricity and chemicals will be a high burden for the operation of the BNR. Therefore, by doubling the present cost and deducting the increased income, it is $0.35 * 3 - 0.25 = 0.8$ m³, which is multiplied by the influx of sewage and if further based on the year, USD 9,328,232 is maintained for the first year of the year, it is estimated as expenses (excluding

personnel expenses and indirect expenses). For the following year and later, it is calculated by multiplying this by 2.5% inflation.

5.2.4.2 Prediction of Upper Limit of Maintenance Cost that can be secured by sewer project in Chitungwiza Municipality

(1) Forecast based on 2018 Budget

Regarding the budget size of the whole city of Chitungwiza, approximately 201 million USD is recorded as revenue in the 2018 budget. However, this amount, like the sewerage project, shows the amount that can be reached if all the city tax and various usage fees are collected.

The budget for sewerage accounts is USD 5,870,727 as income in 2018 and the total cost is USD 2,652,975. In current expenditure, personnel expenses are USD 622,991, general and administrative expenses are USD 813,362, and maintenance and repair costs are USD 359,952. The sum total of general and administrative expenses plus maintenance and repair expenses is 1,173,314 USD. In addition, the capital expenditure of 836,670 USD has been recorded, and the total expenditure budget to Zengeza Sewage Treatment Plant in a situation where BNR which added this to general maintenance fee as maintenance cost and repair cost is not used, is 2,009,984 USD.

However, as stated in Chapter 4, according to the past budget-actual comparison, there is a large gap between the budget amount and the actual amount on a cash basis. In particular, it is assumed that it is difficult to spend according to this budget, as expenditure is largely influenced by income, that is, sewerage fee collection rate.

(2) Forecasts based on Historical Financial Statements

Regarding the income statement concerning past sewerage, as mentioned in Chapter 3, if the financial statements before 2014 are unreliable, 2015 will be 3,173,258 USD on a revenue basis on 2015, and 678,752 USD on cash basis. Regarding the cost aspect, the total of expenses excluding personnel expenses, general administrative expenses and repair / maintenance expenses is 204,384 USD. Therefore, this amount of expenses is a very small proportion (6.4%) of the income-based revenue amount, as it was analyzed in Chapter 3. This would be because the revenue is attributed on an accrual basis. Also, since the equipment of the conventional system was rehabilitated in 2016, it should be considered that the cost up to 2015 when Zengeza sewage treatment plant was not in operation at all.

From the above situation, even based on the financial statements up to 2015, it is difficult to predict to what extent the expenditure is possible if the BNR is rehabilitated in the future. As explained in Chapter 3, 2016 and 2017 financial statements are not yet available because they are being prepared. However, it is expected that revenues will both increase considerably on an accrual basis or cash basis due to the substantial tariff raise from 4.5 USD to 7.6 USD from FY 2016 as shown in Chapter 3. Regarding the tariff collection rate as well, as shown in Chapter 4, there is no data on the period since 2016, but if there is no significant change, it is expected that income will also increase significantly.

It should be noted that the cost of 2016 and 2017 is the cost corresponding to the conventional method. If these are obtained, more accurate calculation for using the conventional system and BNR can be made with the use of actual operation cost for the conventional system.

In addition to examining the financial statements of sewerage accounts in Chitungwiza Municipality, the study team also examined the financial statements of Harare Water, which has already operated BNR. However, since the financial statements of Harare Water are collective financial statements of water supply and sewerage systems, and there are common costs of water supply and sewerage system, it is difficult to extract the individual cost for maintaining BNR. For reference, we extracted the costs imposed directly on the Firle wastewater treatment facility running BNR from Harare Water General Ledger in 2016. The results are as shown in Table 5.2.7.

Table 5.2.7 Cost Directly Imposed on Fillet Wastewater Treatment Plant (2016)

(Fixed assets)	(USD)
Work in progress	1,236,803
(Expenses)	
Sundry materials	57
Rates & Charges	20,131
Loose tools	68
Travelling	3,640
Plant and machinery	420
Vehicle maintenance	5,405
Total expense	29,720

Source: JST based on the information from the contractor

However, this seems that the cover rate is extremely short in order to calculate the expenses for operation and maintenance of BNR.

In the interview at the second dispatch, it was confirmed that the amount of chemicals currently being used in Harare Water is insufficient for proper sewage treatment.

(3) Consideration based on Future Forecasted Cash Flows

Based on the budget and past financial statements, when BNR is rehabilitated, the amount that can be contributed to the extent of operating and maintaining BNR in the sewerage plant in the future is (1) rate collection rate, (2) general administrative expense and the allocation ratio to BNR in the total repair cost. Therefore, by matching these rates with changes, it is possible to estimate what extent of the cost should be allocated to BNR in the future.

The maximum collection amount is set as the charge amount to all scheduled customers, that is, the estimated amount of income on the budget (USD 5,870,727). Personnel expenses are fixed as 1,000,000 USD annually, considering the budget amount and past actual amount, as well as the number of people required for BNR.

In regard to the baseline, the collection rate is difficult to determine because there is a difference among the data as described in Chapter 4. However, according to the interview with the accounting department, it was 36% in November 2017 and 54% after strengthening the collection ability in December. Considering these past trends, about 40% would be the baseline. Therefore, in the analysis below, the focus will be on how far you can raise the monthly collection rate on average from around 40%. Next, the baseline cannot be set for general and administrative expenses and allocation rate to BNR in total repair cost. This is because there are, not only BNR operation and maintenance expenses but also the operation and maintenance expenses of the conventional system not included in the financial statements up to the year 2015. This causes two variables: the operation and maintenance expenses ratio of both BNR and conventional plant.

Change the charge collection rate from the expected budget revenue amount from 40% to 100% at 5% interval. Then, deducting estimated personnel expenses from the estimated earnings amount, amounts obtained by changing the remaining amount from 30% to 60% and at intervals of 5% are as shown in Table 5.2.8.

Table 5.2.8 Possible Operation and Maintenance Cost According to Tariff Collection Rate and Distribution Rate Change (USD)

		Allocation ratio to BNR in total general expenses and repair costs						
		30%	35%	40%	45%	50%	55%	60%
Collection Ratio	40%	474,390	553,455	632,520	711,585	790,650	869,715	948,780
	45%	562,451	656,193	749,934	843,676	937,418	1,031,160	1,124,902
	50%	650,512	758,930	867,349	975,768	1,084,186	1,192,605	1,301,023
	55%	738,573	861,668	984,764	1,107,859	1,230,954	1,354,050	1,477,145
	60%	826,634	964,406	1,102,178	1,239,950	1,377,723	1,515,495	1,653,267
	65%	914,694	1,067,144	1,219,593	1,372,042	1,524,491	1,676,940	1,829,389
	70%	1,002,755	1,169,881	1,337,007	1,504,133	1,671,259	1,838,385	2,005,511
	75%	1,090,816	1,272,619	1,454,422	1,636,224	1,818,027	1,999,830	2,181,633
	80%	1,178,877	1,375,357	1,571,836	1,768,316	1,964,795	2,161,275	2,357,754
	85%	1,266,938	1,478,094	1,689,251	1,900,407	2,111,563	2,322,720	2,533,876
	90%	1,354,999	1,580,832	1,806,665	2,032,498	2,258,332	2,484,165	2,709,998
	95%	1,443,060	1,683,570	1,924,080	2,164,590	2,405,100	2,645,610	2,886,120
100%	1,531,121	1,786,308	2,041,494	2,296,681	2,551,868	2,807,055	3,062,242	

Source: JST

(4) Forecast based on PPP's Financial Plan

According to Sesani's financial plan, the sewerage fee income is 3,989,765 USD since 2020 after setting up the smart meter. This is less than USD 4,081,125 for operation and maintenance expenses corresponding to the conventional treatment plant confirmed above. In this regard, PPP calculates water and sewage together, and there is no restraint that the sewerage service will be operated by collecting sewage tariff collection. Therefore, in implementation by PPP, the upper limit of maintenance cost that can be secured by the sewerage service needs to be predicted based on the sum total of income from both water supply and sewerage services, but to what extent it can be allocated to sewerage service, the amount indicated in the scheme is considered as the upper limit.

According to Sesani's interview, if there is a rehabilitation of the BNR, the premise will change dramatically, so it will be necessary to review the fee structure. Therefore, it was said that the maximum amount will change depending on the revenue after change.

5.2.4.3 Review of Comprehensive Financial Sustainability

Above analysis shows (1) how much expenses will be incurred to maintain BNR (amount of contents), and (2) how much operation and maintenance expenses can be increased in the sewerage account of Chitungwiza Municipality (frame size). Here, we examine the overall financial sustainability.

In examining the cost for operating and maintaining BNR, it is also significant whether or not to use the currently used conventional system after BNR restart, but in considering financial sustainability, it is assumed that the conventional system and BNR are used in combination.

First, in terms of (1), to the extent to which BNR maintenance costs (amount of contents) occurred, this was calculated with three approaches, but as a result it can be understood that for proper operation and maintenance of BNR. Therefore, at least, it is thought that financial budget that can bear additional cost of about 2 million USD besides labor costs.

On the other hand, it is difficult to estimate from the budget and the past financial statements about the extent to which the maintenance cost will be increased (fiscal capacity, framework size). It will be reasonable to apply it to the result of examination based on cash flow.

(1) Conservative Case

Adopting replacement of fixed assets and prediction based on life cycle for the extent to which maintenance cost can be increased (fiscal capacity, size of frame) to generate fiscal capacity of more

than 2 million USD. The collection rate that can be collected, and the range of allocation to BNR in general administrative and repair costs are limited to the cases shown in green in Table 5.2.9.

Table 5.2.9 Conservative Case

		Allocation ratio to BNR in total general expenses and repair costs						
		30%	35%	40%	45%	50%	55%	60%
Collection Ratio	40%	474,390	553,455	632,520	711,585	790,650	869,715	948,780
	45%	562,451	656,193	749,934	843,676	937,418	1,031,160	1,124,902
	50%	650,512	758,930	867,349	975,768	1,084,186	1,192,605	1,301,023
	55%	738,573	861,668	984,764	1,107,859	1,230,954	1,354,050	1,477,145
	60%	826,634	964,406	1,102,178	1,239,950	1,377,723	1,515,495	1,653,267
	65%	914,694	1,067,144	1,219,593	1,372,042	1,524,491	1,676,940	1,829,389
	70%	1,002,755	1,169,881	1,337,007	1,504,133	1,671,259	1,838,385	2,005,511
	75%	1,090,816	1,272,619	1,454,422	1,636,224	1,818,027	1,999,830	2,181,633
	80%	1,178,877	1,375,357	1,571,836	1,768,316	1,964,795	2,161,275	2,357,754
	85%	1,266,938	1,478,094	1,689,251	1,900,407	2,111,563	2,322,720	2,533,876
	90%	1,354,999	1,580,832	1,806,665	2,032,498	2,258,332	2,484,165	2,709,998
	95%	1,443,060	1,683,570	1,924,080	2,164,590	2,405,100	2,645,610	2,886,120
	100%	1,531,121	1,786,308	2,041,494	2,296,681	2,551,868	2,807,055	3,062,242

Source: JST

(2) Case of Chemical Reduction

However, with regard to the above cost estimate, since the proportion of chemicals is so high. If it is assumed that chemicals can be halved due to the reduction of price through local procurement, improvement of the quality of influent wastewater by raising public awareness, the additional cost for BNR operation will be $2,000,000 - 800,000 = 1,200,000$ USD. In this case, the yellow color in Table 5.2.10 will be added as the range of possible burden to pay.

Table 5.2.10 Decrease in Chemicals

		Allocation ratio to BNR in total general expenses and repair costs						
		30%	35%	40%	45%	50%	55%	60%
Collection Ratio	40%	474,390	553,455	632,520	711,585	790,650	869,715	948,780
	45%	562,451	656,193	749,934	843,676	937,418	1,031,160	1,124,902
	50%	650,512	758,930	867,349	975,768	1,084,186	1,192,605	1,301,023
	55%	738,573	861,668	984,764	1,107,859	1,230,954	1,354,050	1,477,145
	60%	826,634	964,406	1,102,178	1,239,950	1,377,723	1,515,495	1,653,267
	65%	914,694	1,067,144	1,219,593	1,372,042	1,524,491	1,676,940	1,829,389
	70%	1,002,755	1,169,881	1,337,007	1,504,133	1,671,259	1,838,385	2,005,511
	75%	1,090,816	1,272,619	1,454,422	1,636,224	1,818,027	1,999,830	2,181,633
	80%	1,178,877	1,375,357	1,571,836	1,768,316	1,964,795	2,161,275	2,357,754
	85%	1,266,938	1,478,094	1,689,251	1,900,407	2,111,563	2,322,720	2,533,876
	90%	1,354,999	1,580,832	1,806,665	2,032,498	2,258,332	2,484,165	2,709,998
	95%	1,443,060	1,683,570	1,924,080	2,164,590	2,405,100	2,645,610	2,886,120
	100%	1,531,121	1,786,308	2,041,494	2,296,681	2,551,868	2,807,055	3,062,242

Source: JST

A summary of the above analysis is made as follows.

- Regarding the size of cost for operating and maintaining BNR, it is not a level of monetary value that cannot be covered even by fully allocating the sewerage income generated.
- Among the additional expenses required when BNR is operated, in particular when strictly estimating chemicals, increase the collection rate of the charge to at least 70% or more, and

further increase general and administrative expenses and maintenance. At least 60% of the administrative expenses should be allocated to BNR, and the other 40% must maintain and manage the conventional treatment plant, pipe catcher and pump station. In order to reduce the allocation rate to BNR, it is necessary to raise the collection rate even more.

- c) It is necessary to raise the charge collection rate to about 50% and increase the allocation rate to BNR to 60% even if it is possible to lower the additional cost required when BNR is operated efficiently.
- d) In order to operate and maintain only one line of BNR, it is necessary to spend BNR of about 55% of the collection rate of 45% and general administrative expenses and repair / maintenance / maintenance expenses.
- e) In the PPP scheme, it is planned to cover the maintenance cost for a large amount of sewerage projects, and in this case, it is assumed that BNR will be properly maintained and managed. However, it is prerequisite that the cost for sewerage maintenance is born by the water supply business the expected collection rate is 100% by smart meter/prepaid system, the price change is flexible, etc. Various concerns for this case are described in Chapter 4.

5.3 Recommendations for Sustainable Water and Sewerage Services

5.3.1 Status Variance from Past Points in Time

As an overall recommendation of this study team, the rehabilitation should consider repairing facilities including improvements according to the living environment in Chitungwiza Municipality. What is of concern in this case is that past outages will be repeated. Therefore, regarding the case where rehabilitation is done according to the proposal of this study team, we summarized the change of various situations in the past and the situation assumed in the future as shown in Table 5.3.1.

Table 5.3.1 Changes in the Past and Circumstances Expected in the Future

Major risks	Situation from 2006 to 2009	After rehabilitation
1. Equipment damages caused by inflow sand volume exceeding treatment capacity	Equipment similar to Harare City, where the amount of sand is relatively small	Risk reduction is possible by increasing GC and increasing the amount of sand processing. (Increased effect by public awareness on sand use as technical cooperation)
2. Shortage of replacement parts for damaged equipment	Spare parts were not purchased and stored.	Risk avoidance is possible by continuously installing replacement parts in the warehouse on site. (Increase in effect due to appropriate operation and maintenance of lead time etc. as technical cooperation)
3. Foreign exchange (inflation) risk for parts purchased from overseas	Overseas parts became difficult to procure owing to the occurrence of hyperinflation and marked deterioration in the exchange rate.	Risk reduction is difficult (the same even by other rehabilitation methods)
4. City budget shortage to purchase parts	Economic turmoil made it impossible to collect fees that match market conditions.	Risk reduction is difficult (the same even by other rehabilitation methods)

Source: JST

The BNR system itself has been operating in Harare City even before 2000, which shows the sophistication of Zimbabwe compared to other African countries at the time. In addition, considering the impact of Harare city and the environmental burden, it seems reasonable that the Zengeza sewage treatment plant selected same BNR system.

Regarding the complete suspension of the Zengeza Sewage Treatment Plant, one of the major reasons would be that the response to the lifestyle habits of the residents of Chitungiza City was insufficient at the design stage of the Plant. Yet, it is presumed that the influence of hyperinflation that should be considered as an external condition was too large to do anything.

Regarding the inflation rate in particular, we examined the situation in recent years already, but as early as the transition from the past, Zimbabwe already had a high inflation rate since the early 2000's, as shown in Table 5.3.2.

Table 5.3.2 Inflation rate after 2001

Year	2001	2002	2003	2004	2005	2006	2007	2008
Inflation rate (%)	76.7	140.1	431.7	282.4	302.1	1096.7	24,411.0	N/A
Year	2009	2010	2011	2012	2013	2014	2015	2016
Inflation rate (%)	N/A	3.0	3.3	3.9	1.6	-0.2	-2.4	-1.6

Source: World Bank WDI, and IMF Economic Outlook created by the study team

The difficulty of Zimbabwe's economic and fiscal policy at that time is obvious even with this data alone. Under such circumstances, the BNR in Zengeza Sewage Treatment Plant was in operation. Considering the diligent personality as a national character in Zimbabwe, until 2009 when the plant completely stopped, it is presumed that hard renovation work continued in Zengeza sewage treatment plant, and even in Harare BNR. Although it is expected that overwhelming economic turmoil will not occur again, this is uncertain.

As the inflation rate for various calculations in this survey, past data and forecasts by the World Bank and the IMF are used. However, in regard to the recent situation, an inflation rate of 130% was reported in the newspaper in October 2017, and there is concern that hyperinflation will occur again. Therefore, the recommendations of this study also include the construction of an emergency measure system that can cope with inflation.

5.3.2 Tasks and Recommendations for Sustainable Water Supply and Sewage Works

At present, due to financial constraints and small inflow which is about 20% of the prescribed capacity, processing is carried out by the trickling filter system. However, the original role of the sewage system is the conservation of water quality (advanced treatment for eutrophication and water pollution improvement) or water shed management (water circulation, water environment) of public water bodies. Considering the impact on the environment from that viewpoint, some improvements are needed to improve the living environment and public health. Table 5.3.3 shows tasks and recommendations for enabling sustainable water supply and sewage works for the future as a measure for that.

Table 5.3.3 Tasks and Recommendations for Sustainable Water Supply and Sewage Works

Task / Timing	Short Term	Mid/Long Term	Negative impact when measures are not taken	Remarks
■ Water quality improvement of public water and hygiene promotion				
Repair of broken pipeline and pump stations	X		Exacerbation of public health and spread of infectious diseases due to leakage of wastewater	*1
Improvement of BNR facilities	X		Water quality deterioration in public water bodies	
Stop discharging water to the farm and discharge the treated water satisfying the criteria to the river		X	Water quality deterioration in public water bodies and groundwater pollution	
■ Capacity development for water and Sewerage management				

Task / Timing	Short Term	Mid/Long Term	Negative impact when measures are not taken	Remarks
Improve water supply rate (promotion of the dam project)	X		Stagnant of collection rate of sewere charge	
Capacity development for BNR operation and maintenance		X	Outage of the facility	In case BNR facility is rehabilitated
Capacity development for inventory controll of spare parts and chemicals for both systems		X	Outage of the facility	
■ Improvement of business management and financial capacity				
Improvement of the capacity for realistic cash-based budget formulation and appropriate preparation of financial statement	X		Unstable operation & management	
Improvement of management capacity using management index including fee collection rate	X		Unstable operation & management	
Improvement of pricing capacity based on general cost		X	Unstable operation & management	
Awareness raising of residents against use of sand at home		X	Decline in processing function or function stop	*2
Establishment of funding system at the central government for uragent occasion such as inflation		X	Turmoil in the inflation period	

Source: JST

*1 According to the residents' consciousness survey in this study shown in Appendix 3, the installation ratio of shallow wells is considerably larger than the survey results by interviews and various documents. Therefore, there is concern that public health issues would occur in the future.

*2 According to the residents' consciousness survey in this study, the reason to use sand is not because sand is cheaper than detergent, but it is used with expectation of its effectiveness. Therefore, it will be possible to suppress the use of sand by enlightenment of residents.

5.3.3 Workshop for Survey Findings

This section summarizes the discussions in the workshop held on 13th April, 2018 to share the survey findings. The minutes of the meeting are included in the appendix 4.

Date: 13 April 2018

Venue: New Ambassador Hotel, 88 Kwame Nkurumah Street, Harare

Chair of the meeting: Ministry of Environment, Water and Climate

Co-chair of the meeting: Ministry of Local Government, Public Works and National Housing

Objective: To share and discuss the survey findings

Agenda and schedule:

Time	Agenda	Responsible
09:30 – 10:00	Registration	
10:00 – 10:05	Opening/Introduction	Ministry of Environment, Water and Climate
10:05 – 10:10	Opening Remarks	JICA HQ
10:10 – 11:20	Presentation on the survey findings	JICA Survey Team
11:20 – 11:40	Break	All
11:40 – 12:40	Discussion	All
12:40 – 12:50	Wrap-up comments/remarks	Ministry of Finance and Economic Development
12:50 – 13:00	Closing Remarks	Ministry of Local Government, Public Works and National Housing
13:00 –	Lunch	All

Attendance List:

No	Organization	Position	Name
1	MEWC	Deputy Director	G. Mawere
2	MEWC	Deputy Director	R. Mutepfa
3	MLGPWNH	PD VLA	E. N. Jones
4	MLGPWNH	Civil Engineer	E. E. Veremu
5	Chitungwiza Council	Director Urban Planning	C. Muchesa
6	Chitungwiza Council	Acting Director Works	E. Mushata
7	Chitungwiza Council	W Superintendent	W. Gowero
8	EMA	E Q Officer	U. Mapxashike
9	Harare Water	A/ Water Manager	T. R. Kunyadini
10	ZINWA	Q A Manager	N. Mawango
11	ZINWA	Head Clear Water	F. G. Manzira
12	ZINWA	Hydrologist	H. Chetenga
13	MOFED	Chief Acc	C. J. Shaumu
14	MOFED	Principal Economist	Forbes Kanogwere
15	MOFED	Economist	S. Timbe
16	MOKOP	D Director	M. Nyaruwanga
17	MFAIT	Desk Officer	P. M. Sigauke
18	Ruwa Town Council	Water Sanitation Engineer	H. Nyakutsikwa
19	Ruwa Town Council	Administration Manager	K. Madanhi
20	Norton Town Council	D.E.S	B. Maramba
21	Epworth Local Board	Head of Eng. Department	J. O . Zvoreva
22	City of Harare	W W Manager	S. T Muserere
23	ZimFund/ AFDB	Manager	E. Nzabanita
24	UNICEF	WO	B. Nzara
25	Sesani	Director	M. Peto
26	Sesani	Director	T. Mputa

No	Organization	Position	Name
27	JICA HQ	Director	Masanori Kurisu
28	JICA HQ	Deputy Director	Ryousuke Nakase
29	JICA Zim Office	Resident Representative	Shumon Yoshiara
30	JICA Zim Office	Project Formulation Advisor	Sakae Kashihara
31	JICA Zim Office	P.O	Tachiwana. Nkomo
32	JICA South Africa	Chief Representative	Seki Tomohiro
33	JICA South Africa	Representative	Tsubota Yumiko
34	JICA Study Team	Consultant	Tatsuo Tomidokoro
35	JICA Study Team	Consultant	Natsuki Shimegi

Discussion points:

- The water treated with trickling filter method has high environmental burden and it is unsuitable to discharge into surface water from the viewpoint of water circulation.
- The participants understand the necessity and importance of restarting BNR at Zengeza sewage treatment plant for reducing environmental burden.
- Zim-Fund has experience of renovation of BNR facility which was in the similar state of Zengeza BNR.
- Since the financial burden of BNR is very large, it is difficult to operate under the current financial situation.
- BNR will be required after the population of Chitungwiza increases (inflow volume increase) in the future.
- It is necessary to lower the maintenance cost in BNR.
- It is desirable that BNR be restarted after the action plan is formulated by Zimbabwean government and short and medium term efforts are made accordingly.

