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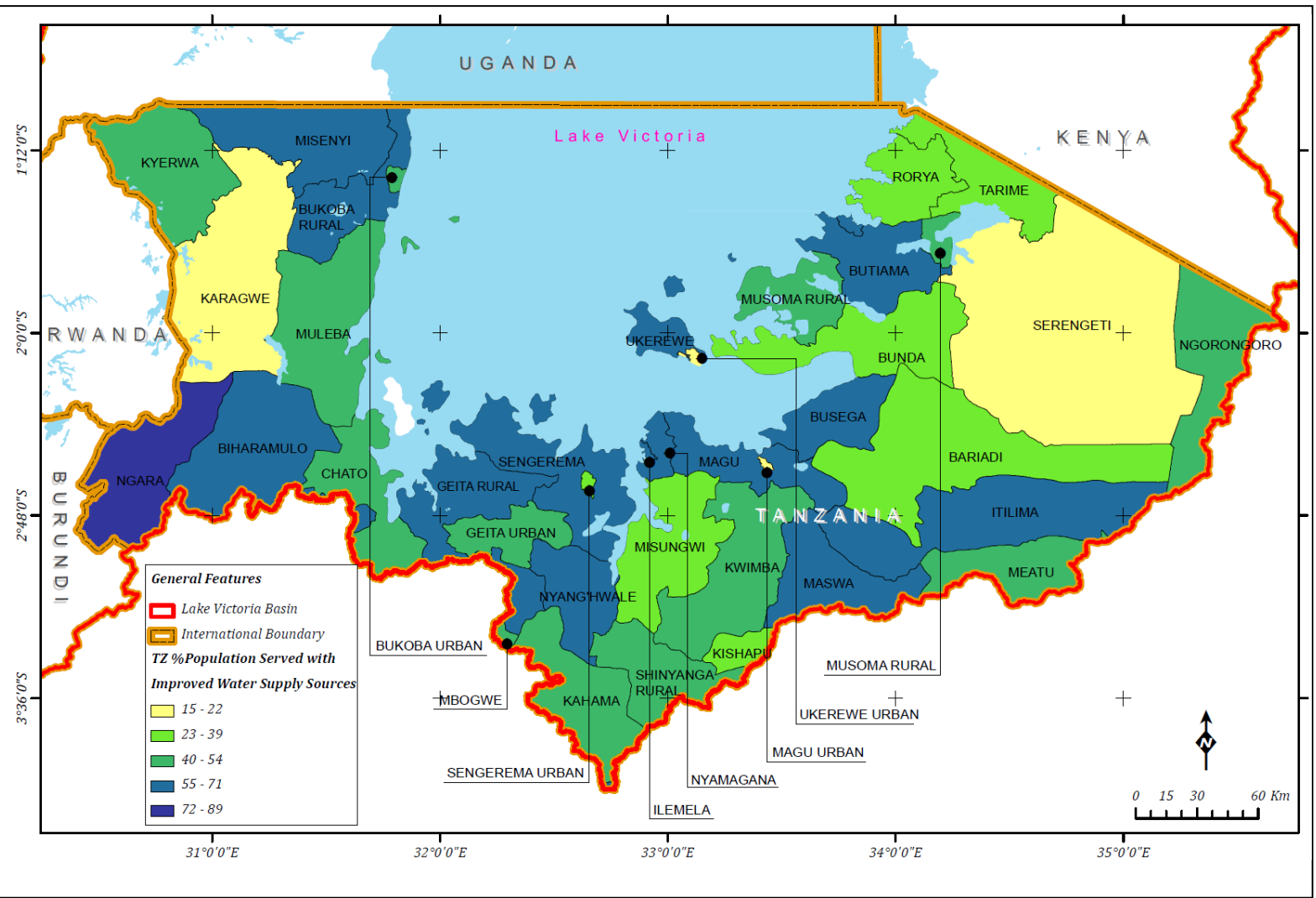
PLANNING FOR RESILIENCE IN EAST AFRICA THROUGH POLICY, ADAPTATION, RESEARCH, AND ECONOMIC DEVELOPMENT (PREPARED)

WASH ASSESSMENT PHASE II: APPRAISAL AND BASELINE STUDY FOR BUNDA AND CHATO WASH SITES IN THE UNITED REPUBLIC OF TANZANIA



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COVER PHOTO: A map showing the improved water supply in the districts of Tanzania.

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SEPTEMBER 10, 2014

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ACRONYMS AND ABBREVIATIONS

AC	Asbestos Cement
BUWSA	Bunda Urban Water Supply Authority
CBO	Community-Based Organizations
CIESIN	Columbia University's Center for International Earth Science Information Network
COWSO	Community Owned Water Supply Organisations
DMA	District Metering Areas
EAC	East African Community
EWURA	Energy Water Utilities Regulatory Authority
FBO	Faith-Based Organizations
GCAP	Global Climate Adaptation Partnership
GS	Galvanized Steel
ICPAC	IGAD Climate Prediction and Applications Centre
IGAD	Intergovernmental Authority on Development
LVB	Lake Victoria Basin
LVBC	Lake Victoria Basin Commission
MoU	Memorandum of Understanding
MoW	Ministry of Water
NGO	Non-Governmental Organization
NRW	Non-Revenue Water
PE	Polyethylene
PREPARED	Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development
PVC	Polyvinyl Chloride
QSIP	Quality Service Improvement Program
RCMRD	Regional Centre for Mapping of Resources for Development
TZS	Tanzanian Shillings
UPVC	Unplasticized Polyvinyl Chloride
USAID	United States Agency for International Development
WASH	Water Sanitation and Hygiene

WEMA Consult	Water and Environmental Management Consultants
WSDP	Water Sector Development Programme
WSSP	Water Supply and Sanitation Service Provider

EXECUTIVE SUMMARY

INTRODUCTION

As a strategy to address the challenges faced by East Africa Community partner states, the United States Agency for International Development (USAID)/East Africa office launched a regional project titled Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development (PREPARED), aimed at strengthening the resiliency and sustainability of East African economies, trans-boundary freshwater ecosystems, and communities. The PREPARED Project targets three key development challenges for the East African Community region:

1. Component 1: Transboundary freshwater biodiversity conservation
2. Component 2: Increased resiliency to climate change
3. Component 3: Improved access to drinking water supply and sanitation services

This report is for component three—water sanitation and hygiene (WASH)—in Tanzania. Prior to this study, an assessment of the WASH situation was carried out in all five EA countries in order to gain an overall understanding of the WASH situation for each EA country. After the reviews, it was agreed that a detailed assessment be conducted of selected water utilities that will be eligible for PREPARED Project support. Selection of the utilities that will be supported under the PREPARED Project was done in Burundi in February 2014 by WASH Task Force members from each EA country, using criteria approved by the task force in collaboration with the PREPARED Project. In Tanzania, utilities in Bunda, Itilima, and Chato were selected for a detailed assessment.

