FORMATION OF WATER UTILITY MANAGEMENT POLICY FRAMEWORK, MANAGEMENT TEAM, AND TRAINING.

UNITY STATE, SOUTH SUDAN.

30th, December, 2020 to 14th, February, 2021

AFFIRMATION

Except as acknowledged by the references in this document to other authors and publications, the assignment described herein consists of our work, undertaken to gather valid, reliable, appropriate, and up-to-date information for the Rubkona and Bentiu Water Utility assets in Rubkona County in Unity State, South Sudan and develop a policy framework to guide the management, training utility management teams for the running of each.

Primary quantitative and qualitative data collected throughout the process remain the property of the communities and families described in this document. Information and data collected were with the community of Rubkona and Bentiu's consent.

CIVITRA Research and Consulting Co. Ltd

January 2021

NOTE TO THE READERS

This Report is supposed to be read together with the accompanying Manual referred to as *"Management Training Manual for Board Members and Water Treatment Plant Operators of Public Water Association First Edition 2021"* as some of the references here are in the Manual. Business Plans for the respective utilities are also annexed separately.

ACKNOWLEDGEMENT

The production of this report was made possible by the contributions of the community members of Rubkona County. They spared their time and overlooked competing priorities to participate in the survey. We are deeply indebted to them. The assignment also benefited from the valuable input from the State Government (the Town Council, the Acting Director-General Mr. Paul Gak, the Secretary-General, and the respective Commissioners). The Water Treatment Plant (WTP) operators in the area provided broad and very helpful perspectives on their respective treatment plants.

We thank Mr. Peter Karanja, in Juba, William Karinga, Eng. Stephen Waswa in Bentiu and the rest of the dedicated Concern South Sudan Staff were steadfast in the realization of the assignment objectives. We also wish to thank entire all the WASH project staff for their excellent performance. Mr. Isaak Ter, Elvis Otieno, and Robert Isadru - all from Concern Worldwide who provided all-time support to CIVITRA Research and Consultancy Co. Ltd field team assigned to carry out the evaluation assignment. Davis and Shirtliff (South Sudan) and Omaski Sai Infra in Juba – both commercial businesses dealing in an assortment of WASH items also deserve acknowledgement. Finally, Mr Jemal Ebrahim Seid, the Director of Program, and Ms Josephine Kuli Ben, the Deputy Director of Programs in Juba provided vas and valuable insights on the last milestone of the assignment considering what had been achieved in the previous milestones. The products of this assignment shall help in having commercially viable vibrant Rubkona and Bentiu Water Utilities and in so doing guarantee access to clean water to all as well plough back money for maintenance. A financially sustainable water utility can draw resources from the financial markets, majorly banks due to its ability to pay back loans in the stipulated time.

CIVITRA Research and Consultancy Co. Ltd

EXECUTIVE SUMMARY

The assignment on the formation of Water Utility Management Policy Framework, Management Team, and Training was commissioned by Concern Worldwide South Sudan (CWW-SSP) at the end of 2021 following the end of the project that was funded by UNICEF. The two Water Utilities are Rubkona Surface Water Treatment (SWAT) and Bentiu conventional water treatment plant (WTP) – all in Rubkona County, Unity State. The objective were two objectives (i) to develop a policy framework to guide the management of the Bentiu conventional water treatment system and the Rubkona emergency water supply system, support Concern staff in the identification, formulation, and training utility management teams for the running of each. (ii) Provide recommendations on how to set appropriate tariffs setting as well as simple guidelines for drafting by-laws to support the operations and provide training for stakeholders on the implementation of the guidance.

This report is supposed to be read together with the accompanying Manual referred to as "*Management Training Manual for Board Members and Water Treatment Plant Operators of Public Water Association First Edition 2021*" continousely referenced in here as "**the Manual.**

More broadly, this report is divided into two: Training and Data Collection, with cross-cutting reconditions coming at the tail end. Other products of the consultancy that are to be read in tandem with the report that are annexed separately are the Bentiu and the Rubkona Business Plans.

The training covered the following topics: Water Governance, Institutional Set up and making of By-Laws, Financial Management, Asset Listing, Tariff Setting, and Business Plans Development. On Tariff design, the Consultants adopted a three-pronged approach, each validating the other. Firtsly, a participatory discussion during the training yielded the following results: Cost of one 20L Jerry-can to be 20 SSP and another suggestion was 10 SSP per 20L Jerry can. Yet another suggestion amongst the training participants was that 30 SSP for a 20 L Jerrlycan HH and Hotels at to be sold water at 50 SSP since they are in businesses. The reasons to support these suggestions ranged from: the prevailing economic situation to the need to factor in the different economic uses of water besides life-saving nature. Paying for water being a new initiative, there is a need to start small as a marketing and promotion plan for the utility so that a period of, say 6 months, is used to educate the communities on the value of paying for water. The second thread was the use of CWWD-SSD/UNICEF willingness' to pay for Water Survey to corroborate the participatory discussion suggestions above. And the last thread was the use of LCCA to calculate a cost-reflective tariff which put Rubkona at 15 SSP per Jerrycan and Bentiu at 50 SSP per Jerrycan.

Challenges abound, households spent nearly 42% of their income on water, 8 times more than the internationally recognized 'burden threshold' benchmark of 5% of the salary/wage. This means that in the short to medium term, the utilities have to rely on grants to replace worn-out assets in the form of cushioning the annuity portion of the capital assets. Some of the innovative support ways by donors as a way of weaning off relief support system as a pathway to

sustainability is to gradually move from grants to a revolving fund with INGOs/UN acting as a guarantor against financial risks (using the donor's money).

The participants were also taken through a process that made them learn how to develop asset inventory that includes the age of the asset and the expected serviceable and remaining life. The output of the training culminated into Business Preparation and started by the respective utilities preparing "dummy" plans that subsequently formed the basis of refined bankable business plans.

The steps needed to actualize the model put are clustered into four tiers (1) State Government: This is the promulgation of a law to recognize the board as a statutory organ backed by laws and the outlaw of Universal Free Water (2) At Water Board level is more induction training on the Manual, Private Sector approaches, PPP, Effective Internal and External Communication Marketing and Customer focus including accountability. (3) At the Community/Customer is the reporting of the utility staff malpractices, stopping and reporting illegal connections and pipe breaks/leakages. And lastly (4) At the utility level, is the ending of collusion with Government officials and communities that increases illegal connections for their personal monetary benefits.

Table of Contents

AFFIRMATION i

NOTE TO THE READERS i

ACKNOWLEDGEMENT ii

EXECUTIVE SUMMARY iii

1.0 INTRODUCTION 1

2.0 SCOPE OF THE ASSIGNMENT 2

3.0 PART I: TRAINING DELIVERY 3

4.0 PART II: DATA COLLECTION 11

5.0 PART III: MAIN FINDINGS BASED ON THE OBJECTIVES 11

6.0 RECOMMENDATIONS 14

7.0 ANNEXES 23

Annexe 1: ToR for the formation of Water Utility Management Policy Framework, Management .. 23
Annexe 2: Agenda for Water Governance & LCCA training 2021 27
Annexe 3: List of Participants 30
Annexe 4: Training Content 31
Annexe 5: Design Period used in the Business Plans 55
Annexe 6: Cost reflective tariff design 56
Annexe 7: Water Supply Construction and O & M Materials and Supplies 71
Annexe 8: Asset Outlay List for the 2 Water Utilities 73
Annexe 9: Technical Data 76
Annex 10: Business Plans – Rubkona & Bentiu 79

List of Figures

Figure 1: Sediments in Water drawn from bulk supply area (for Donkey Carts and Trucks in Bentiu Water Utility 15
Figure 2: Comparison Energy expenditure calculations in Kilowatts hours KwH for old and new pipe . 16
Figure 3: Pic showing a fire hydrant 18
Figure 4: A newly installed Household meter in a House in Dar Es Salam 21
Figure 5: A picture showing the picture of a blue print of the South Sudan Urban Water Corporation 33
Figure 6: Continuum of PPP Contracts showing the Investment needed versus the complexity 39
Figure 7: Structure of assets of the Dutch water supply works (VEWIN, 1990). 51
Figure 8: Annual investments in the Dutch water supply works 51
Figure 9: Amount Respondents are Willing to pay for a Jerrycan of Water (adapted from CWW-SSD WTP report, May 2019) 69

List of Tables

Table 1: Agreements made during two debrief meetings in South Sudan 2
Table 2: Shown proposed names of the two Water Boards 5

Table 3: Shows the result of secret ballot for the applicable tariffs 6
Table 4: Tariff Suggestions from the Training Participants 7
Table 5: Asset management Plan Example used in Annex 8 Asset Outlay List for the 2 Water Utilities .. 8
Table 6: Consumables for the IC servicing 9
Table 7: Shows the plans for the two groups to meet and conclude the Business Plans 14
Table 8: Results of the Sedimentation tests for Rubkona and Bentiu Utility. 15
Table 9: Increasing Temperatures with decreasing reduction in pressure ratings Source: Mays, 2000 . 17
Table 10: Characteristics of Public-Private Partnership Models 40
Table 11: Basis for computation of Water Tariff using LCCA data 47
Table 12: Respondent household Income range per Week 70
Table 13: Respondent Sources of Water 70

List of Boxes

Box 1: The main issues in regards to the assignment 2
Box 6: Comment on Pipe roughness value by a Professor in Hydraulics 14
Box 7: Pipe criticality as an Indicator of pipe need for rehabilitation in asset management 18
Box 2: Corruption Equation 36
Box 3: Customer Complaints Boxes 37
Box 4: Main Components of LCCA 46
Box 5: How to handle fixed and variable expenses 50

List of acronyms and abbreviations

BPT	Break Pressure Tank
BOT	Build-Operate-Transfer
BOO	Build-Operate-Own
BOQ	Bill of Quantities
CWP	Community Water Point
CWW-SSP	Concern Worldwide South Sudan
GI	Galvanized Iron
IC	Internal Combustion engine
JICA	Japan International Cooperation Agency
KwH	Kilowatt hours
LCC	Life Cycle Costing
LCCA	Life Cycle Costing Approach
MEDIWR	Ministry of Electricity, Dams, Irrigation and Water Resources
O & M	Operation and Maintenance
PE	Polyethylene
PRV	Pressure Reducing Valve
PPP	Public Private Partnership
PoC	Protection of Civilians
PVC	Poly Vinyl Chloride
SSUWC	South Sudan Urban Water Corporation
SSP	South Sudanese Pounds

SUWASA	Sustainable Water and Sanitation in Africa
SWAT	Surface water treatment
ToR	Terms of Reference
VSD	Variable Speed Drive
WTO	Water Treatment Operators
WTP	Water Treatment Plant

GLOSSARY

PoC	In the days following the outbreak of violence in South Sudan on 15 December 2013, tens of thousands of people fled to UN peacekeeping bases across the country seeking protection. This so-called Protection of Civilians (POC) sites came to define the response in South Sudan
Rural	In the context of this report, this means areas that are far off the Rubkona and Bentiu towns that are not in included the definition of Urban below
Urban	In the context of this report, Urban means Bentiu town/market, Rubkona Town/Market, the schools and facilities near the Commissioner's office in the respective towns (i.e. Rubkona and Bentiu). All the homes and business establishments in these environs are also included.
Manual	*Management Training Manual for Board Members and Water Treat and Water Treatment Plant Operators of Public Water Association First Edition 2021*

1.0 INTRODUCTION

The assignment on the formation of Water Utility Management Policy Framework, Management Team and Training was commissioned by Concern Worldwide South Sudan (CWW-SSD) and carried out by CIVITRA Research and Consulting Company Limited between December 30th, 2020 and 14th, March 2021. In Rubkona County, Concern operates a water supply network serving the communities of Rubkona surface water treatment (SWAT) and Bentiu conventional water treatment plant (WTP) towns through communal water points, water kiosks, individual tap stands and commercial businesses. Through funding from UNICEF, Concern has been in charge of:

i. Operation and Maintenance: Through the hiring of 1 Electromechanical Technician spending 60% of his time on the two Water Utilities. He is in charge of all the regular maintenance.
ii. Incentive Payment ("salary top-up") for the Water Treatment Operators(WTO)
iii. Hygiene Promotion to work as part of Water Safety Plans: 12 Hygiene Promoters
iv. Supplies and Consumables: Alongside point (i), CWW-SSD supplied oil filters, air filters, engine oil and spare parts as might be needed from time to time.
v. Breakdown maintenance: If there were any major breakdown that would cause the plant to stop hence hindering community access to water then Electromechanical Technician would diagnose the problem, draw up a BoQ and CWW-SSD would buy the needed items for replacement.
vi. Replacement of obsolete assets: CWW-SSD would replace assets as they become worn out.

Concern had planned in the project design to move the two systems from relief support systems to more viable self-sustaining viable commercial approaches, as UNICEF funding was due to end on the 30th, January 2021. This called for putting in place over-sight boards/institutions, reviewing the policy framework in consultation with the State Ministry for Infrastructure, Housing and Roads and the Town Council, stock-taking and valuation of all the Utility assets - Life Cycle Costing (LCC), and the two Utilities having bankable business plans. The two utilities were to be handed over to the Town Council of the Government of Unity State.

A willingness to pay survey was conducted to investigate:

1. The various sources of water available to the households in the two towns which are benefiting from the Rubkona and Bentiu water supply systems and,
2. The communities' willingness to pay for improved water services.

The results of the assessment revealed the willingness of the community to pay for water. Even though the amount people are willing to pay differed from one individual to another for the water service delivery, results indicated that there is an overwhelming agreement among the population that there is a need to improve water governance.

Since January 2014, CWW-SSD has been supporting, along with the programs in Rubkona County through their coordination hubs in Rubkona. The assignment had limitations that prevented the presentation of certain critical asset information as well as calculation of a cost-reflective tariff, and business plan preparation. Firstly, two critical documents were lacking. These are: As-built designs and drawings, and concrete technical and financial information for the pipes and fittings, and electromechanical

manufactures. Technical information is on items like pipes, valves and pump characteristics/curves, which would have acted as a basis for technical performance evaluation. Therefore, assumptions have been made, where applicable. Also given CWW-SSD took over the two facilities after construction, and so the exact cost of the infrastructure could not be ascertained. To circumvent these hurdles, the consultants had to rely on estimates and assumptions, where applicable.

The assignment involved a desk review of existing documents, interviews with CWW-SSD staff, Utility Staff, Town Council Staff, the State Ministry of Instructure DG and stakeholders – including businesses/suppliers in Juba and field visits for assets review purposes and subsequent calculation tariff evaluation, and training of the already selected 2 (two) Water Boards on governance, all of which culminated on the development of respective Business Plans. Quantitative information was gathered during the assignment and analysed to address the objectives. Efforts were made to establish to review secondary literature which has technical information and benchmarks on WTP operations, WTO and Water Utility Management. These have been presented in the list of references. Qualitative information was similarly analysed to address the objectives of the assignment. Inferences were triangulated and discussed before conclusions were drawn and recommendations made. As well as providing a wealth of information, the group work discussions during the training also validated the information from other parties – including observations made.

2.0 SCOPE OF THE ASSIGNMENT

This report is the outcome of the assessment whose primary purpose is two-pronged:

Box 1: The main issues in regards to the assignment

- To develop a policy framework to guide the management of the Bentiu conventional water treatment system and the Rubkona emergency water supply system, support Concern staff in the identification, formulation and training utility management teams for the running of each.
- Provide recommendations on how to set appropriate tariffs setting as well as simple guidelines for drafting bylaws to support the operations and provide training for stakeholders on the implementation of the guidance.

The detailed ToR is Annex 1 of this report. The lists of Participants have been included as Annex 3.

Lastly, two debriefs were done and are presented in Table 1 as follows:

Table 1: Agreements made during two debrief meetings in South Sudan

Date	Concern Staff	Place	Issues Raised
25th, January 2021	William Karinga- Program Manager Stephen Waswa – Project Engineer Isaak Ter – Project Officer	Bentiu	Two models were shared – the Gumbo tariff calculations for the consultants to use as a guide The IRC Excel workbook on water utility financial planning

28th, January, 2021	Mr. Jemal Ebrahim Seid, the Director of Program Ms Kuli Josephine Ben	Juba	Need to concentrate for the Consultants to submit Business Plans for the two utilities

These were vital in charting the direction of the assignment.

BOARD MEMBERS CRITERION FOR SELECTION DEVELOPED BY CIVITRA

- 2 No. Respected members from the Community for each of the Utility (male & female), for example, School teachers, Nurse, social worker
- 4 No. Professional in the community – preferably: Lawyer, Engineer, Accountant/Finance backgrounds (not a must)
- 4 WTO

Therefore, each WTP presented 10 members

3.0 PART I: TRAINING DELIVERY

Methodology & Practical Work/Activities

Professional working class living in the Community were the targeted participants of this training program. Taking this into account, the training programme was been designed to use practical exercises/activities and different mediums that are appropriate for their learning. It is essential to ensure that knowledge is gained not only through information sharing but also through practical learning activities. Indeed, interactive education and activities played a powerful role in the process of training. To generate the maximum interests of participants, different practical exercises/activities and role-plays were conducted by the facilitators. Through this, the participants got to analyse problems; thoroughly study, search for solutions to the problems and act according to what they have learnt. Furthermore, different training methods were applied to accomplish the objectives of the training. These methods included:

- Group activities
- Discussions (Questions and Answers)
- Posters
- Presentation of pictorial illustrations
- Education through play/games
- Acting/Drams/role play
- Scenario Building & Simulations

This was a 5 days training – beginning at 8.30 a.m. and ending at 5.30 p.m. The training agenda had been included as Annex 2. In the remaining paragraphs of the chapter, we present the summary of the content of the training.

Day 1: Training Introductions

The participants introduced themselves by giving their names, ministry and job position. Each of them also stated whether s/he came from Rubkona or Bentiu. The list of Participants for the 5 days has been presented as Annex 3.