APPENDIX 1 DATA FOR FINANCIAL ANALYSIS

1.1 Data for Chapter 3

(1) Budget for Firlle Treatment Plant in 2017

Function.....	Budget 2016	Approximate Actual 2016	Budget 2017
9105 FIRLE			
101 SALARIES	1,055,730	979,426	979,430
105 OVERTIME: SALARIED STAFF	176,004	167,752	107,750
106 COL AWARD PROVISION	0	0	0
107 ANNUAL BONUS	105,573	97,943	97,940
117 PENSION PROV. OTHER EMOLUMEN	1,280,363	1,265,389	1,159,558
1200 ADMIN CHARGE:HEAD OFFICE	0	0	0
1201 ADMINISTRATION CHARGES: OTHE	0	0	0
1218 PENSIONS AND GRATUITIES	0	0	0
1223 GRASS CUTTING	10,000	5,000	10,000
1224 INFECT DISEASES PEST CONTROL	100,000	50,000	100,000
1231 CHEMICALS	85,000	10,000	85,000
1234 DRUGS AND DRESSINGS	10,000	5,000	10,000
1239 SUNDRY MATERIALS	100,000	75,000	50,000
1240 ADVERTISING	0	0	0
1241 BOOKS, PRINTING, STATIONERY	1,000	1,000	1,000
1244 SUNDRY OFFICE EQUIPMENT	5,000	3,500	5,000
1245 TEAS	3,000	2,000	500
1246 TELEPHONE	1,000	1,000	1,000
1252 INSURANCES	0	0	0
1253 PETROL, DIESEL AND OIL	50,000	40,000	20,000
1254 ALLOWANCES	500	500	500
1255 UNIFORMS, PROTECTIVE CLOTH.	50,000	50,000	50,000
1257 TEST AND INVESTIGATIONS	50,000	25,000	50,000
1259 PROTECTIVE MEASURES	100,000	50,000	10,000
1261 ELECTRICITY	939,000	853,000	939,000
1264 LAUNDRY	15,000	15,000	15,000
1265 MEDICAL ATTENTION	50,000	50,000	10,000
1267 SERVICE OR SUPPLEMENTARY	5,000	5,000	5,000
1269 WATER	0	0	0
1274 LICENSES	0	0	0
1285 LOOSE TOOLS	25,000	25,000	25,000
1290 TRAVELLING	2,000	2,000	1,000
1292 HIRE CHARGES	100,000	100,000	30,000
1295 RENTS	0	0	0
1299 APPOINTMENT EXPENSES	1,000	1,000	500
2311 BUILDINGS: ROUTINE	5,500	5,500	5,500
2321 FURNITURE AND EQUIPMENT	500	500	500
2341 LAND IMPROVEMENTS	50,000	50,000	50,000
2361 MAINS	0	0	0
2371 PLANT AND MACHINERY	1,500,000	1,000,000	300,000
2391 VEHICLE MAINTENANCE	10,000	10,000	10,000
3400 INTEREST	0	0	0
3401 REPAYMENTS	0	0	0
4500 REVENUE CONTRIBUTION TO CAPI	6,000,000	0	700,000
Expenditure	11,886,170	4,945,510	4,829,178
Less Amounts Charged out	0	0	
Net Expenditure	11,886,170	4,945,510	4,829,178

(2) Budget for Sewerage in Chitungwiza Municipality

1) Details of Current Expenditure

CODE	DETAILS	Annual Estimates 2013 (12 Months)	Annual Estimates 2014 (12 Months)	Annual Estimates 2015 (12 Months)	Annual Estimates 2016' (12 Months)	Annual Estimates 2017' (12 Months)	Annual Estimates 2018' (12 Months)
Personnel Costs							
	Bonuses	65,709	65,444	30,211	30,211	30,211	30,211
0401	Medical Aid Contributions	14,496	13,920	11,040	11,040	11,040	11,040
0402	Pension Fund Contributions	136,412	135,861	62,717	62,717	62,717	62,717
0403	Dev Levy and workmen's compensation	8,516	8,482	3,915	3,915	3,915	3,915
0101	Salaries and wages & Allowances	985,043	979,502	515,108	515,108	515,108	515,108
Sub-Totals		1,210,176	1,203,208	622,991	622,991	622,991	622,991
Maintenance							
2010	Buildings	10,000	10,000	10,000	6,000	6,000	6,000
2015	Electricity	5,000	5,000	5,000	3,000	3,000	3,000
2020	Furniture and Equipment	5,000	5,000	5,000	3,000	3,000	3,000
2029	Plant and Machinery	600,000	600,000	80,000	60,000	60,000	60,000
	Sewerage treatment plant					51,600	51,600
2027	Sewerage Reticulation	600,000	600,000	600,000	400,000	58,352	58,352
2025	RM-Light Vehicle	100,000	100,000	50,000	30,000	30,000	30,000
Sub-Totals		1,320,000	1,320,000	750,000	502,000	211,952	211,952
Repairs							
	Buildings				4,000	4,000	4,000
	Electricity				2,000	2,000	2,000
	Furniture and Equipment				2,000	2,000	2,000
	Plant and Machinery				20,000	20,000	20,000
	Sewerage Reticulation				200,000	100,000	100,000
	RM-Light Vehicle				20,000	20,000	20,000
Sub-Totals					248,000	148,000	148,000
General Expenses							
1010	Administration Charges	0	0	0	0	0	0
1401	Advertising	4,000	4,000	4,000	4,000	4,000	4,000
1201	Audit Fees	5,000	5,000	5,000	5,000	5,000	5,000
1202	Bank Charges	0	0	0	0	0	0
1203	Books and Periodicals	5,000	5,000	5,000	5,000	5,000	5,000
1204	Chemicals & Cleaning Material	20,000	20,000	20,000	20,000	20,000	20,000
	Computer project development					30,000	20,000
1301	Conferences and official visits	5,000	5,000	5,000	5,000	5,000	5,000
1005	Consumable stores	10,000	10,000	10,000	10,000	10,000	10,000
	Debt Collection costs					50,000	30,000
1210	Electricity	60,000	60,000	200,000	200,000	200,000	170,000
1213	Fire Services	5,000	5,000	5,000	5,000	5,000	5,000
1601	Fuel and Oils	15,000	15,000	15,000	15,000	15,000	15,000
1215	Hire Charges	10,000	10,000	50,000	50,000	50,000	50,000
1217	Insurance	0	0	0	0	0	0
1220	Laundry and linen	1,000	1,000	1,000	1,000	1,000	1,000
1030	Laboratory Tests	40,000	40,000	10,000	10,000	35,000	35,000
1230	Legal and Professional Fees	10,000	10,000	10,000	10,000	10,000	10,000
1221	Loose Tools & Minor Equipment	15,000	15,000	10,000	10,000	10,000	10,000
1701	Manpower levy	9,394	9,351	4,363	4,363	4,363	4,363
1709	Medical examination	30,000	30,000	30,000	30,000	30,000	30,000
	Life cover	0	0	0	0	0	0
1230	Printing and Stationery	3,000	3,000	3,000	3,000	3,000	3,000
1231	Protective Clothes & Uniforms	20,000	20,000	60,000	60,000	60,000	60,000
..							
CODE	DETAILS	Annual Estimates 2013 (12 Months)	Annual Estimates 2014 (12 Months)	Annual Estimates 2015 (12 Months)	Annual Estimates 2016' (12 Months)	Annual Estimates 2017' (12 Months)	Annual Estimates 2018' (12 Months)
1035	Pumping costs	0	0	0	0	141,000	141,000
1036	Recharges - Housing Account	0	0	0	0	0	0
1040	Security Costs Reallocated	0	0	0	0	0	0
1240	Security Measures	10,000	10,000	10,000	10,000	10,000	10,000
1045	Sewerage connection costs	2,000	2,000	2,000	2,000	47,000	47,000
1705	Staff welfare	0	0	50,000	50,000	50,000	50,000
1246	Teas and Refreshments	1,000	1,000	1,000	1,000	1,000	1,000
1245	Telephones	2,000	2,000	2,000	2,000	2,000	2,000
1710	Training Courses	20,000	20,000	20,000	20,000	20,000	20,000
1250	Water Charges	0	0	50,000	50,000	50,000	50,000
Sub-Totals		302,394	302,351	582,363	582,363	873,363	813,363
Capital Charges							
1300	Internal Loans Repayments	0	0	0	0	0	0
1300	Redemption (MLGPW&NH)	0	0	0	0	0	0
Sub-Totals		0	0	0	0	0	0
Revenue Contribution to Capital							
1060	Furniture and Equipment	2,000	2,000	2,000	2,000	15,000	15,000
1290	Plant and Machinery	0	0	0	0	167,500	102,500
	Sewerage rehabilitation						628,870
	Slurry pumps					15,000	15,000
1273	Motor bikes & tri-cycles	0	0	0	0	12,000	12,000
	Squat pan to toilet seat migration					18,300	18,300
	New Sewer Line					45,000	45,000
	Communication Radio						20,000
Sub-Totals		2,000	2,000	2,000	2,000	272,800	856,670
GRAND TOTALS		1,624,394	1,624,351	1,334,363	1,334,363	1,506,115	2,029,985

2) Budget with Total Current Expenditure, Source of Income and Capital Expenditure

CODE	DETAILS	Annual Estimates 2013 (12 Months)	Annual Estimates 2014 (12 Months)	Annual Estimates 2015 (12 Months)	Annual Estimates 2016' (12 Months)	Annual Estimates 2017' (12 Months)	Annual Estimates 2018' (12 Months)
6602	Sewerage Charges	2,499,000	2,586,871	2,586,871	4,362,045	5,527,573	5,527,573
6610	Maintenance Charges	0	0	0	0	0	0
6618	Effluent Charges	0	0	0	0	0	0
6617	Sewer Connection Fees	185,400	269,400	343,154	343,154	343,154	343,154
TOTAL ESTIMATED INCOME		2,684,400	2,856,271	2,930,025	4,705,199	5,870,727	5,870,727
LESS: Revenue Expenditure							
	Personnel Costs	1,210,176	1,203,208	622,991	622,991	622,991	622,991
	General Expenses	302,394	302,351	582,363	582,363	873,363	813,363
	Maintenance				502,000	211,952	211,952
	Repairs	1,320,000	1,320,000	750,000	248,000	148,000	148,000
	Capital Charges	0	0	0	0	0	0
	Others (RCCO)	2,000	2,000	2,000	2,000	272,800	856,670
GROSS EXPENDITURE		2,834,570	2,827,559	1,957,354	1,957,354	2,129,106	2,652,976
SUR/(DEF) FOR THE YEAR		-150,170	28,711	972,671	2,747,845	3,741,621	3,217,751
Surplus/(Deficit) Brought Forward		-277,383	-504,658	949,183	1,025,201	676,780	676,780
RESULTANT SUR/(DEF)		-427,553	-475,947	1,921,854	3,773,046	4,418,401	3,894,532
	Transfers to Engineering account	0	0	0	0	0	0
	Transfers from Water Account	0	0	0	0	0	0
Surplus/(Deficit) Carried forward		-427,553	-475,947	1,921,854	3,773,046	4,418,401	3,894,532
Capital Expenditure							
4565	Furniture and Equipment	2,000,000	2,000,000	0	0	0	15,000
4565	Plant and Machinery	3,500,000	3,500,000	0	0	0	102,500
4565	Sewerage rehabilitation	0	0	1,187,893	1,187,893	210,000	628,870
	Slurry pumps						15,000
4273	Motor bikes & tri-cycles	140,000	140,000	0	0	0	12,000
4565	Squate pan to toilet seat migration	0	0	0	0	0	18,300
	New Sewer Line						45,000
	Communication Radio						20,000
4565	Hard standing concrete(St Mary's 1& 3	300,000	300,000	0	0	0	
		5,940,000	5,940,000	1,187,893	1,187,893	210,000	836,670
Capital Financing							
3600	Loan - MLGPW&NH	4,000,000	4,000,000	0	0	0	0
3403	Grant- ZIMFUND	0	0	1,187,893	1,187,893	210,000	0
3403	Private contributions	0	0	0	0	0	0
	Private Public Participation	0	0	0	0	0	0
3600	Own resources	0	0	0	0	0	0
		4,000,000	4,000,000	1,187,893	1,187,893	210,000	0
TOTAL REV. & CAP. EXPEND.		6,834,570	6,827,559	3,145,247	3,145,247	2,339,106	2,652,976
TOTAL REV. & CAP. INCOME.		6,869,800	7,125,671	4,461,073	6,236,247	6,423,882	6,213,882

(3) Service Level Benchmark of Sewerage in Chitungwiza Municipality

SLB Performance Improvement Plan Template

Town/City: _____ Chitungwiza

Municipality _____ Reporting Period: 2015

Service: waste water management

Indicator: Coverage of toilets, % Benchmark: 100%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		85%		
2013	100%	85%	4	
2014	100%	90%	4	
2015	100%	70%		Strengthen a pay toilet model Adopt user based maintenance and repairs for complete designs for sewer for un-serviced layouts through beneficiary based stand servicing approach by December 2015 refurbish at least 5 public toilets by December 2015
2016				1. Strengthen a pay toilet model throughout 2016 2. Adopt user-pay principle to complete designs for sewer for un-serviced layouts through beneficiary -based stand servicing throughout 2016 3. Refurbish at least 12 public toilets by December 2016
2017	100%	70.50%		§ Adopt a pay toilet model for at least 4 toilets by Dec 2017 § Adopt user-pay principle to complete designs for sewer for at least 2 un-serviced layouts through beneficiary -based stand servicing throughout 2017 § Refurbish at least 12 public toilets by Dec 2017
2018				

Service: waste water management

Indicator: Coverage of sewerage network services, % Benchmark: 66/80%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		83%		
2013	66/80%	70.20%	3	
2014	66/80%	88.97%	3	
2015	66/80%	69.5		Sewer reticulation rehabilitation (10KM) by December 2015 Sewer pipe replacement hot spot areas (5km) and missing lines by December 2015 Provide O and M –reticulation repair materials by December 2015

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2016	66/80%			1.Sewer reticulation rehabilitation (10KM) by December 2016 2.Sewer pipe replacement hot spot areas (5km) and missing lines by December 2016 3.Provide O and M –reticulation repair materials by December 2016
2017	69.60%			1.Connect 60 new customers to the sewer reticulation by Dec 2017
2018				connect unserviced suburbs to the sewer reticulation system targeting unit n,o,p extensions

Service: waste water management

Indicator: Efficiency in collection of sewage, %

Benchmark: 95%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		128.30%		
2013	95%	3.12%	4	
2014	95%	46.40%	4	
2015	95%	47%		Rehabilitation of 5000 manholes by December 2015 Repair / rehabilitation of pump station by December 2015 To increase access to potable water by servicing the debt at City of Harare Sewer pipe replacement hot spot areas(5km) and missing lines by December Repair and installation of influent flow meters by December 2015
2016	95%			1.Rehabilitate 5000 manholes by December 2016 2.Sewer pipe replacement at hot spot areas(5km) and missing lines by December 2016 3. Increase access to potable water by 5ML.day by Dec 2016 4.Repair and install influent flow meters by December 2016
2017	50%			Upsize 4288m of sewer line from pipe sizes ranging from 150mm to pipe sizes ranging from 250mm to 500mm by December 2017]
2018				· Draw KPIs list and dedicate resources for the maintenance of such indicators Install intake flow measuring devices at treatment works

Service: waste water management

Indicator: Adequacy of capacity for treatment of sewage, %

Benchmark: 100%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		320.70%		
2013	100%	18.60%	4	
2014	100%	0%	4	
2015	100%			Commissioning of rehabilitated Zengeza treatment plant by December 2015 Rehabilitation of Tilcor pump station, pipe bridge and ponds (for industrial influent)
2016	100%			1.Rehabilitate Tilcor pump station, pipe bridge and ponds (for industrial influent) by Dec 2016 2.Maintain the Modified conventional treatment works in functional order throughout 2016
2017	450%			1. Rehabilitation of Tilcor pump station, pipe bridge and ponds (for industrial influent) by December 2017 2. Maintain the Modified conventional treatment works in functional order throughout 2017

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2018	100%			Rehabilitation of Tilco pump station and ponds Maintain the modified conventional treatment works in functional order
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Service: waste water management

Indicator: Quality of sewage treatment, %

Benchmark: 100%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		0%		
2013	100%	0%	4	
2014	100%	0%	4	
2015	100%	0%		Site Lab and ancillary now in place awaiting commissioning Recruitment of laboratory personnel.
2016	100%			1. Recruit 2Nox. laboratory personnel to do quality tests internally
2017	100%			Collect at least 1 effluent sample per month. Recruit 2Nox. laboratory personnel to do quality tests internally
2018	100%			Send at least one set of samples per month to an outside reputable analyst for micro-biological and chemical analysis Recruit one lab technician and one assistant technician Recruit one trade waste inspector

Service: waste water management

Indicator: Extent of recycling or reuse of sewage, % Benchmark: 10%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		0%		
2013	10%	0%	4	
2014	10%	0%	4	
2015	10%			Commissioning of rehabilitated effluent pump stations, pumping to Imbwgwa farm
2016	10%			Carry out EIA for land application of effluent at Imbwgwa farm
2017	100%			Pump at least 15.2ML.Day effluent to Imbwgwa farm retention ponds for land application purposes for the 12 months of 2017 Repair effluent flow recorder by July 2017.
2018	10%			Calibrate flow meters for discharge to imbwa farm Ensure that all transfer pumps to imbwa farm are readily usable throughout the year

Service: waste water management

Indicator: Efficiency in satisfactory response/reaction to customer complaints, % Benchmark: 80%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		3.30%		

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2013	80%	91.90%	2	
2014	80%	46.30%	3	
2015	80%	62%		Procure 2No.x utility vehicles ,8Nox communication devices, O and M equipment and information technology equipment by Dec 2016 Institute proper complaints and compliments register
2016	80%			1.Procure 2No.x utility vehicles ,8Nox communication devices, O and M equipment and information technology equipment by Dec 2016 2.Enforce the keeping of proper complaints and compliments register
2017	70%			Monitor complaints register daily . Procure 2No.xMotor bikes, 2No.x tricycles and 1No.x slurry pump by June 2017 To ensure that at least 70% of reported blockages are attended to within 24hrs. Introduce mobile application and digital municipal dashboard to improve customer -Municipality interaction by Dec 2017
2018				To ensure that at least 80% of reported complains are resolved within the 24 hr period To augment transport for reaction teams by using tri cycles To effectively utilise multifaceted ways of receiving complaints and compliments from our customers

Service: waste water management

Indicator: Efficiency of cost recovery in sewage management (%) Benchmark: 150 %

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		265.90%		
2013	150%	321.50%	2	
2014	150%	349%	4	
2015	150%	228%		Complete sewer connection survey Ring-fencing of sewerage account
2016	150%			1.Complete illegal sewer connection surveys by Dec 2016 2.Ring-fence sewerage account by Dec 2016
2017	200%			§ Proffer amnesty to illegally connected customers and regularize at least 60 % of illegal connections by Dec 2017. § Ring-fence the sewerage account by June 2017.
2018	150%			·ring-fence sewerage account and through this we should be able reduce our percentage to acceptable levels of 150%

Service: waste water management

Indicator: Efficiency in collection of sewage charges, % Benchmark: 75%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		36.56%		
2013	75%	45.40%	4	
2014	75%	44%	4	
2015	75%	61%		Improved billing, capturing of correct data account ring fencing Restore ratepayers confidence by improving service delivery

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2016	75%			1.Update property stock database by Aug 2016 2.Ring fence sewerage account by Dec 2016 3.Improve bill collection ratio by at least 15% by Dec 2016
2017	42%			Update sewer connections database for 2 Wards using GIS by Dec 2017 Ring fence sewerage account by June 2017 Handover to lawyers Debtors owing at least \$200 by Dec 2017
2018	75%			Ring fence sewerage account and maintain proper balance sheet to view revenue versus sewerage expenditure.