Task force members and PREPARED Project officials believe that a better understanding of water utilities would enable a formulation of interventions that are more specific, thus addressing the utilities' real needs. For Tanzania, a detailed water utility assessment in Bunda and Chato was conducted June 12–18, 2014, by a team of experts from WEMA Consult (T) Ltd, one WASH Task Force member, and the PREPARED WASH technical advisor. The aim of the assessment was to collect detailed baseline information on the utilities and to analyze the utilities' capacity to provide WASH service effectively. The team collected data through discussion with key staff through entry/exit meetings, a documentary review, interviews, and field observation.

BASELINE INFORMATION

The findings indicate that the Bunda Urban Water Supply Authority (BUWSA) abstracts water from Lake Victoria through an intake located 22 km away from the town center. The total water production of the BUWSA is estimated at 1,260 cubic meters per day, while the demand is 5,000 cubic meters per day. The water production is affected by frequent pump breakdowns, transmission line bursts, vandalism, and intakes clogged by lake weeds. Chlorination of water is done manually. Another challenge is the lack of master/bulk meters for both water production and water supplied. As a result, the total water volume produced and supplied is estimated based on the pump rate, which sometimes is not accurate. In addition, electricity supply for the pumping station and water intake is erratic and unstable; thus, it causes a lot of damage to the equipment due to water hammers. There are no surge vessels installed to deter water hammers; thus, whenever it happens it causes water main breakages.

The utility was designed to serve about 46,168 people. According to the national census of 2012, the population of Bunda has almost doubled and is estimated to be about 89,926 people by which year?. The population increase has also affected the water supply coverage rate. The authority currently serves a population of about 23,740 people, which is just 26.4% of the Bunda Town population.

Non-Revenue Water (NRW)—which is the amount of water produced and supplied by the utilities but not paid for—is one of the major problems facing BUWSA. The trend of NRW for the past three years

was 48.02% in 2010–2011; 46.01% in 2011–2012; and 47.25% in 2012–2013. Physical losses of water in Bunda are associated with network leakages due to old pipe breakage; vandalism of the network system; illegal connections; and road constructions. Commercial losses are attributed to inaccurate meters; unmetered customers (e.g., fire hydrants); meter reading errors; meter tampering; billing errors (as processing is done manually); poor data handling; and low revenue-collection efficiency. Other challenges facing the utility include low water supply coverage; low water production capacity; an old network; leakages; water reservoir/tank overflows; and poor pressure management.

PROPOSED INTERVENTIONS

Based on these findings, there are several WASH interventions that can be implemented for BUWSA under the PREPARED Project. These include: NRW reduction (best implemented by first conducting a diagnostic study to determine the contributing factors to physical and commercial losses); master/bulk meters for production and supply of water; revenue meters; network and customer mapping; a computerized, efficient billing and revenue-collection system; improvement of water testing and treatment techniques; introducing a quality service improvement program (QSIP); protecting water catchment areas and the network system; developing BUWSA staff skills; and developing a community-owned water supply organization (COWSO) and other community groups operating water supply schemes.

There is no water utility in Chato. Therefore, a pre-feasibility study and designs for a Chato WASH site are proposed, especially at Buseresere, a densely-populated part of Chato. It would therefore be worthwhile for the PREPARED Project to undertake the design work for the proposed water supply system at Buseresere.

1.0 BACKGROUND INFORMATION

1.1 INTRODUCTION

As a strategy to address the challenges been faced by East Africa Community Partner states, USAID/East Africa launched PREPARED, a regional five-year project aimed at strengthening the resiliency and sustainability of East African economies, transboundary freshwater ecosystems, and communities. The PREPARED Project targets three key development challenges of the EAC region: transboundary freshwater biodiversity conservation; improved access to drinking water supply and sanitation services; and increased resiliency to climate change. Based on the aforesaid, the PREPARED Project therefore is composed of five components, which include three technical components and two components that focus on cross-cutting program coordination and management. The project's technical components aim to ensure:

- Climate change adaptation technical capacity, policy leadership, and action readiness of regional institutions
- Resilient and sustainable management of biologically significant transboundary freshwater ecosystems in the EAC region
- Resilient and sustainable water supply, sanitation, and wastewater treatment services in the Lake Victoria Basin (LVB)

PREPARED's key institutional partners include the East African Community (EAC), the Lake Victoria Basin Commission (LVBC); the Intergovernmental Authority on Development Climate Prediction and Applications Centre (ICPAC); the Regional Centre for Mapping of Resources for Development (RCMRD); and EAC Partner States. Tetra Tech ARD is the prime institutional contractor implementing the PREPARED Project, and is supported by a team comprising SSG Advisors, a leader in the field of developing public-private partnerships; LTS Africa, with extensive experience in transboundary biodiversity conservation in East Africa; Water and Environmental Management Consultants [WEMA Consult (T) Ltd], with relevant regional experience in WASH activities in East African countries and the LVB; Columbia University's Center for International Earth Science Information Network (CIESIN), which specializes in data and information management and state-of-the-art decision support tools; and the Global Climate Adaptation Partnership (GCAP), a leading climate change adaptation consulting firm whose staff includes some of the world's leading climate adaptation experts and trainers.

During Phase I of assessing the WASH situation at country level in the East Africa partner states, it was established that there is a need to have detailed study at the lower (i.e., utility) levels, where water utilities could be assessed in terms of their capacity to deliver quality water and sanitation services. Better understanding of water utilities would enable formulating interventions that are more specific and that address the utilities' real needs.

The Regional WASH Task Force met in Bujumbura, Burundi, February 11–13, 2014, and formulated the following selection criteria for water utilities that will be supported under the PREPARED Project:

- Its location is within the Lake Victoria basin.
- Population size (8,000 to 300,000 people in service area), including clusters
- Limited investments and access to WASH services
- Areas of high incidence of waterborne diseases and poverty

- Vulnerable to climate change
- Institutional and operational modalities [presence of water supply and sanitation service provider (WSSP) utility] are in place and can be built upon.
- The town is either significantly impacted by or significantly impacts Lake Victoria.
- Potential exists for quick win-win solutions

Based on the set criteria, Regional WASH Task Force members from Tanzania selected three water utilities (Bunda, Chato, and Itirima) to be considered for PREPARED Project interventions. Task Force members further agreed that the three towns should be investigated in two stages. The first stage would involve collecting baseline information for two of the three selected towns/utilities; the second stage would be collecting baseline information for the last town/utility. Therefore, a team of experts from WEMA Consult (T), one WASH Task Force member, and the WASH technical advisor conducted a survey for Bunda and Chato June 12–18, 2014.