The facilitators then took the class through workshop expectations and workshop norms

Workshop Expectations

1) Acquire knowledge
2) Get water from the community
3) Get the certificate and seating allowances in the form of money "hand-outs" and T-Shirts
4) Discuss the management of the water facility
5) Law enforcement obligation on the water facility
6) More knowledge on water systems and quality
7) Adhere to the Ministry of Health Guidelines on COVID 19
8) Transport – for the Rubkona team
9) Committee Mandate

The facilitators reconciled the above objectives from the participants with the training workshop objectives as follows:

- To gain knowledge on how a water board works and how it relates to the WTP and the line State Government departments as well as the community
- To form oversight and decision making Institutions: These were referred "board". So Rubkona will have a Water Board and Bentiu too. These would be independent of each after the formation and training, reflecting unique needs, experiences as well geographic water coverage.
- To be assisted on how to have Water Board By-laws/Regulation (conflict management) and subsequently adopt them
- To train on Business Planning and each Water board to have Business Plan
- To learn the various Accountability mechanisms and tools available for good governance and ethics

Box 2: The operational difference between Water Board and a Water Committee

Note 1:

A participant wanted to know the difference between a Water Board and a Water Committee. The facilitator explained that Concern was forming a Utility Water Board and not a Water Committee. This was important as it distinguishes the water point management committee, which has its management approach and curriculum from the more unique (to CSO social programs) water utility boards which are more complex. For example, a water point committee uses cash accounting procedures while a water utility uses accrual accounting procedure. Also, the Water Board services is larger and reach more beneficiaries than the Water Committee.

<u>Workshop norms</u>

1) Phones on silent mode
2) Respect for each other
3) Avoid unnecessary movements
4) Keep time
5) Permission when going out
6) No smoking
7) Let us have only one meeting and not people conversing and disrupting the meeting

Roles and Responsibilities

Name	*Role*
Time Keeper	Mr. John
Spiritual Leader	Pst. Mathew
Prefect/Monitor	Nya

The facilitator then took the class through the following items of the day:
The following topics were covered through lecture method:

Topic Covered	**Where to find the information**
• Role of a Water Utility	Annex 4
• Role of the Board	P30, P32 – 36 of the Manual
• Duties of Officers	P51 of the Manual
• Indicators of a Sustainable Water Utility	Annex 4
• Background	Annex 4
• Management options available in government reforms	Annex 4
• South Sudan water sector reforms - SUWASA – USAID – 2013	Annex 4

Day 2: Water Governance, Institutional Set up and By-Laws

The facilitator then issued out the following print out:

- Policies and Ordinances
- Laws of Bentiu and Rubkona Water Association
- Water Regulations to Support By-laws

With the facilitator taking the lead, these were discussed and Q & As done. The handouts were later given as take-home materials.

As established by the respective Utility by laws, and as suggested by the respective teams, the names shall be:

Table 2: Shown proposed names of the two Water Boards

Proposed Name of the Board	Proposed Name of the Board
Rubkona Water Utility	Rubkona Water Utility Board
Bentiu Water Utility	Bentiu Water Utility Board

Several participants from the respective Utilities made suggestions for the names to be given to their Utility. After voting on the several proposed names, the consensus was reached on the following names.

Topic Covered	**All from the Manual**
• Policies and Ordinances	p74 – 81
• Laws of Bentiu and Rubkona Water Association	p46 – 54
• Water Regulations to Support By-laws	p123 – 129
• Rural Water Association Bylaws and Board Responsibilities	P29 – 31

- Membership in the water system organization — P29, p38-39
- Boards of directors — P31 – 32
- Duties of the board — P30

Day 3: Asset Listing and Tariff Setting

Asset Listing Exercise

Group work: The facilitator asked the participants to break into two groups corresponding to their respective Utilities. Each group is to list the assets in a water utility. The Details of the assets have been put as Annex 8.

POCKET-CHART VOTING

Pocket-Chart voting was conducted to decide between two types of metering:

- Monthly fixed metering
- Metered

All the 20 members voted by putting their ballot on A4 Envelopes that have been stuck on the wall at the back of the room. The results are shown in Table 3 as follows:

Table 3: Shows the result of the secret ballot for the applicable tariffs

Type of tariff on the ballot	Votes cast
Monthly fixed tariff	7
Metered tariff	13
Total	**20**

Therefore, Metered Tariff was adopted by the majority. Since the board is newly formed and the payment and billing for the water concept are still new in Unity State, other complicated tariffs like Decreasing block Tariff and Decreasing Block Tariff were not discussed as they were considered unsuitable. Therefore, they were not put on the ballot for voting.

The facilitator explained the Smart metering concept concerning telephone money transfer like M-Grouch in South Sudan.

When asked how much they deemed fit as tariff in the metered tariff concept and using the standard 20L jerry can as the point of reference, the following results were obtained. The suggestions are shown on

The facilitator then took the team through the main items to be borne in mind when calculating the Tariff as follows, giving an example of a Donkey cart:

To make the volume-based model definition more clear, the facilitator equated the measurements to the standard 20L Jerry cans common in South Sudan while the water meters are put at the tap stands, with one community member being the caretaker and sells water. The person who sells the water sends the bill each month to the Water Utility

Mr. David the Supervisor for Rubkona had a question: "*We are using middle-men businessmen in donkey carts who come to fetch water at the water point and pay SSP 100 per barrel. Are we making a profit or loss*?"

Answer: It is not possible to know the answer at this point. The reason is that we still do not know the cost of production and transportation of water to the consumer.

CALCULATIONS NEEDED TO ANSWER THE QUESTION ABOVE

Parameter	**Known or unknown**
Cost of Production of Water	Not known
Cost of selling of Water	Is known

Capital Expenses/Expenditure
Maintenance Expenses/Expenditure

Type	**Definition**

- Breakdown Maintenance
- Regular Maintenance

A participant wanted to the groups that should be waived of water payment due to their vulnerabilities. The facilitator suggested the following list:

- ✓ The Disable
- ✓ Elders
- ✓ IDPs
- ✓ Female headed Households (single women)
- ✓ Orphan headed Households

These Households could fill in Hardship forms for the water board to discuss and consider their waivers. (Check Ordinance and Policies on Comprehensive Customer Service Policy p75 to p82 of the Manual)

Table 4 below show the suggestions and the rationale for the tariffs:

Table 4: Tariff Suggestions from the Training Participants

Suggestion	Reason Given
<u>Suggestion 1:</u> Cost of 1No. 20L Jerry-can to 20 SSP	Rational at the prevailing economic situation so 1 L is 1 SSP
<u>Suggestion 2:</u> HH to purchase at 30 SSP and Hotels at 50 SSP since they are in Business	Rational at the prevailing economic situation. Furthermore, the different tires reflect the different economic uses besides the life-saving nature
<u>Suggestion 3:</u> 10 SSP, which is a small amount	As a Marketing and Promotion Plan for the utility so that they use a period of, say 6 months to educate the communities on the value of paying for water. The Utility will increase gradually based on experiences

It was also noted that far off places to sell 1 Jerry-can at 100 SSP from the Donkey Cart due to the distance and efforts. It was noted that this is the current cost due to distance.

The facilitator advised the participants to factor in the following items on meters in the business plan:

- The participants during group work to purchase of new meters so they can rent out meters and raise more revenue.
- Meter Maintenance costs
- Meter replacement costs

A participant wanted to know how metering is done and how the HHs are billed. Further, he wanted to know the number of litres that makes 1 M^3. The facilitator said that billing is done in cubic meter (M3) of water consumed. For instance, a utility might choose to put 900 SSP/M^3. 1 M^3 is equal to 1,000 litres. The facilitator further explained that 50 Jerry cans make 1 M^3. With this example 1 Jerry would therefore cost 18 SSP (900/50= 18). So if one is billed per month, then the cost per jerry can is likely to be lower than if billed per jerrycan drawn since s/he is purchasing in bulk and gets quantity discount, which is very important for any business to adapt to attract customers – this case of the utility, and this translates to more connections thus stable income.

The management of billings and tariff are governed by policies and ordinances are in p123 - 129, and water regulations in p74 – 81 of the Manual respectively.

Day 4:Financial Management

Asset Management Example

• Develop asset inventory that includes:

– Age of the asset

– Expected serviceable and remaining life

– Condition (rank from 1-5; 1 is very poor condition and 5 is excellent condition)

– Expected life multiplied by condition equals prioritization score

Group Exercise: The two Utilities went into group work to discuss how to prioritize their assets. This is demonstrated in Table 5 below as explained by the facilitator.

Table 5: Asset management Plan Example used in Annex 8 Asset Outlay List for the 2 Water Utilities

Asset	Remaining Life	Condition Score	Prioritization Score
Elevated Storage Tank	20	5	100
Chlorinated heads	3	2	6
Line segment 1	20	4	100
Line segment 2	4	1	4

Develop a management plan for storage tank

– Current Cost: $600,000

– Average Annual Cost increase: 3 percent

– Expected life: 20 years

– Future estimated cost: $1,083,667

Example 3: 20 Year Financing Plans

– Borrow $700,000

– Accumulate $383,667 in system funds

– Using a non-interest earning account, set aside $1,600 per month (see next slide)

– At 2 per cent ***savings*** rate, set aside $1,300 each month

During a wrap-up lecture, the following topics were covered by the facilitators

Topic Covered	Where to find the information
• Maintenance Function	Annexe 4 of the Manual
• Operation and Maintenance	Annexe 4 of the Manual
• Maintenance Strategy	Annexe 4 of the Manual
• Financial Management	P144-194 of the Manual
• Rate Review Policy	P98 of the Manual
• Asset Management	P189-193 of the Manual
• Developing an Asset Management Plan	Annexe 4
• Replacement Fund	Annexe 4
• Capital Improvement Planning	P113-119 of the Manual
• Selecting a Professional Civil Engineer for Capital Planning	Annexe 4 of the Manual
• Grant Selection Criteria	Annexe 4 of the Manual
• Sample balance sheet	P157 of the Manual

Day 5 Business Plan Development & Action Plan and Conclusions and Group

In preparation for Business Planning, the two Water Utilities went into the group to discuss the expenditure and revenues of the Utility.

- What is the utility's budget for operation and maintenance – (a) supplies? The participants were asked to fill in Table 6 below.

Table 6: Consumables for the IC servicing

Item	Cost for one	Quantity	Frequency of replenishment per month
Fuel			
Air-filters			
Fuel-filters			
Batteries			
Plumbing supplies			
any other?			

- What is the utility's budget/expenditure for operation and maintenance operation and maintenance: some utilities struggle to pay their salaries and electricity costs and there is not enough revenue to pay for chemicals, fuel, repairs e.t.c.
- What are the utility revenues? how much comes from tariffs e.t.c.
- Does the utility have an investment plan? investing to replace old pipes, equipment, train its staff?
- Does the utility have plans on expanding the system? by adding new sections to the distribution system. how many new connections does the utility add each year?

- Do consumers pay their bills on time? private consumers, industrial sector? do government offices and institutions pay their water bills? and on time
- Does the utility have the powers to disconnect customers for non-payment?
- How much does it cost to connect to the water system? are their hidden fees and costs that make connections unaffordable? are bribes demanded connections?
- Is the cost of the meter part of the connection costs? is the utility pudding the connection costs to make for low tariffs? are there barriers to connecting to the water systems besides the connection fee?

The respective Supervisors gave Consultants the salaries for each of staff of the facilities.

After answering the questions, above, each of the groups did a presentation on the above, and the facilitators promoted more into key critical areas. These are: Revenue streams, O & M Costs, Initial capital items needed to realize the reforms proposed (paying for water concept), Replacements/Capital Improvement Programs, Accountability Mechanisms/Checks and Balances.

However, in the eventual Business Plan preparations, the facilitators relied on the actual market research for the Concern Procurement department in Juba, reputable international Suppliers/Stockers like Omaski and Davis and Shirtliff. These are presented as Annex 6

The following handouts were given to participants and the facilitators went through each of them:

Document	W**here to find the information**
• Sample Balance sheet	P157 of Manual
• Sample of financial projections	P180 of the Manual
• Worksheet for calculating a monthly financial report	P176 of Manual
• Worksheet for figuring financial reserves	P172 of Manual
• Worksheet for figuring the expense budget	P173 of Manual
• Sample of prioritizing needs	P184 of the Manual
• Sample of scheduling capital projects and defining financial strategies	P185 of the Manual
• Schedule and Financing Plan for Capital Improvements With Outside Financing	P186-187 of the Manual
• Projected Funds Available for Capital Improvements - 5 Years	P180-182 of the Manual

After going through the following formats and the facilities explaining each of the documents as well as handling Q & As, the groups were given a frame of simple Business Plans and were asked to break and discuss it. An assumption of a Project Life of 25 years, Design Periods of Water Utility equipment and civil works put as Annex 5 and Populations and Population periods were shared.

Each of the groups made a presentation so their plans and participatory discussions enriched the process as each of the Utilities tried to challenge each other by bringing in some external ideas and therefore enriching each other's plans. After presentations, the facilitator took the participants through a sample business plan from the Manual. Reference is shown below.

Document	**Where to find the information**
Business Plan	P123-123 of the Manual

These prepared "dummy" plans formed the basis of the refined bankable business plans put in as separately from this report as Annex 10.

4.0 PART II: DATA COLLECTION

The consultants visited the two water utilities and had focused group discussions with the WTP operators as well as key informant interview with the respective supervisors. Further, traders/suppliers of consumables in Juba were directly contacted by the Consultants. These are Omaha Enterprises for pipes and fittings and Davis and Shirtliff for electro-mechanicals. Other data on consumables costs, transportations from Juba to Bentiu and steel tank fabrications were obtained from the Procurement department CWW-SD in Juba. The results of these discussions have been used to calculate a cost-reflective tariff. The data used in calculations has been put as Annex 8 & 9 of this report.

5.0 PART III: MAIN FINDINGS BASED ON THE OBJECTIVES

Assets

Assets and their values and their conditions for both Rubkona and Bentiu Water Utilities are listing Annex 8

Cost Reflective Tariff Calculation

In LCCA tariff calculations the following have taken care of (i) CHEMICALS (*Alum)* and *Chlorine* (ii)FUEL COSTS for ic engine (iii) MAINTENANCE COSTS (Engine oil, Air filters and Oil filters, a separate maintenance costs for Pumps, chlorinators and Lime injectors, and Maintenance for Civil works. Since pipe constitutes 60% of the total capital costs, separate maintenance costs have been allocated for pipes conveyance) (iv) ASSETS DEPRECIATION COSTS (have been put in the form of Annual Capital Recovery Amount, and finally (v) *STAFFING COSTS.* This yield the following:

Bentiu WT Tariff:	*50 SSP per 20L Jerrycan*	Rubkona WT Tariff:	*15 SSP per 20L Jerrycan*	

The practicality of the Model

From the willingness to pay for water survey done by Concern and UNICEF, the average income was about 5,000 SSP a week and hadn't changed for the last one year. Households spent nearly 42% of their income on water, 8 times[1] more than the internationally recognized 'burden threshold' benchmark of 5%[2] of salary/wage. This means that in the short to medium term, the utilities have to rely on grant to replace worn-out assets in the form of cushioning the annuity portion of the capital. Some of the innovative support ways by donors a way of weaning off relief support system as a pathway to sustainability is to gradually move from grants to a revolving fund with INGOs/UN (using the donor's money) acting as a guarantor against financial risks. With INGOs investments in Household hold incomes and Livelihoods Programs, more Household would gradually pass the 'burden thresh holds' stated above. More of this has been discussed in the respective Cost Reflective Tariffs put as Annex 6 and Business Plans Business Plan put as Annex 10.

Steps Needed to actualize the model

I. State Government

i. Promulgation of law to recognize the board as a statutory organ backed by law
ii. Outlaw Universal Free Water – with illegal connections being prosecuted in a court of law
iii. Awareness creation and education on paying for water

II. Water Board

i. Adopting the bylaws as a basis for providing oversight
ii. More induction training on the Manual, Private Sector approaches, PPP, Effective Internal and External Communication Marketing and Customer focus including accountability
iii. Purchase of Flow Meters and other items and capacity building highlighted in the respective Business Plans

III. Community/Customer

i. Paying for water
ii. Reporting illegal connection
iii. Reporting leaks
iv. Reporting fraud/bribery solicitations

IV. Utilities

i. Reporting to work on time and following the procedures laid in the manual
ii. More refresher training
iii. Good storage of materials and consumables
iv. Stop colluding with Government officials and communities to increase illegal connections for their monetary benefits

[1] With the system design of 20L per person per day and an average of 6 persons per family and a cost of 50 SSP for Bentiu Water Utility, this translates to 300 SSP per day. In 7 days, it will be 2,100 SSP.

[2] Fankhauser & Tepic (2007). Can poor consumers pay for energy and water? An affordability analysis for transition countries. Energy Policy, 35(2), 1038–49.

(*more of this has been put on the recommendations – managerial section and the respective business plans*)

Policy and Institutional Framework

As of the training period (January, 2021), the Unity State Government hadn't been formed. This was due to be formed in early March, 2021. Only the Judiciary existed. The executive and the legislative assembly hadn't been formed. There was also re-shuffling of the top Government officials – with some of them in an acting capacity. The legislator Mr. William noted that there was a need for the two water utilities to be recognized through an act of parliament from where they will derive their powers as a statutory body. Therefore he noted that upon formation, the legal sub-committee of the legislative (upon election) shall discuss a bill on Rubkona and Bentiu Water Utility. He promised to move the agenda, as a legislator. In the month May, the Council of Ministers in the State shall also meet. The formation of the two utility board is also an agenda. The lay will be passed on paying communities to pay for water. The formation of the board had the blessings of the Governor and the Commissioners for Rubkona and Bentiu.

Despite these challenges, the urban water and sanitation sector has continued to be a high priority for the government of the Republic of South Sudan (RSS) and specifically so for the South Sudan Urban Water Corporation. The SSUWC Provisional Order was passed in 2011 in order to realize the goals and objectives laid out in the Government Water Policy of November 2007. The policy calls for sustainable financial systems and operations to ensure that customers receive reliable access to safe drinking water supply from water utilities. It was therefore recognized that there was a strong need for SSUWC to shift to a model based on commercial and cost recovery principles to improve performance and quality of service for urban water customers.

The participants were first taken through financial planning for all the water utility operations, maintenance, salaries, and consumables. This was done through group work, presentations and Q & As. Each group did a draft plan, which was to set the stage for Business Planning.