Service: waste water management

Indicator: Maintenance Coverage ratio, % Benchmark: 15%

Time Period	Performance Target	Performance Achieved	Reliability Score Achieved	Action Plan to Achieve the Target
2012 (baseline)		2.12%		
2013	15%	10.30%	4	
2014	15%	6.50%	4	
2015	15%	5.80%		Ring-fencing of sewerage account Improve maintenance record
2016	75%			1.Ring-fence sewerage account by Dec 2016 2.Maintain all maintenance record throughout 2016
2017	6%			§ Separate repairs from maintenance budget throughout year 2017 § Prepare and adhere to maintenance schedule throughout year 2017
2018	75%			Make out a maintenance plan focusing on our KPIs and provide resources for it

(4) Balance Sheet of Chitungwiza Municipality in Past Four Years

	2012 US\$ RESTATED	2013 US\$	2014 US\$ RESTATED	2015 US\$
ASSETS				
Current assets				
Cash and cash equivalents	1,971,532	236,516	137,117	294,922
Receivables	39,222,204	34,606,822	21,147,234	23,636,702
Inter-A/c receivables	619,309	2,065	(132)	209
Inventories	198,997	416,356	241,814	3,373
Total	42,012,042	35,261,758	21,526,034	23,935,207
Non-current assets				
Property, plant and equipment	28,214,279	28,602,073	18,421,026	17,162,561
Total assets	70,226,321	63,863,831	39,947,060	41,097,768
LIABILITIES				
Current liabilities				
Accounts payables	34,560,885	39,348,826	53,415,593	64,118,468
Inter-A/c payables	-	-	-	-
Bank overdraft	5,521,272	1,477,207	2,100,518	435,980
Short term Loan-Bank	-	-	-	-
Short term Loan-PSIP	316,894	684,394	684,394	684,394
Short-term provisions	4,424,593	3,835,002	4,259,042	1,849,768
Total	44,823,644	45,345,429	60,459,547	67,088,609
Non-current liabilities				
PSIP Loan	333,106	-	-	-
Bank Loan	-	738,437	(0)	-
	333,106	738,437	(0)	-
Total liabilities	45,156,750	46,083,866	60,459,547	67,088,609
NET ASSETS & RESERVES				
Accumulated surpluses / (Deficits)	(6,275,069)	(13,578,775)	(5,557,394)	(57,040,907)
Revaluation reserves	26,421,093	26,421,093	26,107,235	26,107,235
Estimate Reserve	4,872,147	4,886,244	4,886,244	4,891,044
Capital Development Fund	51,401	51,401	51,401	51,401
Revenue contribution to capital outlay	-	-	-	-
Total	25,069,572	17,779,963	(20,512,513)	(25,991,227)
Total liabilities and reserves	70,226,322	63,863,829	39,947,034	41,097,383

(5) Income Statement of Chitungwiza Municipality in Past Four Years

	2012 US\$ RESTATED	2013 US\$	2014 US\$ RESTATED	2015 US\$
Revenue				
Rates and Supplementary Charges	5,324,896	6,055,643	3,966,821	7,434,137
Fees and Penalties	4,461,442	2,387,133	2,462,780	2,057,943
Sales and Tarriffs	13,354,551	23,443,526	11,072,902	13,929,748
Business Licences	81,052	69,403	116,427	100,869
Rentals	176,697	6,163	296,402	1,281,063
Grants and Other Income	1,115,961	14,673,270	192,057	385,468
Total	24,514,599	46,635,139	18,107,389	25,189,227
Expenses				
Employee costs	21,604,306	18,167,054	19,910,401	10,762,297
General expenses	9,049,333	33,521,704	5,286,325	6,908,564
Repairs and maintenance	263,249	162,301	166,427	339,670
Cost of sales	1,673,745	2,087,786	1,440,869	592,379
Provisions			21,051,575	12,069,441
Total	32,590,633	53,938,845	47,855,597	30,672,350
Surplus/(Deficit) for the year	(8,076,034)	(7,303,706)	(29,748,208)	(5,483,123)
Surplus/(Deficit) b/fwd	1,800,965	(6,275,069)	(21,809,186)	(51,557,784)
Accumulated surpluses / (Deficits)	(6,275,069)	(13,578,775)	(51,557,394)	(57,040,907)

(6) Cash-flow Statement of Chitungwiza Municipality in Past Four Years

	2012 US\$	2013 US\$	2014 US\$	2015 US\$
OPERATING ACTIVITIES				
Surplus / (Deficit) For the Year Before Interest	(8,445,670)	(15,534,117)	(29,748,208)	(5,483,123)
Increase in RCCO	1,122,215	34,399	-	-
Add: Accrued Interest		8,230,409		
Adjust for Non-cash items-Depreciation			1,420,029	
Bad debts provision			19,631,546	
Operating Profit before Working Capital Changes	(7,323,455)	(7,303,706)	(8,696,632)	(5,483,123)
CHANGES IN WORKING CAPITAL	6,949,446	9,213,618	8,495,582	6,042,233
Increase/(Decrease) in Payables	16,082,367	4,787,942	14,066,767	10,702,875
Increase/(Decrease) in Provisions	807,376	(589,591)	424,040	(2,409,274)
Decrease/(Increase) in Inventory	(22,340)	(217,359)	174,541	238,441
Decrease/(Increase) in Interfunds	(3,429,530)	617,244	2,193	(341)
Decrease/(Increase) in Receivables	(6,488,427)	4,615,382	(6,171,960)	(2,489,467)
NET CASH INFLOW/OUTFLOW FROM OPERATING ACTIVITIES	(374,009)	1,909,912	1,909,912	559,110
INVESTING ACTIVITIES				
Acquisition of property, plant & equipment	(426,251)	(387,794)	(70,250)	1,258,465
Proceeds from asset disposal			287,000	
NET CASH INFLOW/OUTFLOW FROM INVESTING ACTIVITIES	(426,251)	(387,794)	216,750	1,258,465
FINANCING ACTIVITIES	782,059	752,534	(738,437)	4,800
Estate reserve	782,059	14,097	-	4,800
Interest on PSIP Loan		-	-	-
Bank loan	-	738,437	(738,437)	0
NET CASH INFLOW/OUTFLOW FROM FINANCING ACTIVITIES	782,059	752,534	(738,437)	4,800
NET MOVEMENT IN CASH & CASH EQUIVALENTS	(18,201)	2,309,048	(722,738)	1,822,376
CASH & CASH EQUIVALENTS AT BEGINNING OF YEAR	(3,531,539)	(3,549,740)	(1,240,691)	(1,963,401)
CASH & CASH EQUIVALENTS AT END OF YEAR	(3,549,740)	(1,240,692)	(1,963,429)	(141,025)

(7) Gains and Losses of Sewerage Sector in Chitungwiza Municipality

<u>Revenue</u>	RATES	HEALTH	HOUSING	SEWERAGE	WATER	WELFAR	BEERH	ENGINEERI	EDUCATI	FINAL
Rates and Supplementary Charges										
Owner's Rates										
Supplementary Charges										
							-	-	-	7,434,137
Fees and Penalties										
Development Fees										-
Bicycle Licences							-	-	-	-
Penalties & other fees							-	-	-	-
Cemetry Fees							-	-	-	-
Connection Fees							-	-	-	-
Hawkers and Vendors							-	-	-	-
Cession Fees							-	-	-	-
Service fees							-	-	-	-
Plan approval fees							-	-	-	-
Market fees							-	-	-	-
Lodgers and application							-	-	-	-
Levies							-	-	-	-
Shop Licences							-	-	-	-
Health Inspection							-	-	-	-
Bus Terminus Fees							-	-	-	-
Maternity fees							-	-	-	-
Clinic Fees							-	-	-	-
Family Planning							-	-	-	-
Drug Fees							-	-	-	-
Hire Charges							-	-	-	-
Rental							-	-	-	-
Hall Hire							-	-	-	-
							-	-	-	2,057,943
Sales and Tarriffs										
Refuse Removal									-	
Sewerage Service							-	-	-	
Beer sales							-	-	-	
Insurance							-	-	-	
Development levy							-	-	-	

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Land sales								-	-	-	
Water Charges								-	-	-	
Admin charges								-	-	-	
											13,929,748
Business Licences											
Liquor licence											
Rentals											
Rents											
Grants and Other											
Interest Received								-	-	-	-
Donations								-	-	-	-
Sundry Revenue								-	-	-	-
Hire of Equipment								-	-	-	-
Grants								-	-	-	-
RCCO write off								-	-	-	-
Credit write off								-	-	-	-
Administration Charges								-	-	-	-
								-	-	-	385,468
Total Revenue											25,189,227

Expenses	RATES	HEALTH	HOUSING	SEWERAGE	WATER	WELFARE	BEERHALL	ENGINEERIN	EDUCATION	FINAL
Employee costs										
Salaries and Wages	4,224,050	1,523,999.29	1,166,362	921,680.00	339,232.18	547,027	72,420	1,837,585	129,943	
General expenses										
Advertising	28,974		2,005			-	-	1,189	-	32,792
Audit fees and expenses	16,624	8,610.27	4,794			2,349	-	6,672	477	43,787
Bank charges	72,231	3,828.00	4,678			5,678	4,279	9,198	1,854	
Discounts	-	-	-	-	-	-	-	-	-	-
Chemicals	1,183	291.30	238			-	-	182	-	10,615
Computer project	56,860	-	-	-	-	-	-	-	-	56,860

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Computer stationery	16,584	76.00	-	-	-	-	418	84	17,161
Councillors' allowances	13,325	-	-	-	-	-	-	-	13,325
Electricity	18,016	7,100.00	2,585	-	556	11,704	-	-	39,961
Staff Funeral Expenses	7,776	-	5,570	-	-	22,270	9,086	-	44,752
General expenses	9,114	4,000.00	6,600	-	-	2,968	1,843	-	24,525
Irrecoverable Debts	-	-	-	-	-	-	-	-	-
Insurance	13,832	-	-	-	-	-	-	-	13,832
Land Improvement	-	-	-	-	-	-	-	-	-
Legal and Professional	708,388	422.00	6,555	-	-	-	319	-	-
Trade fair expences	3,150	-	-	-	-	-	-	-	3,150
Postage and Telephones	60,915	815.00	63	-	-	3,854	223	-	66,182
Protective clothing	3,138	297.99	4,214	-	-	-	26,493	-	57,701
Subscriptions and Donations	10,044	-	3,627	-	3,000	2,160	-	-	18,831
Transport-Fuel	218,752	33,653.82	21,890	-	2,015	50,106	-	-	-
Staff Training	-	4,367.00	-	-	-	-	-	-	5,802
Teas and refreshments	40,889	776.11	14,651	-	-	-	833	-	57,262
Water purchases	408	-	-	-	-	-	-	-	408
Refuse bins	-	-	-	-	-	-	14,395	-	14,395
Printing and stationery	33,090	8,195.50	254	-	-	1,723	1,982	-	45,345
Plant Hire	15,395	-	100	-	-	-	1,652	-	17,237
Conferences and official	153,446	5,525.00	16,034	-	-	-	2,000	-	-
Interest Charges	380,336	-	-	-	-	-	-	-	-
Licence fees	55,416	-	-	-	-	6,477	930	-	62,823
Rentals	2,815	-	-	-	-	4,040	1,372	-	8,227
Tools	6,973	9,906.71	299	-	335	-	26,703	70	56,265
Travelling and subsistence	273,523	25,856.00	1,115	-	-	-	9,900	-	-
Loan redemption	-	-	-	-	-	-	-	-	-
Purchases	-	-	-	-	-	-	-	-	-
Drugs	-	14,641.16	-	-	-	-	-	-	14,641
	2,221,199	128,361.86	623,810		13,833	109,580	439,286	2,485	6,908,564
Repairs and maintainance									
Repairs	44,004	5,097.61	1,847	-	-	699	-	-	-
maintanance	-	-	-	-	-	-	-	-	-
Cost of sales						592,379			
Provision	3,616,175.67	97,024.41				91,988.71		208,405.26	
Depreciation	157,089	97,024.41	92,302	-	32,085	91,989	83,297	65,652	
Bad Debts	3,459,087	-						142,753	

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area in Zimbabwe
 April 2018

Loan Repayments										
Loans repaid										
Revenue Contribution to										-
Total Expenditure	10,105,428	1,754,483	2,605,590			592,945	274,688	4,293,845	340,833	30,672,350
Surplus/(Deficit) for the	(1,496,426)	(1,482,512.36)	1,577,397			(549,466)	362,156	(790,945)	(61,115)	(5,483,123)
Surplus/(Deficit) b/fwd	(30,890,314)	(9,510,822.12)					(3,806,149)		346,167	
Accumulated surpluses /	(32,386,741)		(1,417,338)			(2,161,962)	(3,443,993)	(8,715,974)	285,052	(57,040,517)

(8) Income Statement of Sewerage Account in Chitungwiza Municipality

	2012	2013	2014	2015
Revenue				
Fees and Penalties	22,773	38,501	9,961	10,588
Penalties & other fees	4,840	23,514	400	2,484
Connection Fees	17,933	14,987	9,561	8,104
Sales and Tarriffs	540,237	3,137,305	2,342,872	3,162,670
Refuse Removal	0	0	0	0
Sewerage Service Charges	540,237	3,137,305	2,342,872	3,162,670
Grants and Other Income	65	13	2	0
Interest Received	65	0	0	0
Sundry Revenue	0	13	2	0
Total Revenue	563,075	3,175,819	2,352,835	3,173,258
Expenses				
Employee costs	1,420,602	1,103,065	1,220,335	921,680
Salaries and Wages	1,420,602	1,103,065	1,220,335	921,680
General expenses	55,395	4,805,855	100,268	141,884
Advertising	0	0	0	624
Audit fees and expenses	5,033	4,538	-1,508	3,030
Bank charges	2,614	5,975	3,292	6,214
Discount	0	55,086	0	0
Chemicals	0	0	50	8,721
Electricity	-6,869	2,493	4,809	0
Irrecoverable Debts	0	4,651,917	0	0
Legal and Professional expenses	1,000	5,000	2,845	2,049
Postage and Telephones	0	0	0	302
Protective clothing	7,620	8,746	9,732	23,558
Subscriptions and Donations	0	0	0	0
Transport-Fuel	42,299	17,706	76,204	84,997
Staff Welfare	1,110	740	1,320	1,535
Teas and refreshments	0	0	0	113
Printing and stationery	0	0	0	85
Plant Hire	0	6,092	0	0
Interest Charges	2,301	34,406	0	0
Tools	287	13,156	3,525	10,656
Repairs and maintanance	52,196	4,892	8,691	62,503
Repairs	52,196	4,892	8,691	62,503
maintanance			0	0
Cost of sales				
Provision	非計上	非計上	4,870,295	3,068,060
Depreciation			483,101	483,101
Bad Debts			4,387,194	2,584,959
Total Expenditure	1,528,193	5,913,812	6,199,590	4,194,127
Surplus/(Deficit) for the year	-965,118	-2,737,993	-3,846,755	-1,020,869
Surplus/(Deficit) b/fwd	7,010,066	6,044,948	905,539	-2,941,216
Accumulated surpluses / (Deficits)	6,044,948	3,306,955	-2,941,216	-3,962,085

(9) Balance Sheet of Sewerage Sector in Chitungwiza Municipality

	2012	2013	2014	2015
ASSETS				
Current assets				
Cash and cash equivalents	62,295	1,403	8,516	10,365
Metbank	48,031	49	0	0
FBC	10,455	1,345	8,516	10,157
Kingdom-Main	1	0		
Kingdom-PSIP	3,808	9		
Receivables	6,084,005	3,843,607	2,044,776	2,145,610
Sewer	6,070,692	3,575,222	6,361,431	9,063,799
Sewer provisions for bad debts			-4,387,194	-6,972,153
Staff Receivables		7,629	7,629	7,629
Other	13,313	260,756	62,910	46,335
Interfund Receivables	745,901	1,089,064	-1,289,443	-1,497,305
Non-current assets				
Property, plant and equipment	7,011,098	7,011,098	3,845,710	3,362,609
Buildings	2,200,933	2,200,933	2,200,933	2,200,933
Accumulated depreciation Buildings			-330,140	-385,163
Vehicles	21,600	21,600	21,600	21,600
Accumulated depreciation vehicles			-21,600	-21,600
Plant & Equipment	4,416,500	4,416,500	4,129,500	4,129,500
Accumulated depreciation plant & machinery			-2,477,700	-2,890,650
Sewer Reticulation	372,065	372,065	378,195	378,195
Accumulated depreciation sewer reticulation			-55,078	-70,206
Total assets	13,903,299	11,945,171	4,609,559	4,021,279
LIABILITIES				
Current liabilities				
Accounts payables	1,161,943	1,379,783	1,664,309	2,188,123
Trade Payables	493,636	251,715	47,044	43,149
Payroll Payables		0		
Other	348,697	0		
Short Term Loans-PSIP	316,894	684,394	684,394	684,394
VAT	2,716	443,674	932,871	1,460,580
Interfund Payables	4,131	623,808	-741,770	-741,770
Bank Overdraft	155	155	0	0
Kingdom Admin		0	0	0
FBC-PSIP	155	155		
Short-term provisions	355,681	282,437	276,204	184,979
Audit fees		4,538	0	0
Leave pay	355,681	277,898	276,204	184,979
Non-current liabilities	333,106	0	-0	-0
Long term Loan-PSIP	333,106		-0	-0
Total liabilities	1,855,016	2,286,183	1,198,742	1,631,331
NET ASSETS & RESERVES				
NET ASSETS AND RESERVES				
Accumulated surpluses / (Deficits)	5,677,561	3,306,955	-2,941,216	-3,962,085
Revaluation reserves	6,352,033	6,352,033	6,352,033	6,352,033
Revenue contribution to capital outlay	18,690	0	0	0
	12,048,284	9,658,988	3,410,817	2,389,948
Total Liabilities and Reserves	13,903,300	11,945,171	4,609,559	4,021,279

(10) Financial Schedule of Sewerage PPP Project in Chitungwiza Municipality
No. 1/10

Year	2017	2018	2019	2020	2021	2022	2023
	0	1	2	3	4	5	6
Capital expenditure							
Pre-financial Close	1,050,000	0	0	0	0	0	0
Project 1 - PE and emergency repairs and metering	0	15,973,499	15,973,499	0	0	0	0
Project 3 - New transmission mains and water storage	0	10,633,777	10,633,777	0	0	0	0
Project 5 - Muda Dam and Pipeline , plus Bulk Supply transfer	0	0	0	54,342,297	54,342,297	0	0
Project 6 - Offices and Workshops	0	2,681,777	2,681,777	0	0	0	0
Credit Risk Insurance	0	2,669,209	0	5,529,329	0	0	0
Interest during Construction	84,000	2,433,850	5,185,220	4,347,384	9,042,560	0	0
Capital Expenditure	197,604,250	1,134,000	34,392,111	34,474,273	64,219,010	63,384,857	0
Expenditure							
Treated Water purchased from Harare	7,952,474	8,222,858	8,502,436	9,011,307	9,544,952	10,127,967	10,739,593
Cost of pumping water from Muda Dam to P E Waterworks				0	0	1,388,207	1,551,636
Water Reticulation in Chitungwiza		0	0	695,841	713,238	731,068	749,345
Sewage treatment costs pa		0	0	4,081,125	4,183,154	4,287,732	4,394,926
Staff and director costs				3,087,505	3,164,693	3,243,810	3,324,905
Plant and vehicles				1,503,451	1,541,037	1,579,563	1,619,052
Debt Repayment Short term measures				4,675,360	5,975,360	5,975,360	5,975,360
Debt Repayment Muda Dam and Pipeline						8,192,490	10,892,490
Reactive maintenance costs		0	0	363,189	375,495	384,882	394,504
Admin costs		0	0	272,392	281,621	288,661	295,878
Annual contingency		0	0	375,900	388,637	398,353	408,312
Municipality Annual Levy %						0	0
Municipality Annual Levy (On Turnover 5%)	110,091,561						480,327
Annual Operating cost				24,066,071	26,168,186	36,598,095	40,826,328
Gross income (corrected below for no payments)							
Domestic Standing Charges		0	0	6,720,000	7,295,904	7,924,790	8,602,875
Domestic Metered Charges		0	0	11,584,881	12,614,243	13,699,793	14,844,718
Domestic Sewerage Charges		0	0	2,896,220	3,176,248	3,471,865	3,783,948
Commercial Standing Charges		0	0	12,000	13,104	14,288	15,557
Commercial Metered Charges		0	0	1,625,947	1,763,549	1,915,243	2,081,982
Commercial Sewerage Charges		0	0	404,953	437,715	472,252	515,409
Imitational Standing Charges		0	0	25,728	27,970	30,354	32,911
Institutional Metered Charges		0	0	2,304,751	2,500,622	2,706,928	2,942,718
Institutional Sewerage Charges		0	0	568,072	620,960	676,732	735,679
Industrial Standing Charges		0	0	9,000	9,828	10,718	11,673
Industrial Metered Charges		0	0	1,315,420	1,428,818	1,548,341	1,681,519
Industrial Sewerage Charges		0	0	330,508	362,332	395,923	431,346
Sales to Harare of Raw Water at PEWW from Muda Dam		0	0	0	0	2,402,666	2,715,362
Income							
<i>Income recovery rate (pre-paid meters)</i>		<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>
Domestic Standing Charges		0	0	6,384,000	6,931,109	7,924,790	8,602,875
Domestic Metered Charges		0	0	11,005,637	11,983,531	13,699,793	14,844,718
Domestic Sewerage Charges		0	0	2,751,409	3,017,436	3,471,865	3,783,948
Commercial Standing Charges		0	0	11,400	12,449	14,288	15,557
Commercial Metered Charges		0	0	1,544,650	1,675,371	1,915,243	2,081,982
Commercial Sewerage Charges		0	0	384,705	415,830	472,252	515,409
Imitational Standing Charges		0	0	24,442	26,571	30,354	32,911
Institutional Metered Charges		0	0	2,189,513	2,375,591	2,706,928	2,942,718
Institutional Sewerage Charges		0	0	539,669	589,912	676,732	735,679
Industrial Standing Charges		0	0	8,550	9,337	10,718	11,673
Industrial Metered Charges		0	0	1,249,649	1,357,377	1,548,341	1,681,519
Industrial Sewerage Charges		0	0	313,982	344,215	395,923	431,346
Sales to Harare of Raw Water at PEWW from Muda Dam		0	0	0	0	2,402,666	2,715,362
Annual income		0	0	26,407,606	28,738,728	44,940,619	48,032,698