1.2 OVERVIEW OF BUNDA URBAN WATER SUPPLY AUTHORITY (BUWASA)

BUWSA is a fully registered entity that was established June 21, 2003, under the Water Works Ordinance Chapter 281-Supplementary 62 of November 4, 1949, revised in Water Act No. 12 of 2009. The Water Authority supplies water to Bunda Town , Guta, Tairo, and Migungani villages. All these towns and villages are located along water transmission mains. The water supply scheme was constructed back in 1971 with a design period of 20 years. It is 40 years beyond the design period, and the scheme still supplies water to the community without any upgrades or modifications. Thus, the water scheme is too old in every aspect, and its operations are far from being efficient and economical.

Bunda Town has a population of 89,926 (Population Census 2012) and is the main commercial center. The BUWSA falls into Bunda Town in Bunda District and it gained its official status as an water utility authority in September 2004 and serves the urban areas as well as villages within the district. Bunda District is in the Mara Region and is bordered by the Musoma (Rural) District to the north, Serengeti National Park to the east, Busega District to the south and Lake Victoria to the west. The headquarters of Bunda District is located in Bunda Town. The town is about 65 km from Musoma Town and 150 km from Mwanza City along the Musoma–Mwanza road. Geographically, Bunda Town is located between latitude 1° 30' and 2° 45' S and between longitude 33° 39' and 34° 05' E.

The water authority operates under a board of directors with a managing director and cooperates with the district council through a memorandum of understanding (MoU) between the BUWSA and the Ministry of Water (MoW). The MoU defines the roles and responsibilities of each stakeholder as well as the limits and boundaries of execution within the water supply area. The board of directors is responsible for policy formulation, guidance monitoring, and evaluation, while the managing director is responsible for carrying out the water authority's functions and managing its business and affairs. The board is appointed by the MoW in consultation with the regional secretariat or Bunda local council . Board members are drawn from various stakeholders such as local authorities, the business community, women's groups, consumers, and civil societies [i.e., faith-based organizations (FBOs), community-based organizations (CBOs), and non-governmental organizations (NGOs)] involved in providing water and sanitation services. The board is headed by the chairperson. The managing director of the water authority is the secretary of the board. According to the Water Supply and Sanitation Act (2009), the board may delegate its functions, powers, and authority to any committee or person except those people relating to: approving plans and budget; approving annual reports or audited accounts; and borrowing the sum of money as may be necessary for the water authority.

The day-to-day activities of the utility are handled by the managing director, who is assisted by the technical manager, the commercial manager, and the finance and administration manager (see Figure 1).

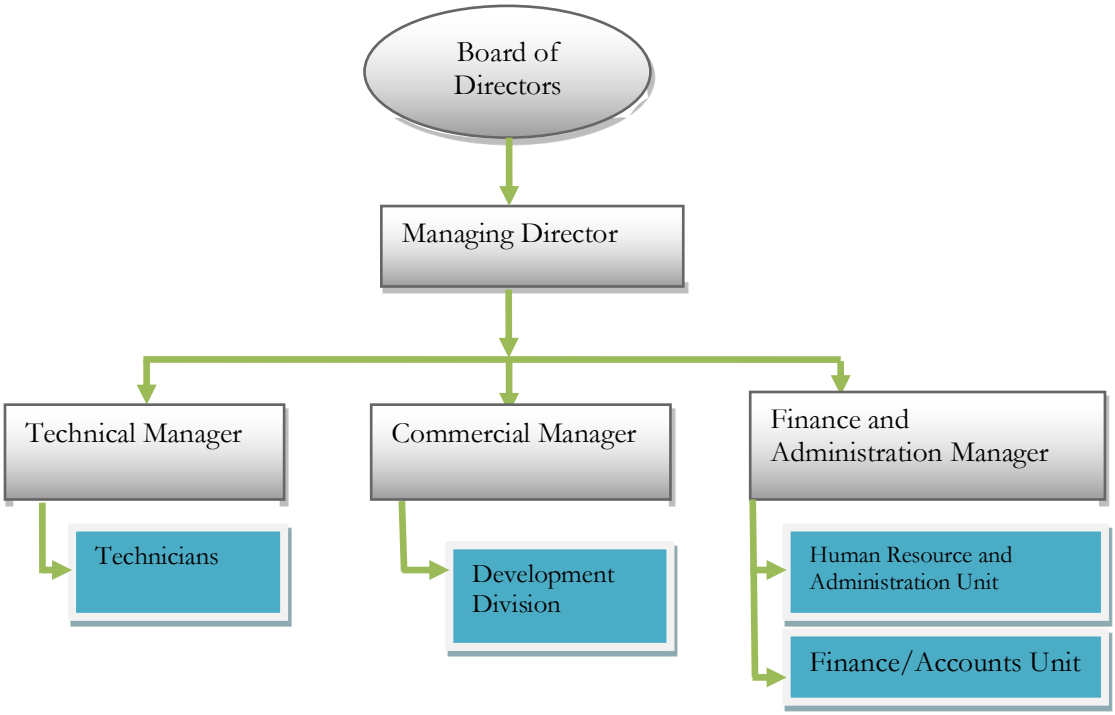

Figure 1: Organogram structure of the Bunda Urban Water Supply Authority (BUWSA)

1.3 OVERVIEW OF CHATO DISTRICT COUNCIL

The Chato District was formed in 2005 within the Kagera Region. The district had been part of Biharamulo Region before its formation. In 2012, it was transferred to the newly created Geita Region. It is now among the five districts of Geita Region, with its administrative headquarters located in Chato Town. The annual rainfall in Chato District is adequate for most crops grown in the district. The rainfall ranges between 700 and 1,000 millimetres per year. The maximum temperature averages around 30.5 °C (86.9 °F), and the minimum temperature averages around 26.6 °C (79.9 °F).