Action Plan and Conclusions

The following documents were handed over to participants as Take Home materials

Document	Day
1) Draft Water By laws (11 pages)	Day 2
2) Draft Water Policies and Ordnance (7 pages)	Day 2
3) Draft Water regulations	Day 4
4) Sample Business Plan (7 pages	Day 4
5) Worksheet for figuring financial reserves	Day 4

- The participants expressed concern that the materials on various topics given to them to take home on the various days might get lost as they are not bound together. As such, they requested CIVITRA Research and Consulting Company Ltd to bind this in the form pf a manual and send it to them for reference. This should be done by the 25th February, 2021

- Legislator Hon Mr. William Riak Dual and Hon Mrs Norino Jagei Mut committed to lobbying the legal committee for the legislative assembly for unity state to discuss and publish a bill for discussion on the following:
- Stopping universal free water, effecting payment, households and all the other institutions that use water from the respective utilities.
- Incorporating the two Water Boards through an Act of Parliament as legal entities responsible to the Town Council

Correction of the Business Plan as shown in Table 8 below:

Table 7: Shows the plans for the two groups to meet and conclude the Business Plans

Name of the Utility	Date	Venue
Bentiu Water Utility board	the 29th February, 2021 at 11.00 a.m	Ministry of State Infrastructure offices
Rubkona Water Utility board	the 28th February, 2021 at 10.00 a.m	Youth Center offices

- Also these debut meetings, the respective Water Boards shall elect Chairman, Vice Chairman, and Secretary to the Town Councils
- CIVITRA to give written comments on the respective business plans by the 25th, January, 2021
- 2nd February, 2021, forward names of the Chairman, Vice-Chairman, and Secretary to the Town Councils and the State Ministry of Infrastructure.
- At an agreed date, the respective boards shall discuss the bylaws for adoption

6.0 RECOMMENDATIONS

Technical

- *Pipe flushing in relation to reduced efficiency:* Sample photos of the inside of the pipes were sent to Prof Nemnaja Trifunuvic, a Professor of Hydraulics at UNESCO-IHE, at Delft, the Netherlands and below in box 6 is his comment:

Box 2: Comment on Pipe roughness value by a Professor in Hydraulics

"*The condition of the pipes on the photos is not bad. Visually, k = 0.5-1.0 mm would be a safe bet. If you want to be sure, and you are able to fit two pressure gauges on a pipe section of say 100 mm, and you can observe the flow, then you can calculate it from Darcy-Weisbach formula or similar.*" Prof Nemnaja Trifunuvic

Sedimentation tests were done on final products (purified water) from both utilities plant and sampled a tap. These were put on Jar and left still for three days. The results are tabulated in Table 9 below. Also, read the section Sedimentation Tests under pipes below:

Table 8: Results of the Sedimentation tests for Rubkona and Bentiu Utility.

	Results	
Utility	At the Utility	Tap
Rubkona Water Utility	Has sediments	Has sediments
Bentiu Water Utility	Has sediments	Clean

Inference:

1) The treatment process in Rubkhona Utility is not exhaustive as sediments still end up at the consumers' taps. This is because the retention period at the tanks is shorter.
2) The pipes will get rougher and rougher due to low velocities or velocity fluxes therefore leading to more deposition build up in the pipes in Rubkona.

Figure 1: Sediments in Water drawn from bulk supply area (for Donkey Carts and Trucks in Bentiu Water Utility

Remedy

1) Rubkona - The sedimentation period before supply needs to be prolonged.
2) Rubkona - Frequent back wash of the rapid sand filters (*if they are there. If not then this unit needs to be included*)
3) More frequent flushing of the pipe systems - For both systems
4) Water Operator refresher trainings
5) Back Washing of the Rapid Sand Filters and Sand Replacements

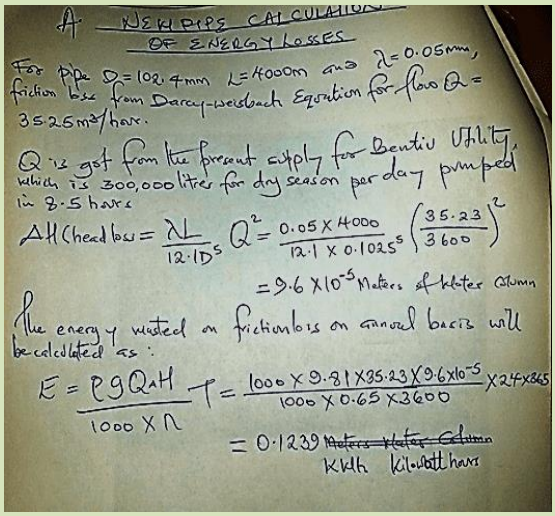
Read PART II: Chapter on Reservoirs, Chapter on Pipe Repairs and Chapter on Chlorination and, PART I: Distribution System Flushing and Hydrant Policy p99 and 104 of the Manual.

Efficiency calculation:

Taking PVC, PE pipes as an example, and taking maximum roughness in the ranges provided and assuming pipe diameter of 102.4mm and length of 4000m only for both systems. Also, assume a total efficiency η = 65%

New Pipe roughness λ = 0.020 – 0.05 (Source: Wessex Water)

Old Pipe roughness of λ =1



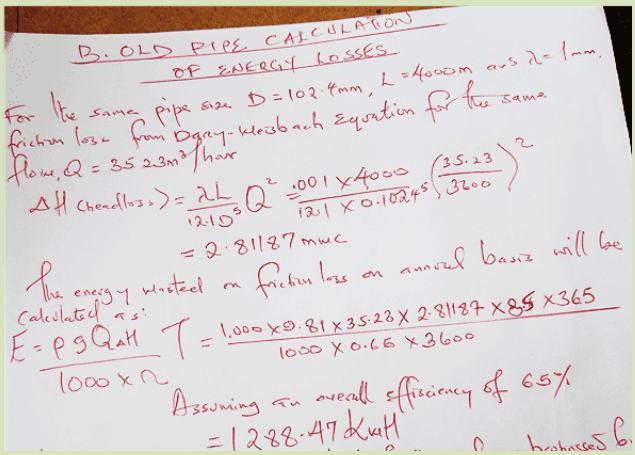


Figure 2: Comparison Energy expenditure calculations in Kilowatts hours KwH for old and new pipe

These efficiency calculations can be looked at in the light of sedimentation tests that was done on the clean water product of the two water utilities and points on the need for periodic pipe cleaning through flushing. This is vital as it affects energy consumption as demonstrated in the calculations in figure 6 above.

Final Analysis of Figure 6

For all assumptions and all factors kept constant, the old pipe consume more energy in terms of pumping (translated to more diesel in IC) owing to deposition in the pipe hence increased roughness. This can be attested to by the sedimentation tests. This could either be due to soil intrusion due to bursts, inadequate treatment processes i.e. less retention times in the sedimentation basins, or inadequate back-washing or less regular change of sand in the rapid sand filter facilities.

- *The need for standardization:* Regarding planning and design, it allows engineers to be more precise in drafting specifications. The required testing and inspection of materials guarantees quality of applied materials. Regarding O&M, it reduces difficulties caused by the diversity of the installed material. The first step towards standardization is the elimination of variety within certain products. However, standardization of joints does not really exist. It is wise to limit the choice of joints to a few types; mixing different manufacturers and models my create stocking and repair difficulties. Poor jointing is often a major source of leakage. Hence, special attention should be paid to promote water tightness and protection from corrosion.

- *Valve regeneration:* The number of section valves was noted to huge, with vast majority of them not frequently operated. In case of calamity, turning them on or closing can be difficult. Occasionally turning the valves on is known as *valve regeneration*, and is part of regular network maintenance in order to prevent clogging mechanism.

- *Pipes: (i) Handling and Storage:* Most of the piping in both Water Utilities was done with PVC. The disadvantage of PVC lies in the reduction of its impact strength in extremely low temperatures, and of its tension strength in extremely high temperatures. As a result, careful handling, stacking and

laying under extreme temperatures characteristic of Unity State, in South Sudan, is crucial. Table 10 below shows reduction in pressure rating with increasing temperatures:

Table 9: Increasing Temperatures with decreasing reduction in pressure ratings Source: Mays, 2000

Source temperatures (^{0}C)	*27*	*32*	*38*	*43*	*49*	*54*	*60*
% of original pressure rating	88	75	62	50	40	30	22

(ii) *Permeability of PVC Pipes:* Another problem in operation occurs when the pipe is exposed to organic soil pollutants (oils, gasoline etc.) over long periods. Even in constantly pressurized pipes and without leakage, water quality may be affected after several months. This is a consequence of organic molecules passing through the pipe walls, which is known as pipe permeability. The result of it is taste and odour problems with considerable health hazards. Additionally, the pipe material will be softening, which weakens its structural strength. The oil fields are about 50KM away, but even then, there are garages within in both Bentiu and Rubkona pipe network coverage. Furthermore, there is a water-for-diesel exchange between Bentiu Water Utility and oil companies, which puts the utility more vulnerable to permeability impacts. Laying of PVC and PE pipes is therefore not advised in the vicinity of refineries or petrol stations.

(iii) Pipe Marker Posts in the fields that are frequently set on fire: Marker Posts should be put along pipelines at every 200m except where they follow permanent roads. Also markers should be put places at all bends, rivers and road crossings which can be easily found otherwise. In Kenya, the Marker is square 100 x 100mm, height 700mm lettered MAJI and is blue with white lettering. The two water utilities could adopt the word *PII*, a Nuer word for water.

(iv) *Settling of dirt in pipes*

Just as with operation, efficient and effective maintenance lies largely on the effective monitoring of the piping system. If water that has stayed overnight has the by-products being released into the water, then a possible remedy is the control of the retention times through modification of the operation. When this problem occurs on a large scale, re-lining or pipe replacement should be carried out.

The other reason for dirts in pipes can be: High velocity, which is causing re-suspension of the sediments in the pipes. The maintenance action in this case should be flushing of the pipe, if necessary, coating.

(v) Pipe Criticality

The classification of pipes based on the flows they convey suggest that these pipes have different levels of significance for the hydraulic operation of the water distribution networkN. This so called hydraulic significance differs from the significance that considers the structural condition of the pipe. The combination of both aspects defines the pipe criticality as an indicator of the pipe rehabilitation and eventually a replacement. The mathematical expression is shown in box below.

Box 3: Pipe criticality as an Indicator of pipe need for rehabilitation in asset management

$$SI_j = \frac{Q_j L_i}{C_{hw,j} D_j}$$

SI_j	=	significance index of pipe j
Q_j	=	pipe flow
L_i	=	pipe length
$Chw,_j$	=	Hazen-Williams factor of pipe j
D_j	=	pie diameter

Source: Arulraj and Rao, 1995

- *Fire Hydrants:* Because of the incessant bush fires in summers in Unity State, the consultants recommend that fire hydrants be placed in areas with fire risk, town centres, institutions like hospitals and schools, industrial areas, and markets etc. The distance between fire hydrants shall be 65-100m, and in residential areas 150-200m. As noted by the Hydraulic modelling consultant, a redesign of pumps and pipes will need to factor in fire demand. For the Fire Hydrants –Dry Barrel, a potentially damaged hydrant is not going to leak. Moreover, illegal water use is impossible without access to the (underground) valve and finally, the freezing of water in the hydrant is prevented. Alternatively, the wet barrel hydrant will be full with water all the time, allowing potential risks but also more prompt operation. Apart from firefighting, hydrants can be used for pipe cleaning, flushing of streets, or to take samples for water quality analyses. Fire hydrants are usually painted in bright colours: yellow, red, orange, etc., coding the various capacities of the hydrants. The hydrants above ground are easy to detect but they are considered as an anaesthetic; they can be damaged by cars or vandalised for illegal water use.

Figure 3: Pic showing a fire hydrant

- *WASH-OUTS (i) Washouts:* Table 10 above presents findings of the state of cleanliness of pipes with an effect on the final quality deteriorated physical quality at the tap. This is ab even bigger problem in Rubkona SWAT. The number of low points and hence the number of wash-outs should be kept to a minimum. Washouts should be placed only at low accentuate points on raw water and clear water mains of inside diameter 80 mm or larger. In this context it may be considered that a low point is accentuate if the succeeding major high point is situated on a 10m higher level. Assuming shear stress of 10N/m^2 on the walls of the main pipe and an available pressure of 0.1 – 0.2MPa the diameter, d, of the washout should be:

d = 0.6D If the upstream and the downstream sides of the main are washed simultaneously

D = 0.4D If only one side is washed at a time

Where:

d is the diameter at the wash out in mmm
D is the diameter of the main pipe in mm

(ii) *Wash-out valve:* There shall be a valve only on the wash-out pipe and **not** on the main pipeline unless the valve can be combined with the section valve

(iii) Drain: There shall be an open drain leading the water from the wash out to a suitable stream or discharge point near-by.

- *Section Valves:* Section on mains (≥80mm) should be located a distance of 2-3KM for rural areas about 0.5KM for urban areas. All branch lines should be valves at the connection. Pumping mains must not have any section valves outside of the pump house. The vales should be placed in such way that rationing of water can be done by closing suitable parts of the supply for certain periods. Whenever possible the section valves should be placed in a joint valve changer with air-release valves or wash outs **upstreams** of these valves. In urban areas where firefighting is provided for there should be an isolating valve downstream of each fire hydrant.

- *Break Pressure Tanks (BPTs):* As recommended by the Hydraulic modelling consultant on redesigning and also with the possibility that the PoCs and IDP Camps at the Hub might be dissolved, with people returning to their homes and communities to resume normal life, the elevated tanks in both utilities might need to be raised in height 1.5 or two-fold to provide more pressure in order to meet the demand of the increased coverage. Problems portend of excessive pressure in the vicinity of the respective utilities. McKenzie et al., (2002) pointed out that through considerable research, it has been shown that burst frequency is very sensitive to maximum system pressure. An effective leakage management strategy should take into account the pressure dynamics of a water distribution network. Some of the most important ways of managing pressure is by either using a pressure reducing valves (manual or automatic) (PRVs) or by using variable speed pump controllers (VSDs). A leak management strategy comprises active leakage control, asset management, pressure management and repairs (Pike, 2007). Such factors affect the management of leakages and hence leakage economics.

  It is against this back-drop that break pressure tanks will be required in pipework in the immediate vicinity of respective water utilities as dictated by a well-calibrated hydraulic model. BPTs should be used to keep pressures within design limits and to make it possible to use lower pipe classes hence minimize the costs of the pipeline. They are preferable to PSVs and VSDs due to ease of maintenance. BPTs should be combined with the balancing tanks whenever feasible. The volume of the tank should be large enough to give a retention period of minimum 2 minutes. They should be:
  - Be covered and have a lockable man-hole
  - Have inlet pipes which end near the floor to prevent air entrainment by falling jet
  - Have an overflow placed at least 50mm above the normal top water level and which allows the overflowing water to be seen in operation
  - Be designed so that the ball valve is easily accessible from the manhole bit not block the same
  - Have a valve on the inlet pipe

- *Valve Chambers:* Valve chambers should be at least 1000 x 1000mm internally. There must not be UPVC-pipes within the chamber. The cover should be lockable. The chamber should be drained through the floor or through a drain pipe.

- *Distribution Points* (i) Individual Connection: Individual connection lines to schools, hospitals, health centres and dispensaries should be included in the main design. Other connections will be designed and laid by the local water administration as the need arises.
  (ii) Meters: It shall be assumed that all individual connections will be metered. Meters for the first 3 years after the commissioning of a supply shall be included in the bills of quantities. "It is highly recommended that all distribution main lines are fitted with zonal meters to monitor eventual losses." More information on meter management can be found in the Manual.
  (iii) Communal Water Points (CWP) and Kiosks ***(a) Siting in Rural Areas:*** The water points should be sited so that the maximum walking distance for 90% of the water users will be approximately 0.5km, 1km and 1.5km in high, medium and low potential areas respectively. However the number of water users per water point should be in the range of 200-500 which should be achieved by adjusting the walking distances if necessary. The water points should be placed on high ground to facilitate the drainage of spilt water and to make the point serve as an air-outlet from peaks in the distribution pipe. The positioning of the water points should be made in co-operation with the beneficiaries and the chiefs from the areas. ***(b) Siting in Urban Areas:*** The maximum walking distance in low class housing areas should be approximately 100m and the number of users per water point should be between 100m and 480m. However the local water collection habits, the number of IC in the area etc. should always be considered before siting the water points. Standard and type drawing of CWP and Kiosks should be used, when available in the Ministry. Each water point should be installed with a stopcock in a valve chamber near the water point. There should also be preparations for the installation of the water meter in the valve chamber. The piping within the valve chamber and between the chamber and the taps should be made of galvanized steel. There should be proper drainage from the water point. If the terrain is too flat to allow natural drainage away from the point, a soak-pit or a soak-away trench should be made.

Managerial

- The first step to the **commercialization of water services is metering.** All the stands should be metered. It was noted that illegal connections is prevalent particularly amongst the state Government officials. With the promise to have a bill that governs the working of the Water Board and with the Government acquisition of the two utilities, the next should be selling water and good asset management, which takes care of NRW. Also, leakages have the effect of affecting pressure in the systems, hence lower hydraulic performance of the system. Education of the communities should precede punishment by law as this is the first time the community is paying for water. This should be followed by a robust training program on database management and NRW in general. Bulk water meters and District Management Metered Areas (DMA) should be introduced.

Figure 4: A newly installed Household meter in a House in Dar Es Salam

- **Network Extension and Coverage Improvements** is seen as critical to overall sustainability of the stations. Both stations only serve a fraction of the population in their service areas. The Boards will therefore work out ways to improve coverage. This will result in higher volumes in water sold and hence revenues for the station.
- The two Boards should also contribute **to Improvements in Technical Operations and Maintenance** by monitoring service delivery issues including reductions in NRW, distribution efficiency (through metering, reduction of leakages and compliance with Water Quality standards).
- **Improved Commercial Operations** through proper billing and customer account management will be essential to ensure higher revenues and accountability. The two boards will support the town council management to ensure that this is achieved.
- **Customer Orientation and Care:** The success of any utility can in many cases be measured against the customer satisfaction index within its service area. The committee will therefore support the station to adopt a customer-centric management policy and attitude focusing on improving the customer's experience
- **The Departments proposed for the management of the Utility should be categorized into three –** Technical, Managerial, and Finance & Marketing. Legal and audit department shall be cross-cutting. Within the board set up, the heads of these departments should also have similar knowledge and experiences.
- All **repairs, replacements, rehabilitations** should be recorded neatly and stored safely as these for a strong basis for management decisions.
- **Map for maintenance purposes** (of smaller scale that have more detailed information) have to be kept by the utilities. These have to show the location of service pipes, major valves, domestic connections etc. This is then used for various purposes, such as the roughness of pipe estimate in computer modelling, projection of asset value, remaining economic life time, and the optimal timing for pipe replacement, as well as the selection of an adequate pipe cleaning program. A similar map showing water metering of service connections is the primary source for billing of

consumers but is also effectively used for the design of nodal demands and calibration of computer models.