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No. 2/10

Year	2024	2025	2026	2027	2028	2029	2030
	7	8	9	10	11	12	13
Capital expenditure							
Pre-financial Close	0	0	0				
Project 1 - PE and emergency repairs and metering	0	0	0				
Project 3 - New transmission mains and water storage	0	0	0				
Project 5 - Muda Dam and Pipeline , plus Bulk Supply transfer	0	0	0				
Project 6 - Offices and Workshops	0	0	0				
Credit Risk Insurance	0						
Interest during Construction	0	0	0				
Capital Expenditure	197,604,250						
Expenditure							
Treated Water purchased from Harare	11,381,102	12,053,818	12,785,984	13,554,002	14,165,044	14,824,001	15,503,652
Cost of pumping water from Muda Dam to P E Waterworks	1,725,911	1,911,513	2,108,945	2,318,729	2,471,416	2,644,887	2,826,178
Water Reticulation in Chitungwiza	768,079	787,281	806,963	827,137	847,815	869,011	890,736
Sewage treatment costs pa	4,504,799	4,617,419	4,732,854	4,851,176	4,972,455	5,096,766	5,224,186
Staff and director costs	3,408,028	3,493,229	3,580,559	3,670,073	3,761,825	3,855,871	3,952,268
Plant and vehicles	1,659,528	1,701,017	1,743,542	1,787,131	1,831,809	1,877,604	1,924,544
Debt Repayment Short term measures	5,975,360	5,975,360	5,975,360	5,975,360	5,975,360	5,975,360	5,975,360
Debt Repayment Muda Dam and Pipeline	10,892,490	10,892,490	10,892,490	10,892,490	10,892,490	10,892,490	10,892,490
Reactive maintenance costs	404,367	414,476	424,838	435,459	446,345	457,504	468,941
Admin costs	303,275	310,857	318,628	326,594	334,759	343,128	351,706
Annual contingency	418,519	428,982	439,707	450,700	461,967	473,516	485,354
Municipality Annual Levy %	0	0	0	0	0	0	0
Municipality Annual Levy (On Turnover 5%)	110,091,561	1,027,956	1,618,866	2,265,456	2,972,200	3,089,866	3,211,771
Annual Operating cost	42,469,414	44,205,307	46,075,326	48,061,049	49,251,150	50,521,910	51,837,886
Gross income (corrected below for no payments)							
Domestic Standing Charges	9,340,923	9,896,729	10,487,746	11,116,080	11,624,189	12,157,125	12,706,751
Domestic Metered Charges	16,152,148	17,116,547	18,127,371	19,187,240	20,023,674	20,885,789	21,891,809
Domestic Sewerage Charges	4,113,280	4,356,939	4,612,290	4,879,992	5,090,765	5,307,991	5,531,801
Commercial Standing Charges	16,920	17,942	19,002	20,106	20,927	21,780	22,665
Commercial Metered Charges	2,257,751	2,392,137	2,534,020	2,682,400	2,806,595	2,934,877	3,067,347
Commercial Sewerage Charges	560,932	594,410	629,756	666,724	695,719	725,657	756,557
Imitational Standing Charges	35,806	37,996	40,249	42,595	44,520	46,519	48,594
Institutional Metered Charges	3,191,107	3,376,454	3,570,795	3,794,905	3,975,142	4,161,602	4,353,720
Institutional Sewerage Charges	797,777	844,114	892,699	943,598	983,325	1,024,394	1,066,661
Industrial Standing Charges	12,695	13,464	14,262	15,091	15,709	16,347	17,013
Industrial Metered Charges	1,829,314	1,938,033	2,052,599	2,172,261	2,275,574	2,382,238	2,492,330
Industrial Sewerage Charges	468,667	500,138	533,353	568,130	596,593	625,990	656,343
Sales to Harare of Raw Water at PEWW from Muda Dam	3,051,915	3,413,417	3,801,006	4,215,870	4,530,929	4,860,874	5,206,118
Income							
<i>Income recovery rate (pre-paid meters)</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>
Domestic Standing Charges	9,340,923	9,896,729	10,487,746	11,116,080	11,624,189	12,157,125	12,706,751
Domestic Metered Charges	16,152,148	17,116,547	18,127,371	19,187,240	20,023,674	20,885,789	21,891,809
Domestic Sewerage Charges	4,113,280	4,356,939	4,612,290	4,879,992	5,090,765	5,307,991	5,531,801
Commercial Standing Charges	16,920	17,942	19,002	20,106	20,927	21,780	22,665
Commercial Metered Charges	2,257,751	2,392,137	2,534,020	2,682,400	2,806,595	2,934,877	3,067,347
Commercial Sewerage Charges	560,932	594,410	629,756	666,724	695,719	725,657	756,557
Imitational Standing Charges	35,806	37,996	40,249	42,595	44,520	46,519	48,594
Institutional Metered Charges	3,191,107	3,376,454	3,570,795	3,794,905	3,975,142	4,161,602	4,353,720
Institutional Sewerage Charges	797,777	844,114	892,699	943,598	983,325	1,024,394	1,066,661
Industrial Standing Charges	12,695	13,464	14,262	15,091	15,709	16,347	17,013
Industrial Metered Charges	1,829,314	1,938,033	2,052,599	2,172,261	2,275,574	2,382,238	2,492,330
Industrial Sewerage Charges	468,667	500,138	533,353	568,130	596,593	625,990	656,343
Sales to Harare of Raw Water at PEWW from Muda Dam	3,051,915	3,413,417	3,801,006	4,215,870	4,530,929	4,860,874	5,206,118
Annual income	51,397,810	53,962,190	56,636,396	59,443,992	61,797,316	64,235,422	66,849,412

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No. 3/10

Year	2031	2032	2033	2034	2035	2036	2037
	14	15	16	17	18	19	20
Capital expenditure							
Pre-financial Close							
Project 1 - PE and emergency repairs and metering							
Project 3 - New transmission mains and water storage							
Project 5 - Muda Dam and Pipeline , plus Bulk Supply transfer							
Project 6 - Offices and Workshops							
Credit Risk Insurance							
Interest during Construction							
Capital Expenditure	197,604,250						
Expenditure							
Treated Water purchased from Harare	16,204,558	16,927,299	17,703,747	18,504,482	19,362,707	20,247,859	21,160,673
Cost of pumping water from Muda Dam to P E Waterworks	3,015,502	3,213,079	3,419,135	3,633,899	3,857,608	4,090,507	4,352,099
Water Reticulation in Chitungwiza	913,004	935,829	959,225	983,206	1,007,786	1,032,981	1,058,805
Sewage treatment costs pa	5,354,790	5,488,660	5,625,877	5,766,523	5,910,687	6,058,454	6,209,915
Staff and director costs	4,051,074	4,152,351	4,256,160	4,362,564	4,471,628	4,583,419	4,698,004
Plant and vehicles	1,972,658	2,021,974	2,072,524	2,124,337	2,177,445	2,231,881	2,287,678
Debt Repayment Short term measures	5,975,360	5,975,360	5,975,360	5,975,360	5,975,360	5,975,360	5,975,360
Debt Repayment Muda Dam and Pipeline	10,892,490	10,892,490	10,892,490	10,892,490	10,892,490	10,892,490	10,892,490
Reactive maintenance costs	480,665	492,681	504,998	517,623	530,564	543,828	557,424
Admin costs	360,499	369,511	378,749	388,218	397,923	407,871	418,068
Annual contingency	497,488	509,925	522,673	535,740	549,134	562,862	576,934
Municipality Annual Levy %	0	0	0	0	0	0	0
Municipality Annual Levy (On Turnover 5%)	110,091,561	3,476,875	3,615,562	3,758,193	3,905,385	4,058,443	4,216,397
Annual Operating cost	53,194,963	54,594,723	56,069,130	57,589,827	59,191,775	60,843,909	62,566,936
Gross income (corrected below for no payments)							
Domestic Standing Charges	13,282,613	13,885,797	14,517,423	15,178,469	15,870,122	16,593,419	17,349,617
Domestic Metered Charges	22,929,961	24,000,955	25,105,503	26,244,318	27,418,880	28,629,958	29,878,316
Domestic Sewerage Charges	5,762,503	6,000,239	6,245,150	6,497,380	6,757,260	7,024,943	7,300,584
Commercial Standing Charges	23,574	24,517	25,494	26,506	27,553	28,636	29,757
Commercial Metered Charges	3,204,101	3,353,795	3,508,314	3,667,768	3,832,266	4,011,182	4,195,733
Commercial Sewerage Charges	788,444	821,338	855,261	890,235	935,364	981,952	1,030,034
Imitational Standing Charges	50,745	52,976	55,482	58,081	60,775	63,565	66,454
Institutional Metered Charges	4,551,605	4,756,133	4,966,683	5,184,168	5,431,967	5,687,956	5,951,464
Institutional Sewerage Charges	1,110,148	1,155,061	1,201,244	1,248,913	1,297,904	1,348,438	1,400,344
Industrial Standing Charges	17,699	18,406	19,144	19,903	20,684	21,497	22,333
Industrial Metered Charges	2,605,925	2,723,101	2,843,934	2,978,108	3,116,480	3,259,136	3,406,165
Industrial Sewerage Charges	687,675	720,006	753,360	787,758	823,221	859,772	897,433
Sales to Harare of Raw Water at PEWW from Muda Dam	5,567,081	5,944,197	6,337,908	6,748,669	7,176,946	7,623,217	8,087,972
Income							
<i>Income recovery rate (pre-paid meters)</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>
Domestic Standing Charges	13,282,613	13,885,797	14,517,423	15,178,469	15,870,122	16,593,419	17,349,617
Domestic Metered Charges	22,929,961	24,000,955	25,105,503	26,244,318	27,418,880	28,629,958	29,878,316
Domestic Sewerage Charges	5,762,503	6,000,239	6,245,150	6,497,380	6,757,260	7,024,943	7,300,584
Commercial Standing Charges	23,574	24,517	25,494	26,506	27,553	28,636	29,757
Commercial Metered Charges	3,204,101	3,353,795	3,508,314	3,667,768	3,832,266	4,011,182	4,195,733
Commercial Sewerage Charges	788,444	821,338	855,261	890,235	935,364	981,952	1,030,034
Imitational Standing Charges	50,745	52,976	55,482	58,081	60,775	63,565	66,454
Institutional Metered Charges	4,551,605	4,756,133	4,966,683	5,184,168	5,431,967	5,687,956	5,951,464
Institutional Sewerage Charges	1,110,148	1,155,061	1,201,244	1,248,913	1,297,904	1,348,438	1,400,344
Industrial Standing Charges	17,699	18,406	19,144	19,903	20,684	21,497	22,333
Industrial Metered Charges	2,605,925	2,723,101	2,843,934	2,978,108	3,116,480	3,259,136	3,406,165
Industrial Sewerage Charges	687,675	720,006	753,360	787,758	823,221	859,772	897,433
Sales to Harare of Raw Water at PEWW from Muda Dam	5,567,081	5,944,197	6,337,908	6,748,669	7,176,946	7,623,217	8,087,972
Annual income	69,537,490	72,311,243	75,163,858	78,107,707	81,168,866	84,327,947	87,589,735

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area in Zimbabwe
April 2018

No. 4/10

Year	2038	2039	2040	2041	2042	2043	2044
	21	22	23	24	25	26	27
Capital expenditure							
Pre-financial Close							
Project 1 - PE and emergency repairs and metering							
Project 3 - New transmission mains and water storage							
Project 5 - Muda Dam and Pipeline , plus Bulk Supply transfer							
Project 6 - Offices and Workshops							
Credit Risk Insurance							
Interest during Construction							
Capital Expenditure	197,604,250						
Expenditure							
Treated Water purchased from Harare	22,136,434	23,142,761	24,180,486	25,287,112	26,428,330	27,643,211	28,896,116
Cost of pumping water from Muda Dam to P E Waterworks	4,624,739	4,908,727	5,204,374	5,511,997	5,831,923	6,164,485	6,534,316
Water Reticulation in Chitungwiza	1,085,275	1,112,407	1,140,217	1,168,723	1,197,941	1,227,889	1,258,587
Sewage treatment costs pa	6,365,163	6,524,292	6,687,399	6,854,584	7,025,949	7,201,598	7,381,638
Staff and director costs	4,815,454	4,935,841	5,059,237	5,185,718	5,315,361	5,448,245	5,584,451
Plant and vehicles	2,344,870	2,403,492	2,463,579	2,525,169	2,588,298	2,653,005	2,719,331
Debt Repayment Short term measures	1,300,000						
Debt Repayment Muda Dam and Pipeline	10,892,490	10,892,490	2,700,000				
Reactive maintenance costs	571,359	585,643	600,284	615,292	630,674	646,441	662,602
Admin costs	428,520	439,233	450,213	461,469	473,005	484,830	496,951
Annual contingency	591,357	606,141	621,294	636,827	652,747	669,066	685,793
Municipality Annual Levy %	0	0	0	0	0	0	0
Municipality Annual Levy (On Turnover 5%)	110,091,561	4,554,148	4,734,454	4,920,490	5,111,864	5,311,581	5,517,745
Annual Operating cost	59,709,809	60,285,480	54,027,574	53,358,753	55,455,809	57,656,515	59,959,592
Gross income (corrected below for no payments)							
Domestic Standing Charges	18,140,018	18,965,970	19,828,647	20,729,472	21,669,915	22,651,261	23,686,952
Domestic Metered Charges	31,303,448	32,773,792	34,290,334	35,854,060	37,466,870	39,129,818	40,843,953
Domestic Sewerage Charges	7,584,536	7,876,963	8,178,029	8,487,900	8,806,954	9,135,366	9,628,612
Commercial Standing Charges	30,915	32,534	34,213	35,954	37,758	39,637	41,583
Commercial Metered Charges	4,386,041	4,582,225	4,794,436	5,013,166	5,238,546	5,481,351	5,731,493
Commercial Sewerage Charges	1,079,641	1,130,807	1,183,564	1,237,945	1,293,983	1,351,712	1,411,163
Imitational Standing Charges	69,444	72,538	75,736	79,281	82,987	86,819	90,780
Institutional Metered Charges	6,223,513	6,504,300	6,794,022	7,091,921	7,426,713	7,772,091	8,128,284
Institutional Sewerage Charges	1,453,853	1,508,998	1,565,810	1,624,104	1,711,733	1,802,224	1,895,642
Industrial Standing Charges	23,202	24,412	25,672	26,983	28,336	29,743	31,205
Industrial Metered Charges	3,557,655	3,724,303	3,896,010	4,072,874	4,254,995	4,443,882	4,650,001
Industrial Sewerage Charges	936,225	976,171	1,017,292	1,059,610	1,103,147	1,148,290	1,206,424
Sales to Harare of Raw Water at PEWW from Muda Dam	8,571,714	9,074,957	9,598,230	10,142,074	10,707,046	11,293,712	11,902,658
Income							
<i>Income recovery rate (pre-paid meters)</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>
Domestic Standing Charges	18,140,018	18,965,970	19,828,647	20,729,472	21,669,915	22,651,261	23,686,952
Domestic Metered Charges	31,303,448	32,773,792	34,290,334	35,854,060	37,466,870	39,129,818	40,843,953
Domestic Sewerage Charges	7,584,536	7,876,963	8,178,029	8,487,900	8,806,954	9,135,366	9,628,612
Commercial Standing Charges	30,915	32,534	34,213	35,954	37,758	39,637	41,583
Commercial Metered Charges	4,386,041	4,582,225	4,794,436	5,013,166	5,238,546	5,481,351	5,731,493
Commercial Sewerage Charges	1,079,641	1,130,807	1,183,564	1,237,945	1,293,983	1,351,712	1,411,163
Imitational Standing Charges	69,444	72,538	75,736	79,281	82,987	86,819	90,780
Institutional Metered Charges	6,223,513	6,504,300	6,794,022	7,091,921	7,426,713	7,772,091	8,128,284
Institutional Sewerage Charges	1,453,853	1,508,998	1,565,810	1,624,104	1,711,733	1,802,224	1,895,642
Industrial Standing Charges	23,202	24,412	25,672	26,983	28,336	29,743	31,205
Industrial Metered Charges	3,557,655	3,724,303	3,896,010	4,072,874	4,254,995	4,443,882	4,650,001
Industrial Sewerage Charges	936,225	976,171	1,017,292	1,059,610	1,103,147	1,148,290	1,206,424
Sales to Harare of Raw Water at PEWW from Muda Dam	8,571,714	9,074,957	9,598,230	10,142,074	10,707,046	11,293,712	11,902,658
	7,722,748	7,441,116	7,127,796	6,781,929	6,402,632	5,989,003	5,547,426
Annual income	91,082,952	94,689,084	98,409,791	102,237,271	106,231,615	110,354,910	114,796,174

No.5/10

	Year	2045	2046	2047
		28	29	30
Capital expenditure				
Pre-financial Close				
Project 1 - PE and emergency repairs and metering				
Project 3 - New transmission mains and water storage				
Project 5 - Muda Dam and Pipeline , plus Bulk Supply transfer				
Project 6 - Offices and Workshops				
Credit Risk Insurance				
Interest during Construction				
Capital Expenditure	197,604,250			
Expenditure				
Treated Water purchased from Harare		30,227,748	31,601,088	33,058,541
Cost of pumping water from Muda Dam to P E Waterworks		6,919,033	7,319,042	7,734,760
Water Reticulation in Chitungwiza		1,290,051	1,322,302	1,355,360
Sewage treatment costs pa		7,566,178	7,755,333	7,949,216
Staff and director costs		5,724,062	5,867,164	6,013,843
Plant and vehicles		2,787,314	2,856,997	2,928,422
Debt Repayment Short term measures				
Debt Repayment Muda Dam and Pipeline				
Reactive maintenance costs		679,167	696,146	713,550
Admin costs		509,375	522,109	535,162
Annual contingency		702,938	720,511	738,524
Municipality Annual Levy %		0	0	0
Municipality Annual Levy (On Turnover 5%)	110,091,561	5,976,312	6,220,568	6,472,139
Annual Operating cost		62,382,179	64,881,260	67,499,516
Gross income (corrected below for no payments)				
Domestic Standing Charges		24,767,173	25,893,340	27,067,412
Domestic Metered Charges		42,769,715	44,756,150	46,804,563
Domestic Sewerage Charges		10,138,006	10,663,920	11,206,726
Commercial Standing Charges		43,606	45,700	47,876
Commercial Metered Charges		5,989,113	6,267,671	6,554,539
Commercial Sewerage Charges		1,472,370	1,535,862	1,601,197
Imitational Standing Charges		94,871	99,139	103,545
Institutional Metered Charges		8,495,521	8,875,117	9,266,270
Institutional Sewerage Charges		1,992,053	2,091,779	2,194,643
Industrial Standing Charges		32,724	34,300	35,935
Industrial Metered Charges		4,862,205	5,080,603	5,306,863
Industrial Sewerage Charges		1,266,324	1,328,023	1,391,964
Sales to Harare of Raw Water at PEWW from Muda Dam		12,534,481	13,189,793	13,869,225
Income				
<i>Income recovery rate (pre-paid meters)</i>		1	1	1
Domestic Standing Charges		24,767,173	25,893,340	27,067,412
Domestic Metered Charges		42,769,715	44,756,150	46,804,563
Domestic Sewerage Charges		10,138,006	10,663,920	11,206,726
Commercial Standing Charges		43,606	45,700	47,876
Commercial Metered Charges		5,989,113	6,267,671	6,554,539
Commercial Sewerage Charges		1,472,370	1,535,862	1,601,197
Imitational Standing Charges		94,871	99,139	103,545
Institutional Metered Charges		8,495,521	8,875,117	9,266,270
Institutional Sewerage Charges		1,992,053	2,091,779	2,194,643
Industrial Standing Charges		32,724	34,300	35,935
Industrial Metered Charges		4,862,205	5,080,603	5,306,863
Industrial Sewerage Charges		1,266,324	1,328,023	1,391,964
Sales to Harare of Raw Water at PEWW from Muda Dam		12,534,481	13,189,793	13,869,225
		5,068,086	4,549,964	3,992,015
Annual income		119,526,248	124,411,362	129,442,772

No. 6/10

Year		2017	2018	2019	2020	2021	2022	2023
		0	1	2	3	4	5	6
No of Consumers								
	Domestic Standing Charges				56,000	57,904	59,873	61,909
	Domestic Metered Charges				24,045	24,863	25,708	26,582
	Domestic Sewerage Charges				24,045	24,863	25,708	26,582
	Commercial Standing Charges				50	52	54	56
	Commercial Metered Charges				1,681	1,738	1,797	1,858
	Commercial Sewerage Charges				1,681	1,738	1,797	1,858
	Imitational Standing Charges				200	207	214	221
	Institutional Metered Charges				4,447	4,598	4,754	4,916
	Institutional Sewerage Charges				4,447	4,598	4,754	4,916
	Industrial Standing Charges				50	52	54	56
	Industrial Metered Charges				1,811	1,873	1,937	2,003
	Industrial Sewerage Charges				1,811	1,873	1,937	2,003
Volumes								
	Annual demand	m3 pa	19,881,185	20,557,146	21,256,089	21,978,797	22,726,077	23,498,764
	BNR Supply	m3 pa	-	-	-	-	-	0
	New dam Supply	m3 pa	-	-	-	-	-	31,600,000
	Guaranteed Harare Supply	m3 pa	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000
	Supply PE Water Works balance from Muda Dam	m3 pa	-	-	-	-	-	8,898,764
	Balance of Muda Water available to other off-takers	m3 pa	-	-	-	-	-	9,697,722
Tariff assumed								
	Domestic Standing Charges	/month				10.00	10.50	11.03
	Domestic Metered Charges	/m3 water	0.82	1.03	1.30	1.32	1.39	1.46
	Domestic Sewerage Charges	/m3 water				0.33	0.35	0.37
	Commercial Standing Charges	/month	1.26			20.00	21.00	22.05
	Commercial Metered Charges	/m3 water				2.65	2.78	2.92
	Commercial Sewerage Charges	/m3 water				0.66	0.69	0.72
	Institutional Standing Charges	/month				10.72	11.26	11.82
	Institutional Metered Charges	/m3 water				1.42	1.49	1.56
	Institutional Sewerage Charges	/m3 water				0.35	0.37	0.39
	Industrial Standing Charges	/month				15.00	15.75	16.54
	Industrial Metered Charges	/m3 water				1.99	2.09	2.19
	Industrial Sewerage Charges	/m3 water				0.50	0.53	0.56
	Rate for purified water from Harare	/m3	0.40	0.40	0.40	0.41	0.42	0.43
	Rate To Harare for Raw Water Sales at PEWW from Muda Dam	/m3				0.25	0.26	0.27
	Cost of pumping water from Muda Dam to PEWW	\$/m3	0.14	0.14	0.14	0.15	0.15	0.16
Profitability								
	gross expenditure				24,066,071	26,168,186	36,598,095	40,826,328
	Gross income				26,407,606	28,738,728	44,940,619	48,032,698
	Operating profit				2,341,535	2,570,543	8,342,525	7,206,370
	Portion of Contingency unspent	0.50			187,950	194,318	199,176	204,156
	Gross Profit	750,037,695			2,529,485	2,764,861	8,541,701	7,410,526
	Cumulative losses				0	0	0	0
TAXATION								
	Taxable income/(loss)				2,529,485	2,764,861	8,541,701	7,410,526
197,604,250	add: Depreciation/amortisation	0	0	0	7,057,295	7,057,295	7,057,295	7,057,295
	less: capital allowances Short-term measures	0	0	0	-17,500,096	-17,500,096	-17,500,096	-17,500,096
	less: capital allowances Muda Dam & Pipeline	0	0	0	0	0	-31,900,967	-31,900,967
	Tax (loss)/taxable amount	0	0	0	-7,913,316	-7,677,910	-33,802,067	-34,933,212
	Cumulative taxable income/(loss)	0	0	0	-7,913,316	-15,391,256	-49,393,323	-84,326,565
	Taxation PROJECT REQUESTS TAX EXEMPTION UNDER THE 3rd SCHEDULE	0	0	0	0	0	0	0
Profit After Tax								
	Profit After Tax				2,529,485	2,764,861	8,541,701	7,410,526
	Expected cumulative cash surplus/(deficit)				2,529,485	5,294,346	13,836,047	21,246,573
IRR ON FREECASHFLOW								
	IRR on Free Cashflow	15.9%			2,529,485	2,764,861	8,541,701	7,410,526
	Effective shares:							