Chato District, which also includes the highly densely populated metropolis of Buseresere, has about 58,000 people. Chato Center has about 11,360 people, while Buseresere has about 38,000 people. Currently there is no water utility under operation; thus, all water works are under the district water engineer. Construction of a water supply system for Chato Town was ongoing at the time of this assessment. The water supply system is expected to be completed and operational during the 2014–2015 financial year. Ongoing activities include construction of water reservoirs and laying down water mains and distribution networks.

Water supply coverage in the district is estimated at 53%. The main water sources are springs and wells/boreholes. In town, therefore, people rely on water for domestic use from water vendors, who sell a 20-liter bucket for 200–250 Tanzanian shillings (TZS). Alternatively, water in villages is collected from shallow wells/springs by mostly women and children. Water selling employs a good number of people. In Chato Town, there are an estimated 800 water vendors, while in Buseresere the number of water vendors is estimated at 750.

Buseresere Center, which has a high population density, relies on shallow wells dug by the Anglican Church through the Tumaini Fund. This situation has resulted in a high prevalence of waterborne diseases such as typhoid, dysentery, bilharzia, and cholera. In view of this situation, Chato District management requested assistance from the PREPARED Project to develop a water supply design for Buseresere Center. District management believes that once the water supply design is in place, it can find financing from other sources with the design in hand. Currently, without the design, finding fund sources to implement a project in Buseresere Center will not be an easy task.

2.0 KEY WASH PROJECT OBJECTIVES

The USAID/EA PREPARED Project's overall goal is to strengthen the resiliency and sustainability of East African economies, transboundary freshwater ecosystems, and communities. The project targets three key development challenges. Among them is improved access to drinking water supply and sanitation services. This WASH objective fits well within the overall objectives of the BUWSA and the vision and mission of the Chato District Council. PREPARED Project interventions in Bunda will enhance availability of water to the served population. The interventions will also help reduce NRW and provide adequate quality water to consumers. For Buseresere, a water supply system design will be a step toward enabling the highly populated Buseresere Town to get clean, safe drinking water in the future. A detailed baseline assessment of the current WASH situation in Bunda and Chato districts was undertaken in order to have better planned interventions This baseline study had the following objectives:

1. Collect and characterize baseline information in the following categories:
    - Sources of raw water supply (e.g., spring, river, lake or groundwater)
    - Drinking water treatment processes and facilities
    - Sanitation treatment processes and disposal procedures
    - Type, length, and size of distribution network
    - Percentage and area of service provision
    - Level of billing and NRW
    - Personnel management and capacity building
    - Financial sustainability
2. Analyze and describe service delivery effectiveness by determining:
    - Institutional and governance framework that adequately describes the type of water supply and sanitation service provision (WSSP) utility, legal basis, operational modalities, management structure, and existence and content of strategic or operational plans
    - Challenges in meeting the national and regional standards for service provision
    - Levels of WSSP regulation, including provisions for establishing and revising tariffs
    - Mechanisms for developing and implementing performance service improvement programs
    - Compliance with required subsidiary legislation on management of water resources and protection of the environment
    - National or local government subsidies, if any, and level to which they are targeted at specific groups (e.g. pro-poor).

3.0 METHODOLOGY

To achieve the mission objective, the baseline study team used the following methods to collect the needed data.

3.1 ENTRY/BRIEF MEETINGS

The team started with brief meetings with top utility management, where explanations about the mission, the PREPARED Project, its components, and its objectives were discussed. Management was able to ask questions and seek clarification as necessary. Responses were given by the team members to ensure a common understanding and to enable operation of the mission objective. In addition to meetings with top management, a discussion with key staffers was held when clarification was sought on a particular matter.

Figure 2: The WASH technical advisor emphasizes a point during the entry meeting with BUWSA management.

3.2 DOCUMENTARY REVIEW

Various documents provided by management were reviewed, and information relevant to the assignment was recorded. Various websites were also used to extract relevant information.

3.3 EXIT/DEBRIEFING MEETING

This was held at the end of the assignment at each district/utility. The purpose was to briefly explain how the assignment was conducted and to highlight some of the key issues observed during the assessment. This meeting gave management and staff an opportunity to express their commitment towards implementing PREPARED Project interventions.

3.4 ANALYSIS OF COLLECTED DATA

Descriptive statistics and content analysis were employed for data analysis. Descriptive statistics such as frequencies, percentages, and means were used to obtain the variability and central tendencies of variables. Content analysis was used to analyze the qualitative data obtained from respondents during the entry/briefing meeting, field visits, the exit/debriefing meeting, and discussion with key informants. This

entailed transcribing all response notes and categorizing the obtained information into main themes and issues. The findings and issues found out during this study are presented in the next section.

4.0 FINDINGS AND DISCUSSION

4.1 WATER SOURCES AND PRODUCTION

BUWSA abstracts water from Lake Victoria through an intake located about 22 km away from the town center. The total water production is estimated to be 1,260 cubic meters per day, while the demand is 5,000 cubic meters per day. Thus, part of the population obtains water from unreliable sources such as non-protected shallow wells, springs, and open ponds. This could be among the contributing factors to such waterborne diseases as bilharzia, dysentery, and cholera. Water production is done at Nyaruga and Guta, which have the daily production design capacity of 1,533.6 and 189,000 cubic meters, respectively. The current water production from Nyaruga and Guta is 645.4 and 836.4 cubic meters per day, respectively. In total, the annual water production amount to 235,577.2 cubic meters and 305,275.08 cubic meters for Nyaruga and Guta, respectively.

BUWSA has a capacity to produce 540,852.28 cubic meters of water per year. However, water production is affected by frequent pump breakdowns, transmission line bursts, vandalism, and intakes clogged by lake weeds. Another problem is that water chlorination is done manually. Also, a lack of master/bulk meters for both water produced and water supplied poses significant challenges to water demand management. As a result, the volume of water produced and supplied is estimated based on the pump rate, which is often not accurate. Another challenge to the utility is electricity supply for the pumping station and water intake. Because electricity is erratic and unstable and because the production plants lack surge vessels, water hammers have caused a lot of damage to equipment.

The authority owns a total of 13 water storage tanks, whose total capacity is 2,029.5 cubic meters. Table 1 presents the different sizes of water tanks belonging to the utility. Generally, the water tanks are made of concrete blocks. The majority have been in a poor state, with surface cracks, although there are ongoing initiatives to rehabilitate them. In order to meet the high water demand in Bunda, a new water supply network from Nyabehu to Bunda is under construction. So far, there are nine new pumps waiting for installation, and the ongoing activities include procurement and transporting of steel pipes; trench excavation; and rehabilitation of the old storage water tanks. Thus, the proposed intervention by the PREPARED Project could be timely as there is a new system under construction.