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[3] WASHFIN Program for USAID is SUWASA's next phase

7.0 ANNEXES

Annexe 1: ToR for the formation of Water Utility Management Policy Framework, Management

Consultancy for Formation of Water Utility Management Policy Framework, Management Team and Training

1. Background

Protracted conflict and associated economic decline in South Sudan continue to take toll on consistent access to basic services by the people. Services like water supply and hygiene services have been severely affected across states within the country. Access to improved water sources remains challenging across Unity State. Concern began working in Unity State in January 2014 in response to the 2013 political crisis thanks to support from donors such as USAID, UNICEF, and DFATD/GAC. As people fled to Bentiu PoC, Concern's team established WASH, shelter/NFI and nutrition activities in the PoC, and also expanded these more to locations in wider Unity as part of the Beyond Bentiu Response.

In Rubkona County, Concern operates a water supply network serving the communities of Rubkona surface water treatment (SWAT) and Bentiu conventional water treatment plant (WTP) towns through communal water points, water kiosks, individual tap stands and commercial business. People are using donkey carts as well as water tankers to access water from the water treatment plant and the Rubkona emergency SWAT system. In the recent past, the two towns have seen an influx in the number of people settling in these locations in the aftermath of the signed peace agreement in South Sudan. This has put further pressure on the existing water supply systems.

A willingness to pay survey was conducted to investigate 1) the various sources of water available to the households in the two towns which are benefiting from the Rubkona and Bentiu water supply systems, and 2) their willingness to pay for improved water services. The results of the assessment revealed the willingness of the community to pay for water. Even though the amount people are willing to pay differed from individual to another for the water service delivery, results indicated that there is an overwhelming agreement among the population that there is a need to improve water governance.

Results from an assessment showed that there is no guiding policy for how this is to be done. A policy framework is key in guiding the implementation processes, in addition to defining the various services required and outline of the operational aspects involved in the decision to charge for water.

Concern has secured funding from UNICEF for the identification and formation of a utility system, which includes a utility management team that will manage the treatment and supply systems in Unity State. This will include training utility management teams to take over service delivery.

Concern, therefore, seeks a competent consultant/team of consultants to lead in the formation and training of a utility management team to run the system.

2. Purpose of the Consultancy

The overall purpose of the consultancy is to develop a policy framework to guide the management of the Bentiu conventional water treatment system and the Rubkona emergency water supply system, support Concern staff in the identification, formulation and training utility management teams for the running of each. The consultant will also provide recommendations on how to set appropriate tariffs setting as well as simple guidelines for drafting bylaws to support the operations and provide training for stakeholders on the implementation of the guidance.

4. Objectives and Specific Tasks to be undertaken by the Consultant(s)

1. Development of an Assets Registry

This will include a review of the current status of both water supply systems, their efficiency and future needs. This will include a review of the structures in place to support asset management, taking into consideration the conditions of the physical infrastructure. The consultant will provide recommendations for prioritizing investments for any future new systems, expansions or improvements, and the replacing components of the existing systems. This will include comprehensive data on the age and condition of the existing infrastructure.

2. Support the State Ministry in formulating operations by-laws.

The consultant will define the roles and responsibilities of the Ministry, Town Councils and / or the private sector in sustaining, operating and maintaining the water systems and associated by-laws. This will include guidelines on obtaining legal status, if applicable, and facilitating moderation in case of conflicts, helping solve disputes as they may arise.

3. Development of a business plan for the two water systems

The business plan is to be designed as a roadmap, primarily aimed at the Ministry and the Town Council, towards transferring service delivery to government agencies. The plan will include a snap shot of the existing enabling environment for conducting business, technical feasibility and commercial viability of the water supply system. This will include suitable contingency plans.

The business plan will include recommendations to the State Ministry for appropriate tariff structures for the two water supply systems. This should be based on guidance from the Willingness to Pay survey, and should consider the different costs necessary to provide a sustainable service and to what degree these categories can be covered by the tariffs;

The Business Plan will include set guidelines for the formulation of necessary documents - including water connection application forms, metering etc.

4. Development of Institutional Support Packages

In close collaboration with the Ministry, the WTP operators, and the water users, develop multiple training/support packages on topics identified as critical to ensure sustainability of the water supply systems, as well as the governance framework.

5. Utility Management System

Identify any need for replacement of existing systems of management (managing resources).

Lead in identifying and putting in place a utility management team which will be able to manage and technically support the day to day operation of water treatment units and can be able to implement new systems with a capacity of planning, assessment, design and supervision of projects.

Formulation of tools for monitoring of the provision of services (quality, quantity, continuity and coverage of water, administrative operation).

Formulate local accountability mechanisms to support in ensuring effective service delivery to the population.

Methodology

To be developed by the consultant and approved by Concern at the beginning of the assignment.

Methodology must include:

- Meetings with the Ministry of Gender and its key staff
- Meeting with Ministry of Physical Infrastructure and the Ministry of Health
- Meeting with UNICEF and other key stakeholders such as WASH agencies, the WASH Cluster State focal point at Bentiu and if possible with National WASH cluster coordinator.
- After completion of the field, visits and meetings in Bentiu the Consultant should present the findings to Concern and UNICEF jointly and incorporate the feedback.

Operational support:

- Concern will provide basic accommodation in the Humanitarian Hub when in Bentiu.
- Return travel from consultants' home country to South Sudan and local travel within South Sudan will be paid by Concern.
- Consultants are required to follow the Covid-19 restrictions at all times as laid out by the Ministry of Health, South Sudan.

5. Outputs

Final Report

The outputs will be submitted in 3 No. copies for the draft and 3 No. copies for the final. The Consultant shall submit 3 No. electronic Pendrives of the data, training manuals and reports in PDF and original format to the Client.

The report, no longer than 40 pages excluding annexes, will be presented in English and will include at minimum: Preamble covering background information, current running and management of the water supply systems for the two locations, a summary of tariff setting structure, a summary of formulated by-laws and the proposed structure for utility management.

All reports, graphs, training manuals, drawings shall be submitted to Concern in English. The reports shall be in word format, Calibri 12, double spacing, and justify electronic copies. The pages should not exceed 40 pages excluding annexes, drawings, appendices

The following full reports will be presented as annexes:

1. The recommended by-laws, which are to be forwarded to the State Ministry for adoption
2. Complete business plan, including guidelines on tariffs as agreed
3. The utility management model including organograms
4. Different sets of institutional training manuals as packages for all stakeholder groups - the utility management teams, the Ministry and Town Council staff.

The final payment is dependent on the submission of a good quality, well-written final report or completion of agreed outputs (as detailed in the TOR). In addition to methodology, findings and discussion, the report should include a comprehensive executive summary and a section outlining clear and concise conclusions and recommendations. Concern WASH team at Bentiu level, Programme Director and Concern WASH advisor will review the report and provide feedback which must be addressed before payment is made.

A digital copy of all reports will be required by Concern at the end of the piece of work.

7. Timeframe

Due to the nature of the proposed work, the identification of the utility management unit and trainings is expected to take 45 days including Covid restrictions based on the current government policy for quarantining on arrival in country, travel days, field data collection, report writing and submission to Concern. Please note, timeframe may be adjusted at time of contracting to account for any changes in Covid restrictions as set by the government of South Sudan.

Annexe 2: Agenda for Water Governance & LCCA training 2021

Subject: **Consultancy for Formation of Water Utility Management Policy Framework, Management Team and Training, Unity State, South Sudan**
Date and participants: 5 days - aimed at Water Board member

Day 1

Session	Duration	Objective
Introduction of participants, expectations, housekeeping	8.30 – 9.00h	Participants' and the facilitators get to know and understand each other
Session 1: Functions of Water Utility Team (Group work, presentation by the facilitators)	9.00h – 10.30h	To understand the clear cut roles for each of the employees of the two Water Utility
Coffee break	10.30h – 11.00h	
Session 2: Group work	11.00h - 12.30h	For the team to understand the purpose of having a Utility Management Team
Lunch break	12.30h-13.30h	
Session 3: Presentation of the water Systems	13.30h - 15.00h	To have an oversight organ for which the Water Utility will be accountable to
Coffee break	15.00-15.30h	
Session 4:	15.30h – 17.00h	Ditto

Day 2

Session	Duration	Objective
Recap of day 1	8.30 – 9.00h	
Session 5: Company	9.00h – 10.30h	For the board members to know their functions as interim water utility
Coffee break	10.30h – 11.00h	
Session 6: Oversight role of the on the Water Utility	11.00h - 12.30h	For the Water Utility Teams to understand the different models of Water Utility Management
Lunch break	12.30h-13.30h	
Session 7: Group work - Accountability: Service Charter, Important communication mechanisms, Corruption, Complaints/Criticisms handling, regulation of unscrupulous practices, KPIs – Key Performance Indicators		For the respective Utility Teams and the Board to know their assets and values
Coffee break	15.00-15.30h	
Session 8: Presentation	15.30h – 17.00h	Presentation by the facilitators on Asset Management and LCCA

Day 3

Session	Duration	Objective
Recap of day 2	8.30 – 9.00h	
Session 9: Utility Management Models – including organograms	9.00h – 10.30h	**(The Water Utilities to break and discuss the models that best suit them and give the reasons for their choice)**
Coffee break	10.30h – 11.00h	
Session 10: Introduction to Tariff setting - presentation of the different models of tariff, the setting, advantages and disadvantages of each model	11.00h - 12.30h	Asset Management and Life Cycle Costing (Groups to present a Matrix Table of: Asset, Value, Status, Problems, Frequency of the problem, Remedy)
Lunch break	12.30h-13.30h	
Session 11: Group work – the two groups break to set tariff and make presentation	13.30h - 15.00h	Presentation by the facilitators on Asset Management and LCCA – cont'd
Coffee break	15.00-15.30h	
Session 12: Ditto	15.30h – 17.00h	

Day 4

Session	Duration	Objective
Recap of day 3	8.30 – 9.00h	
Session 9: Asset Listing and Aseet Management	9.00h – 10.30h	For the participants to lean the prioritization matrix for asset replament taking care of the manufature's catalogues and standard design periods. Also for a proper valuation and make choices taking into LCCA into account.
Coffee break	10.30h – 11.00h	
Session 10: By-laws Role play: Group 1: Conflict resolution Group 2: Customer care Both Groups: Ethical Practices	11.00h - 12.30h	For the group to have a a proper name of thr utility board, learn its legal jurisdictions and how these laws govern the utility management, customer relations as well as the Government
Lunch break	12.30h-13.30h	
Session 11: Financial Management	13.30h - 15.00h	For the group to be aquinted with Double entry cashbook, balance sheet, financial reserve, debt service e.t.c. along side other finaicial concepts
Coffee break	15.00-15.30h	
Session 12: Long range planning	15.30h – 17.00h	Foe the participansts to be able to use the LCCA information to do plan that will not only make sure that production is satifctory to consumers, but also recorgnizes asset management.

Day 4

Session	Duration	Objective
Recap of day 4	8.30 – 9.00h	
Session 9:	9.00h – 10.30h	
Coffee break	10.30h – 11.00h	

Session 10: Role play: Group 1: Conflict resolution Group 2: Customer care	11.00h - 12.30h	For the team to know how to resolve conflect as and when they arise without the need to an ecterna arbitrator
Lunch break	12.30h-13.30h	
Session 11: Accrual Accounting	13.30h - 15.00h	For the team to be aquinted with accrual accounting basics that are instrumental in running complex organizations
Coffee break	15.00-15.30h	
Session 12: Accrual Accounting	15.30h – 17.00h	Ditto

Day 5: Any pending topics that was not sufficiently exhausted within the four days. This day was for Business Plan Development and Action Planning

Annexe 3: List of Participants

S/no	Names In full
1	Peter Gatduel Mayik
2	David Batheng Ruot
3	Marieak Jany Kier
4	Mayiel Gany Guigui
5	John Wuor Gatnyai
6	Mut Geng Chiek
7	David Gatwich Tut
8	Nhial Gai Bong
9	Gatmai Gatkuoth
10	John Manythot Wichoth
11	Kuany Juor Gai
12	William Riak Dual
13	Diu Ruach Nyoat
14	David Dhoal Yar
15	Gatphan Magok Hoth
16	Norino Jagei Mut
17	Nyagai Gatdet Dak
18	Ran Thot Gatkek
19	Teresa Nyalam Chan
20	Peter Thuok Rundial
21	Kuok Gatdor
22	Isaac Ter Luony

Annexe 4: Training Content

Day 1:
Role of a Water Utility:

- Collection of technical data (mapping)
- Design and computer modelling of main network
- Financial aspect of the design and operation
- Maintaining of the network operation (control centre)
- Control of major consumers
- Meter reading and billing of consumers
- Central administration and revenue collection
- Construction of the network and service connections
- Preventive maintenance (repair and cleaning)
- Respond to failure service
- Installation and maintenance of water meters
- Leakage detection and repair
- Water quality sampling control activities
- Control of indoor installations
- Connection and disconnection of consumers
- Management of the stock of spare-parts
- Measurements in the network (flow, pressure)
- Registration of the technical data
- Administration of activities

- Oversight: should always be aware of how the organization is functioning and how resources are being used to ensure that the organization is complying with all laws and regulations.

Indicators of a Sustainable Water Utility

The facilitator noted that a system is said to have achieved sustainability when:

- Its management is institutionalized (goes beyond the key people involved now and will continue once those people are not involved);
- Its operation, maintenance, administrative and replacement costs are covered at local level (through user fees for example);
- It can be operated and maintained at the local level with limited but feasible external support (for technical assistance, training and monitoring); and
- It does not affect the environment negatively.

Triple "A" test

Affordable: myth and assumption is that poor people do not want to pay for water and that serving poor neighbourhoods would lead to a loss. In contrast, Many poor people do pay for water (and usually at a higher price per litre than rich people with water connections) .They do, however, require revenue collection systems that are flexible and innovative and fit with the patterns of their personal income and flow. Poor people need equity and fairness i.e. treat similar customers equally and customers in different situations differently.

Accessible: the water supply systems is within a reasonable distance of the homes of all residents of that town or city.

Adequate: the water supply systems provides enough water of safe quality for enough hours daily to provide everybody with the minimum amount to meet basic needs

Required Minimum Service Level (Code of practice)

- The World health organization and the government require providers to ensure efficient, affordable and sustainable water supply and sanitation services within the service areas.
- This implies that the providers must guaranty a certain and defined level of services to the customer for a specified price ensuring therefore "value for money".
- Requirements regarding the price of water aiming at full cost recovery and social feasibility, as well as, standards for a minimum service level are some of the main instruments of regulation necessary to balance the interests of the providers and the consumers in a market with limited competition.
- **First Service Level Agreement**: To start the cycle of Service Level Adjustment Agreements the provider shall propose a First Service Level Agreement.
- **Service Contract**: A contract signed between the provider and the customer containing the rights and obligations of each party. The Service Contract has to contain a clause indicating that regulations issued by the regulator are part of the contract and prevail in case of differences.

BACKGROUND

- According to the 2010 Country Status Overview (CSO) Report prepared by the Water and Sanitation Program, operation and maintenance of urban water supply facilities in South Sudan was poor and South Sudan Urban Water Corporation (SSUWC) did not have sufficient autonomy to allow good performance.
- At the same time individual Urban Water Corporation (UWC) station revenues were not ring-fenced but rather, transferred to the Ministry of Finance and Economic Planning (MoFEP) Block Account in the capital city Juba. It was also observed that SSUWC was fully dependent on the Government allocated annual budget as its revenues were insufficient to cover operating costs.

Management options available in government reforms

There are two main ways that urban water systems can be run:

- As a public utility
- As a profit-making private company

There is also a range of other options such as cooperatives and social businesses, i.e. businesses that reinvest their profits in the business in order to achieve social goals than benefit the shareholders. A public utility is often criticised for poor service[4]. This is the reason for water sector reforms

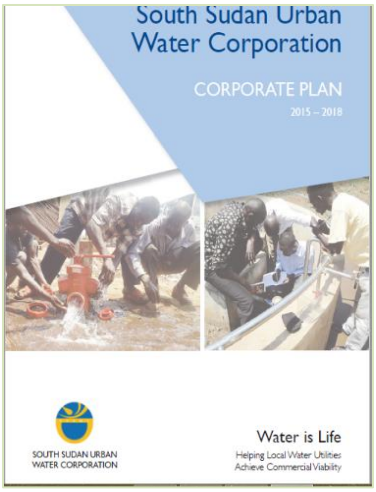

Figure 5: A picture showing blue print of the South Sudan Urban Water Corporation Plan

South Sudan water sector reforms - SUWASA – USAID – 2013

The urban water component had three specific objectives:

I. Support the establishment of a clear institutional framework for urban water supply in South Sudan
II. Set up a Framework for Local Government Participation in the Management of Local Water Stations
III. Development of a framework for local government participation in management of the local water stations in line with policy

The Urban Water Sector Reform Initiative was signed on November 3, 2011 by MEDIWR and the SSUWC with GIZ, JICA and SUWASA as witnesses

Day 3:
Factors to bear in mind When Designing Tariffs:

Cost recovery – for the water utility

Economic efficiency – water resources that are available in the town or city are used in an optimal manner by different consumers

Conservation of water resources: water is not wasted by the utility or consumers

Equity: water tariffs fair for all consumers and services offered by the utility are fair

Affordability: every human being has a basic right to access water at an affordable price

Simplicity: tariffs should be easy to explain, understand and administer

[4] Water Aid (2007), our water, our waste, our town supporting civil society to engage in urban water and sanitation reforms Guidance manual

Enforceability: water bills need to be easy to pay

Ease of payment: revenue collection systems need to be flexible and responsive to the circumstances of different consumer groups.

APPLICABLE TARIF MODELS

A. Monthly fixed rate

Advantages

- It's cheaper than installing, maintaining and reading meters and avoid more complex billing system required of metered tariffs
- It provides the utility with stable cash flow if set at an appropriate level

Disadvantages

- Consumer have no incentive to economise
- Allow water customers with water connections to supply to other users such as vendors and unconnected neighbours without an additional charge
- People who use large quantities of water pay the same as those who use little
- Household are unable to reduce their bills by cutting down on their water use

B. Volume of water used

If the tariff is "volumetric", then the volume consumed must be measured in some way, which usually means meters are required.

1. Uniform volumetric charge

In this systems a household's water simply the water bill multiplied by the price per unit of water.

Advantages

- It's easy for consumers to understand
- People pay according to how they actually use
- People can reduce their bills by limiting the amount of water they use

2. Block tariff

This is where the price per cubic meter of water depends on the volume used in total. A common system is to charge a low price for the first 10 cubic meters and then a high price per cubic meter of water beyond this level. Increasing bock tariffs (IBT) are very common and can provide incentives to conserve water because the more is used the more expensive it becomes.