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area in Zimbabwe
April 2018

No. 7/10

Year	2024	2025	2026	2027	2028	2029	2030	
	7	8	9	10	11	12	13	
No of Consumers								
Domestic Standing Charges	64,014	66,190	68,440	70,767	72,182	73,626	75,099	
Domestic Metered Charges	27,486	28,421	29,387	30,386	30,994	31,614	32,246	
Domestic Sewerage Charges	27,486	28,421	29,387	30,386	30,994	31,614	32,246	
Commercial Standing Charges	58	60	62	64	65	66	67	
Commercial Metered Charges	1,921	1,986	2,054	2,124	2,166	2,209	2,253	
Commercial Sewerage Charges	1,921	1,986	2,054	2,124	2,166	2,209	2,253	
Imitational Standing Charges	229	237	245	253	258	263	268	
Institutional Metered Charges	5,083	5,256	5,435	5,620	5,732	5,847	5,964	
Institutional Sewerage Charges	5,083	5,256	5,435	5,620	5,732	5,847	5,964	
Industrial Standing Charges	58	60	62	64	65	66	67	
Industrial Metered Charges	2,071	2,141	2,214	2,289	2,335	2,382	2,430	
Industrial Sewerage Charges	2,071	2,141	2,214	2,289	2,335	2,382	2,430	
Volumes								
Annual demand	m3 pa	25,123,845	25,978,056	26,861,310	27,774,595	28,330,087	28,896,689	29,474,623
BNR Supply	m3 pa	0	0	0	0	0	0	0
New dam Supply	m3 pa	31,600,000	31,600,000	31,600,000	31,600,000	31,600,000	31,600,000	31,600,000
Guaranteed Harare Supply	m3 pa	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000
Supply PE Water Works balance from Muda Dam	m3 pa	10,523,845	11,378,056	12,261,310	13,174,595	13,730,087	14,296,689	14,874,623
Balance of Muda Water available to other offtakers	m3 pa	21,076,155	20,221,944	19,338,690	18,425,405	17,869,913	17,303,311	16,725,377
Tariff assumed								
Domestic Standing Charges	/month	12.16	12.46	12.77	13.09	13.42	13.76	14.10
Domestic Metered Charges	/m3 water	1.61	1.65	1.69	1.73	1.77	1.81	1.86
Domestic Sewerage Charges	/m3 water	0.41	0.42	0.43	0.44	0.45	0.46	0.47
Commercial Standing Charges	/month	24.31	24.92	25.54	26.18	26.83	27.50	28.19
Commercial Metered Charges	/m3 water	3.22	3.30	3.38	3.46	3.55	3.64	3.73
Commercial Sewerage Charges	/m3 water	0.80	0.82	0.84	0.86	0.88	0.90	0.92
Institutional Standing Charges	/month	13.03	13.36	13.69	14.03	14.38	14.74	15.11
Institutional Metered Charges	/m3 water	1.72	1.76	1.80	1.85	1.90	1.95	2.00
Institutional Sewerage Charges	/m3 water	0.43	0.44	0.45	0.46	0.47	0.48	0.49
Industrial Standing Charges	/month	18.24	18.70	19.17	19.65	20.14	20.64	21.16
Industrial Metered Charges	/m3 water	2.42	2.48	2.54	2.60	2.67	2.74	2.81
Industrial Sewerage Charges	/m3 water	0.62	0.64	0.66	0.68	0.70	0.72	0.74
Rate for purified water from Harare	/m3	0.45	0.46	0.48	0.49	0.50	0.51	0.53
Rate To Harare for Raw Water Sales at PEWW from Muda Dam	/m3	0.29	0.30	0.31	0.32	0.33	0.34	0.35
Cost of pumping water from Muda Dam to PEWW	\$/m3	0.16	0.17	0.17	0.18	0.18	0.19	0.19
Profitability								
gross expenditure		42,469,414	44,205,307	46,075,326	48,061,049	49,251,150	50,521,910	51,837,886
Gross income		51,397,810	53,962,190	56,636,396	59,443,992	61,797,316	64,235,422	66,849,412
Operating profit		8,928,397	9,756,883	10,561,070	11,382,943	12,546,166	13,713,512	15,011,527
Portion of Contingency unspent	0.50	209,260	214,491	219,853	225,350	230,984	236,758	242,677
Gross Profit	750,037,695	9,137,657	9,971,374	10,780,923	11,608,293	12,777,149	13,950,270	15,254,204
Cumulative losses		0	0	0	0	0	0	0
TAXATION								
Taxable income/(loss)		9,137,657	9,971,374	10,780,923	11,608,293	12,777,149	13,950,270	15,254,204
197,604,250 add: Depreciation/amortisation		7,057,295	7,057,295	7,057,295	7,057,295	7,057,295	7,057,295	7,057,295
less: capital allowances Short-term measures				0	0	0	0	0
less: capital allowances Muda Dam & Pipeline		-31,900,967	-31,900,967	0	0	0	0	0
Tax (loss)/taxable amount		-15,706,015	-14,872,298	17,838,218	18,665,587	19,834,414	21,007,565	22,311,499
Cumulative taxable income/(loss)		-100,032,580	-114,904,878	-97,066,661	-78,401,073	-58,566,630	-37,559,065	-15,247,566
Taxation PROJECT REQUESTS TAX EXEMPTION UNDER THE 3rd SCHEDULE		0	0	0	0	0	0	0
Profit After Tax								
Profit After Tax		9,137,657	9,971,374	10,780,923	11,608,293	12,777,149	13,950,270	15,254,204
Expected cumulative cash surplus/(deficit)		30,384,230	40,355,604	51,136,527	62,744,820	75,521,969	89,472,239	104,726,443
IRR ON FREECASHFLOW								
IRR on Free Cashflow	15.9%	9,137,657	9,971,374	10,780,923	11,608,293	12,777,149	13,950,270	15,254,204

No. 8/10

Year		2031	2032	2033	2034	2035	2036	2037	
		14	15	16	17	18	19	20	
No of Consumers									
	Domestic Standing Charges	76,601	78,133	79,696	81,290	82,916	84,574	86,265	
	Domestic Metered Charges	32,891	33,549	34,220	34,904	35,602	36,314	37,040	
	Domestic Sewerage Charges	32,891	33,549	34,220	34,904	35,602	36,314	37,040	
	Commercial Standing Charges	68	69	70	71	72	73	74	
	Commercial Metered Charges	2,298	2,344	2,391	2,439	2,488	2,538	2,589	
	Commercial Sewerage Charges	2,298	2,344	2,391	2,439	2,488	2,538	2,589	
	Imitational Standing Charges	273	278	284	290	296	302	308	
	Institutional Metered Charges	6,083	6,205	6,329	6,456	6,585	6,717	6,851	
	Institutional Sewerage Charges	6,083	6,205	6,329	6,456	6,585	6,717	6,851	
	Industrial Standing Charges	68	69	70	71	72	73	74	
	Industrial Metered Charges	2,479	2,529	2,580	2,632	2,685	2,739	2,794	
	Industrial Sewerage Charges	2,479	2,529	2,580	2,632	2,685	2,739	2,794	
Volumes	Annual demand	m3 pa	30,064,115	30,665,397	31,278,705	31,904,279	32,542,365	33,193,212	33,857,076
	BNR Supply	m3 pa	0	0	0	0	0	0	
	New dam Supply	m3 pa	31,600,000	31,600,000	31,600,000	31,600,000	31,600,000	31,600,000	
	Guaranteed Harare Supply	m3 pa	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	
	Supply PE Water Works balance from Muda Dam	m3 pa	15,464,115	16,065,397	16,678,705	17,304,279	17,942,365	18,593,212	19,257,076
	Balance of Muda Water available to other off-takers	m3 pa	16,135,885	15,534,603	14,921,295	14,295,721	13,657,635	13,006,788	12,342,924
Tariff assumed									
	Domestic Standing Charges	/month	14.45	14.81	15.18	15.56	15.95	16.35	16.76
	Domestic Metered Charges	/m3 water	1.91	1.96	2.01	2.06	2.11	2.16	2.21
	Domestic Sewerage Charges	/m3 water	0.48	0.49	0.50	0.51	0.52	0.53	0.54
	Commercial Standing Charges	/month	28.89	29.61	30.35	31.11	31.89	32.69	33.51
	Commercial Metered Charges	/m3 water	3.82	3.92	4.02	4.12	4.22	4.33	4.44
	Commercial Sewerage Charges	/m3 water	0.94	0.96	0.98	1.00	1.03	1.06	1.09
	Institutional Standing Charges	/month	15.49	15.88	16.28	16.69	17.11	17.54	17.98
	Institutional Metered Charges	/m3 water	2.05	2.10	2.15	2.20	2.26	2.32	2.38
	Institutional Sewerage Charges	/m3 water	0.50	0.51	0.52	0.53	0.54	0.55	0.56
	Industrial Standing Charges	/month	21.69	22.23	22.79	23.36	23.94	24.54	25.15
	Industrial Metered Charges	/m3 water	2.88	2.95	3.02	3.10	3.18	3.26	3.34
	Industrial Sewerage Charges	/m3 water	0.76	0.78	0.80	0.82	0.84	0.86	0.88
	Rate for purified water from Harare	/m3	0.54	0.55	0.57	0.58	0.60	0.61	0.63
	Rate To Harare for Raw Water Sales at PEWW from Muda Dam	/m3	0.36	0.37	0.38	0.39	0.40	0.41	0.42
	Cost of pumping water from Muda Dam to PEWW	\$/m3	0.20	0.20	0.21	0.21	0.22	0.22	0.23
Profitability									
	gross expenditure		53,194,963	54,594,723	56,069,130	57,589,827	59,191,775	60,843,909	62,566,936
	Gross income		69,537,490	72,311,243	75,163,858	78,107,707	81,168,866	84,327,947	87,589,735
	Operating profit		16,342,527	17,716,520	19,094,727	20,517,880	21,977,091	23,484,038	25,022,799
	Portion of Contingency unspent	0.50	248,744	254,963	261,337	267,870	274,567	281,431	288,467
	Gross Profit	750,037,695	16,591,271	17,971,482	19,356,064	20,785,750	22,251,658	23,765,469	25,311,266
	Cumulative losses		0	0	0	0	0	0	
TAXATION									
	Taxable income/(loss)		16,591,271	17,971,482	19,356,064	20,785,750	22,251,658	23,765,469	25,311,266
197,601,250	add: Depreciation/amortisation		7,057,295	7,057,295	7,057,295	7,057,295	7,057,295	7,057,295	7,057,295
	less: capital allowances Short-term measures								
	less: capital allowances Muda Dam & Pipeline								
	Tax (loss)/taxable amount		23,648,566	25,028,777	26,413,359	27,843,045	29,308,952	30,822,764	32,388,560
	Cumulative taxable income/(loss)		8,401,000	33,429,776	59,843,135	87,686,180	116,995,132	147,817,896	180,186,456
	Taxation PROJECT REQUESTS TAX EXEMPTION UNDER THE 3rd SCHEDULE		0	0	0	0	0	0	
Profit After Tax									
	Profit After Tax		16,591,271	17,971,482	19,356,064	20,785,750	22,251,658	23,765,469	25,311,266
	Expected cumulative cash surplus/(deficit)		121,317,714	139,289,196	158,645,260	179,431,010	201,682,668	225,448,137	250,759,403
IRR ON FREECASHFLOW									
	IRR on Free Cashflow	15.9%	16,591,271	17,971,482	19,356,064	20,785,750	22,251,658	23,765,469	25,311,266

No. 9/10

Year		2038	2039	2040	2041	2042	2043	2044	
		21	22	23	24	25	26	27	
No of Consumers									
	Domestic Standing Charges	87,990	89,750	91,545	93,376	95,244	97,149	99,092	
	Domestic Metered Charges	37,781	38,537	39,308	40,094	40,896	41,714	42,548	
	Domestic Sewerage Charges	37,781	38,537	39,308	40,094	40,896	41,714	42,548	
	Commercial Standing Charges	75	77	79	81	83	85	87	
	Commercial Metered Charges	2,641	2,694	2,748	2,803	2,859	2,916	2,974	
	Commercial Sewerage Charges	2,641	2,694	2,748	2,803	2,859	2,916	2,974	
	Imitational Standing Charges	314	320	326	333	340	347	354	
	Institutional Metered Charges	6,988	7,128	7,271	7,416	7,564	7,715	7,869	
	Institutional Sewerage Charges	6,988	7,128	7,271	7,416	7,564	7,715	7,869	
	Industrial Standing Charges	75	77	79	81	83	85	87	
	Industrial Metered Charges	2,850	2,907	2,965	3,024	3,084	3,146	3,209	
	Industrial Sewerage Charges	2,850	2,907	2,965	3,024	3,084	3,146	3,209	
Volumes	Annual demand	m3 pa	34,534,218	35,224,902	35,929,400	36,647,988	37,380,948	38,128,567	38,891,138
	BNR Supply	m3 pa	0	0	0	0	0	0	
	New dam Supply	m3 pa	31,600,000	31,600,000	31,600,000	31,600,000	31,600,000	31,600,000	
	Guaranteed Harare Supply	m3 pa	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	
	Supply PE Water Works balance from Muda Dam	m3 pa	19,934,218	20,624,902	21,329,400	22,047,988	22,780,948	23,528,567	24,291,138
	Balance of Muda Water available to other off-takers	m3 pa	11,665,782	10,975,098	10,270,600	9,552,012	8,819,052	8,071,433	7,308,862
Tariff assumed									
	Domestic Standing Charges	/month	17.18	17.61	18.05	18.50	18.96	19.43	19.92
	Domestic Metered Charges	/m3 water	2.27	2.33	2.39	2.45	2.51	2.57	2.63
	Domestic Sewerage Charges	/m3 water	0.55	0.56	0.57	0.58	0.59	0.60	0.62
	Commercial Standing Charges	/month	34.35	35.21	36.09	36.99	37.91	38.86	39.83
	Commercial Metered Charges	/m3 water	4.55	4.66	4.78	4.90	5.02	5.15	5.28
	Commercial Sewerage Charges	/m3 water	1.12	1.15	1.18	1.21	1.24	1.27	1.30
	Institutional Standing Charges	/month	18.43	18.89	19.36	19.84	20.34	20.85	21.37
	Institutional Metered Charges	/m3 water	2.44	2.50	2.56	2.62	2.69	2.76	2.83
	Institutional Sewerage Charges	/m3 water	0.57	0.58	0.59	0.60	0.62	0.64	0.66
	Industrial Standing Charges	/month	25.78	26.42	27.08	27.76	28.45	29.16	29.89
	Industrial Metered Charges	/m3 water	3.42	3.51	3.60	3.69	3.78	3.87	3.97
	Industrial Sewerage Charges	/m3 water	0.90	0.92	0.94	0.96	0.98	1.00	1.03
	Rate for purified water from Harare	/m3	0.64	0.66	0.67	0.69	0.71	0.73	0.74
	Rate To Harare for Raw Water Sales at PEWW from Muda Dam	/m3	0.43	0.44	0.45	0.46	0.47	0.48	0.49
	Cost of pumping water from Muda Dam to PEWW	\$/m3	0.23	0.24	0.24	0.25	0.26	0.26	0.27
Profitability									
	gross expenditure		59,709,809	60,285,480	54,027,574	53,358,753	55,455,809	57,656,515	59,959,592
	Gross income		91,082,952	94,689,084	98,409,791	102,237,271	106,231,615	110,354,910	114,796,174
	Operating profit		31,373,144	34,403,604	44,382,217	48,878,518	50,775,807	52,698,394	54,836,583
	Portion of Contingency unspent	0.50	295,678	303,070	310,647	318,413	326,374	334,533	342,896
	Gross Profit	750,037,695	31,668,822	34,706,674	44,692,864	49,196,932	51,102,180	53,032,927	55,179,479
	Cumulative losses		0	0	0	0	0	0	
TAXATION									
	Taxable income/(loss)		31,668,822	34,706,674	44,692,864	49,196,932	51,102,180	53,032,927	55,179,479
197,604,250	add: Depreciation/amortisation		7,057,295	7,057,295	7,057,295	7,057,295	7,057,295	7,057,295	7,057,295
	less: capital allowances Short-term measures								
	less: capital allowances Muda Dam & Pipeline								
	Tax (loss)/taxable amount		38,726,117	41,763,969	51,750,159	56,254,226	58,159,475	60,090,222	62,236,771
	Cumulative taxable income/(loss)		218,912,573	260,676,542	312,426,701	368,680,927	426,840,402	486,930,621	549,167,398
	Taxation PROJECT REQUESTS TAX EXEMPTION UNDER THE 3rd SCHEDULE		0	0	0	0	0	0	
Profit After Tax									
	Profit After Tax		31,668,822	34,706,674	44,692,864	49,196,932	51,102,180	53,032,927	55,179,479
	Expected cumulative cash surplus/(deficit)		282,428,225	317,134,899	361,827,763	411,024,695	462,126,875	515,159,803	570,339,282
IRR ON FREECASHFLOW									
	IRR on Free Cashflow	15.9%	31,668,822	34,706,674	44,692,864	49,196,932	51,102,180	53,032,927	55,179,479

No. 10/10

Year		2045	2046	2047	
		28	29	30	
No of Consumers					
	Domestic Standing Charges	101,074	103,095	105,157	
	Domestic Metered Charges	43,399	44,267	45,152	
	Domestic Sewerage Charges	43,399	44,267	45,152	
	Commercial Standing Charges	89	91	93	
	Commercial Metered Charges	3,033	3,094	3,156	
	Commercial Sewerage Charges	3,033	3,094	3,156	
	Imitational Standing Charges	361	368	375	
	Institutional Metered Charges	8,026	8,187	8,351	
	Institutional Sewerage Charges	8,026	8,187	8,351	
	Industrial Standing Charges	89	91	93	
	Industrial Metered Charges	3,273	3,338	3,405	
	Industrial Sewerage Charges	3,273	3,338	3,405	
Volumes	Annual demand	m3 pa	39,668,961	40,462,340	41,271,587
	BNR Supply	m3 pa	0	0	0
	New dam Supply	m3 pa	31,600,000	31,600,000	31,600,000
	Guaranteed Harare Supply	m3 pa	14,600,000	14,600,000	14,600,000
	Supply PE Water Works balance from Muda Dam	m3 pa	25,068,961	25,862,340	26,671,587
	Balance of Muda Water available to other off-takers	m3 pa	6,531,039	5,737,660	4,928,413
Tariff assumed					
	Domestic Standing Charges	/month	20.42	20.93	21.45
	Domestic Metered Charges	/m3 water	2.70	2.77	2.84
	Domestic Sewerage Charges	/m3 water	0.64	0.66	0.68
	Commercial Standing Charges	/month	40.83	41.85	42.90
	Commercial Metered Charges	/m3 water	5.41	5.55	5.69
	Commercial Sewerage Charges	/m3 water	1.33	1.36	1.39
	Institutional Standing Charges	/month	21.90	22.45	23.01
	Institutional Metered Charges	/m3 water	2.90	2.97	3.04
	Institutional Sewerage Charges	/m3 water	0.68	0.70	0.72
	Industrial Standing Charges	/month	30.64	31.41	32.20
	Industrial Metered Charges	/m3 water	4.07	4.17	4.27
	Industrial Sewerage Charges	/m3 water	1.06	1.09	1.12
	Rate for purified water from Harare	/m3	0.76	0.78	0.80
	Rate To Harare for Raw Water Sales at PEWW from Muda Dam	/m3	0.50	0.51	0.52
	Cost of pumping water from Muda Dam to PEWW	\$/m3	0.28	0.28	0.29
Profitability					
	gross expenditure		62,382,179	64,881,260	67,499,516
	Gross income		119,526,248	124,411,362	129,442,772
	Operating profit		57,144,069	59,530,102	61,943,256
	Portion of Contingency unspent	0.50	351,469	360,255	369,262
	Gross Profit	750,037,695	57,495,538	59,890,357	62,312,518
	Cumulative losses		0	0	0
TAXATION					
	Taxable income/(loss)		57,495,538	59,890,357	62,312,518
197,601,250	add: Depreciation/amortisation		7,057,295	7,057,295	7,057,295
	less: capital allowances Short-term measures				
	less: capital allowances Muda Dam & Pipeline				
	Tax (loss)/taxable amount		61,552,832	66,947,652	69,369,812
	Cumulative taxable income/(loss)		613,720,230	680,667,882	730,037,695
	Taxation PROJECT REQUESTS TAX EXEMPTION UNDER THE 3rd SCHEDULE		0	0	0
Profit After Tax					
	Profit After Tax		57,495,538	59,890,357	62,312,518
	Expected cumulative cash surplus/(deficit)		627,834,820	687,725,177	750,037,695
IRR ON FREECASHFLOW					
	IRR on Free Cashflow	15.9%	57,495,538	59,890,357	62,312,518