Table 1: Number of Tanks and their capacity in BUWSA

S/N	NUMBER OF TANKS	TANK CAPACITY (M^3)
1	1	4.5
2	5	45
3	1	90
4	1	135
5	4	225
6	1	675
TOTAL	**13**	**1174.5**

4.2 WATER SUPPLY COVERAGE

The utility was designed to serve about 46,168 people back in 1971. Since then, the population of Bunda has nearly doubled to 89,926 (national census of 2012). The population increase has also affected water supply coverage. The authority currently serves a population of about 23,740 people, roughly half of the designed capacity and only 26.4% of the entire population. The major challenges facing water supply

coverage include low production capacity; high NRW due to an old network; leakages; overflow; poor pressure management; and vandalism of the network system.

4.3 WATER DISTRIBUTION SYSTEM

The water transmission system is characterized by one unplasticized polyvinyl chloride (UPVC) raising main of 150 mm diameter, with a total length of about 22 km. The total pipeline network is estimated to have a length of about 77 km. The water distribution system is quite old, as it was designed for the project period of 20 years in 1971. This means that the system is 20 years beyond its project period. This could be a reason why the water scheme cannot supply water services to the entire Bunda population. Considering its age and the management effort, it is worth noting that the scheme is unlikely to operate efficiently and economically.

Generally, the distribution network is divided into two pressure zones—A and B. Zone A comprises Ikizu Road, Ukerewe Road, Kabarimu, Kiabakari Road, and Balili, Tairo, and Guta villages. Zone B comprises Bunda Stoo, Sabasaba Road, Posta Road, Nyasura Boma quarters, and Boma Road. The network is mainly made of asbestos cement (AC) pipe, polyethylene (PE) pipe, galvanized steel (GS) pipe, and polyvinyl chloride (PVC) pipe ranging from 25 to 100 mm in diameter.

4.4 WATER QUALITY AND WATER TREATMENT

The Bunda water utility, where treatment capacity is 675 cubic meters per day, treats its water by chlorination. There is no water treatment in Bunda apart from chlorine dosing at the Bomani hills main reservoirs. Currently, the chlorine is added using a very rudimentary method (manually), which does not allow for adequate chlorination contact time. High prevalence of waterborne diseases such as bilharzia, typhoid, and dysentery were reported.

Recent analysis of Bunda Town water quality by the Musoma Water Laboratory shows that the samples failed the bacteriological quality test. Most samples had a high coliform count beyond the allowable level for domestic use (NIL coliform count per 100 milliliter sample). Any drinking water sample that exceeds this coliform count of NIL/100 ml is considered polluted. this may be due to poor management of the source catchment. But on the other hand, the pollution could originate from or within the lake due to a lack of nearby latrines. This implies that serious water treatment should be done to safeguard customers and to comply with national and international standards.

4.5 NETWORK CONNECTIONS

BUWSA has four connection categories: households/domestic; public tap/stand pipe; commercial; and institutional (see Table 2). This implies that BUWSA has 1,366 customers. The data further indicates that the average number of customers billed per month is 1,038 (equal to 24%), implying that 328 customers are not billed. There are two reasons attributed to this. Either their accounts are inactive, or their meters were not read.

Table 2: Customer categories with respective active status

CONNECTION TYPE	TOTAL CONNECTIONS	PEOPLE PER CONNECTIONS	METERED	NOT ESTIMATED (METERED)	BILLED
House Connection	1,192	6	1,046	146	899
Public Tap/Stand pipe	29	250	28	1	20
Commercial use	77	100	72	5	62
Institutional use	68	250	67	1	57
Grand Total	1,366	-	1,213	153	1,038

4.6 NON REVENUE WATER (NRW)

NRW is attributed to physical and commercial losses. Physical losses in Bunda are associated with network leakages due to old pipes, vandalism of the network system, illegal connections, and construction actions. Commercial losses are attributed to inaccurate meters, unmetering of customers, meter reading errors, meter tampering, billing errors, and poor data handling. NRW was 48.02% in 2010–2011, 46.01% in 2011–2012, and 47.25% in 2012–2013. The utility has some measures to address this issue. Some of the measures include universal metering, which currently stands at 80%, and repair of leakages, as well as an introduction of incentive packages to those who report illegal connections and meter tampering.

4.7 METERING EFFICIENCY

Metering enables the utility to charge consumers for the water they used appropriately. This is because water payment is then proportional to consumption. As a result, consumers will probably tend to consume less water in order to avoid excess water costs (consumer-pays principle). Metering is also a tool for controlling NRW resulting from commercial losses. Currently, the metering ratio in BUWSA is at 80%, leaving 20% of customers unmetered. This implies that BUWSA issues unmetered bills to those customers, a flat rate based on estimated consumption. The estimated bills could be part of the commercial losses or of overcharges on the customers' side. The major challenges facing metering efficiency in Bunda is the heavy workload for meter readers, attributed to inadequate staff. It is estimated that one meter reader is required to read at least 100 meters per day in a billing cycle of 30 days. Distribution of customers over a large area means meter readers must take even more time to do their job, thus affecting their efficiency. Another challenge is meter tampering by customers. It was reported that at least five incidences of meter tampering are reported every month. Figures 3, 4, and 5 show the different types of meter tampering in BUWSA, which plays a massive contribution to NRW.

Figure 3: This is an example of a "reversed" meter. It has been tampered with so it can register a low reading.

Figure 4: Meter with inserted steel wire to prevent it from measuring consumed water

Figure 5: Part of a stick inserted in a water meter to prevent it from measuring consumed water

Based on the above empirical evidence, it is clear that meter tampering is a serious problem that needs to be addressed urgently. Section 47 of the Water Supply and Sanitation Act (2009) requires a person who destroys or damages a water or sewerage system to pay a fine of TZS 50,000 to TZS 5 million or to be imprisoned for one month to five years (or both). From this provision, BUWSA can develop relevant rules or other tools with respect to the local context in order to address this vandalism problem. Additionally, strengthening the established incentive packages for reporting illegal connections and for reporting on those damaging the network system would be essential. Awareness and community engagement regarding service provision issues is also important.