Disadvantages

- costs more to install meters and meter readers and a more complicated billing system is required

C. TWO-PART TARIFFS

The consumers' water bill is based on a fixed charge and a charge related to the amount of water used. The fixed charge is often a fee for installing a meter in someone's home or the cost of maintaining the fixed assets of pipes, pumping stations etc.

II. METERS

All tariff structures, except fixed rates, require a meter to measure the volume of water supplied. How much the meter costs depends on how accurate and durable it is. A suitable meter for the water points is a half-inch mechanical meter (Woltmann brand) is available in Juba at around US$ 70.

There are two options for paying for the meter:

- It can be paid for by the consumer as part of the connection charge, either as a lump sum or spread over time
- Its cost can be considered part of the system's operating cost and added on the water charges over time.

Advantages

Consumers pay for the amount of water they use.

- For poor people who don't use much water, paying for a meter (which can cost up to $50) could take several months.
- Meters allow more complicated billing systems such as increasing block tariffs, which can be difficult to understand

Other advantages included:

- Speedy connections: to new customers – usually within 48 hours
- Reduced non- revenue water: staff and resident monitor pipes or hoses above and respond quickly when pipes are damaged.

Models of Management, the Life Cycle Costing Approach, Financial Management and Board Ethics

Models of management

Structural Adjustment Programs (SAPs) in the 1980s by the World Bank and International Monetary Fund (IMF)

1) Public Management
2) Turn Around Management
3) Private Sector

The facilitator explained to the participants that this was a continuum where Public Management side is on the low end where the Government has 100% control while in the Private Sector end of the continuum, the Government has zero percent control. The Private sector is the converse in the continuum.

Until recently the World Bank has argued for three points:

1) There is need for massive investment in urban water supply, sewerage and sanitation
2) Major changes in the ways water utilities operate are pre-requisite for changes
3) These changes are required urgently

Private sector participation would accelerate the introduction of modern management techniques. Increasing attention is now being given to reforming public utilities. Priority to expanding the water network to poor neighbourhoods (connections). The utility accepting a universal service obligation/service charter i.e. responsibility for serving all of the area, especially those areas beyond the water supply network which require service by other methods. Priority in adequate levels of service provision. The following, were recommended:

- Private players should guarantee of good quality water
- Private players would bring in technical, managerial and customer focus necessary in generating revenue through cost-reflective tariff from the users
- A commitment to higher standard of environmentally responsible water resource management (wetlands, ground water, waste water management.)
- Priority stronger management of the utility, such as:

    - Increased financial and management autonomy
    - Improving corporate oversight and public reporting
    - Setting clear and agreed performance targets
    - Increased customer orientation
    - Good governance – expanded opportunities for all sections of the area to have a voice in setting investment priorities and guidelines for operation; full and timely reporting on performance etc.
    - Separation of roles (ownership, operations, policy setting, economic regulation, environmental regulation, finance etc.)
    - Incentives for management and staff to achieve expanded coverage and improved service levels.

ANTI CORRUPTION IN THE WATER SECTOR

What is corruption?
It is the abuse of entrusted power for private gain.

"The crisis of water is a crisis of water governance, with corruption as one root cause." (Transparency International, 2008)

The definition of corruption by Klitgaard (1988) points towards the monopolistic and discretionary control of resources found in many (non-)governmental structures and organizations show in box 2 below:

Box 4: Corruption Equation

Corruption = Monopoly + Discretion – Accountability

- Corruption may occur in different forms, including embezzlement, bribery, or patronage /nepotism. It may occur on administrative and operational levels (petty corruption), in high-level decision-making processes (grand corruption), or even in the design of a country's policy and legal framework (state capture).
- Openly addressing corruption among government officials or service providers would in many cases have serious and negative consequences for the working environment
- Indeed, it can even be dangerous to expose corrupt practices openly to the public eye.
- Corruption impairs the effectiveness and predictability of public institutions and leads to the siphoning off for personal use of public funds that ought to be employed for sustainable and socially inclusive development.
- Sound structures and checks and balances in national and local institutions.

The main elements of corrupt practices

1) Abuse: behaviour that deviates from established entrusted power: either appointive (bureaucrats, managers) or elective (politicians) – including the private sector; and
2) Private gain: cash, material goods, status, power, benefits to relatives (which may occur years later).

Corruption flourishes wherever an individual or individuals have a monopoly on a good or service (as is often the case in the water sector), decide at their discretion who receives that good or service and for how much in compensation, and have no incentive to adhere to standards and practices of transparency, accountability and integrity in decision-making

Principles of good governance relevant to anticorruption

- **Transparency:** Access of consumers /water users to information, public understanding /supervision of decision-making processes, clearly defined rules and responsibilities
- **Accountability:** The obligation of institutions and individuals to answer for their actions and decisions. Capability of civil society and governmental supervisory bodies to scrutinize public action and hold decision-makers responsible. Consumers having the right to complain and be accorded appropriate decisions in good time and in accord with binding regulations.
- **Participation:** Meaningful involvement of stakeholders (including underserved citizens, water users, vulnerable groups) in decision-making processes in water use.
- **Integrity:** Need for public, private and civil society representatives to be honest in carrying out their functions and abstain from corrupt practices
- **F**inancial resources are allocated or transferred (among stakeholders or institutions)
- Decisions are made (political, structural, staffing) in a context in which roles /functions are not separated but concentrated in few individuals (e.g. politicians making decisions related to service delivery, board directors having a stake in a water utility's business) and /or other resources are exchanged (goods, services, information, etc.).

Box 5: Customer Complaints Boxes

The participants agreed that a Customer Complaints Box shall be put at a conspicuous public place. They selected the Commissioners and the Director Generals offices as the place where customers can access the Complaints Boxes.

PUBLIC UTILITY

Over 90% of water utilities are run as public utilities. Many face difficult management challenges and provide very poor services. Public water utilities are often limited by under-investment and political interference (can be addressed by good political will). This has happened in Kampala in Uganda, Tamil Nadu in India, Recife in Brazil and Phnom in Phen Cambodia with reforms, these utilities have expanded their services to reach more people, moved toward cost recovery and reduced the amount of water through leaks.

Challenges in public utility turn around

- Public water utilities can be undermined by excessive bureaucracy as they tend to be modelled on government ways of managing people, programs, budgets, investments etc.
- Sometimes public staff are appointed on grounds of nepotism and politics rather than because they are right for the job
- Public utilities trade unions may resist change; they have to be brought along in the reform process
- Need to address insufficient pay for utility workers

PUBLIC UTILITY TURN AROUND MODEL

New knowledge and skills developed during the reform process are more likely to stay in the country if the public utility remains with the public sector. A public utility will respond to unanticipated issues and events during the reform process in a manner that serves the national interest. The private sector will perceive these as beyond its contract and seek more money

Challenges in public utility turn around

- Challenges to turn utilities performing poorly around will not happen overnight.
- Unless Leaders capable of making changes are selected by the board, changes will not happen.

PRIVATE SECTOR MANAGEMENT MODEL

How PPP/PSP management options work

A private company is contracted and paid to help a public utility deliver a water system. This should relieve some of the responsibility from the public utility so that its staff can focus on what they can do well or learn how to better perform on what is required. There **are five major ways** in which a private company might be contracted to provide its skills and knowledge in the management of a water utility. These are discussed below. The sixth PSP option – privatization.

Public-Private Partnership Options

A review of the literature reveals that PPP options ranged along a spectrum - at one end are those in which the government retains full responsibility for operations, maintenance, capital investment, financing, and commercial risk; while at the other, are those in which the private sector takes on much of this responsibility[5]. Based on this premise, PPP options fall under six broad categories, namely, service

[5] *World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.*

contracts, management contracts, leases, BOT/BOO, concessions, and divestitures. The basic features of these five categories of PPP models are shown in figure 9.

Figure 2: Public-private partnership models[6]

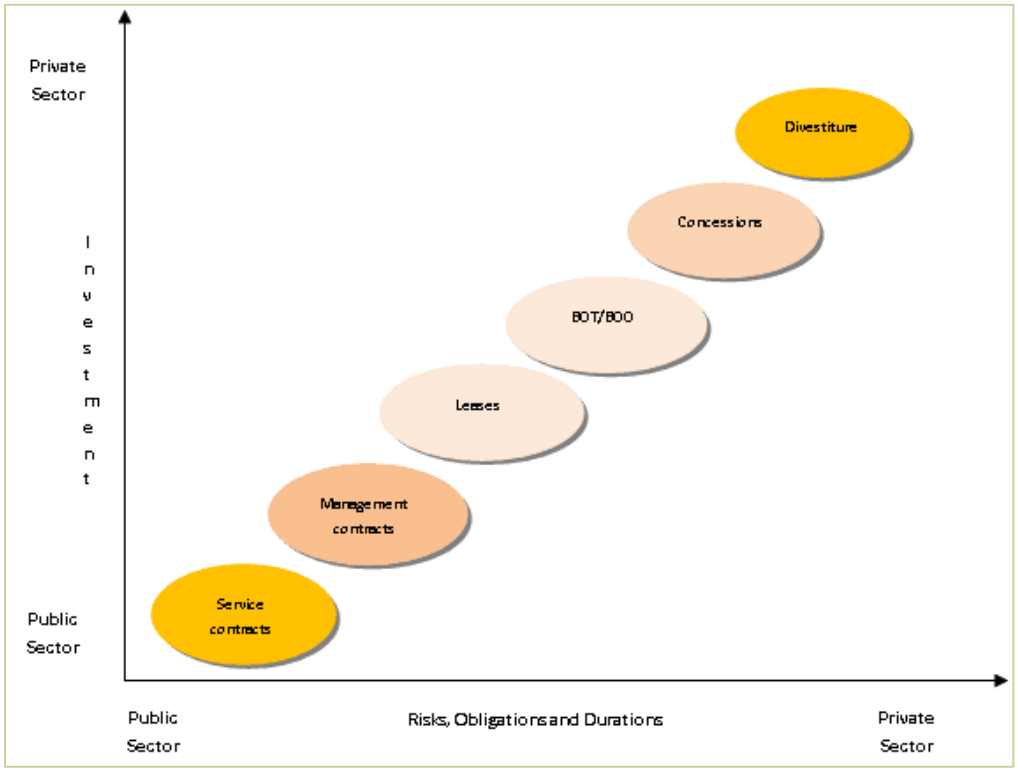

Figure 6: Continuum of PPP Contracts showing the Investment needed versus the complexity

While selecting the most appropriate model(s) to be adopted individually or in combination, it is important for project staff and key partners to understand the key attributes, strengths, and limitations. Table 35 below provides a detailed categorization of the PPP models together with their main characteristics. Whereas models shown in the table can be adopted as individual options, combinations are also possible; for instance, a management or lease contract for existing water and sanitation facilities may incorporate provisions for expansion under the Build-Operate-Transfer (BOT) model[7], or BOT contract for bulk water supply might be combined with a lease contract for operating the distribution system[8]. In this regard, Philippe and Izaguirre point out that many PPP projects of recent times are of combination type[9].

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[6] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.

[7] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.

[8] World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.

[9] Philippe, M. and Izaguirre, A.K. (2006). "Private participation in water toward a new generation of projects." Gridlines Note No. 14. September. Washington, DC: PPIAF. Available at http://info.worldbank.org/etools/docs/library/24 0096.pdf

Table 10: Characteristics of Public-Private Partnership Models[10]

PPP option	Asset ownership	Operations & maintenance	Capital investment	Commercial Risk	Contract Duration (Years)
Service contract	Public	Public & Private	Public	Public	1-2
Management contract	Public	Private	Public	Public	3-5
Lease	Public	Private	Public	Shared	8-15
Concession	Public	Private	Private	Private	25-30
BOT/BOO	Private & Public	Private	Private	Private	20-30
Divestiture	Private or Private & Public	Private	Private	Private	Indefinite (but may be limited by license)

Notes:
BOT => Build-Operate-Transfer
BOO => Build-Own-Operate

Service contracts

Service contracts are contractual arrangements for the management of part or entire public project by private sector operators. The model allows private sector to provide services such as installing or reading water meters, monitoring losses, repairing pipes, or collecting bills[11]. Besides, it provides opportunity for private sector efficiency, expertise, and technology to be injected into public service delivery[12]. The contracting authority uses competitive bidding procedures to award contracts to the most competitive bidder from the private sector. The successful private operator is then assigned specific responsibilities concerning a service, but does not assume commercial risks.

The private operator is paid a predetermined fee to manage and operate services, which may be a fixed fee, on a cost-plus basis, or for compensation based on the volume of service provided,[13] and attainment of performance targets set by the public sector[14]. Consequently, the operator's profit increases if it can reduce its operating costs, while meeting required service standards. Typically, the contract period ranges from 1 to 2 years, but may be longer for large and complex facilities such as sea and airports[15].

Service contracts are the most common form of private sector participation in developing countries. They ensure satisfactory service at a reasonable cost provided there are a sufficient number of qualified operators to constitute a competitive market. The model can be adopted in tandem with more comprehensive types of private sector participation[16].

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[10] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.
[11] World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.
[12] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.
[13] Ibid
[14] Philippe, M. and Izaguirre, A.K. (2006). "Private participation in water toward a new generation of projects." Gridlines Note No. 14. September. Washington, DC: PPIAF. Available at http://info.worldbank.org/etools/docs/library/24 0096.pdf
[15] Asian Development Bank (2010). Public Private Partnership Handbook. Manila, AsDB.
[16] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.

The good point about the model is that it is the simplest of all PPP arrangements, most flexible and can be implemented within a short time[17]. In this regard, the model can be used to meet short-term emergency or personnel shortage or to transfer operational responsibility from the public to private sector[18]. Furthermore, they take advantage of private-sector expertise for technical tasks or open these tasks to competition. In this way, it allows for the entrenchment of competition and good governance in the water and sanitation sector. Barriers to entry are also low given that only a discrete service is up for bid[19].

However, the model has some limitations; for instance, the private sector has no financing obligations, thus, lacking incentive for innovation and expansion. Consequently, the model is unsuitable if the main objective is to attract capital investment. Besides, the model is limited to existing infrastructural projects only suggesting that it may not be appropriate for facilities that are yet to be constructed[20].

Given that the government bears all the commercial risks, the model may be compromised in the event that finances expected from donors do not materialize. The government remains in charge of tariff setting and assets, both of which are vulnerable to political manipulation, thus, affecting project sustainability[21]. Service contracts are at best a cost-effective way to meet special technical needs for a utility that is already well managed and commercially viable. They cannot substitute for reform in a utility plagued by inefficient management and poor cost recovery.

Management contracts

This type of PPP arrangement is more comprehensive than a service contract. Management contracts transfer complete responsibility for the operation and maintenance of government-owned project facilities to private operators and the freedom to make day-to-day management decisions[22]. Under this model, the private operator is selected through a competitive bidding process and the contract duration range from 3 to 5 years.

The government encourages facility maintenance through payment, which may be pegged on two ways. The simplest can be a fixed fee for performing managerial tasks and other anticipated operating costs, while more sophisticated management contracts can introduce greater incentives for efficiency, by defining performance targets and basing remuneration at least in part on their fulfilment[23]. However, the government assumes all commercial risks such as a decline in revenue and retains the obligation for major capital investment, particularly for facility expansion or improvement. The government is also responsible for regulating tariffs[24].

The model is advantageous, particularly to the private sector because it provides opportunity for operators who may wish to assess challenges inherent in a sector before making commitments that are

[17] *United Nations (2011). A Guidebook on Public-Private Partnership in Infrastructure. Bangkok, UNESCAP.*
[18] *Ibid*
[19] *Farlam, P. (2005). Assessing Public–Private Partnerships in Africa: NEPAD Policy Focus Series. Durban: The South African Institute of International Affairs.*
[20] *United Nations (2011). A Guidebook on Public-Private Partnership in Infrastructure. Bangkok, UNESCAP.*
[21] *Asian Development Bank (2010). Public Private Partnership Handbook. Manila, AsDB.*
[22] *Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.*
[23] *World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.*
[24] *Asian Development Bank (2010). Public Private Partnership Handbook. Manila, AsDB.*

more comprehensive. Besides, the contractual agreement is simple and easy to enforce[25]. However, the model may not be a suitable option in situations where a government intends to access private finance for new investments. Because the model does not transfer commercial risks to private operators, it fails to institute internal cost reduction measures for higher returns and better quality services[26].

Besides, the model may not be appropriate for a market lacking a regulatory oversight with capacity to monitor project performance and enforce contractual terms. Once a provider has been contracted, it may be difficult to change contractual provisions; hence, the need for an effective regulatory oversight to ensure that the operator lives up to contractual obligations[27].

Lease/Affermage

Lease contracts are more comprehensive than management contracts, where the private operator rents existing facilities and assumes total responsibility for operation, maintenance, and service delivery. Under this model, the private operator collects tariffs from users, retains an agreed proportion and pays the remainder to the public authority as a rental fee. If the agreed rate is based on collection efficiency, then the operator has the incentive to increase collections, reduce costs, and generally improve efficiency to boost the profit margin[28].

Because the lessor acquires the rights to operate project facilities, it assumes much of the commercial risk of the operations. In this regard, the operator is required to finance working capital and replacement of equipment such as vehicles, pumps, and generators. However, ownership of the facilities remains in the hands of the public authority, who also assume liability for major fixed assets[29]. This suggests that the authority finances the construction and establishment of facilities; thus, the authority also takes responsibility for investment risks, while operational risks such as losses and debts are transferred to the operator[30].

The good points about this type of model are that it most appropriate where government priority is to increase operating efficiency of existing project facilities. However, the model has little incentive for the private operator's investments, particularly, where the lease period is less than 10 years. Leases are sometimes advocated for as stepping stones towards more intensive private sector involvement through concessions[31].

More still, there is a risk of the operator reducing the level of maintenance on fixed assets, particularly in the final years of the contract in order to maximize profits. The operators' revenues are derived from user fees; hence, the questions of tariff levels become sensitive, and may spark off disagreements[32].

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[25] Farlam, P. (2005). Assessing Public–Private Partnerships in Africa: NEPAD Policy Focus Series. Durban: The South African Institute of International Affairs.

[26] World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.

[27] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.

[28] ibid

[29] Ibid

[30] United Nations (2011). A Guidebook on Public-Private Partnership in Infrastructure. Bangkok, UNESCAP.

[31] World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.