1.2 Data for Chapter 4

Assumptions for Sewerage PPP Plan in Chitungwiza Municipality

ref	Description	Variable	reference
Variables and Outputs			
Water Economics			
1.0	Cost of Bulk Purified Water supplied by Harare	0.40 USD/m ³	
2.0	Water losses in Chitungwiza	31%	From UWSSRP Table 6-8
3.0	Number of Domestic Stands to be metered	56,000 number	
4.0	Population of Chitungwiza	356,840 people	From UWSSRP Table 6-8
5.0	Domestic water consumption	29,645 m ³ /d	From UWSSRP Table 6-8
6.0	Institutional water consumption	4,447 m ³ /d	From UWSSRP Table 6-8
7.0	Commercial water consumption	1,681 m ³ /d	From UWSSRP Table 6-8
8.0	Industrial water consumption	1,811 m ³ /d	From UWSSRP Table 6-8
9.0	Average daily demand (including losses)	54,469 m ³ /d	From UWSSRP Table 6-8
10.0	Peak daily demand	68,086 m ³ /d	From UWSSRP Table 6-8
11.0	Muda Dam annual Yield	31 600,000 m ³ /year	From Muda Dam Design Report
12.0	Muda Dam daily Yield	86,575 m ³ /d	
13.0	Catchment Council Fees	3 \$/1000m ³ Dam Yield	
14.0	Cost of electricity	0.11 \$/kWhr	
15.0	Assumed domestic Water Supply rate	1.32 USD/m ³	
16.0	Gross Cost of pumping Raw water from Muda Dam to Manyame	0.14 USD/m ³	From Muda Operating costs
17.0	Gross Cost of pumping Raw water from Morton Jaffray to PE water	0.1 USD/m ³	From calculation
18.0	Bulk selling price of excess treated water from P.F. Waterworks to Harare	0.79 USD/m ³	Domestic supply rate less 40% mark up
19.0	Bulk Selling price of raw water pumped from Muda Dam into Manyame	0.24 USD/m ³	
20.0	Fixed monthly charge per domestic connection	10.00 USD pcm	
21.0	Premium to Commercial users	100%	
22.0	Premium to Institutional Users	7%	
23.0	Premium to Industrial users	50%	
24.0	Premium for Bulk Sales (RAW WATER)	-40%	
25.0	General premium to water cost for sewerage	25%	
26.0	Chitungwiza Grant to Water Co	10,000,000.00 pa	not used in model
27.0	Grant reduction over	5 years	not used in model
28.0	Cost of treating water	0.2 USD/m ³	
29.0	Cost of reticulation in Chitungwiza per m ³ (pumping cost etc)	0.035 USD/m ³	
30.0	Cost of pumping water from Muda Dam to Prince Edward Waterworks	0.14 USD/m ³	From Muda costing
31.0	Water demand increase YEARS 1 - 10	3.40% pa	
32.0	Water demand increase YEARS 11 ONWARDS	2.00% pa	
33.0	Free water per Household	100 l/day	
34.0	Sewage Processing costs	0.35 USD/m ³	
35.0	Sewage volumes as % of Potable consumed	85%	
36.0	Capacity of Prince Edward Waterworks	90,000.00 m ³ /d	
37.0	Guaranteed minimum supply of treated water from Harare at PEW	40,000.00 m ³ /d	Letter from CoH
Operating Economics			
38.0	Directors Costs	198,000.00 pa	From staff and director Sheet
39.0	Staff Costs	2,889,505.22 pa	From staff and director Sheet
40.0	Vehicles Plant and Equipment costs	1,503,451 pa	from Vehicle sheet
41.0	Admin costs (allow)	1.50% pa	of turnover
42.0	Reactive maintenance suppliers	2.00% pa	of turnover
43.0	Annual contingency	2.00%	
44.0	Municipality annual levy	10.00% pa	of Turnover
Development Economics			
45.0	Transaction costs to FC (professional fees)	1,029,411.76	allow
47.0	Repair to reticulation	6,265,698.00	From UWSSRP appendix 10.1
48.0	Install smart meters	21,394,000.00	From separate calculation (excl VAT) reduced from 21,739,000
53.0	Installation of new transmission and Primary Mains	7,716,898.00	From UWSSRP appendix 10.1
54.0	22Ml extra Water Storage at Makoni	10,696,455.00	From UWSSRP appendix 10.1
56.0	Muda dam and pipeline to Manyame River Construction Costs	108,684,594.27	From separate calculation includes VAT
57.0	Costs of setting up SPV systems and premises	4,000,000.00	reduced from US\$6.24million down to US\$4million
58.0	Offices Workshops stores (inc FF&E)	1,363,554.00	From UWSSRP appendix 10.1 less professional services
59.0	Construction contingency	5.00%	
60.0	Dam and Pipeline design and construction contingency	10.00%	
61.0	Interest rate on construction loan	8.00%	Construction loan
62.0	Post FC professional fees	10.00%	of construction cost
Macro Economics			
63.0	General Inflation	2.50% pa	
64.0	Water price rises first 5 years	5.00% pa	
65.0	Water price rises after 5 years	2.50% pa	
66.0	Long-term Loan Interest Rate	8.00% pa	
67.0	loan term	18 years	
68.0	Debt to equity	98.5% /	1.50%
69.0	Return on equity required (IRR)	10.00% pa	
70.0	Net profit as % of gross	75.00%	
71.0	Dividend fund as % of Net Profit	100.00%	
72.0	Percentage of dividend received by Equity Investor	10.00%	
Outputs			
Short term measures			
74.0	Total capital expenditure	70,000,383.60	from Calculation page
75.0	Gross capital Requirement	70,000,383.60	
77.0	Net Capital requirement	70,000,383.60	
78.0	Equity Requirement	14,000,076.72	20%
79.0	Debt Requirement	56,000,306.88	80%
80.0	Annual Loan Payments (Capital and interest) on short term Measures	5,975,360.00	from short term measures loan page
Muda Dam and Pipeline			
81.0	Total capital expenditure	127,603,866.77	from Calculation page
82.0	Gross capital Requirement	127,603,866.77	
84.0	Net Capital requirement	127,603,866.77	
85.0	Equity Requirement	25,520,773.35	20%
86.0	Debt Requirement	102,083,093.42	80%
87.0	Annual Loan Payments (Capital and interest) on Muda Dam and Pipeline	10,892,490.00	from Muda loan page
Investment Returns			
88.0	IRR on Free Cashflows	16%	
89.0	IRR on Dividend Distribution	16%	
Water Costs (year 0)			
90.0	Domestic	1.32	1.66 10.00
91.0	Commercial	2.65	3.31 20.00
92.0	Institutional	1.42	1.77 10.72
93.0	Industrial	1.99	2.48 15.00
94.0	Bulk Sales (RAW WATER)	0.79	
Cost for family of 5 people consuming 15m ³ water per month		\$29.86	per month
Equity Inputs			
95.0	Equity risk premium	39,520,850	20% Okay
96.0	Percentage of Shares Received by Financial Investor	0%	

APPENDIX 2 INSPECTION RESULT OF ZENGEZA WWTP

(1) Machines and Motors

(1) Actuator & Machinery Condition in Zengeza WWTP				Requirement (need to repair or replace)							
No.	Name of Equipment	Capacity kW Design	Capacity kW Actual	Nos.	Machine Pump	Gearbox	Motor	Submer-gible Pump	Cable outdoor	Switch box outdoor	MCC
Preliminary											
1	Grit Chamber Sand Discharge Submergible Pump 1	3		1	—	—	—	replace	—	replace	OK
2	Grit Chamber Sand Discharge Submergible Pump 2	3		1	—	—	—	replace	—	replace	OK
3	Primary Sedimentation Tank Sludge Collector 1 with Torque SW	0.37	0.37	1	repair	overhole	replace	—	replace	OK	replace
4	Primary Sedimentation Tank Sludge Collector 2 with Torque SW	0.37	0.37	1	repair	overhole	replace	—	replace	OK	replace
5	Primary Sedimentation Tank Sludge Pump 1	5.5	5.5	1	repair	—	OK	—	OK	OK	OK
6	Primary Sedimentation Tank Sludge Pump 2	5.5	5.5	1	OK	—	OK	—	OK	OK	OK
7	Primary Sedimentation Tank Sludge Pump 3	5.5	5.5	1	OK	—	OK	—	OK	OK	OK
8	Waste Tower Supply Submergible Pump 1	6.5		1				replace			
9	Waste Tower Supply Submergible Pump 2	6.5		1				replace			
10	Floor Discharge Submergible Pump 1	1.5		1	—	—	—	replace	—	OK	OK
11	Equalization Basin Mixer 1	11	7.5	1	repair	overhole	replace	—	replace	OK	OK
12	Equalization Basin Mixer 2	11	7.5	1	OK	overhole	OK	—	replace	OK	OK
13	Equalization Basin Mixer 3	11	7.5	1	OK	overhole	OK	—	replace	OK	OK
14	Equalization Basin Mixer 4	11	7.5	1	OK	overhole	OK	—	replace	OK	OK
15	Equalization Tank Outlet Gate	?	0.55	1	replace	overhole	replace	—	replace	OK	OK
Train 1											
16	Anaerobic Mixer 1-1	11	11	1	OK	overhole	replace	—	replace	OK	OK
17	Anoxic Mixer 1-1	11	11	1	OK	overhole	replace	—	replace	OK	OK
18	Anoxic Mixer 1-2	11	11	1	OK	overhole	replace	—	replace	OK	OK
19	Anoxic Mixer 1-3	11	11	1	OK	overhole	replace	—	replace	OK	OK
20	Anoxic Mixer 1-4	11	11	1	OK	overhole	replace	—	replace	OK	OK
21	Anoxic Mixer 1-5	11	11	1	OK	overhole	replace	—	replace	OK	OK
22	Aerobic Aerator A 1-1	90/132	90/132	1	OK	Pressure SW	OK	—	replace	OK	OK
23	Aerobic Aerator A 1-1 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
24	Aerobic Aerator A 1-2	90/132	90/132	1	OK	P-SW overhaul	OK	—	replace	OK	OK
25	Aerobic Aerator A 1-2 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
26	Aerobic Aerator A 1-3	90/132	90/132	1	OK	P-SW overhaul	OK	—	replace	OK	OK
27	Aerobic Aerator A 1-3 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
28	Aerobic Aerator B 1-4	30/45	30/45	1	OK	P-SW overhaul	OK	—	replace	OK	OK
29	Aerobic Aerator B 1-4 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
30	Aerobic Aerator B 1-5	30/45	30/45	1	OK	P-SW overhaul	OK	—	replace	OK	OK
31	Aerobic Aerator B 1-5 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
32	Recirculation Submergible Pump 1-1	22		1	—	—	—	OK	—	OK	OK
33	Recirculation Submergible Pump 1-2	22		1	—	—	—	OK	—	OK	OK
34	Recirculation Submergible Pump 1-3	22		1	—	—	—	OK	—	OK	OK
Train 2											
35	Anaerobic Mixer 2-1	11	11	1	OK	overhole	replace	—	replace	OK	OK
36	Anoxic Mixer 2-1	11	11	1	OK	overhole	replace	—	replace	OK	OK
37	Anoxic Mixer 2-2	11	11	1	OK	overhole	replace	—	replace	OK	OK
38	Anoxic Mixer 2-3	11	11	1	OK	overhole	replace	—	replace	OK	OK
39	Anoxic Mixer 2-4	11	11	1	OK	overhole	replace	—	replace	OK	OK
40	Anoxic Mixer 2-5	11	11	1	OK	overhole	replace	—	replace	OK	OK
41	Aerobic Aerator A 2-1	90/132	90/132	1	OK	P-SW overhaul	OK	—	replace	OK	OK
42	Aerobic Aerator A 2-1 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
43	Aerobic Aerator A 2-2	90/132	90/132	1	OK	P-SW overhaul	OK	—	replace	OK	OK
44	Aerobic Aerator A 2-2 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
45	Aerobic Aerator A 2-3	90/132	90/132	1	OK	P-SW overhaul	OK	—	replace	OK	OK
46	Aerobic Aerator A 2-3 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
47	Aerobic Aerator B 2-4	30/45	30/45	1	OK	P-SW overhaul	OK	—	replace	OK	OK
48	Aerobic Aerator B 2-4 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
49	Aerobic Aerator B 2-5	30/45	30/45	1	OK	P-SW overhaul	OK	—	replace	OK	OK
50	Aerobic Aerator B 2-5 oil pump	0.75		1	—	—	OK	—	replace	OK	OK
51	Recirculation Submergible Pump 2-1	22		1	—	—	—	OK	—	OK	OK
52	Recirculation Submergible Pump 2-2	22		1	—	—	—	OK	—	OK	OK
53	Recirculation Submergible Pump 2-3	22		1	—	—	—	OK	—	OK	OK

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area in Zimbabwe
April 2018

No.	Name of Equipment	Capacity kW Design	Capacity kW Actual	Nos.	Requirement (need to repair or replace)						
					Machine Pump	Gearbox	Motor	Submer- gible Pump	Cable outdoor	Switch box outdoor	MCC
Alkaline											
54	Hydrated Lime Dissolving Agitator 1	4	4	1	—	—	not use	—	—	—	—
55	Hydrated Lime Dissolving Agitator 2	4	4	1	—	—	not use	—	—	—	—
56	Hydrated Lime Dosing Pump 1	0.05		1	—	—	not use	—	—	—	—
57	Hydrated Lime Dosing Pump 2	0.05		1	—	—	not use	—	—	—	—
Final											
58	Final Sedimentation Tank Sludge Collector 1 with Torque SW	0.37	0.37	1	repair	overhole	replace	—	replace	OK	OK
59	Final Sedimentation Tank Sludge Collector 2 with Torque SW	0.37	0.37	1	repair	overhole	replace	—	replace	OK	OK
60	Final Sedimentation Tank Sludge Collector 3 with Torque SW	0.37	0.37	1	repair	overhole	replace	—	replace	OK	OK
61	Final Sedimentation Tank Sludge Collector 4 with Torque SW	0.37	0.37	1	repair	overhole	replace	—	replace	OK	OK
62	Return Activated Sludge Submergible Pump 1	22		1	—	—	—	replace	—	OK	OK
63	Return Activated Sludge Submergible Pump 2	22		1	—	—	—	replace	—	OK	OK
64	Return Activated Sludge Submergible Pump 3	22		1	—	—	—	replace	—	OK	OK
65	Return Activated Sludge Submergible Pump 4	22		1	—	—	—	replace	—	OK	OK
66	Waste Activated Sludge Submergible Pump 1	5.5		1	—	—	—	replace	—	OK	OK
67	Infiltration Pump 1	5.5		1				replace	—	OK	OK
68	Waste Activated Sludge Submergible Pump 2	5.5		1	—	—	—	replace	—	OK	OK
69	Infiltration Pump 2	5.5		1				replace	—	OK	OK
Sludge											
70	Primary Sedimentation Tank Sludge Thicker 1	0.25	0.25	1	repair	overhole	replace	—	replace	OK	OK
71	Primary Sedimentation Tank Sludge Thicker 2	0.25	0.25	1	repair	overhole	replace	—	replace	OK	OK
72	Primary Sedimentation Tank Sludge Thicker Sludge Pump 1	5.5	5.5	1	OK	—	replace	—	OK	OK	OK
73	Primary Sedimentation Tank Sludge Thicker Sludge Pump 2	5.5	5.5	1	OK	—	OK	—	OK	OK	OK
74	Primary Sedimentation Tank Sludge Thicker Sludge Pump 3	5.5	5.5	1	OK	—	OK	—	OK	OK	OK
75	Final Sedimentation Tank Sludge Thicker 1	0.25	0.25	1	repair	overhole	replace	—	replace	OK	OK
76	Final Sedimentation Tank Sludge Thicker 2	0.25	0.25	1	repair	overhole	replace	—	replace	OK	OK
77	Final Sedimentation Tank Sludge Thicker Sludge Pump 1	5.5	5.5	1	replace	—	replace	—	OK	OK	OK
78	Final Sedimentation Tank Sludge Thicker Sludge Pump 2	5.5	5.5	1	OK	—	OK	—	OK	OK	OK
79	Final Sedimentation Tank Sludge Thicker Sludge Pump 3	5.5	5.5	1	OK	—	OK	—	OK	OK	OK
80	Digestion Tank Mixing Pump 1	15		1	replace foundation work	—	replace	—	OK	OK	OK
81	Digestion Tank Mixing Pump 2	15		1	replace foundation work	—	replace	—	OK	OK	OK
82	Digestion Tank Mixing Pump 3	15		1	replace foundation work	—	replace	—	OK	OK	OK
83	Digestion Tank Sludge Pump 1	3	3	1	OK	—	OK	—	OK	OK	OK
84	Digestion Tank Sludge Pump 2	3	3	1	OK	—	OK	—	OK	OK	OK
85	Digestion Tank Sludge Pump 3	3	3	1	OK	—	OK	—	OK	OK	OK
86	Floor Discharge Submergible Pump 2	1.5		1	—	—	—	replace	—	OK	OK
87	Floor Discharge Submergible Pump 3	1.5		1	—	—	—	replace	—	OK	OK

(2) Instrumentation

(2) Instrumentation Condition in Zengeza WWTP

No.	Name of Instrumentation	Type	Nos.	Requirement (repair or replace)
1	Flow meter at Inlet Channel	Parshall flume	1	replace
2	Flow meter at the Channel after Equalization Tank	Parshall flume	1	replace
3	pH meter at the Channel after Equalization Tank		1	replace
4	Level meter at Aerobic Basin 1		1	replace
5	Level meter at Aerobic Basin 2		1	replace
6	Level meter at Waste Activated Sludge Pit		1	replace
7	Level meter at Infiltration Pump Pit		1	replace
8	Level meter at Waste Tower Tank		1	replace
9	Level meter at Waste Tower Supply Pit		1	replace
10	Level meter at Floor Discharge Pump Pit 1		1	replace
11	Level meter at Floor Discharge Pump Pit 2		1	replace
12	Level meter at Floor Discharge Pump Pit 3		1	replace

(3) Manual Equipments

(3) Manual Equipment Condition in Zengeza WWTP

Requirement (need to repair or replace)

No.	Name of Equipment	Operation	Nos.	Machinery	Gearbox	Remarks
1	Inlet Gate	Manual	1	OK	—	
3	No.1 Cannel Coarse Screen	Manual	1	OK	—	
4	No.1 Cannel Meddle Screen	Manual	1	OK	—	
5	No.1 Cannel Chain Block	Manual	1	replace	—	
6	No.1 Cannel Outlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
7	No.2 Cannel Coarse Screen	Manual	1	OK	—	
8	No.2 Cannel Meddle Screen	Manual	1	OK	—	
9	No.2 Cannel Chain Block	Manual	1	replace	—	
10	No.2 Cannel Outlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
11	Distribution Tank before Primary Sedimentation Tank inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
12	Distribution Tank before Primary Sedimentation Tank Outlet Gate No.1	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
13	Distribution Tank before Primary Sedimentation Tank Outlet Gate No.2	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
14	Train A BNR Anaerobic tank Inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
15	Train B BNR Anaerobic tank Inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
16	Distribution Tank before Final Sedimentation Tank Inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
17	Distribution Tank before Final Sedimentation Tank Outlet Gate No.1	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
18	Distribution Tank before Final Sedimentation Tank Outlet Gate No.2	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
19	Distribution Tank before Final Sedimentation Tank Outlet Gate No.3	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
20	Distribution Tank before Secondary Sedimentation Tank Outlet Gate No.4	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
21	No.1 Maturation Pond Inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
22	No.1 Maturation Pond Bypass Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
23	No.2 Maturation Pond Inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
24	No.3 Maturation Pond Inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
25	No.4 Maturation Pond Inlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
26	No.4 Maturation Pond Outlet Gate	Manual	1	replace	—	Wooden Gate now, replace to Stainless steel
27	Chain Block of Sludge Thickening Tank Pump Station for Primary Sedimentation Tank	Manual	1	replace	—	
28	Chain Block of Sludge Thickening Tank Pump Station for Final Sedimentation Tank	Manual	1	replace	—	
29	Chain Block of Sludge Digestion Tank Pump Station	Manual	1	replace	—	
30	Valve of Sludge Drying Bed		52	replace	—	
31	Valve, Pipe, lighting and roof of Sludge Storage Yard		1	replace		

(4) Electrical Equipments

(4) Power Supply Equipment Condition in Zengeza WWTP		Requirement (need to repair or replace)		
No.	Name of Equipment	Nos.	Equipment	Cable indoor
1	No.1 Transformer Main EER 1F	1	OK	OK
2	No.1 Transformer Main EER 1F	1	OK	OK
3	Power Distribution Swichboard Main EER 1F	1	OK	OK
4	Monitor Panel Main EER 2F	1	OK	OK
5	Motor Control Center	1	OK	OK

(5) Equipments in the laboratory

(5) Laboratory Equipment Condition in Zengeza WWTP				
No.	Name of Equipment	Nos.	Requirement (need to repair or replace)	Supplied by JIM Fund
1	50 Litter Verticle Autoclave	1	OK	Z M Fund
2	80 Litter Digital Incubator	1	OK	Z M Fund
3	Open Balance (6kg)	1	OK	Z M Fund
4	Analytical Balance (520g)	1	OK	Z M Fund
5	Multi-parameter portable meter	1	OK	Z M Fund
6	Spectrophotometer	1	OK	Z M Fund
7	BOD Measurement System	1	OK	Z M Fund
8	Floc Tester	1	OK	Z M Fund
9	Jar Stirrer	1	OK	Z M Fund
10	Turbidity Portable & Bench meter	1	OK	Z M Fund
11	Scientific Oven 1	1	OK	Z M Fund
12	Scientific Oven 2	1	OK	Z M Fund
13	Lovibond Comparator	1	OK	Z M Fund
14	Water Purification system	1	OK	Z M Fund

(6) Concrete Structure

(6) Civil Structure Condition in Zengeza WWTP

No.	Name of Equipment	Nos.	Grass	Mud	Structure
1	Grit Chamber 1	1	take out	take out	clean up
2	Grit Chamber 2	1	take out	take out	clean up
3	Primary Sedimentation Tank 1	1	take out	take out	clean up
4	Primary Sedimentation Tank 2	1	take out	take out	clean up
5	Primary Sedimentation Tank Sludge Pump Station	1	take out	take out	clean up
6	Equalization Basin	1	take out	take out	clean up
7	Anaerobic Basin 1	1	take out	take out	clean up
8	Anoxic Basin 1	1	take out	take out	clean up
9	Aerobic Basin 1	1	take out	take out	clean up
10	Anaerobic Basin 2	1	take out	take out	clean up
11	Anoxic Basin 2	1	take out	take out	clean up
12	Aerobic Basin 2	1	take out	take out	clean up
13	Recirculation Pump Station	1	take out	take out	clean up
14	Hydrated Lime House	1	take out	take out	clean up
15	Final Sedimentation Tank 1	1	take out	take out	clean up
16	Final Sedimentation Tank 2	1	take out	take out	clean up
17	Final Sedimentation Tank 3	1	take out	take out	clean up
18	Final Sedimentation Tank 4	1	take out	take out	clean up
19	Return Activated Sludge Pump Station	1	take out	take out	clean up
20	Primary Sedimentation Tank Sludge Thicker 1	1	take out	take out	clean up
21	Primary Sedimentation Tank Sludge Thicker 2	1	take out	take out	clean up
22	Primary Sedimentation Tank Sludge Thicker Sludge Pump Station	1	take out	take out	clean up
23	Final Sedimentation Tank Sludge Thicker 1	1	take out	take out	clean up
24	Final Sedimentation Tank Sludge Thicker 2	1	take out	take out	clean up
25	Final Sedimentation Tank Sludge Thicker Sludge Pump Station	1	take out	take out	clean up
26	Digestion Tank 1	1	take out	take out	clean up
27	Digestion Tank 2	1	take out	take out	clean up
28	Digestion Tank Sludge Pump Station	1	take out	take out	clean up
29	Sludge Drying Bed	52	take out	take out	clean up
30	Sludge Storage Yard	1	take out	take out	clean up

APPENDIX 3 RESIDENTS' CONSCIOUSNESS SURVEY RESULT

In this study, a survey on awareness about water supply and sewerage was conducted for 450 sample households. The outline of survey results and the questions and summary results are shown below:

3.1 Outline of Survey Results

(1) Current Water Supply and Sewer Service

1) Current status

Regarding current water supply and sewerage services, about 85% of residents are receiving services for sewer service, and households without service use septic tanks. Regarding water supply, there are many households that are supplied two or three times per week, and about 60% of families use shallow wells etc. In terms of payment of fee, there are some unpaid items in households of about 60% of water supply and sewage fee claims. About 30% of the residents concerning sewerage billing, there is appropriate recognition of the current amount of sewage fee.

2) Reflection on study report

Regarding the frequency of use of water supply, it is almost consistent with the content of hearings with each related organization. On the other hand, the installation ratio of shallow wells is considerably larger than the survey results by hearings and various documents. Therefore, there is concern that public health problems would occur in the future.

(2) Willingness to Pay for Water Supply and Sewerage

1) Current status

Even if the sewerage tariff was appropriately developed, the average amount of willingness to pay is USD 4, 16, and one for water supply is USD 5.69 on average.

2) Reflection on study report

Since the current tariff level is higher than the willingness to pay, it is assumed that a sharp increase in the tariff collection rate will be difficult. In addition, as Sesani's PPP setting is much higher than the willingness to pay, it is considered necessary to revalidate as a financial assumption setting.

(3) Public Information from Chitungwiza City

1) Current status

As information sources of residents, TV, radio, conversations in the neighborhood are major resources. There are not so many families to obtain information via the Internet etc. As to PR from the city, it is expected that information on new policies, water quality, water supply and sewerage services, and public health will be disseminated.

2) Reflection on study report

As the mean of public awareness rising in the future, it is necessary to consider above result. Also, information on water supply and sewer service is highly expected.