4.8 BILLING AND REVENUE COLLECTION

Billing efficiency is very critical in ensuring that consumed water is paid for on a timely bases. In Bunda, billing is done manually. Given the number of customers and the number of staff that BUWSA has, it can be concluded that the billing process is slow. Its efficiency is low, resulting in poor billing and collection performance. This increases the likelihood for data handling errors and, in turn, commercial NRW losses. The provided data indicate that the average monthly billing is TZS 8,783,707.20, which calculates to annual billing of about TZS 105,404,486.40. This correlates with annual revenue collection for the year 2012–2013, which was TZS 127,126,121, whereas the expected revenue was 168,000,000; therefore, average collection efficiency was about 75.77%. In 2011–2012, revenue collection was 73.3%, and in 2010–2011, it was 72.4%. The trend is encouraging, as there have been gradual increases in collections. Non-payment of water bills, especially by government institutions, is one of the major factors affecting revenue collection by the utility.

Because BUWSA is categorized as a water utility under category C, it is entitled to get a subsidy from the government. The total government subsidy accounts for 57.7% of the utility's total financial requirement. The subsidy is targeted at paying salaries of government employees it has loaned to the utility as well as electricity costs. In the year 2012–2013, the utility had a total budget of TZS 11,963,607,040, with the sources as indicated in Table 3. The government provided the development fund to enable construction of the Nyabehu–Bunda water scheme.

Table 3: Sources of funding for the BUWSA for 2012–2013

S/N	SOURCE OF FUNDS	AMOUNT (TZS)
1	Funds from own source (water sales)	168,000,000
2	Funds from District Council (electric expenses)	270,607,040
3	Funds from Central Government (development)	11,525,000,000
TOTAL		**11,963,607,040**

4.9 CUSTOMER COMPLAINTS HANDLING

Considering the categories of customer complaints (Table 4) about BUWSA water service provision, it is noted that for the past three years, there is a rising trend of complaints regarding water meter inaccuracy and meter reading. It can be postulated that inadequate meter readers and manual billing could be the reasons for such complaints. Moreover, lack of water treatment facilities results in low water quality and, in turn, customer complaints. Complaints related to water quantity are due to the fact that the utility cannot supply adequate water, as it exercises water rationing. Currently, water is rationed at 9 hours every five days per zone, which is very much below the recommended number of 12 hours to customers per day.

Table 4: Customer complaints received by BUWSA for the past three years

TYPES OF COMPLAINT	NUMBER OF COMPLAINTS RECEIVED		
	2010–2011	2011–2012	2012–2013
Low Water quantity	293	250	287
Water quality	288	212	269
Water meter inaccuracy	216	230	320
Meter reading	197	214	235

4.10 HUMAN RESOURCE ISSUES

BUWSA daily operations are handled by a total of 18 employees—7 regular and 11 contractual. The distribution of staff is shown in Table 5. The low number of staff especially, in the commercial department, affects meter reading efficiency, as staffers must travel long distances in addition to working in the office.

Minor contract works are carried out by the private sector—and in the case of heavy construction works or in the case of a major pipeline repair, the technical department communicates with the District Council for support. Daily payees (causal workers without formal contract) are mostly involved in the repair of pipe leakages, watch guards, and pump attendants. The number of staff per 1,000 water connections for each of the past three years was noted to be 16, 17, and 16.

Table 5: Number of BUWSA staff by department in June 2014

NAME OF DEPARTMENT	REGULAR EMPLOYEES	CONTRACTUAL EMPLOYEES
Technical	3	12
Commercial	1	3
Financial and Administration	3	3
Total employees	7	18

In addition to fewer staff members, technical teams lack sufficient tools to effectively carry out field tasks, such as repairs and leakage detection. It is clear that for the water network inspection team to perform its duties effectively; adequate support is needed in terms of facilities and appropriate skills. During the visit to BUWSA, it was reported that inadequate facilities and equipment limit the utilities' performance.

4.11 POLICY AND INSTITUTIONAL FRAMEWORK

BUWSA operation is directly guided by the Water Resource Management Act (2009), the Water Supply and Sanitation Act (2009), the Energy Water Utilities Regulatory Authority (EWURA) Act, and the Public Health Act (2009). The authority has to develop bylaws based on these legislative frameworks in order to manage water sources and the supply system. However, these bylaws are still being prepared. Besides, the Water Authority operates under the Water Board on one side and cooperates with the District Council on the other hand through an MoU between BUWSA and the MoW. The MoU defines the roles and responsibilities of each stakeholder and the limits and boundaries of execution within the supply area. However, it was noted that the board of directors' tenure expired in January 2014, and the process of appointing the new board is under way.

The EWURA establishes and regulates water tariffs. Notably, the process of establishing these tariffs emanates from the prior tariffs proposal from BUWSA to EWURA. Afterwards, EWURA conducts the utility stakeholders meeting for consensus before decreeing the tariff establishment. The current water tariffs setup shows that individual connections pay about TZS 800 per cubic meter, while commercial and public institutions pay about TZS 1,200 per cubic meter. For public taps (kiosk), it was noted that the established dues are TZS 50 per 20 liters of water; the utility collects only TZS 16, and the rest (TZS. 34) is for kiosk operators.

It was further noted that the utility had a strategic development plan for 2011–2014. The priority areas in this strategic plan were: finalization of the design of a new water project for Buseresere Center;

improvement of water treatment methodology; establishment of a computerized billing system; and installation of a universal metering system.

The utility already has an informative public awareness program on water resource protection and the water supply that includes public meetings; customer outreach; a customer service charter and advertisements through various media.

5.0 PROPOSED WASH INTERVENTION PROJECT ACTIVITIES

Based on the findings of this study and on the key priorities given by the BUWSA and the Chato District Council, the following WASH intervention project activities are proposed for Chato and Bunda.

5.1 PRE-FEASIBILITY AND DETAILED DESIGN OF WATER SUPPLY FOR BUSERESERE IN CHATO

This study has envisaged that there is no utility in operation in Chato District regardless of it being selected by the Task Force members for PREPARED intervention. It was interesting to note during the study, however, that the population of Buseresere, which is a part of the Chato WASH site, is actually greater than that of Chato Town (district headquarters). However, in Chato Town there is a water project that is being implemented through the Water Sector Development Program (WSDP). Unfortunately, the highly populated area of Buseresere has nothing. Chato District officials asked that the PREPARED Project assist them in undertaking a pre-feasibility study and design of water supply systems in Buseresere.

5.2 REDUCTION OF NON-REVENUE WATER

Reduction of NRW in BUWSA is one of the key proposed activities. Water losses were reported to be due to network leakages, burst pipes, vandalism, illegal connections, billing errors, erroneous meters, and other administrative errors. Therefore, a diagnostic study on the factors contributing to physical and commercial losses as shown in Figure 6 will be necessary. The results of the diagnostic study will determine the way forward in measuring reduced NRW. However installation of master/bulk meters (both for production and supply) and revenue meters are issues that should be strongly considered during implementation of the proposed PREPARED interventions.