[32] United Nations (2011). A Guidebook on Public-Private Partnership in Infrastructure. Bangkok, UNESCAP.

BOT/BOO

Build-operate-transfer (BOT) and build-operate-own (BOO) types of PPP arrangements are recent innovations in financing public sector infrastructure development and service delivery. Under both models, private sector operators or consortia build and operate new infrastructural assets in accordance with performance standards set by the government. However, with BOT, the operator has to transfer facilities to the public authority after a specified contract period, whereas under BOO assets remain with the operator[33].

The government pays BOT operator for water from the project, at a price calculated over the life of the contract to cover its construction and operating costs and provide a reasonable return. BOT contracts are founded on the take-or-pay basis; thus, obligating the government to pay for a specified quantity of water whether or not that quantity is consumed[34], which in turn, places all risks associated with demand on the public authority. Alternatively, the government might pay a capacity and consumption charges, which shares demand risks between the operator and the public authority[35].

The PPP models quite common in the water and sanitation sector are BOT and BOO schemes. BOTs have been used for water treatment in such countries as Australia and Malaysia and for sewage treatment in Mexico, Chile, and New Zealand[36]. Under BOT, the contract period ranges from 20 to 30 years, during which the operator is expected to recoup its investments. BOO operates in the same way at the outset, but assets are not transferred; both models ensure investors an adequate rate of return. So far, BOT has had limited success worldwide. Of several hundred projects initiated in developing countries, only about a dozen are operational[37].

Under the two models, the operational and investment risks are substantially transferred to the private operator. However, the government retains explicit and implicit contingent liabilities that may arise due to loan guarantees. BOT and BOO schemes are highly innovative and complex but, when successful, can serve as models to attract additional private investment. However, the models tend to work well if the main challenge relates to water supply, rather than where the challenge is a faulty distribution system or poor collections performance[38].

Concessions

In this form of PPP arrangement, the government defines and grants specific rights to a private operator (concessionaire) to build and operate a facility for a fixed period[39]. Concessions are more comprehensive than BOT and BOO arrangements because they transfer complete operational and financial responsibility for a system[40]. BOT and BOO schemes are considered subsets of concessions; and investments in project facilities can assume either of the two. Although the public authority owns facilities, the private operator has wide-ranging powers over the operation and finances of the system.

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[33] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.

[34] Ibid

[35] Ibid

[36] Ibid

[37] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.

[38] World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.

[39] United Nations (2011). A Guidebook on Public-Private Partnership in Infrastructure. Bangkok, UNESCAP.

[40] Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.

Concessions are often bid by price, in which case the bidder that proposes to operate project facilities and meets investment targets wins the contract. Concessions are governed by contracts, which set out performance targets, including service coverage, quality, standards, arrangements for capital investment, mechanisms for adjusting tariffs, as well as arbitration over disputes[41].

The concessionaire collects tariffs directly from service users. The tariff is typically established by concession contracts, which also include provisions on how it may be adjusted over time in response to social, political, or macro-economic stimuli. Payments can take place both ways: concessionaire paying the authority for concession rights or the authority paying the concessionaire, based on target achievements[42].

Divestiture

This refers to complete privatization of water and sanitation facilities through a sale of existing assets or shares or through a management buyout[43]. Like concessions, divestitures give private operators full responsibility for operations, maintenance, and investment[44]. The private operator is contracted through a long-term agreement, which in some cases may be indefinite. However, unlike concessions, divestitures transfer ownership of assets to the private sector.

Under this model, the public authority retains regulatory obligations to protect consumers from monopolistic type of pricing, as well as enforce health, environmental standards, and subsidies to ensure that vulnerable community members access services. In this regard, the private operator should be concerned about maintaining its asset base[45]. On the same note, divestiture contracts bear direct financial obligations, as well as investment and commercial risks to the private operator[46]

Key advantages of the model include the transfer of all risks to the private sector, high level of private investment, a high potential for efficiency gains as well as high chances of success. This type of PPP agreement reduces risks of cost overruns since the operator's future earnings depend on cost control measures[47]. However, the model is faulted for complexity in implementing and managing contractual regimes, while negotiation between the parties may take a long time. Moreover, the public sector must have capacity for regulatory efficiency in tariff; thus, limiting its suitability for developing PPP markets.

[41] *World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.*
[42] *Ibid*
[43] *World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.*

[44] *Walker, J. (1993). Preparing for private sector participation in the provision of water supply and sanitation services: WASH Technical Report No. 84. Office of Health, Bureau for Research and Development, USAID.*
[45] *World Bank (1997). Selecting an Option for Private Sector Participation. Washington DC: The International Bank for Reconstruction and Development/ the World Bank.*
[46] *Asian Development Bank (2010). Public Private Partnership Handbook. Manila, AsDB.*
[47] *United Nations (2011). A Guidebook on Public-Private Partnership in Infrastructure. Bangkok, UNESCAP.*

Day 4:
Life Cycle Costing and Financial Management

The participants were take through LCCA as follows:

LCCA analyses the aggregate costs of ensuring the delivery of adequate, equitable and sustainable WASH services to a population in a specified area. The costs assessed here cover the construction and maintenance of systems in the short and long term, taking into account the need for hardware and software, operation and maintenance, the cost of capital, source protection, and the need for direct and indirect support costs, including training, planning and institutional pro-poor support (Fonseca et al. 2011). The delivery of sustainable services also requires that financial systems are in place to ensure that infrastructure can be renewed or replaced at the end of its useful life and to extend delivery systems in response to increases in demand (Reddy et al. 2009).

The competitiveness of organizations is increasingly dependent on the optimization of the LCC of their physical assets and how well they achieve their required function. Depending on the sector, the cost of maintaining physical assets represents around 5%–20% of the added value achieved by maintenance; 5%–12% of the total capital invested; 1%–15% of gross sales; 3%–10% of the production costs. These are strong reasons to emphasize the importance of maintenance costs in the annual budget and within LCC.

Webster's dictionary defines maintenance as

- To maintain
- Keep in existing condition
- Preserve, protect
- Keep from failure or decline

EN 13306:2010 defines maintenance management as "all activities of the management that determine the maintenance objectives, strategies, and responsibilities, and implement them by means, such as maintenance planning, maintenance control and supervision, improvement of methods in the organization, including economic, environmental, and safety aspects.

The main purpose for adopting LCCA in the WASH sector in the is to arrive at disaggregated unit costs and identify the gaps in terms of different cost components. A fully developed life-cycle cost model will include various components that represent acquisition as well as sustaining costs (Barringer 2003). The cost components include not only the construction and operational costs but also the rehabilitation and IEC (Information, Education and Communication) costs. These are: Capital expenditure on hardware (initial construction cost) (CapExHrd); capital expenditure on software (CapExSoft); capital maintenance expenditure (rehabilitation cost) (CapManEx); Cost of capital (CoC); direct support costs (ExDS); indirect support costs (ExIDS), and annual operation and maintenance cost (OpEx). These are broadly grouped under fixed and recurring costs (Box 4). Apart from public investments, households also invest to complement the service levels. Such contributions could be in respect of infrastructure costs, such as for wells, storage, toilets, etc., and operational costs, such as minor repairs, cleaning, etc. These costs are incurred in order to overcome reliability and convenience issues related to water services. Along with these expenditures, households also spend time in fetching water and money towards buying water;

Box 6: Main Components of LCCA

I. Fixed Costs

CapExHrd: Includes government expenditure on infrastructure, such as water sources, pumps, storage, filters, distributions systems, etc.

HHCapExHrd: Includes household expenditure on infrastructure, such as water storage, toilets, wells, pumps, etc.

CapExSft: Includes government expenditure on planning and design costs of the scheme

II. Recurring Costs

CapManEx: Includes capital maintenance, such as rehabilitation of sources, systems, etc.

CoC: Includes the interest paid on the borrowed capital for investment in the WASH sector

ExDS: Includes staff salaries, and post-implementation activities, such as IEC, demand management and training of mechanics.

ExIDS: Includes costs of policy planning at the macro level, i.e., central and state

OpEx: Includes regular operation and maintenance of the systems, such as energy costs, minor repairs, filtering costs, salaries of water men, etc.

HHOpEx: Includes household expenditure on expenditure on operation and maintenance of water systems, sanitation facilities, etc.

Maintenance Function

The process of maintaining physical assets covers all actions necessary for

- Retaining an asset in a specified condition
- Restoring an asset to a specified condition

Relevance of Maintenance Function in Asset Management 5

- Economic service delivery
- Retention of asset value
- Rational demand for capital investment

The risks associated with a lack of effective maintenance management include the following:

- Loss of asset capacity and potential
- Loss of asset value
- Increased costs of service delivery
- Legal and other liabilities
- Poor image and community criticism
- Premature replacement
- Inappropriate maintenance standards and performance
- Unscheduled/unexpected major expenditure
- Wastage of resources

- Inappropriate funding of maintenance
- Stakeholder dissatisfaction
- Loss of productivity, and employee dissatisfaction

Maintenance requires a commitment of resources in an environment of competing demands.

One of the problem areas of the sector has been the absence of proper operation and maintenance of the water supply systems, resulting in wastages, leakages, high-energy consumption, etc.

Table 11: Basis for computation of Water Tariff using LCCA data

Classification of Tariff	Description	Included in Tariff
Tariff based on Historical Costs	Tariff to recover Operating Expenses (OPEX)	Operating Expenses e.g. salaries/wages, chemicals, power, overheads
	Tariff to Recover Operating Expenses (OPEX) and Capital Expenses (CAPEX)	• Operating Expenses e.g. salaries/wages, chemicals, power, overheads • Capital Expenses i.e. expenditure on acquiring a new asset or extending the life of an existing asset
	Tariff with a target rate of return based on Fixed Assets (ROFA) or Capital Employed (ROCE)	• Operating expenses • Capital Expenses • A percentage of mark-up based on ROFA or ROCE
Tariff based on Economic Costs	Tariff includes all financial costs pertaining to the project and Economic Externalities	Long run marginal costs of all financial flows and economic costs and benefits (estimated using average incremental Costs method)
Tariff based on Full Costs	Tariff based includes all financial costs to the project as well as Economic and Environmental Externalities	Long run marginal costs of all financial flows, economic and environmental costs and benefits (estimated using average incremental Costs method)

The facilitator noted that there is need for **Annual investment** in the respective networks in in order to expand coverage by having annual targets for new connections and maintenance of the 12 km of pipeline in Bentiu and 8KM pipeline in Rubkona. Optimization of design, operation and maintenance has always been, and will remain, the key challenge of any water supply company.

Operation and Maintenance

As-built drawings*:* information needs to be computer-processed. The detailed position and description of the valves, fittings, wash-outs, pits, crossings, etc. is should be indicated on the map layout, with all the information necessary for maintenance

I. *Pipe flushing:* this is done at two-yearly intervals. The water for this purpose is drawn from the system
II. P*ipes replacement:* the pipe is normally replace in three instances:
    - Where there is frequent leakage at the same segment
    - Due to increase in the capacity
III. *System monitoring:* In selected points in the system (usually the ends of the system), the pressure should be monitored continuously but during the seasonal peaks in summer, pressures and flows are measured in all the pumping facilities, throughout the year
IV. *Leakage:* Most of the registered breakages in the distribution system are for AC pipes. There should be a leakage detection program
V. *Metering:* all the service connections in the system have water meters installed. The meters should be replaced every 7 – 10 years
VI. *Training:* A qualified cadre of staff should be recruited and further trained on the job

Maintenance Strategy

The selection of the type and level of maintenance follows an overall asset management strategy based on two main principles:

1) Standard of service to the customer should regarded as the primary objective
2) Within the constraints set by the standard of service, decisions should take into consideration the economic life file of the network components.

Practical factors that influence the strategy are:

a) Design and technical layout
b) Soil conditions
c) Surface activities
d) Climate
e) Material selection
f) Construction methods; and
g) Operational pressures

A preference for either preventive or reactive maintenance is derived from the strategy selected. Generally speaking, the annual costs of repairs and cleaning operations spent responding to consumer complaints are lower than the annual costs of the investment necessary for main rehabilitation and replacement. However, this is only true for standard frequency of pipe bursts. The expected trend is that the number of ruptures will increase over time. Preventive maintenance can extend the economic life time of the system, and therefore is a “must”.

Set Standard of Service

Compile Information on the next works

Hydraulic Analysis for present and future demands

Assess current levels of service (Current performance)

Diagnose causes of service deficiencies

Assess current pipe condition

Assess current operational costs

Focus on future condition, levels of service and costs

Perform an economic analysis of feasible options

Choose best options and schedule of work

- Standard of service to the consumer should be regarded as a primary objective
- Within constraints set by the standard of service, decisions should be made on economic grounds
- Problems caused by network deterioration determine the form of strategy
- Their thorough description and good understanding is a pre-requisite
- The strategy should be future-oriented and also sufficiently flexible to allow for easy incorporation of improvements in technology.

Reactive maintenance: Response to bursts
Preventive maintenance: Proper maintenance contributes to the optimal operation of the systems. As such, it is more of a condition or requirement, for effective maintenance.

Financial Management

Fiscal Year July 9th – FY

Ways in which Water Utilities are funded in developing countries get funded is represented by 3Ts

T *Transfer:* Official Development Assistance from donors and developed countries and international financial institutions. Not reliable

Taxation: From tax money from the Government as part of her obligations to citizens. Not a very effective

Tariff: Paid by the community using the water service

– During high water consumption time, unless the increase is designed to encourage conservation

Determining Current and Future Budgetary Requirements

Fixed Expenses – the expenses incurred
– Whether or not water is produced or sold
– The minimum rate usually recovers fixed expenses

Variable Expenses – the expenses that
– Change depending on levels of production,
– Consumption and operations and maintenance
– The flow rate usually recovers variable expenses

Rate Structure Components

Minimum water charge
– The fixed charge that includes a water usage allowance for a billing cycle
– Typically used to recover fixed expenses of the water system (debt service and salaries)

Minimum water usage
– The maximum amount of water consumed with no additional charges other than the minimum charge

- **Flow Rate**
  – The variable charge for water consumed in addition to that allowed by the minimum charge
  – Typically used to recover variable expenses of the water system (most operational expenses)
- **Flow Rate Measurement**
  – Unit of measurement for flow rate calculation (i.e., thousands of 20L Jerrycans, cubic feet)

Box 7: How to handle fixed and variable expenses

Remember that the minimum rate should be designed to recoup fixed expenses.

Fixed expenses rarely increase substantially unless you encumber more debt or have a large system expansion.

Most systems should view the fixed-rate part of their structure as debt service and depreciation recoupment tool.
Likewise, remember that the flow rate should be designed to recoup variable expenses.

Variable expenses are more subject to inflation, so the flow rate should be adjusted periodically (usually 1-2 years).

Asset Management

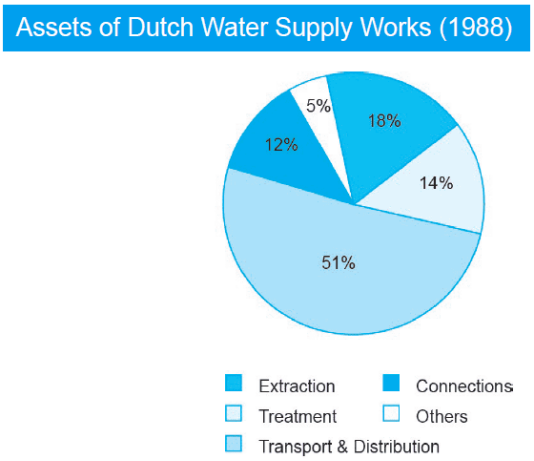

Figure 7: Structure of assets of the Dutch water supply works (VEWIN, 1990).

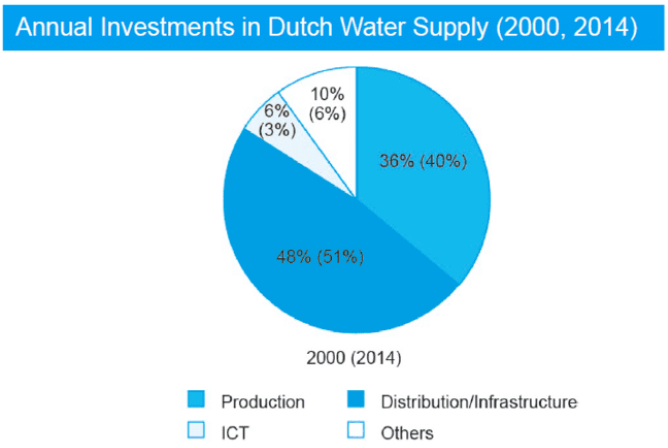

Figure 8: Annual investments in the Dutch water supply works

The two charts for the Netherlands are not unique and are likely to be found in many other countries, pointing to the conclusion that transport and distribution are dominant processes in any water supply system. Moreover, the data shown include capital investments, without exploitation costs, which are the costs that can be greatly affected by inadequate design, operation and maintenance of the system, resulting in excessive water and energy losses or deterioration of water quality on its way to consumers. Regarding the first problem, there are numerous examples of water distribution systems in the world where nearly half of the total production remains unaccounted for, and where a vast quantity of it is physically lost from the system.

A planned approach to maintaining and utilizing current assets and preparing for future asset needs and replacement.

- Benefits:
  – Prolongs the life of the asset
  – Reduces asset costs
  – Increases ability to meet customer demands
  – Provides a basis for rate setting
  – Creates a budgeting base
  – Increases the ability to meet service expectations and regulatory requirements
  – Improves emergency response capability
  – Identifies methods to improve asset security

- Elements:
  – Planning and Targets
  – Practice and Process
  – Information Systems
  – Data and Records
  – People and Organization

- Developing an Asset Management Plan:
  – Create a current asset inventory list that includes the physical condition of the assets
  – Identify expected/remaining sustainable service life
  – Prioritize assets that are critical to sustained performance (chlorinators, mains, intakes, tanks, e.t.c.)
  – Develop a method to objectively evaluate options

- Purchase price
- Maintenance costs
- Expected life
- Salvage value (if any)
  – Develop long-term funding strategies
- Risk of incidence
- Remaining life, residual value
- Repair, rehab, replacement schedule
- Procedures
- GIS solutions

Replacement Fund

- All mechanical equipment begins to wear out as soon as it is installed Items to consider include
  – Pumps
  – Motors
  – Vehicles
  – Earth equipment
  – Chlorination equipment
  – Electrical controls
  – Meters
  – Hydrants
  – Lines
  – Intake works

Capital Improvement Planning

- The following information should be used for planning for system capital improvements
  – The Sanitary Surveys (comprehensive inspection reports)
  – Monthly operator reports and other maintenance records
  – Documented customer complaints related to pressure or other service quality problems
  – Customer requests for line extensions and new connections (by geographic area
  – Calibrated Hydraulic modelling data

Annual Budgeting Needs

- Determine debt service reserve requirements
- Determine necessary financial reserve levels
  – Equipment replacement, emergency expenses
- Use previous years' expense statements as well as anticipated inflation to estimate future expenses
- Use previous years' income statements as well as anticipated growth to estimate future revenues
  – Look at all possible savings interest rate scenarios to generate the most money for the system
- Make adjustments to revenue through rate adjustments to cover estimated expenses

Restructuring considerations

Restructuring should take place if the water system is able to determine that the system could benefit by adjusting individuals and assets in a manner that will streamline the management, treatment, and distribution process.