(4) Others

1) Current status

About 30% of the households use the sand at home, more than half of the families are using it every day. The reason for using it is that households think sand to be more effective than detergents, and moreover, the proportion of families using it as a social habit is high. Expectations for waste management, water supply and sewerage, road maintenance management are high as policy priority.

2) Reflection on study report

Regarding the use of sand, it is not reason that sand is cheaper than detergent, but it is used with expectation of its effectiveness. Therefore, it is considered possible to suppress the use of sand by enlightenment of residents. Also, as expectations for policies, expectations for improvements in water supply and sewage systems are high, and it is also important to distribute budgets in line with such expectations.

3.2 Survey Results

3.2.1 Service Provision of Water and Sewerage

(1) Questions about Service Provision of the Sewerage Service

1) The sewerage service by municipality is available at your home?

	No. of answers	Percentage (%)
1. Yes	387	85.8
2. No	64	14.2
Total	451	100.0

2) Does your home have a private septic tank?

	No. of answers	Percentage (%)
1. Yes	66	14.6
2. No	385	85.4
Total	451	100.0

3) Currently, how much is your bill for the sewage service?

	No. of answers	Percentage (%)
Correct answer	117	25.9
No answer	334	74.1
Total	451	100.0

4) Are you paying for bill for the sewage service?

	No. of answers	Percentage (%)
1. All	193	42.9
2. Never	4	0.9
3. Some	253	57.5
Total	450	100.0

(2) Questions about Service Provision of the Water Supply Service

1) How many days per week water through municipality's water supply service are available?

	No. of answers	Percentage (%)
1 Day	28	6.4
2 Days	186	42.6
3 Days	153	35
4 Days	41	9.4
5 Days	1	0.2
6 Days	0	0
7 Days	28	6.4
Total	437	100.0

2) Does your home have a private borehole or a shallow well?

	No. of answers	Percentage (%)
1. Yes	268	59.6
2. No	182	40.4
Total	450	100.0

3) Currently, how much is your bill for the water supply service?

	No. of answers	Percentage (%)
Correct answer	116	25.7
No answer	335	74.3
Total	451	100.0

4) Are you paying for bill for the water supply service?

	No. of answers	Percentage (%)
1. All	191	42.3
2. Never	1	0.2
3. Some	260	57.5
Total	452	100.0

(3) Questions for Those Who Do not Pay for Both or One of above Tariffs

1) Are you paying for other rates including other service fees such as fire or housing service?

	No. of answers	Percentage (%)
1. Yes	5	1.9
2. No	1	0.4
3. Some	259	97.7
Total	265	100.0

2) If you do not pay, what is the first and second reason of unpaid fees?

	First reason	Second Reason	Percentage of first (%)	Percentage of second (%)
1. Feeling dissatisfied with the overall service from municipality	53	103	20.3	39.6
2. Feeling dissatisfied with the water supply service	4	67	1.5	25.8
3. Household's income is not enough to pay for them	188	16	72	6.2
4. Usage of collected money is not transparent	12	29	4.6	11.2
5. Explanation from municipality is not enough	4	45	1.5	17.3
Total	261	260	100.0	100.0

3.2.2 Willingness to Pay for Water Supply and Sewerage Service

Currently, the municipality is struggling with improving water supply through the construction of a new dam, or rehabilitation of the sewer system.

1) If the sewerage service meets your expectation, how much can you pay for the service? Currently, it is almost 7.6USD per month.

Average answer	4.16USD
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- 2) **If the water supply service meets your expectation, how much can you pay for the service? Currently, it is almost 3.5USD for fixed part and 0.5USD/m³ per month.**

Average answer	5.69USD
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3.2.3 Public Relations from the Municipality

- 1) **Have you ever seen or heard the public relations regarding the water supply or sewerage such as explanations about the fee, usage of them, or saving water?**

	No. of answers	Percentage (%)
1. Yes	1	0.2
2. No	447	99.1
Total	448	100.0

- 2) **What is the major resource of information?**

	First resource	Second resource	Percentage of first (%)	Percentage of second (%)
1. Conversation with neighbours	153	25	34.8	5.7
2. Newspaper	37	5	8.4	1.1
3. SNS	74	61	16.8	13.8
4. Online news	7	10	1.6	2.3
5. TV	144	48	32.7	10.9
6. Radio	25	293	5.7	66.3
Total	440	442	100.0	100.0

- 3) **What kind of information through Municipality's public relation is useful for you? Please answer the first and second choice.**

	First relation	Second relation	Percentage of first (%)	Percentage of second (%)
1. New policy	164	30	36.4	6.7
2. Plan of public work or construction	37	73	8.2	16.2
3. Water quality report	115	53	25.5	11.8
4. Sewerage and water	48	109	10.6	24.2
5. Information about the usage of collected service fees	7	6	1.6	1.3
6. Public health	57	90	12.6	20
7. Education	16	52	3.5	11.5
8. Housing	7	38	1.6	8.4
Total	451	451	100.0	100.0

3.2.4 Others

- 1) **In your home, do you use sand for dishwashing or other purpose?**

	No. of answers	Percentage (%)
1. Yes	131	29.1
2. No	316	70.2
Total	447	100.0

2) If yes, how frequent?

	No. of answers	Percentage (%)
1. Every day	71	55.9
2. Once or twice per week	28	22
3. Occasionally	28	22
Total	127	100.0

3) Why do you use it?

	No. of answers	Percentage (%)
1 More effective than detergent	59	46.5
2 Detergent is costly	29	22.8
3 Other households also use it	6	4.7
4 Social habit	33	26
5 Recommendation from a particular organization	0	0
6 Others	0	0
Total	127	100.0

4) What is your priority among services which are provided by the municipality? Please answer the first and second choice.

	First service	Second service	Percentage of first (%)	Percentage of second (%)
1. Refuse service	132	22	29.3	4.9
2. Sewer service	141	67	31.3	14.9
3. Insurance	0	0	0	0
4. Fire fighting	0	0	0	0
5. Public lightning	32	7	7.1	1.6
6. Water supply service	137	182	30.4	40.4
7. Road maintenance	9	172	2	38.1
8. Others		1		0.2
Total	451	451	100.0	100.0

APPENDIX 4 MINUTES OF MEETING FOR WORKSHOP

DATE : 13/4/2018

Venue: New Ambassador Hotel, Harare

Welcome and opening remarks from Ministry of Environment, Water and Climate (MEWC)

He asked that participants give self-introductions. In his opening remarks he stated the purpose for the workshop.

Opening remarks from JICA representative:

In 2000, JICA supported construction of a Bio Nutrient Removal (BNR) Plant at the Zengeza Waste Water Treatment Plant (ZWWTP) and donated it to the municipality for its residents. However, the BNR plant at ZWWTP has not been operational since 2009. Although JICA funded the project, it is not currently, in a position to financially support the rehabilitation of the system. JICA carried out the survey in order to give direction and options on the way forward.

Presentation (1): JICA Study Team (JST)

1. Outline of the Survey.
2. Current situation at the Zengeza Waste Water Treatment Plant (WWTP) and its surrounding places. Granted Bio Nutrient Removal (BNR) System not operational since 2009. Most parts need replacement for overall rehabilitation of the plant. Other parts need to be upgraded. The main BNR facilities are clogged with mud. No subsidy from the central government due to devolution. Active external funding resource is ZimFund through the African Development Bank (AfDB). Chitown relies on water supply from the Harare City Council but the recognition gap of purchased water causes insufficient payment. Several pipelines and pump stations are damaged, which negatively impact residents' living conditions. The inflow area into ZWWTP is about half the planned area. The water basin of Lake Chivero includes Harare City and Chitungwiza. Water pollution in Lake Chivero is worsening. About 220, 000 tons of pollutant load is stored in nine years. Possibility of a cholera outbreak.

Presentation (2): JICA Study Team

JST explained the sewerage fee level and allocation of expenses to BNR. In order to maintain the BNR properly, it is necessary to consider two points: sewerage fees, and proper allocation of the sewerage budget.

To maintain the BNR, USD2,000,000 will be required. Regarding the sewerage tariff, it is necessary to raise the collection rate to 70% at least, though currently the collection rate is around 54 percent.

In terms of proper allocation of the sewerage budget, it is necessary to allocate the budget of 60% to the BNR maintenance at least.

Above combination of 70% and 60% is just example, so combination of other ratios in the range of green area will be alternative. In addition, if it is possible to reduce the amount of chemical use, the range of yellow becomes the target area to maintain the BNR.

As other recommendation, it is necessary to improve consistency on data, improve the capacity to make financial statements and practical budget, and improve financial stability

As to PPP scheme, overall, it seems good plan; however, the financial plan looks unfeasible. Therefore, it would be necessary to reconsider and verify the assumption or premises.

Discussion:

1. Policy, and future projections:

EMA:

There is a policy in place that was enacted in 2009 and within that policy there is a legal framework which ensures that EMA regulates the quality of all environmental issues, including the quality of waste water. It is hoped that with time, through the improvement of various treatment processes there is a possibility that the water quality will improve.

Sesani:

The catchment for water supply is heavily polluted, and that the cycle of polluting the Manyame River catchment is increasing. A different catchment up-stream, such as Mupfuri River or the building of Muda Dam could be the solution to Chitungwiza's clean water supply.

MEWC:

The Ministry drafted a bill proposing the creation of Water and Waste Water Regulatory Authority which will be a stand-alone institution mandated to monitor those who are polluting, such as Chitungwiza City and the City of Harare. Currently, EMA and ZINWA are carrying out both, operational and monitoring activities. There is need to separate monitoring and operations. The new institution will be responsible for monitoring and enforcing the regulations pertaining to the environment quality.

Ministry of Local Government, Public Works, and National Housing (MLGPWNH):

This country has a lot of good regulations and statutory instruments. However, there should be more enabling than regulating. Chitungwiza is shouted at but with no help to solve its problems.

ZINWA:

The main challenge is the pollution of the Manyame System. The solution is to correct the quality of discharge, so that it is not transferred to the Harare Metro and other several centres down-stream. There is a need to look more at the waste water treatment plants, rather than importing water.

Sesani:

Sesani submitted a tender proposing to commercialize and not privatize the water and waste water, which is also what AfDB recommended. Sesani appealed for support of the project proposal because this would solve Chitungwiza's clean water supply and waste water management issues. Also revenue collection will be guaranteed through the prepaid meter system Sesani is proposing, adding that the National Water Act supports such an initiative through the "user must pay" policy.

Harare Water:

Consideration should be on 1) cost of rehabilitation, 2) sustainability, 3) tariff, 4) power supply and 5) the quality of effluent when deciding whether a BNR plant is right for Chitungwiza at this moment in time. Harare Water knows without doubt, that the BNR produces the highest quality of effluent but comparison of cost (BNR versus the conventional bio-filters and hybrid systems), sewerage treatment regime and capacity building have to be included in the analysis. If the BNR is resuscitated, are the desired results going to be achieved?

2. The current situation - Survey Results:

AfDB:

Chitungwiza City and City of Harare need to work together for solutions to the pollution of Manyame River. Chitungwiza is discharging into the river and Harare uses eight (8) chemicals to treat the water.

Operation and maintenance is not being done properly because Chitungwiza does not have the money. AfDB through their studies, have recommended ring-fencing the water and sewerage revenue. Sustainability of donor investments is critical for the benefit of the citizens, and even the municipalities that are involved.

Ruwa Town Council:

Under ZimFund, Phase I they rehabilitated three BNR plants in Mutare, Kwekwe and Masvingo (partially). Masvingo's BNR is operating well except when experiencing power outages. Mutare's BNR state before rehabilitation was quite similar to the Chitungwiza one but it is now operating and well maintained because of the resources. Mutare also has a power dedicated to it and power outages are not experienced that much. Kwekwe had a similar rehabilitation program. Their plant is working well and it is hoped that they will continue to make it work. The last one is, Redclif which has two smaller BNR plants compared to other cities. It is their hope that by the end of the rehabilitation of those two plants, the municipality will be able to sustain them. The issue with these BNR plants is about sustainability.

AfDB:

For Chitungwiza to get sufficient water, they have to pay. How do we make sure that Chitown has sustainable income to pay for the water supply from Harare? There is a proposal among other proposals to ring-fence the revenues that are coming from water and sewerage so that they are able to maintain the systems. Mutare has started ring-fencing and is now able to maintain their systems. Other cities are trying to ring-fence revenues from water. Those that are not, are having problems. He said he was not sure about City of Harare. He suggested the need to share information.

Harare Water:

From what Ruwa Town Council said about the rehabilitation in Mutare, and what said, people can be in a position to ask how much it cost to rehabilitate the Mutare system and whether it is sustainable for Chitungwiza?

Harare Water:

What needs to be done as a country, is to have a uniform model to run a BNR plant. There are about ten models available. Latest models run under process control and the inflow quality is checked at each and every stage. Once raw sewerage quality information is loaded into the model, it tells you what it is supposed to read at each stage and will pre-inform the reader what prevailing measures are supposed to be taken. Currently BNR plants produce inconsistent results of effluent quality because 1) people/personnel are not pre-informed, and 2) they are not optimizing these BNR plants. For example, Firlle uses 444 mega litres (ML)/day but if it is optimized, it will only use around 200 ML/day. The result is a saving of US\$56 million of investment with a model that one pays a subscription of only US\$2,500 per year. City of Harare has two such connections and the University of Zimbabwe has one but I don't think other municipalities have the same thing. Latest models bring in sustainability for the whole plant because they run efficiently. By using the same model in all local authorities, it becomes easy in terms of training, improving operations and it becomes an opportunity for interaction/collaboration with all other local authorities because the engineers/process controllers will be trained by the same consultant.

JICA:

Collaboration is necessary in order to minimize the cost and maximize performance. JICA hoped that the Zengeza BNR system could be rehabilitated.

Break: 11:00 AM

Presentation: JICA Study Team

Institution and Organization

Issues in Sewerage Works

The minimum cost of investment is US\$1,740,000 estimate.

The maximum dollar amount is US\$3,910,000.

Maintenance cost is estimated at US\$2,000,000, annually.

Discussion:

MLGPWNH:

Local authorities use the three A-s as a government policy. Thus, service has to be accessible, affordable and appropriate. Example, she is from a local authority that uses ponds and she pays US\$2.80/month for sewerage and the ponds are good enough to take her kids to watch waterworks. It is affordable, accessible and appropriate. She wanted to know, 1) what the figure would be to build equivalent size ponds? 2) What else can a BNR be used for besides BNR producing better quality effluent? She added that, Chitungwiza does not have a strong economic base, it is politically weak and the chances of increasing revenue are slim. She explained that the Commission engaged the services of a debt collector, however, the residents are calling on their councillors to have him fired and management cannot do anything about it. She also pointed that Chitungwiza is in salary arrears for more than a year. If staff is increased, they are not going to be paid, anyway. Chitungwiza cannot afford a BNR system at the present moment.

Sesani:

The sewerage ponds at Zengeza are not designed with an effluent quality suitable to discharge into the river but to irrigate land to avoid polluting the river. He was not sure how efficiently that operation is happening. To answer PD VLA, MLGPWNH's second question, he explained that if gas is collected it can be used to generate electricity to continuously run the BNR system and other uses. She clarified that she was talking about a derelict BNR and not a working one. He suggested that the best thing would be to abandon it unless one is willing to pay \$6 million, which is what JICA suggested. However, if a donor agency gave \$6 million to fix the BNR, then that is the right solution because the quality of water that comes out of there could be pumped back into Seke or other dams. It is then re-cycle to Chitungwiza without having to put it into the Manyame System.

MLGPWNH:

It is greatly embarrassing to have to tell the Japanese that, "Sorry, we killed your kid," over and over again. She suggested that the group talk about solutions that will suit Chitungwiza as Waste Water Manager, Harare Water pointed out earlier. We need to decide whether Chitungwiza is a BNR council at this stage because of the current problems that are not likely to change in the short-term. Director, Sesani suggested that Chitungwiza rates go up by 10 percent to increase revenue collection in order to reach international standards of 75 percent. He added that without an effective Town Clerk, the town council is not in a position to make changes which will enable Chitungwiza to operate as a council. He argued that ponds need to be financed, then maintained and still have to irrigate the land as opposed to discharging into the river. PD VLA, MLGPWNH maintained that government does not have the financial capacity to resuscitate the BNR in Chitungwiza. She also pointed that there are 31 other local authorities that are better managed than Chitungwiza and those are better investment destinations. She added that Chitungwiza residents do not like to pay for services and that their attitude is not going to change. On the willingness to pay, Director, Sesani indicated that Sesani carried out a survey on that and the residents pay \$0.25 per 20 litres of water, which translates to \$12.00/m³. He stated that the current tariff is around \$0.60/month per cubic metre and Sesani, in its analysis, suggested a tariff of \$0.75. Chitungwiza residents are already paying ten times more than

what they should be buying the 20 litre water at \$0.25. The willingness to pay is there. All that is needed is organizational restructuring, adding that prepaid meters give them water that they pay for.

MEWC:

If ponds are a feasible option for Chitungwiza.

Harare Water:

The BNR system is mainly for industry. If a municipality has predominantly domestic effluent it may use ponds and if the flow quantity is not very much it may also use ponds. Ponds also occupy a very large area. Chitungwiza is not an industrial town and indications are that Chitungwiza uses 35ML/day while the plant's capacity is about 30 ML/day. Chitungwiza is predominantly domestic and has a small industry. Also, the discharge from the industry is not continuous. Of what benefit is the resuscitation of the BNR plant? Alternatively, there is a working conventional system, and all that could be done is to add another pond, and another biological filter. Then, the only thing to focus on is making sure the pump stations pumping to the farms are always functioning.

Ruwa Town Council:

Pollution is the biggest problem, therefore, effluent must be pumped to the farms and must not be discharged into the environment. The consequences of polluting are now evident at the water source for our treatment works at Morton Jaffrey and it makes it extremely expensive to treat. A total cost analysis has to be done from beginning to end. For the ponds, you have to incorporate the cost of pollution which translates to the chemical needed to treat the water for it to be portable and pumped back to Harare. A BNR plant achieves the desirable quality of effluent.

MLGPWNH:

When doing a cost benefit analysis, there is need to also look at Chitungwiza Municipality's current ability to pay. It is better to pump EMA green water to Imbwa Farm than to pump EMA yellow or red water into the river. If the BNR does not work properly, the water still goes into the Manyame River. She argued that BNR water cannot be pumped to Imbwa farm because it is not connected that way. If we opt for BNR, it has to be maintainable. Chitungwiza has to obtain the spare parts and store the parts. That is tied up money, and in addition to that, more people are needed to operate and maintain the plant. All those costs have to be put into the cost-benefit-analysis. She clarified that she was not writing off the BNR but foresaw Chitungwiza drowning from the cost of running a BNR plant.

MEWC:

Ponds are the way to go unless there is no land. She said she is talking about the hybrid system and a good pipeline.

Zengeza WWTP:

When partially treated effluent is pumped to Imbwa Farm, in a way pollution is transferred to the Mupfuri catchment. He suggested that since the infrastructure is already there at Zengeza, rehabilitating the BNR would be the way to go. The existing set up at Zengeza, he explained, is that if the waste water from the BNR plant fails to meet the required standard, it can be pumped to Imbwa farm. He pointed out that the BNR may be expensive but it is the "in-thing," considering our environment. Deputy Director, MEWC was surprised to learn that pumping treated effluent to the pastures in a way contributes to polluting the environment. E Q Officer, EMA explained that if the current capacity of a hybrid plant is failing, it means that the desired treatment efficiency is reduced and in instances where high percolation occurs, underground water contamination is possible.

Harare Water:

Referring to page 26 of the survey report regarding the current situation, the focus be on the conventional system for now and fix the BNR at a later stage followed by the hybrid system in the

long-term. Later, the town council can then decommission the more expensive operation and maintenance system. (Note: BNR system is more expensive in operation and maintenance than conventional treatment system.) Waste Water Manager, Harare Water highlighted that technology has moved extensively to improve efficiency. The cost of constructing an older version of a BNR system is about \$1 million/ML on one hand and on the other, the newer models cost around \$400,000/ML to build. The question is, should we sustain the Zengeza BNR plant or replace it? The conventional system requires more land for irrigation, however. PD VLA, MLGPWNH thought JST was going to highlight the cost of treating per cubic metre of the BNR versus the conventional plant.

ZINWA:

Imbwa Farm should not be used as a dumping ground but as part of the treatment process. She suggested that the town council consider paying whoever is running the farm so that they are accountable to the way they manage the effluent discharged to their land. She added that whilst the BNR is the in-thing, there is need to determine what type of BNR is at Zengeza. If the BNR plant was to be resuscitated, what other challenges that could be encountered in the future if everyone else is moving with the times? Responding to the issue of paying for the use of Imbwa Farm, Waste Water Manager, Harare Water stated that the water she mentioned is more valuable to the farmers if they use it properly. The people at Imbwa Farm should be paying not Chitown.

AfDB:

JICA's statement that they (JICA) do not currently have funds to rehabilitate the BNR in Chitungwiza. There could be changes within the government structure and the use of Imbwa farm could change as well. What will you do if Imbwa Farm ceases to exist? Chitungwiza's population is going to increase. Will you be able to sustain the current system on a long-term? Do we need to make plans for the future? We may tell JICA that maybe they consider providing us a modern BNR system that can be manageable. That is another option. Then we can talk about the planning, to say when can this happen? How can we manage to make these investments sustainable? Can we make an analysis and see which one in the long run is maintainable? I agree with PD VLA, MLGPWNH that at the moment we cannot sustain Chitungwiza. However, as time goes on something will change. We need to look at short-term, medium-term and long-term and plan from there. JICA is always looking for sustainability before they commit to an investment. We have to look at all the available scenarios and come to a conclusion. Acting Water Manager, Harare Water asked if there is a way to have future cooperation of waste water treatment between the southern cooperated areas and Chitungwiza rather than having dotted areas and they are all polluting the same water source.

AfDB:

Currently the inflow from the sewerage is not sufficient to run those parts. So there is a need to look at the capacity. PD VLA, MLGPWNH emphasized the lack of funds to fix the BNR. Shimegi, JST explained that US\$2 million was for operation and maintenance, annually.

(Not sure whose contribution this is):

The system under discussion is a system that will cater for the current Chitungwiza residents, or cater for the existing boundaries but with Chitungwiza is expanding across Nyatsime River, it is anticipated that additional households will go up 40,000 and above. This system cannot cater for the new stands.

Harare Water:

We need to make suggestions on how the problems in Chitungwiza can be rectified.

JICA:

Somebody talked about the population increase and I am surprised that you are still maintaining the old conventional treatment system which produces low quality of water which will be discharged into the environment and not the BNR which is high quality of treatment. Is it a good idea to create more ponds to treat waste water as the population increases?