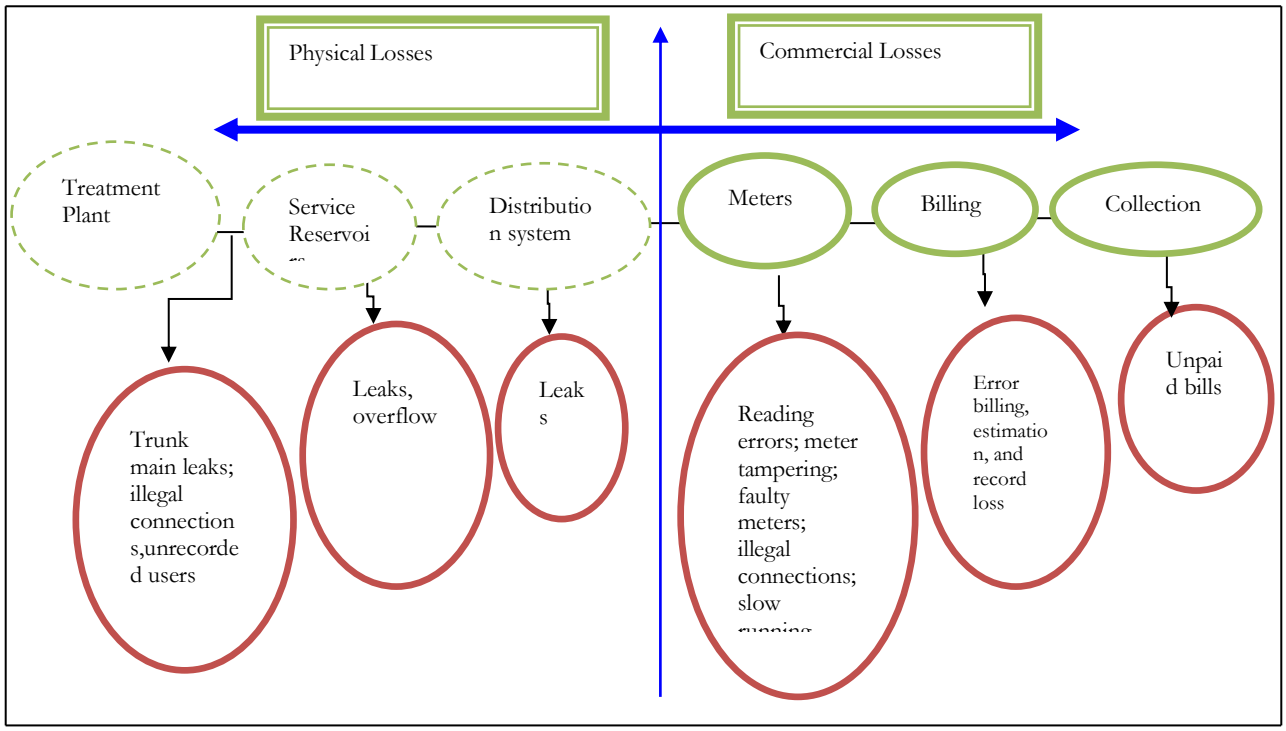

Figure 6: Possible causes of physical and commercial water losses

5.3 NETWORK AND CUSTOMER MAPPING

Network mapping is one of the approaches that allows monitoring of the whole network system—including customers—more effectively. In addition, the approach assists in managing different system zones and in instituting appropriate actions to a specific area, hence increasing network efficiency. With a computerized network, managers will get exact information for decision making without physically going into the field. Suffice it to say here that institution of district meter areas (DMAs) will improve water network management as information on leaks, water theft, overflow, metering inaccuracies, and other data errors will be obtained instantly—and thus appropriate measures will be taken on time.

5.4 INSTALLATION OF COMPUTERIZED AND EFFICIENT BILLING AND REVENUE COLLECTION SYSTEM

Currently, billing is done manually, and there is a need to computerize billing activities to enhance the BUWSA's efficiency. By computerizing the billing system, bills will be prepared and delivered to customers in an accurate, timely manner. In addition, introducing an electronic payment system through banks or mobile phones will not only reduce pressure on the currently understaffed organization but also increase revenue collection, which currently is at 75% collection efficiency with an annual increase of about 1% every year. Another important issue is to ensure that the current problem of meter tampering is addressed by installing "tamper proof" meters.

5.5 IMPROVEMENT OF WATER TESTING AND TREATMENT APPROACHES

Water treatment is currently through chlorination, which is not properly done. Improved water treatment would enhance provision of quality water to customers. Installation of an appropriate chlorination unit should be one of the key considerations for this aspect.

5.6 INTRODUCE QUALITY SERVICE IMPROVEMENT PROGRAM

A quality service improvement program (QSIP) is an interlocking series of activities within an organization to move it towards a more service- and customer-focused culture. Sometimes called an "organizational culture change" campaign, it attempts to change attitudes, behaviors, and actual practices within an organization. It is important that the PREPARED Project introduce, demonstrate, and institutionalize a QSIP, which will foster a service culture by involving managers, staff, and customers in establishing service standards and in defining the means to achieve them. The PREPARED Project should therefore train BUWSA staff in QSIP and assist in piloting it. BUWSA could implement QSIP by conducting service audits and preparing and implementing service improvement strategies.

5.7 PROTECTION OF WATER SOURCES, CATCHMENT AREAS AND NETWORK SYSTEM

Protecting sources is important for ensuring continuous water resource quality and quantity. Protection of the network system—especially for the main pipelines and water reservoirs—is also very important. The main issue here is to ensure that way-leave agreements are sought where the pipeline traverses individually owned land. The Water Supply and Sanitation Act (2009) categorically specifies the need to do so. Section 21 Chapter (Cap) 2 of the act requires the following way leave for different sizes of pipes (Table 6). This would ensure that in the future there is no land conflict.

Table 6: Way-leave standard for different pipe sizes in Tanzania

S/N	PIPE TYPE	WAY LEAVE FROM THE EDGE OF THE PIPE ON ONE (M)	WAY LEAVE FROM THE EDGE OF THE PIPE ON THE OTHER SIDE (M)	TOTAL WAY LEAVE
1	Main pipe	5	5	10m + pipe diameter
2	Secondary pipe	2	2	4m + pipe diameter
3	Tertiary pipe	0.5	0.5	1m + pipe diameter

Source: Water Supply and Sanitation Act (2009) page 443

Also: Involvement of the six existing COWSOs provides an opportunity to improve the operations of BUWSA activities. These organizations should be involved in protecting water sources and the network system and in running water kiosks.