Consolidation

Consolidation can be defined as "one community water system being absorbed into, combined with, or served by other utilities to gain the resources they lack otherwise."

Consolidation types

– **Informal Cooperation**: assistance but without contractual obligations
– **Contractual Assistance**: Contract for services but under system's control
– **Joint Powers Agencies**: New entity that serves all systems that form it
– **Ownership Transfer**: Takeover by an existing system to create a new system

• Considerations:
– Operating and debt coverage ratios
– Condition of infrastructure
– Ability of system to pay for needed improvements
– Customer base
– Reasonable price and terms
– Impact on customers
– Additional investment needed
– Alternatives
– Public sentiment
– Short- and long-term economics

Pros	Cons
– Can lower customer costs and water rates	– Communities may lose autonomy and independence
– Greater access to capital	– Debt acquisition
– Greater access to grant funding	– May cause loss of jobs
– Duplicated services can be eliminated saving money and increasing efficiency	– Customer confusion
	– Political conflicts
– Increased reliability of water source	– Cost and benefit inequities
– More skilled employees	– Physical connection limitations
– Can lower cost of complying with regulations	– Conflict of management goals

Selecting a Professional Civil Engineer for Capital Planning

- Develop request for qualifications to several civil engineering firms with experience in **water system construction**

– From the responses, determine the firm(s) that are deemed qualified for your capital project

- Develop request for qualifications for specific proposals and submit to qualified firms

– Select the engineer that provides the best proposal for your project

- Execute an engineering agreement complete with specifications of the deliverables

Financing Alternatives Grants vs. Loans

- **Fact** – Most systems would prefer to receive financial assistance through a 100% grant
- **Reality** – Even though grant money for water system capital improvement projects is available, competition is very stiff. Few systems now don't receive 100% grants unless they are seeking to fund very small projects

Grant Selection Criteria

- All grant programs prioritize applicants pursuant to at least some of the following criteria:
  – Low-income areas
  – Current debt service requirements
  – Critical needs including threats to public health or economic stability
  – Extension of service to unserved households
  – Job creation/retention
  – Designated federal or state target areas
  – Level of matching funds committed
  – Number of years since last project/grant award

Loan resources

– Received from the Commercial banks
Must have Audited account statements
Must have a Co-guarantor – customer base & bills payment

Financing Follow-up

- After financial assistance is leveraged and project is begun, your capital improvement planning does not end!
- You should regularly review and modify your existing long-term capital improvement plan
- Remember:
  – Securing funding takes time
  – Engineering (plans and specs) takes time
  – Regulatory approval takes time
  – Bids and construction takes time

Annexe 5: Design Period used in the Business Plans

	Asset	Design period
A.	Pumping	
	i. Pumping house (civil works)	30
	ii. Electrical and pumps	15
B.	Water treatment units	15
C.	Pipes	30
D.	Raw water and clear connecting mains	30
E.	Distribution systems	30
F.	Clear water reserves at the head work and service reservoir	30
G.	Steel Tanks	30 year
H.	Flow meters	5 year

ASSUMPTIONS

CUSTOMERS

Utility	Now in 2021	After 5 years
Rubkona	1,590 HH	2200H
Bentiu	4,000 HH	5000H

WATER CONSUMPTION PER HH

Utility	
Rubkona	150 L/day
Bentiu	150 L/day

Meter Maintenance is 2 years

Annexe 6: Cost reflective tariff design

As said in the report the design of tariff for the two schemes ought to be simple given the fact that this is the first time that this concept is being introduced. Decreasing or increasing block tariffs are therefore excluded, despite their benefits. The calculations are premised on the standard 20L Jerrican capacity for ease of comprehension and uptake by the community.

I. BENTIU WATER UTILITY

a. CHEMICALS

Aluminium Sulphate (Alum)

Assumed solution strength, St	=	5%
Assumed dosage quantity, D	=	40mg/L
Gross water demand for supply presently(2021), Q	=	$300M^3$/day
Weight of Allum required		860,000L/day
Weight of Alum required, QD	=	$\frac{40mg/L \times 860,000L/day}{1,000,000}$
	=	42kg(from records)[48] Calc. above yield 34.4 kg
Cost of Alum in Juba	=	50kg costs US$ 39 (1kg/2$
	=	US$0.78 X 365 X X 42
		US$ 11,957.4

Chlorine

Assuming Tropical Chloride of Lime(TCL) with 35%

Available chlorine is used, CL_A	=	35%
Gross Water Demand for Supply area (2021), Q	=	$860M^3$/day
		860,000 L/day
Recommended Dosage, D	=	5ppm which is 5mg/L
Amount of Free Chlorine required, CL_F = QD	=	$\frac{5mg/L \times 860,000L/day}{1,000,000}$
	=	4.3 Kg per day
	=	1,569.5 Kg

[48] Based on Jar Test

Amount of TCL Required = $\frac{CL_F}{CL_A}$ = $\frac{1{,}569.5 \text{ Kg}}{35\%}$

= 4,484.29 Kg per year

Cost of TCL in Juba is US$ 20 for 25kg = US$0.8/KG = 4,484.29 Kg per year X0.8

= US$3,587.43 per year

Therefore the total Costs of Chemicals in a year = 1 US$3,587.43 + US$ 11,957.4

US$ 15,544.83 per year

b. FUEL COSTS FOR IC ENGINE

39 L of fuel for 8.5 hours/day

20L of diesel fuel cost 12,000 SSP (assuming US$ 1 = 600 SSP Ex.rate of

Therefore, $\frac{39 \text{ X } 12{,}000 \text{ SSP}}{20 \text{ X } 600}$

In 1 year, then = 365 X US$39 per day

= **US$14,235**

c. MAINTENANCE COSTS

Time for the Electromechanical Technician serving two Water Utilities at valorized time of 60% of the total time for which he is hired by CW-SSD is:

- Gross Salary is US$ 1,950, the at 60% for both Rubkona and Bentiu Water Utility it will be US$ 1,170. So in Bentiu alone, it will be US$ 585 (i.e. only 30% of his time per month)
- The IC Engine, the prime mover needs consumables during regular maintenance which has to be done every 250 hours. Also remember the IC Engine run-time is 8.5 hours per day

No. of Regular maintenance in a year = $\frac{8{,}750}{8.5 \times 250}$ = 4.11 times

In each maintenance cycle, the following items need to replenished

- Engine oil = 24 liters of oil is needed per service. Also 1 Jerrycan =5L=US$ 30

  $\frac{24}{5}$ X US$30 = US$ 144 per service

- Air filters = 5 Replacements per service. 1 costs US$ 30

  5 x US$ 30 = US$ 150 per service

- Oil filters = 5 Replacements per service. 1 costs US$ 30

  5 x US$ 30 = US$ 150 per service

Total Consumables per service is US$ 150 US$ 150 US$ 144 = US$ 444

In 1 year, then 4.12 = US$ 444 x 4.11, then add the Cost of 2 Sealed Lead Acid AGM Battery FC Series 12V for Automobiles, which are replaced annually

= With the cost of 1 battery put at US$ 100 (Juba costs), then

= US$ 1,829.28 + US$ 200 which gives US$ 2,029.28

For two IC Engines = US$ 2,029.28 X 2 = **US$ 4,058.46**

For Pumps, chlorinators and Lime injectors, all put together assume 25% of the fuel costs, for the first 10 years and then the figure doubling in the successive years, this gives 25 % X US$ 14,235

= **US$ 3,558.75** (First 10 years there are manufactures warranties and the times are also new and so efficiencies are still high

Maintenance for Civil works is assumed to be 10% that of fuel costs annually, for the first 10 years and then the figure doubling in the successive years, this gives 10 % X US$ 14,235

= **US$ 1,423.5**

Assume 3 breakdown maintenance for electromechanical in the first 10 years and the frequency rises to 5 times in the next 5 years

Each maintenance is a year is assumed at 5 % of the fuel Cost

This comes to = US$ 14,235 X 5% = US$ 711.75

Therefore 3 will be = US$ 711.35 X 3 times in a year = **US$ 2,135.25**

Since piping and conveyance consists 60% of the total capital asset costs (from research), these maintenance costs are treated separately. This will recoup the costs in form of NRW reduction due to reduced leakages and pipe repairs/rehabilitation and energy costs. A flat figure of US$ 2,000 annually has been assumed for this.

The total Operation and Maintenance Costs will therefore be a total of maintenance costs plus fuel costs. This is:

US$ 2,000 + US$ 2,135.25 + US$ 1,423.5 + US$ 3,558.75 + US$ US$ 4,058.46 + US$14,235+ US$ 15,544.83 per year per year

Maintenance/year = US$ 27,363.21 per year

O & M will be = US$ 27,363.21 add fuel = US$ 43,627.48 /year

d. ASSETS DEPRECIATION COSTS – CREDITED TO DEPRECIATION ACCOUNT

Allan Twort[49] in Chapter 14 of his book suggests a 8% capital recovery for a period of not less than 15 years. Therefore using the present worth method, then :

$$\frac{1}{S_{n,r}} = \frac{1}{(1+r)^n}$$

r = Compound Interest

n = Number of years

$$\text{Annuity} = \frac{\text{Principal}}{(1+r)^n}$$

(Total Asset Costs can be found in Annex 8, which is US$ 256,570) $= \frac{256{,}570}{(1.08)^{30}} = 25{,}497.24$

Annual Capital Recovery Amount = **US$ 25,497.24/year**

Given that tariff is being introduced for the first time, the value of US$ 55,045.63 can be paid for by grants from donors (transfers) or taxes. This is justifiable due to the present socio-economic situation in Unity State. This might be in the form of any donor repairing, rehabilitating or replacing an item each year.

Staff Costs	No.	Govnmt.(SSP)	CW-SSD (SSP)	Total (A+B)
Supervisor	1	2,500	36,036	38,536
Water Quality Officer	2	1,050	36,036	77,072
Cleaners	2	1,050	21,582	45,264
Security Guards	2	1,500	21,582	45,264
Operators	9	1,050	36,036	333,774
Plumbers	3	1,050	36,036	111,258
Totals	In US$, its 1,085.28 spent on staff per month			651,168 SSP
	Per Year, its, US$ 1,085.28 x 12			**US$ 13,023.36**

[49] Water Supply 5th Edition, Allan C. Twort, Don D. Ratnayaka and Malcolm J. Brandt, Binnie Black and Veatch

In dry period, then, the total costs for Bentiu Water Utility will be the summation of all these sub-items:

Staffing Costs + Operation and Maintenance Costs + Annual Depreciation Costs

= US$ 13,023.36 + US$ 25,497.24+ US$ 43,627.48

= **US$ 97,692.92 Total Annual Production Costs**

Total Annual Production for sale = $860M^3$ per day, Assume a NRW of 20%, this comes to $688M^3$ per day

20% assumes only leakages, there should be a Governemt order to disconnect all the Government Officers' houses/homes, institutions, and businesses. The Consultants noted that illegal connections are very many and could be more than leakages in valves, storage tanks over flows and valves. This needs utmost urgency.

= $688\ M^3$ per day x 365 days

= **$251,120\ M^3$ per year for the present coverage**

Total Production Cost/M^3 = $\frac{\text{US\$ 97,692.92}}{251,120M^3}$

US$0.38 /$M^3$

IN WET SEASON

Production drastically drops to only $45M^3$ per day in Wet Season. This means that communities are relying on polluted water n ponds, puddles, e.t.c. possibly without treatment. Intensive health/hygiene education will help create demand in these seasons.

However, for the Water Utility to remain liquid and operational without outside support, then an average between wet season and dry season tariff is needed.

Assuming 4.5 months of wet season in Unity State , In wet season, = $45M^3$ X .8 X365

$$= \frac{13{,}140 \times 4.5}{12}$$

$$= 4{,}927.5\ M^3$$

Production Cost will also be $$= \frac{97{,}693 \times 4.5}{12}$$

$$= 36{,}634.85$$

= Round up to US$ 37,000

(More chemicals needed[50])

$$= \frac{\text{US\$ } 37{,}000}{4{,}927M^3}$$

$$= \text{US\$ } 7.51 \text{ per } M^3$$

Therefore the average between the wet and the dry season per M^3: $$= \frac{0.39 + 7.51}{2}$$

$$= \textbf{US\$ 3.95/M}^{\mathbf{3}}$$

II. RUBKONA WATER UTILITY

a. CHEMICALS

Alumunium Sulphate (Allum)

Assumed solution strength, St = 5%

Assumed dosage quantity, D = 40mg/L

Gross water demand for supply presently(2021), Q = $300M^3$/day

[50] Durig rainy season, more chemicals in terms of mass is needed due to turbid river water

Weight of Allum required 300,000L/day

Weight of Alum required, QD = $\frac{40mg/L \times 300,000L/day}{1,000,000}$

= 50kg (from records)[51] Calc. above yield 12 kg

Cost of Allum in Juba = 50kg costs US$ 39

= 0.78 US$ X 365 X 50

US$ 14,235

Chlorine

Assuming Tropical Chloride of Lime(TCL) with 35%

Available chlorine is used, CL_A = 35%

Gross Water Demand for Supply area (2021), Q = $300M^3$/day

300,000 L/day

Recommended Dosage, D = 5ppm which is 5mg/L

Amount of Free Chlorine required, CLF = QD = $\frac{5mg/L \times 300,000L/day}{1,000,000}$

= 1.5Kg per day

= 547.5 Kg

Ammount of TCL Required = $\frac{CL_F}{CL_A}$ = $\frac{547.5\ Kg}{35\%}$ = 1,564.29

[51] Based on Jar Test

= 1,564.29 Kg per year

Cost of TCL in Juba is US$ 20 for 25kg = US$0.8/KG = 1,564.29 Kg per year X US$0.8

= US$ 1,251.43 per year

Therefore the total Costs of Chemicals in a year = 1 US$1,251.43 + US$14,235

US$ 15,486.43 per year

b. FUEL COSTS FOR IC ENGINE

During dry period 56L of fuel for 8.5 hours/day for 7.5 m/Y

20 liters of diesel fuel cost 12,000 SSP (assuming Ex.rate of US$ 1 = 600 SSP

Therefore, $\frac{56 \text{ X } 12{,}000 \text{ SSP}}{20 \text{ X } 600}$

In 1 year, then = 7.5/12 X 365 X US$56 per day

= US$14,775

During rainy period 50L of fuel for 8.5 hours/day for 4.5 m/ = 4.5/12 X 365 X US$50 per day

= 6,843.75

Now, for a whole year of fuel for 8.5 hours/day = US$6,843.75 + US$14,775

= **US$ 19,618.75**

c. MAINTENANCE COSTS

Time for the Electromechanical Technician serving two Water Utilities ata valorized time of 60% of the total time for which he is hored by CW-SSD is:

- Gross Salary is US$ 1,950, the at 60% for both Rubkona and Bentiu Water Utility it will be US$ 1,170. So in Bentiu alone, it will be US$ 585 (i.e. only 30% of his time per month)

- The IC Engine, the prime mover needs consummables during regular maintenance which has to be done every 250 hours. Also remember the IC Engine run-time is 8.5 hours per day

No. of Regular maintenance in a year = $\frac{8{,}750}{8.5 \times 250}$ = 4.11 times

In each maintenance cycle, the following items need to replenished

- Engine oil = 24 liters of oil is needed per service. Also 1 Jerrycan =5L=US$ 30

  $\frac{25}{5}$ X US$30 = US$ 150 per service

- Air filters = 5 Replacements per service. 1 costs US$ 30

  5 x US$ 30 = US$ 150 per service

- Oil filters = 5 Replacements per service. 1 costs US$ 30

  5 x US$ 30 = US$ 150 per service

Total Consummables per service is US$ 150 US$ 150 US$ 150 = US$ 450

In 1 year, then 4.12 = US$ 450 x 4.12, then add the Cost of 2 Sealed Lead Acid AGM Battery FC Series 12V for Automobiles, which are replaced annually

= With the cost of 1 battery put at US$ 100 (Juba costs), then

= US$ 1,854 + US$ 200 which gives US$ 2,054

For two IC Engines = US$ 2,054 X 2 = **US$ 4,108**

For Pumps, chlolrinators and Lime injectors, all put together assume 25% of the fuel costs, for the first 10 years and then the figure doubling in the successive years, this gives 25 % X US$ 19,618.75

= **US$ 4,904.69** (First 10 years there are manufactures warranties and the itimes are also new and so efficiencies are still high

Maintenance for Civil works is assumed to be 10% that of fuel costs annually, for the first 10 years and then the figure doubling in the successive years, this gives 10 % X 19,618.75

= **US$ 1,961.875**

Assume 3 breakdown maintenance for electromechanical in the first 10 years and the frequency rises to 5 times in the next 5 years

Each maintenance is a year is assumed at 5 % of the fuel Cost

This comes to = US$ 19,618.75 X 5% = US$ 980.94

Therefore 3 will be = US$ 980.94 X 3 times in a year = **US$ 2,942.81**

Since piping and conveyance consists 60% of the total capital asset costs (from research), these maintenance costs are treated separately. This will recoup the costs in form of NRW reduction due to reduced leakages and pipe repairs/rehabilitation and energy costs . A flat figure of US$ 2,000 annually has been assumed for this.