Harare Water:

Participants were not being understood. He explained that currently there is the conventional system, working with about 35 ML to be treated at ZWWTP. The current plant takes about 22 ML. On the BNR plant, \$2 million/yearly is needed to run the BNR. There are new advanced BNR systems that are way cheaper to run than the one we have. If we run the conventional, we save \$1.8 million per year, which we can then use to construct a more efficient and much cheaper BNR plant. The BNR we currently have is the oldest of systems. There is need to compare the cost of resuscitating the old BNR plant in Chitungwiza or should we buy a more modern system which cost \$400,000/ML. (Note: There is no established BNR technology which is low in construction and maintenance cost.)

MEWC:

Let us look at the available options.

Wrap up comments from the Ministry of Finance:

Principal Economist, Ministry of Finance and Economic Development thanked JICA for the study which triggered a fruitful debate and discussion. He appealed to JICA to reconsider offering financial support for the rehabilitation of the BNR plant in Chitungwiza. He pointed out that JICA's decision not to financially assist Chitungwiza at this stage was before they heard the discussion which has also enlightened them. He said he was pessimistic that JICA will come to Chitungwiza's much needed aid and that the government of Zimbabwe will appreciate it. He mentioned that some development partners are taking part in assisting Chitungwiza and other local authorities. He urged JICA, saying that it will be pleasing to see JICA joining hands with other donors in improving the lives of the people in Chitungwiza. He added that population growth, some threats of disease outbreaks are some of the issues that call for our attention. He praised ZimFund for its intervention initiatives in Chitungwiza and elsewhere. He said, there were, however, still some gaps that need intervention and that could be a cause to chip in and assist, so that all the areas are bridged. He reiterated that government does not have enough resources to address all the challenges that have been noted. So Zimbabwe also relies on the development partners in times of need. That also will buttress our re-engagement process that is ongoing. The need might be more than the figures highlighted in this report, however, government will appreciate additional support at whatever level. He noted that the report indicated that the revenue collection rate in Chitungwiza is low. Chitungwiza needs to improve on that by providing services to its residents, as well as educating them on the importance of contributing towards their own service provision.

Closing Remarks by the Ministry of Local Government, Public Works and National Housing:

PD VLA, MLGPWNH thanked JICA for not giving up on assisting Zimbabwe, especially in Chitungwiza. She hoped that JICA will understand the way the group was debating. She indicated that it was important to urge Chitungwiza to have a short-term, medium-term and a long-term plan. She urged Chitungwiza to maintain its relationship with JICA. She pointed out that at least this time there is a completed report, unlike the last time when JICA quit mid-way because the assistance from Chitungwiza, and the situation in Chitungwiza was unmanageable. There are some positives in the report, good job on debt collection and other things. That means Chitungwiza has the potential to grow and she urged Chitungwiza to maintain its relationship with JICA. Every time they come back show them that you have made progress. The way forward is depended on Chitungwiza. We have democracy in Zimbabwe, local authorities make their own decisions. There is nothing that stops others from helping Chitungwiza but the ultimate decision will be with them. The town council needs all the help it can get because it still is in great danger of collapse. This document contains information that Chitungwiza needs to be looking at very carefully, keeping it and making notes of it. If Chitungwiza does not understand some of the contents, there are plenty of people who can help them. Chitungwiza needs to use the Engineers' Forum and ask engineers like Waste Water Manager of Harare Water who can give them practical advice. Chitungwiza also has funding from ZimFund and engineers at ZimFund are also very practical. The Ministry of Environment, Water and Climate is duty-bound to help the municipality because it carries out their mandate for them. Ministries need to back-up Chitungwiza. We hope that we will continue to be

able to call on JICA's country officer for help. Sometimes it is useful to get an unbiased report like this one because it does not care about the politics. So we are grateful to that. Chitungwiza has to remember the three As. It is a government policy – accessible, affordable and appropriate. Do not give up the BNR, if you are not going to use it sooner, you may want to use it at a later time when things come right. I genuinely believe that things are coming right in Zimbabwe and we are going to grow. The urban population growth has dropped. Chitungwiza has to stop planning vast housing programs without planning offsite infrastructure. Stop planning things that you cannot service. Chitungwiza has to come up with a list of enablers and present those to the respective officers, so that we can help you to put your plans into place. She appealed to JICA not to give up on the BNR system in Zengeza.

Workshop ended at 1:00 PM

Lunch 1:00 PM

Material for Presentation

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area in Zimbabwe

April 13. 2018

WORKSHOP on Survey Findings

Government of Zimbabwe

**Ministry of Environment, Water and Climate
Ministry of Local Government, Public Works
and National Housing**

**Environment Management Agency
Zimbabwe National Water Authority
Harare Municipality, Harare Water
Chitungwiza Municipality**

Japan International Cooperation Agency

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area

April 13. 2018

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- ✓ Past Cooperation by Japan
- ✓ Activity Log

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- ✓ Facility (Zengeza WWTP, Pipeline)
- ✓ Estimation of Pollution Load
- ✓ Finance

3. Issues in Sewage Works in Chitungwiza

- ✓ Institution and Organization
- ✓ Technology
- ✓ Finance

4. Recommendations

1. Outline of the Survey

➤ Objectives of the Survey

- Collection of information on activities, plans and financial condition in water supply and sewage sector in Harare City Area
- Inspection of facilities in Zengeza WWTP
- Analysis on options for utilization of existing facilities
- Making proposals for sustainable management of water supply and sewage sector in Chitungwiza municipality

➤ Duration of the Survey

Commencement: October 2017

Completion: April 2018

1. Outline of the Survey

➤ Past Cooperation by Japan

- (1) The Project for the Improvement of Sanitary Condition in the Municipality of Chitungwiza in the Republic of Zimbabwe, 1997
- (2) The project for Improvement of Sewage Facilities in the Municipality of Chitungwiza in the Republic of Zimbabwe, 1998
- (3) Data Collection Survey for Improvement of Hygiene Condition in Chitungwiza Municipality in the Republic of Zimbabwe, 2012
- (4) The Project for the Improvement of Water Supply, Sewage and Solid Waste Management in Chitungwiza in the Republic of Zimbabwe, 2013

The 2013 project was suspended due to the serious financial condition in Chitungwiza municipality.

1. Outline of the Survey

➤ Activity log

- We visited governmental and other relevant organizations as follows.

Governmental Organizations		Other Relevant Organizations
<ul style="list-style-type: none">• Ministry of Environment, Water and Climate• Environment Management Agency(EMA)• Ministry of Local Government Public Works and National Housing• Ministry of Finance and EconomicDevelopment	<ul style="list-style-type: none">• Zimbabwe National Water Authority(ZINWA)• Harare Water• Chitungwiza Municipality• Zengeza Sewage Treatment Plant• Other WWTP and Water Treatment Plant	<ul style="list-style-type: none">• AfDB• Sesani• Chinese Embassy• UNICEF

2. Current Situation in Zengeza WWTP and its Surroundings

➤ Facilities

- Granted BNR has been stopped since 2009.
- Most of machineries need to replace for overall rehabilitation of the plant.
- Some of machinery will work with several upgrades.

➤ Finance

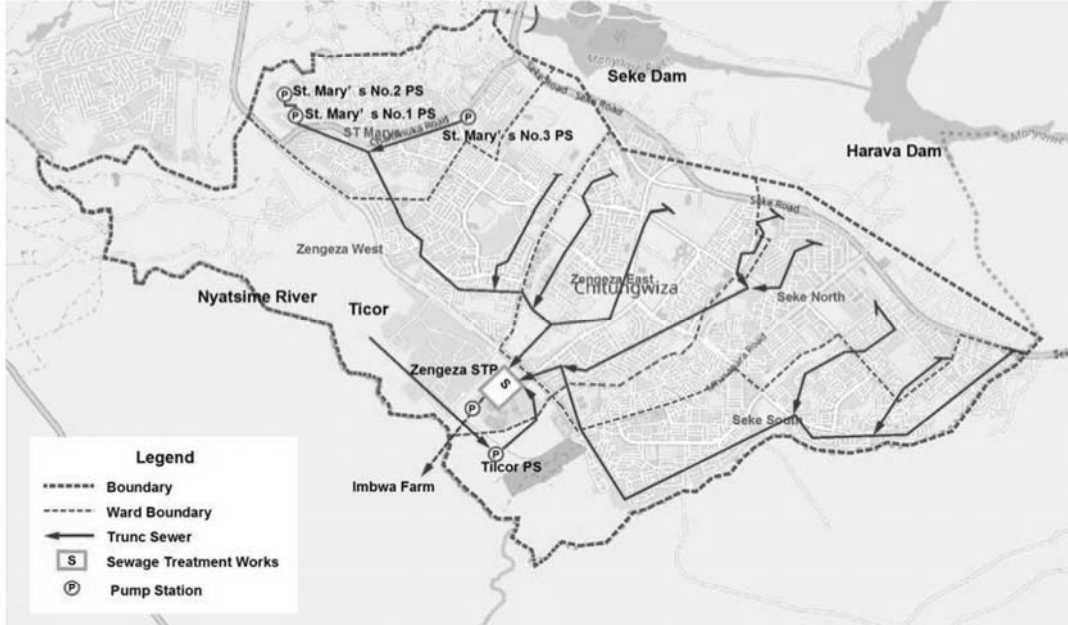
- There is no subsidy from the central government due to the devolution.
- Chitown is autonomous, so almost all activities should be funded by own financial resources.
- Active external funding resource is Zim-Fund.

➤ Others

- Water supply relies on the Harare Water, but the recognition gap of the purchased water causes the insufficient payment.

2. Current Situation in Zengeza WWTP and its Surroundings

➤ Sewage Network in Chitungwiza Municipality



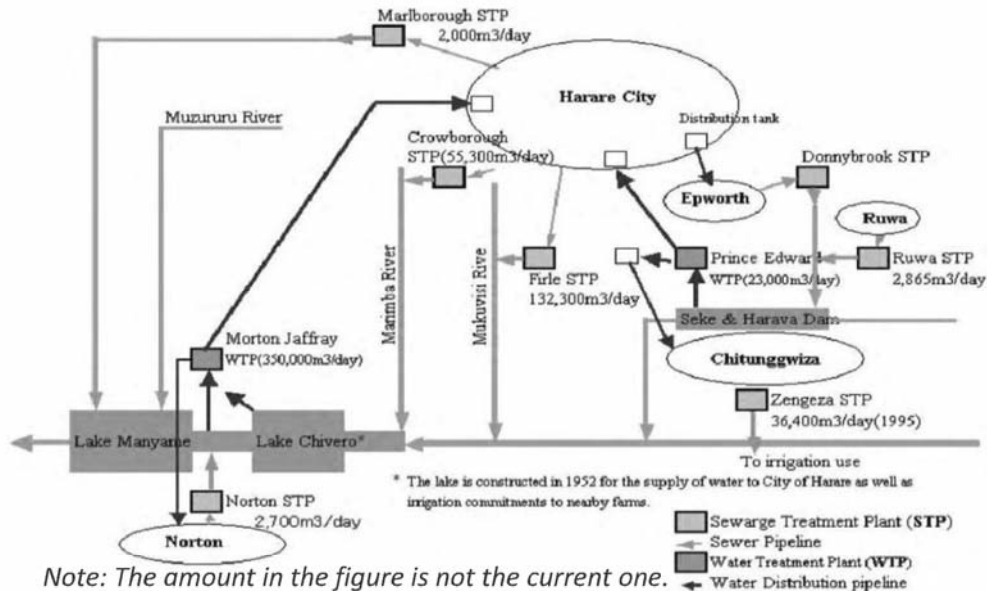
2. Current Situation in Zengeza WWTP and its Surroundings

➤ Sewage is overflowing from manholes



2. Current Situation in Zengeza WWTP and its Surroundings

➤ Water Cycle in Harare City Area



2. Current Situation in Zengeza WWTP and its Surroundings

➤ Estimation of Pollution Load of Lake Chivero

	Estimated Pollution Load		Remarks
	Harare	Chitungwiza	
Population(person) : a	1,581,887	354,472	
Water usage(L/day) : b	80	60	
Sewage collection rate(%) : c	65		
Sewage drainage(m ³ /day) : A=a*b*c	82,258	13,824	
Treatment Capacity at WWTP	No. of WWTP	5	1
	Treatment amount (m ³ /day) B,C,D,E,F,G	170.5	35*
Untreated Sewage (m ³ /日) : X=A-B-C-D-E-F-G	82,092	13,789	
pollution loading rate(BOD) (mg/L)	700		
Pollution load (BOD) (kg/day)	57,464	9,653	
Pollution load (BOD) (ton/year)	20,974	3,523	
Total amount of pollution load in the basin after 2009 when Zengeza WWTP was shut down(ton)	188,770	31,709	
	220,478		

2. Current Situation in Zengeza WWTP and its Surroundings

➤ Possibility of Cholera Outbreak



Source: Cholera Outbreak by Zambia National Public Health Institute January 2018

2. Current Situation in Zengeza WWTP and its Surroundings

➤ The Current State of the Main BNR Facilities

Facility	Current State
GC (Grit Chamber)	The submergible pumps to pump up the sand and the pipe to transfer the sand are removed. Mud is deposited in the GC tank.
Primary Sedimentation Tank	Sludge collector has rusted and mud is deposited in the PST. The motor of the collector running at the round pond terminal has been broken and needs to be replaced.
Equalization Basin	Mud is deposited in the basin. One out of four mixers is out of order.
Biological Reactor	All the motors in the anoxic basin and all the pressure switches of the aerators in aerobic basin, which detect the normal condition of lubrication for the gearbox, are out of order. The aerators cannot run due to interlocking.
Final Sedimentation Tank	FST is filled with mud and covered with weeds.
Return Activated Sludge pump	All the RAS and Waste Activated Sludge pump (WAS) are out of order.
Sludge Thicker	All the sludge collectors in all four sludge thicker are out of order.
Digester	Mud accumulates to half of the tank and weeds have grown abundantly.
Sludge Dry Bed	The valves to control the sludge to the bed has been almost tatter and rust. They need to overhaul in order to use.
Infiltration Pit	All the infiltration pumps are broken.
Sludge Storage Yard	The roof of the yard is broken.
Maturation Pond	Weeds have grown abundantly.

3. Issues in Sewage Works in Chitungwiza

➤ Institution and Organization

◆ Water Supply and Sewerage Fee Level and Allocation

The cost of repair, operation and maintenance should be covered by water and sewage charges.

There is need to properly set the water and sewerage tariff levels and to properly allocate the sewerage budget.

◆ Ensure Fee Collection

The collection rate has remained 54%.

There is need to raise the collection rate from the viewpoint of fairness and securing financial resources.

◆ Securing Necessary Personnel

51 personnel is few considering the size of treatment facility. secure personnel and experts for sustainable maintenance and stable operation.

3. Issues in Sewage Works in Chitungwiza

➤ Technology

◆ Strengthen Planning Ability

prepare an integrated plan with the repair program of water supply infrastructure. Planning ability is required to make such a plan.

◆ Technology Improvement Related to Maintenance

Appropriate maintenance is essential for prolonging the life of the sewage system.

Improvement in technology related to operation and maintenance is a challenge for the future.

◆ Improvement of Sewer Inspection Technology

In order to rightly grasp the current situation, learning of inspection techniques is necessary.

Improve the inspection technology, such as using TV cameras.

3. Issues in Sewage Works in Chitungwiza

- Finance
 - ◆ Improve consistency among data
 - ◆ Improve the capacity to make financial statements and practical budget (Including timing and accuracy)
 - ◆ Improve financial stability through sectorial financial segregation
- PPP
 - ◆ Consider IT system risk response e.g.) Safetynet when errors happen
 - ◆ Reconsider financial feasibility

4. Recommendations

- Survey team makes recommendation for the next step as follows.

4. Recommendation : Future Direction of Sewage Sector

➤ Priority Matters in Repair

- Removal of sand

One of the causes of failure of BNR facility is inflow of sand.

It is therefore required to install facility to remove sand.

- Extension of service life

Given breakdown began to occur in five years from the start of operation, extension of service life of the facility is required.

- Easy maintenance

One of the reasons for failure early was that technical level of the staffs was low or maintenance was not done as specified.

Installation of equipment using the latest technology that is easy to maintain is recommended.

- Procurement of spare parts and expendable items

Machine failure occurs unexpectedly, so it is necessary to provide spare parts and expendable items to minimize the down time due to failure.

4. Recommendations

➤ Consideration of Options for Utilizing Zengeza WWTP

- Currently there are 2 processing lines, and we will propose for both cases of operation of only 1 line and operation of 2 lines according to incremental step inflow.
- Option A: Required items. Measures for sustainable operation, and shift prevention as well as technical measures against inflow of sand. Additional installation of GC.
- Option B: Change of the specification for mixer in anoxic tank. Improvement of aerator pressure switch. BNR can stop operation due to failure of one small pressure switch which makes aerator non-functional.
- Option C: Change of specification for circulation pump, Return Activated Sludge pump, and Waste Activated Sludge pump. Change from submersible pump to ground pump (Improve maintainability by separation of pump and motor)

4. Recommendation : Comparison Table of BNR Improvement Options

No	Option	Line	A	B	C
1	Overhaul Utilize and repair the current mechanical and electrical equipment (asset management) e.g. Repair of machines, gear box overhaul, repair of motor, replacement of outdoor cable, piping repair, replacement of parts	1	726,050	726,050	726,050
		2	1,034,350	1,034,350	1,034,350
2	Change of GC specifications Change the specifications of GC and new installation (adopt air lift system and upgrade of capacity) (countermeasure for inflow of sand, extend service life)	1	303,500	303,500	303,500
		2	586,500	586,500	586,500
3	Change of mixer for anoxic tank Upgrade the capacity so as not to overload (Avoid capacity shortage, extend service life)	1		82,500	82,500
		2		165,000	165,000
4	Change of aerator pressure switch Replace with aerator that does not use special pressure switch (Eliminate weakness of machine, extend service life)	1		274,100	274,100
		2		548,200	548,200
5	Aerator soft start Start the aerator with soft starter unit (SSU). Add SSU to MCC. (Shock release at startup, extend service life)	1			110,000
		2			110,000
6	Ground pump Design change of circulation pump for aerobic, Return Activated Sludge pump, and Waste Activated Sludge pump Replace submersible pump to ground pump (Improve maintainability by separation of pump and motor)	1			387,200
		2			759,400
7	Secure financial and human resources, spare parts and expendable items	-	600,000	600,000	600,000
8	Security enhancement (prevention of robbers)	-	50,000	50,000	50,000
9	Cleaning	-	61,400	61,400	61,400
Total Amount (USD)		1	1,740,950	2,097,550	2,594,750
		2	2,332,250	3,045,450	3,914,850

4. Recommendations

➤ Possible Financial Matrix for Sustainable Operation of Zengeza WWTP

- Study team estimates USD2,000,000 for sustainable operation of Zengeza WWTP.
- It would be affordable for Chitown to par for them through expanding marginal efforts.

		Allocation ratio to BNR in total general expenses and repair costs						
		30%	35%	40%	45%	50%	55%	60%
Collection Ratio	40%	474,390	553,455	632,520	711,585	790,650	869,715	948,780
	45%	562,451	656,193	749,934	843,676	937,418	1,031,160	1,124,902
	50%	650,512	758,930	867,349	975,768	1,084,186	1,192,605	1,301,023
	55%	738,573	861,668	984,764	1,107,859	1,230,954	1,354,050	1,477,145
	60%	826,634	964,406	1,102,178	1,239,950	1,377,723	1,515,495	1,653,267
	65%	914,694	1,067,144	1,219,593	1,372,042	1,524,491	1,676,940	1,829,389
	70%	1,002,755	1,169,881	1,337,007	1,504,133	1,671,259	1,838,385	2,005,511
	75%	1,090,816	1,272,619	1,454,422	1,636,224	1,818,027	1,999,830	2,181,633
	80%	1,178,877	1,375,357	1,571,836	1,768,316	1,964,795	2,161,275	2,357,754
	85%	1,266,938	1,478,094	1,689,251	1,900,407	2,111,563	2,322,720	2,533,876
	90%	1,354,999	1,580,832	1,806,665	2,032,498	2,258,332	2,484,165	2,709,998
	95%	1,443,060	1,683,570	1,924,080	2,164,590	2,405,100	2,645,610	2,886,120
100%	1,531,121	1,786,308	2,041,494	2,296,681	2,551,868	2,807,055	3,062,242	

4. Recommendations

- **Financial forecast and consideration for sustainable operation of Zengeza WWTP**
 - Non-PPP
 - The total amount of cost for operating and maintaining BNR is too big considering the size of total income for sewerage service.
 - (Strict case) Targeted tariff collection rate is 70%, and 60% of expenses other than salary have to be allocated to the BNR.
 - (Possible option) Collection rate 60% , and 45% of budget allocation.
 - PPP
 - Seems good scheme, but need to reconsider some risks including system risk, and the overall level of income.

4. Recommendations

- **Past Situation and Future Scenario**
 - ◆ **Equipment damage due to sand inflow exceeding capacity**

Risk reduction is possible by increasing GC and increasing the capacity of sand processing.(Increase effect by awareness raising on sand use in technical cooperation)
 - ◆ **Lack of spare parts and expendable items**

Risk reduction is possible by keeping spare parts and expendable items in storage.(Increase effect with technical cooperation)
 - ◆ **Foreign exchange (inflation) risk that spare parts cannot be purchased from overseas**
 - ◆ **Budget shortage of the city to purchase spare parts**

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area

April 13, 2018

4.Recommendation : Tasks and Recommendations for Sustainable Water Supply and Sewage Works(1)

Improvement of water quality in public water bodies / improvement of public health :

Task / Timing	Short term	Medium / Long term	Negative impacts when measures are not taken
Repair of broken pipeline and pump stations	X		Exacerbation of public health and spread of infectious diseases due to leakage of wastewater
Stop discharging water to the farm and discharge the treated water satisfying the criteria to the river		X	Water quality deterioration in public water bodies and groundwater pollution
Improvement of BNR facility		X	Water quality deterioration in public water bodies

Data Collection Survey on Water Supply and Sewage Sector in Harare City Area

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4.Recommendation : Tasks and Recommendations for Sustainable Water Supply and Sewage Works(2)

Improvement of water supply and sewage management capacity:

Task / Timing	Short term	Medium / Long term	Negative impacts when measures are not taken
Improve water supply rate (Promotion of dam projects)	X		Sluggish water and sewerage fee collection rate
Improvement of O&M capacity for BNR system		X	Frequent breakdown / outage of the facility
Improvement of inventory and spare parts management capacity		X	Frequent breakdown / outage of the facility

4.Recommendation : Tasks and Recommendations for Sustainable Water Supply and Sewage Works(3)

Improvement of business management and financial capacity:

Task / Timing	Short term	Medium / Long term	Negative impacts when measures are not taken
Improvement of the capacity for realistic cash-based budget formulation and appropriate preparation of financial statement	X		Unstable operation & management
Improvement of management capacity using management index including fee collection rate	X		Unstable operation & management
Improvement of pricing capacity based on general cost		X	Unstable operation & management
Awareness raising of residents against use of sand at home		X	Decline in processing function or function stop
Establishment of funding system at the central government for urgent occasion such as inflation		X	Turmoil in the inflation period

Thank you for listening