5.8 SKILLS DEVELOPMENT/CAPACITY BUILDING

Building BUWSA staff capacity to enable execution of their duties will help utilities realize their vision and mission. Water treatment technical know-how; an efficient billing system; electronic bill payment and revenue collection; and a measure to reduce NRW are key areas for BUWSA capacity building. For COWSO and other NGOs, capacity building on protecting water sources, the network system, and kiosk operations is also needed.

5.9 MAJOR CHALLENGES WITH BUNDA WATER OFFICE

The major challenges in the Bunda Water Utility include but are not limited to:

- Aged infrastructure (although water main construction is ongoing); due to this old infrastructure, there are many pipeline bursts, which have contributed to high NRW levels.
- NRW has remained almost constant: 2010–2011(48.02%); 2011–2012 (46.01%); and 2012–2013 (47.25%).
- No master/bulk meters for production and supply
- The quality of electricity supply is low (i.e., erratic and unstable), especially in the pumping stations and water intakes. This causes a lot of damage to the equipment due to water hammers. There are no surge vessels installed to deter water hammers. Thus, whenever it happens, it causes breakages of the water mains.

- Billing is done manually, making it especially time-consuming to prepare and distribute to customers.
- Water main vandalism by pastoralists, especially during the dry seasons
- Raw water provision: Sometimes, the utility supplies water with algal bloom to customers.
- Chlorination is done manually.
- Low water coverage due to a limited water-distribution network
- Customers tampering with water meters
- There is a conflict of roles between government ministries responsible for local government and water.
- Lack of interministerial committee to coordinate planning, especially during road construction, which results in damaging pipeline networks
- The utility is using old pumps, and finding and replacing these pump parts is difficult; also, the suction lines are old.
- Sewerage designs and stabilization pond land—which might be required in the near future—is non-existent.

5.10 RECOMMENDATIONS AND WAY FORWARD

Below is a clear road map and the way forward for addressing some of the Bunda Water Utility's challenges.

- Design a chlorination unit
- Increase metering percentage to 100%
- Procure and install production and supply master/bulk meters
- Increase revenue collection efficiency to about 95%
- Undertake NRW reduction strategy
- Involve the district commissioner in all PREPARED Project activities in Bunda Town
- The PREPARED Project could support COWSO capacity building.

6.0 PROPOSED INTERVENTION AND IMPLEMENTATION FRAMEWORK

In order to have effective implementation of the proposed interventions, the existing framework should be used to enhance ownership and sustainability, as project activities can be easily mainstreamed into BUWSA's normal operation. Interventions related to NRW reduction and the partnership with Itron France will enable a detailed NRW diagnostic study to establish the factors contributing to both apparent and real water losses; BUWSA staff should also be fully involved.

Protection of water sources, catchment areas, and the network system should involve BUWSA, COWSO, and other community-based organizations and private actors. Involvement of all these actors on a water network system will help BUWSA with coherent system management—particularly with detecting leaks as well as with monitoring network system vandalism and other illegal water use. However, preparation of the framework, which will enable effective involvement of these groups, is very important as this will clearly stipulate how these actors will execute their roles.

The utility thus has to formalize the bylaws on water supply management, including water source protection. The bylaws will be an essential local tool capable of enforcing and translating the national policy instruments, including the Water Supply and Sanitation Act (2009) as well as the Water Resource Management Act (2009).

Building BUWSA staff capacity should be through long-term and short-term courses as well as on-the-job training. The proposed training arrangement will help BUWSA have the skills necessary for effective implementation of its activities. On other hand, building capacity for COWSO and other NGOs is also important to enable them to execute their activities related to protecting water sources, water catchment areas, and the network system, as well as to managing water kiosks.

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7.0 RISKS ANALYSIS

Successful implementation of the proposed interventions will depend on how various actors and stakeholders will be involved and on their willingness to actively participate in executing the proposed interventions. However, the following risks are envisaged (Table 7). Notice that the risks have been analyzed by identifying their level of significance to the proposed interventions. Thus, during the risk analysis, two levels of impact were identified as likely/expected to happen during the implementation. These are:

- High risk
- Medium risk

For each identified risk, the consultant has established mitigation measures. The mitigation measure is aimed at reducing the impact of the risks.

Table 7: Risk analysis to the proposed interventions

RISK	RISK LEVEL BEFORE MITIGATION	MITIGATION MEASURE	RISK LEVEL AFTER MITIGATION
Inadequate commitment of BUWSA to implement PREPARED Project interventions and mainstream into BUWSA operations for sustainability of the interventions	Medium	Holistic engagement of the utility management, district management and ministry officials/representative	Low
Funding of PREPARED Project interventions depends on co-funding mechanisms from key actors, including BUWSA or the Government of Tanzania, as BUWSA depends on subsidies from the government; if such funds will not be set aside, the suggested interventions will be at high risk.	High	PREPARED demonstrates to BUWSA the importance of the proposed interventions and supports some of the activities through grants. This may be done through funding of very important activities.	Medium
Unwillingness of COWSO and other community-based groups to participate in PREPARED Project interventions	Medium	Engage the NGO and the community from the onset of the project and award a USAID grant to the identified NGO	Low

8.0 CONCLUSION AND RECOMMENDATIONS

The potable water supply situation in Bunda needs urgent and immediate action. This need is justified by the stagnant high level of NRW due to an obsolete water distribution network as well as vandalism. In addition, the quality of supplied water is questionable because the utility only runs rudimentary water disinfection, not credible water treatment. It's further noted that the utility has not yet enforced its bylaws and the Water Supply and Sewerage Act (2009) on those who tamper with the network system. Based on the observations and PREPARED objectives, the following are recommended:

1. Diagnostic study to determine the actual factors contributing to physical and commercial losses; implement the recommendations thereafter
2. Install master bulk meter for water production and supply, to enable accurate measure of water produced and supplied
3. Institute 100% universal customer metering; meters should be tamper resistant
4. Put in place appropriate water chlorination methodology; install a chlorination unit
5. Computerize billing with an efficient billing system
6. Strategize to increase revenue-collection efficiency to the recommended level of at least 95%
7. Provide appropriate working tools such as computers, Internet service, billing devices (e.g., handheld billing gadgets, mobile phone etc.) and other software to improve work performance
8. Design water supply system for Buseresere Town

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