The total Operation and Maintenance Costs will therefore be te total of maintenance costs plus fuel costs. This is:

US$ 2,000 + US$ US$ 2,942.81+ US$ 1,961.875+ US$ 4,904.69 + US$ 4,108+ 19,618.75+ US$ US$ 15,486.43 per year

Maintenance/year = US$ 31,403.82 per year

O & M will be = US$ 31,403.82 add fuel = **US$ 51,022.56 /year**

d. ASSETS DEPRECIATION COSTS – CREDITED TO DEPRECIATION ACCOUNT

Allan Twort[52] in Chapter 14 of his book suggests a 8% capital recorvery for a period of not less that 15 years. Therefore using the present worth method, then :

[52] Water Supply 5th Edition, Allan C. Twort, Don D. Ratnayaka and Malcolm J. Brandt, Binnie Black and Veatch

$$\frac{1}{S_{n,r}} = \frac{1}{(1+r)^n}$$

r = Compound Interest

n = Number of years

$$\text{Annuity} = \frac{\text{Principal}}{(1+r)^n}$$

(Total Asset Costs can be found in Annex 9, which is US$ 231,700) $= \frac{231,700}{(1.08)^{17.5}} =$ 49,710.82

SWAT system is meant for Emergency Water Supply and therefore the Consultant has used *n = 17.5* years, as compared to Bentiu Water Utility were *n = 30*. The temporary nature akes its capital recovery factor higher.

Annual Capital Recovery Amount = **US$ 49,710.82/year**

Given that tariff is being introduced for the first time, the value of US$ 55,045.63 can be paid for by grants from donors (transfers) or taxes. This is justifiable due to the present socio-economic situation in Unity State. This might be in the form of any donor repairing, rehabilitating or replacing an item each year.

Staff Costs	*No.*	*Govt.(SSP)*	*CW-SSD (SSP)*	*Total (A+B)*
Supervisor	1	2,500	36,036	38,536
Water Quality Officer	1	1,050	36,036	37,886
Cleaners	1	1,050	21,582	22,632
Security Guards	2	1,500	21,582	45,264
Operators	3	1,050	36,036	111,258
Plumbers	2	1,050	36,036	74,172
Totals	In US$, its 549.58 spent on staff per month			329,748 SSP
	Per Year, its, US$ 549.58 x 12			**US$ 6,594.96**

Then, the total costs for Bentiu Water Utility will be the summation of all these sub-items:

Staffing Costs + Operation and Maintenance Costs + Annual Depreciation Costs

= US$ 6,594.96+ US$ 51,022.56 +US$49,710.82

= **US$ 107,328.34 Total Annual Production Costs**

Total Annual Production for sale = 300M^3 per day, Assume a NRW of 20%, this comes to 240M^3 per day

20% assumes only leakages, there should be a Government order to disconnect all the Government Officers' houses/homes, institutions, and businesses. The Consultants noted that illegal connections are very many and could be more than leakages in valves, storage tanks over flows and valves. This needs utmost urgency.

= 240 M^3 per day x 365 days

= **87,600M^3 per year for the present coverage**

Total Production Cost/M^3 = US$ **107,328.34**

87,600M^3

US$ 1.23/M^3

CWW-SSD WTP survey report

From the willingness to pay water services report, Majority of the respondents (76.8%) among those using improved sources, stated that they could pay for water per jerrycan. Further, 81.8% (N=225) of them were willing to pay between 10SSP and 50 SSP, with 25.5% willing to pay 10 SSP per jerrycan of water.

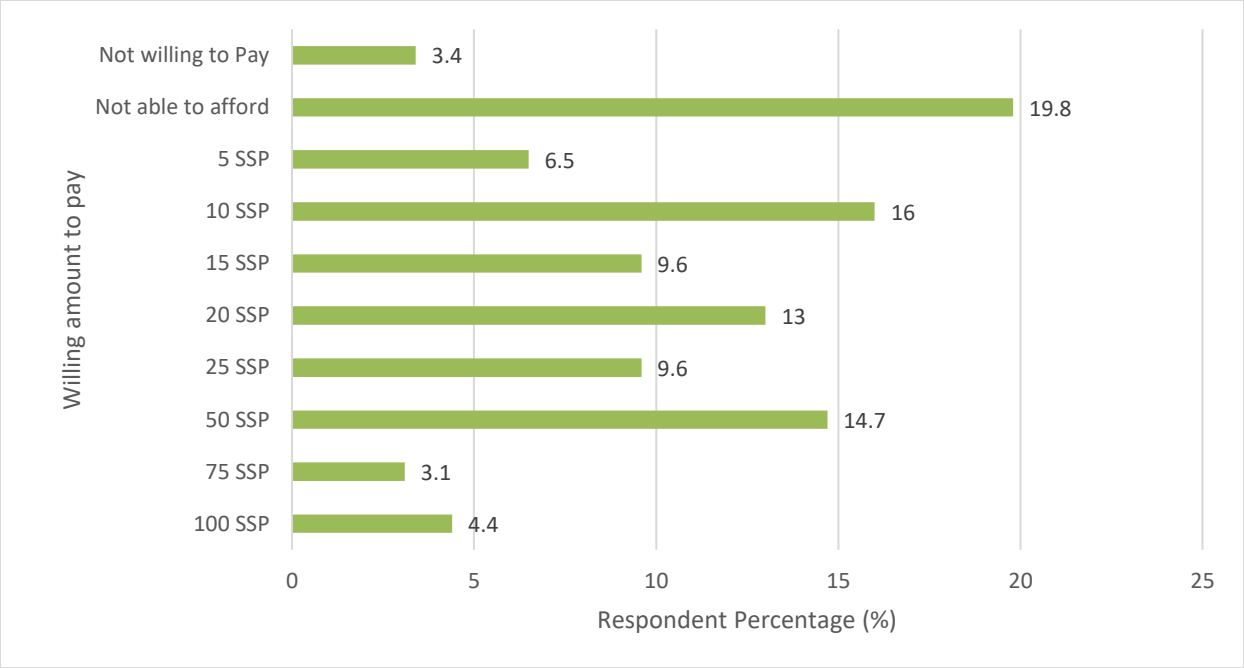

Figure 9: Amount Respondents are Willing to pay for a Jerrycan of Water (adapted from CWW-SSD WTP report, May 2019)

Among those using unimproved sources of water for drinking, domestic and animal watering, 32% (N=25) stated that they could pay 50 SSP for a 20L jerrycan of water every time they access to water. Notably from this group, 24% and 16% reported that they could not afford or were not willing to pay for water respectively. In the final analysis, the tariff calculations above, the WTP survey conducted by CWW-SSD in May, 2019, and Table 4 p13, of the training report (participant's views) point to the same range of amounts per 20L jerry can. However, as noted in the WTP survey, more consultations and education of the community as well as a legal and institutional backing. Introducing payment for water would require a paradigm that will effectively fit into the context. The report further notes that:

> "*Given that those living in the localities are vulnerable, it will imperative that shifting from the current model would have far-reaching effects on their livelihoods. However, due to the need and drive for the sustainability of services, it is vital that people view water as an economic good and their wellbeing*".

Most of the residents have weekly incomes of more than 2,000 South Sudanese Pound (SSP). Two-thirds of those who confirmed that their weekly income could adequately cover their weekly expenditures were those with income above 2,000 SSP.

Table 12: Respondent household Income range per Week

Income Range	No. of respondents (N)	Respondent Percentage (%)
Less than 100 SSP	18	4.5
100 -500 SSP	53	13.3
500 -1000 SSP	55	13.8
1000 -2000 SSP	65	16.3
Above 2000 SSP	177	44.4
Don't Know	31	7.8
Total	**399**	**100**

Access to Water

Most of the respondents (93.5%; N=399) mainly accessed drinking water from known safe sources in the locality. Only 6.3% stated that they accessed their drinking water from the river. This is as shown in the table below.

Table 13: Respondent Sources of Water

Water Source	No. of Respondents (N)	Respondent Percentage
Water Point/Borehole	131	32.8
Yard Tap in Compound	48	12.0
Water kiosk/Tap Stand	186	46.6
Water tanker	3	0.8
Donkey cart vendor	5	1.3
River/stream	25	6.3
Other	1	0.3
Total	398	100

Most of the respondents (90%; N= 399) reported that their primary water source is accessible throughout the year.

Annexe 7: Water Supply Construction and O & M Materials and Supplies

I. Electromechanical Consumables

Item	UNITS sold (Quantity/Package Sold e.g. No, bags, bottles, packets, boxes e.t.c)	Weight/Volume/Capacity of one UNIT	Costs of 1 UNIT presently
1. Sealed Lead Acid AGM Battery FC Series 12V for Automobiles		Piece	100$
2. Engine oil	Jerrycan 5ltr	5 ltr	30$
3. Air filters			30$
4. Oil filters			30$
5. Diesel		Ltr	1$

II. Water Production Consumables

Item	*UNITS sold* *(Quantity/Package Sold e.g. bags, bottles, packets, boxes e.t.c)*	*Weight/Volume/Capacity of one UNIT*	*Costs of 1 UNIT presently*
1. Aluminum Sulphate		50 kg	100 $
2. Chlorine powder for mixing in Water Treatment Plant – 70% Concentration		5 kg 25kg 45 kg	30$ 100$ 200$
3. Chlorine powder for mixing in Water Treatment Plant – 30% or 35% Concentration		N/A	N/A
4. Lime		25kg	20$

III. Pipes

Sold in lengths of 3 Meters

Pipe	A Length of 3 Meters
PVC 4 Inch	15$
Ductile Iron Inch???	
Galvanized Iron of 3 Inch	120$ 6mtr Pipe
HDPE 3 inch	7$ / per meter
HDPE 4 inch	12$ / per meter
HDPE 6 inch	17$ / per meter
PVC Pipe 4''	30$-drainage
PVC Pipe 3''	20$

Omaski Suppliers in Juba

Item description	Unit	Unit cost
Fuel Filter ED 2175 -	Piece	50.00
Fuel filters: 2656117	Piece	15.00
Air cleaner element 0054961820-S	Piece	50.00
Maintenance-free battery N70	Piece	100.00
Oil Filter ED 2175-284-S -	Piece	50.00
Oil filters: 140517050	Piece	10.00
HDPE pipes ND 40mm PN 20, 100m per roll	roll	250.00
HDPE pipes ND 63mm PN 20, 100m per roll	roll	350.00
HDPE pipes ND 90mm PN 20, 100m per roll	roll	450.00
HDPE pipes ND 110mm PN 20, 100m long roll	roll	600.00
HDPE Equal tee ND 40mm	Piece	3.00
HDPE coupling ND 40mm	Piece	3.00
HDPE female adaptor ND 40mm	Piece	3.00
HTH chlorine for disinfection, 65-70% HTH-45 Ltr bucket	Bucket	156
Aluminium sulphate-50Kg bag	Bag	39.00

IV. Transportation Costs using a 20 tonne truck from Juba to Bentiu

Please, also give us some advice on the charges of material costs in a big truck from Juba to Bentiu

20 TON - 7,500 $

40 TON - 15,000 $

Annexe 8: Asset Outlay List for the 2 Water Utilities

– Condition (rank from 1-5; 1 is very poor condition and 5 is excellent condition)
– Expected life multiplied by condition equals prioritization score
– Should be read alongside the design life periods in Annex 7

Rubkona SWAT						Bentiu Conventional Water Treatment Plant					
Rubkona SWAT	Costs	Condition	Remaining Life	Condition Score	Prioritization Score		Costs	Condition	Remaining Life	Condition Score	Prioritization Score
Steel elevated tank A	30,000	Good	20	4	80	The ground concrete clear water tank of volume 95 M3.	20,000	Good	20	20	80
2No. T95 and 1 No. T70 Onion Tanks	38,000	Good	20	4	80	There are 21 No. water points most of which are communal water points. There are also yard taps, connection to hotels, dispensaries and institutions.	19,000	Not verified	N/A	N/A	N/A
There are 48 No. water points53 whereby 45 No. are communal taps/yard taps/Institutional taps	50,000	Not verified	N/A	N/A	N/A	Floating intake and suction pipe. The suction pipe is 3 inches GI pipe of length 14m which terminates at the raw water pumping station on the bank.	5,000	Poor	3	1	3

[53] A typical public/communal waterpoint consists of 4 taps.

2 No. water kiosks	3,000	Good	29	5	145	Station consisting of 2 No. diesel pumps Model DE 65/20 with impeller diameter 214mm.	26,000	Fair	15	2	30
1 No. bulk dispenser.	1,200	Good	12	5	60	Assortment of pipes of various materials and sizes all totalling 12.441km. BoQ attached in excel separately)	100,000	Good	40	3	120
Raw water pumping station: Raw water pumping station consisting of 2 No. diesel pumps Model PTD 306. Each has a discharge capacity of 902 L/Min and head of 28m. The pumps deliver water to flexible water holding	26000	Good	12	4	48	Steel elevated tanks (2 No.) each 22.5M3 and totalling 45M3. The height of the steel tower is 12m.	25,000	Good	13	4	52
Assortment of pipes of various materials and sizes all totaling to 8.27km (BoQ attached in excel separately)	67,000					Water delivery to the treatment chambers is via 40m long GI pipe of 3 inch diameter.	1,500	Poor	2	2	4

Elevated Steel Tank B – booster tank in the village	15,000	Good	25	5	100	Pedrolle Pump	650	Good	12	4	48
Pump House	1,500					Chemical dosing pump	920	Good	12	4	48
						IC Engine for powering the Chemical dosing unit	12,000	Good	12	4	48
						I Bulk Water Dispenser	1,500	Good	12	4	48
						1 large Concrete made sedimentation basins with 3 chambers	45,000	Good	25	4	100
						Pump House	1,500	Good	25	4	100
	231,700						**256,570**				

Annexe 9: Technical Data

Technical Data from the field

Item	Rubkona SWAT		Bentiu Conventional Water Treatment Plant	
	Dry Season	Wet Season	Dry Season	Wet Season
Aluminum Sulphate usage rate	50kg	50Kg	42Kg	30Kg
Chlorine usage rate	1.75Kg	12Kg Production of 12 onion tank per day	4KG Kg	2.5Kg
Fuel for the Internal Combustion Engine	56 liters	50 liters	39 liters	36 liters Cost (20 liters is 12,000 SSP)
Pumping hours in 24 hours	Morning – 8.00 a.m. – 12 p.m. Afternoon – 2.00p.m. – 5.30p.m. 8.5 hours of pumping		Morning – 8.00 a.m. – 12 p.m. Afternoon – 2.00p.m. – 5.30p.m. 8.5 hours of pumping	
The common type of maintenance and frequency of the same	Service kits obtained from Kenya or Uganda are used. There are no major break downs CWW-SSD and IOM assist during breakdowns			
Indicators that show that the IC needs servicing				

Inspection	Per operator manual	Dearly or 8 hrs	Weekly or 50 hrs	Monthly or 100 hrs	6 month or 250 hrs	Yearly 500 hrs
General inspection						
Coolant heater						
Fuel level						
Change air cleaner						
Battery charging system						
Drain water from separator trap						
Drain exhaust condensate trap						
Starting battery inspection						
Drain water from separator						
Replace air cleaner elements						
Inspect cooling systems hose						
Changing of engine oil						
Replacement of fuel filters						
Replacement of oil filters						
Lubrication of generators bearings						
Clean the cooling system						
Drive belt tension						
Generator insulation resistance test						
Test basin leak detection switch						

Who does the maintenance?	Mr. Elvis Otieno, the Electro Mechanical technician the Electro-Mechanical technician's fee is 1,950 USD/month, all-inclusive tax LoE is 60% Bentiu and Rubkona translating to 1,170 USD per month for the two systems
What are the supplies used in the maintenance described in (5), (6), and (7)	

Items usage:	Rubkona SWAT	Bentiu WTP
Oil filters	2 bottles per service	
Air filters	5 air cleaners	
Engine oil	25 L	

In the last 12 months, has the machine broken down?	None	None

Production

Item	Rubkona SWAT	Bentiu Conventional Water Treatment Plant	
	Constant regardless of the weather	Dry Season	Wet Season
The amount of water produced per day (from KII):	300,000 liters per day	860,000liters	45,000 liters
(from the Hydraulic Modelling report)	440 M3/day	400 M3/day.	
Figures from the Hydraulic Modelling reports			
Length of Pipelines	8.27km	12.441km.	

Consumption

	Rubkona SWAT	Bentiu Conventional Water Treatment Plant
Number of HH	1,590 HH	4,000 HH
Number of Tap Stands		
Donkey cart haulage at the Water point	Yes	Yes
Trucks haulage at the Water point	No	Yes
Connections	1. Community water points ✓ Suk siter ✓ Non gak ✓ Kurkal ✓ Mankuwai ✓ Shilak 1,2,3 ✓ High salam 1,2,3 ✓ Mankuai 1,2 ✓ zalment 2. Schools connected ✓ Robkona primary ✓ Nyue jul 3. Ministries connected ✓ Commissioner office ✓ Amy barrack ✓ Io comp[commissioner palace] 4. Business promises connected	1. Ministries connected; ✓ Education ✓ Physical infrastructure ✓ Information ✓ Finance ✓ Prison ✓ Health ✓ State [legislation assembly] ✓ Governor ✓ Police 2. Hospitals connected ✓ Bentiu hospital ✓ Msf 3. Schools connected ✓ Birr ✓ Machakos ✓ dereB ✓ dereA

	✓ Peace hotel ✓ John jesh ✓ Superior hotel (disconnected) 4. Hospitals connected ✓ IOM ✓ Care international 5. Residents connected ✓ Commissioner home ✓ Duong thiel	✓ charly kuot ✓ leach 4. residential and homestead connected ✓ Sinner governor ✓ x commander ✓ police officer NB more connection with plumber from ministry done 5. Water kiosk connected ✓ Suk sitter ✓ Kalibalek blo15 ✓ Kalibalek blo16 6. Community water points ✓ Highergas 1,2,3 ✓ Kosey 1,2 ✓ Kue longe ✓ Bimrock ✓ Block 15 ✓ Block 16 ✓ Kurbone ✓ Suksita ✓ Macharik ✓ Amiya ✓ DereB 7. NGOS connected ✓ Rrc ✓ Humanitarian hub ✓ Non-violence ✓ Msf ✓ Red cross ✓ Mercy Corps youth centre ✓ Hingas youth centre

Personnel

Item	Rubkona SWAT	Bentiu Conventional Water Treatment Plant
Staff		

Position	No.	Govt
Security Guards	2	1,500
Cleaners	2	1,050
Gate Valve Officer (Rationing Program)	1	1,050
Supervisor	1	2,500
Operators (with different skills)	3	1,050
Plumbers	2	1,050
Concern staff	2	

Position	No.	Govt
Security Guards	2	1,500
Cleaners	2	1,050
Water Quality Officer	3	1,050
Supervisor	1	2,500
Operators (with different skills)	9	1,050
Plumbers	3	1,050
Concern staff	2	

Annex 10: Business Plans – Rubkona & Bentiu