

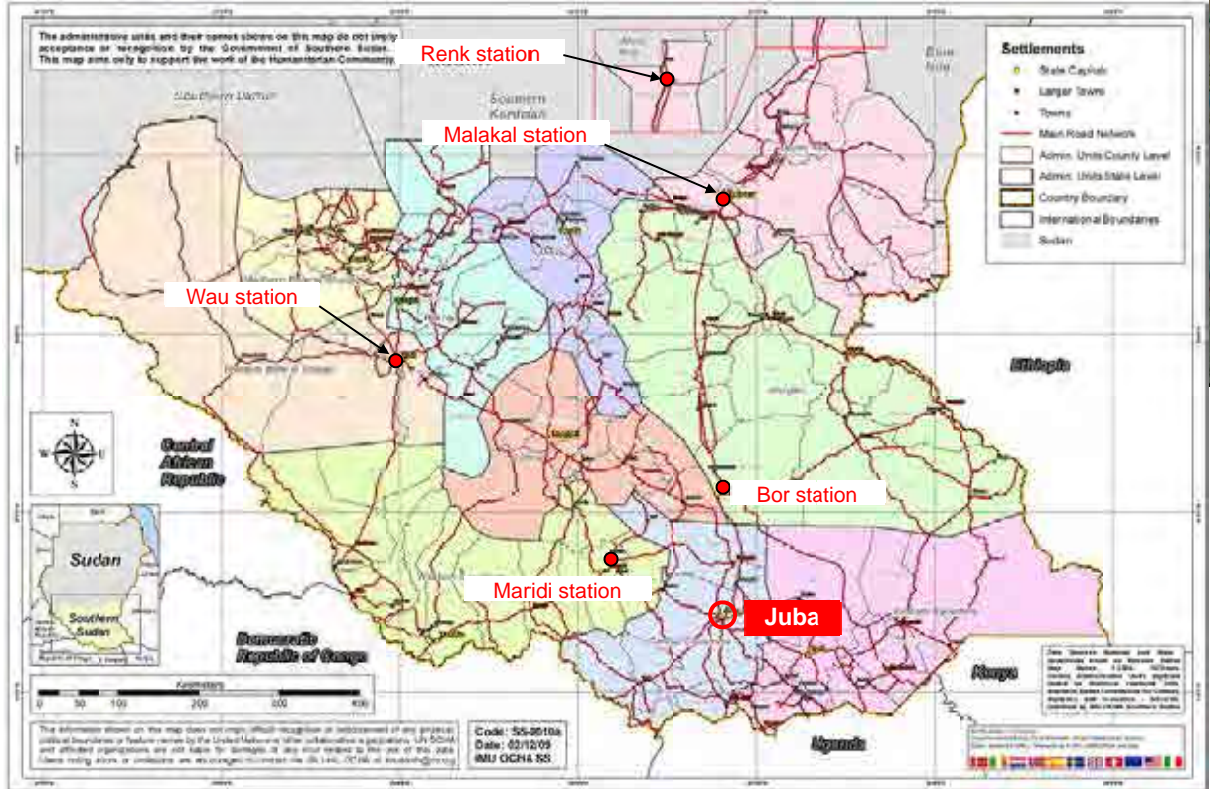
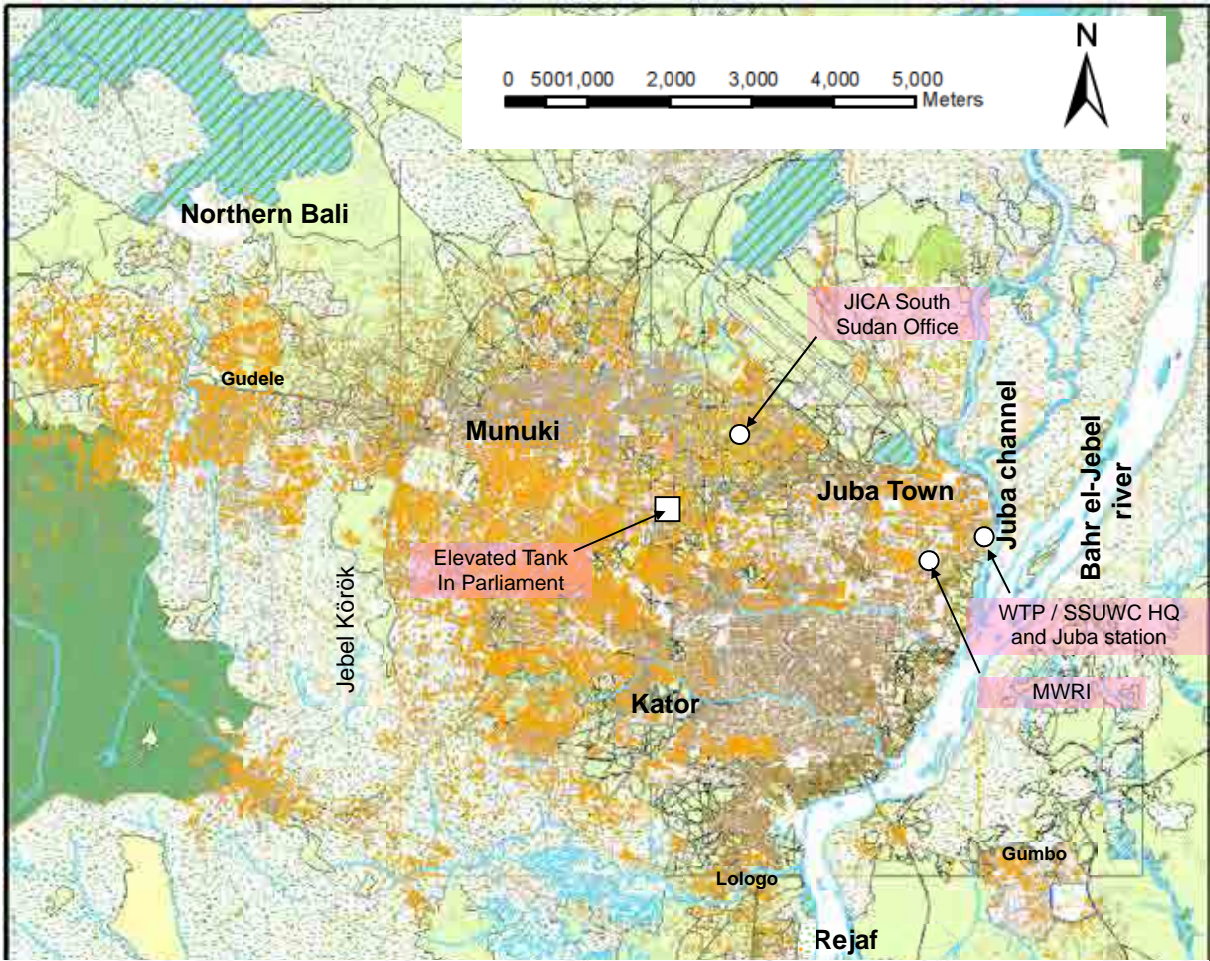
**THE GOVERNMENT OF SOUTH SUDAN (GOSS)
MINISTRY OF ELECTRICITY, DAMS, IRRIGATION AND WATER
RESOURCES (MEDIWR)
SOUTH SUDAN URBAN WATER CORPORATION (SSUWC)**

**PROJECT COMPLETION REPORT
ON
THE PROJECT FOR MANAGEMENT CAPACITY
ENHANCEMENT
OF
SOUTH SUDAN URBAN WATER CORPORATION
IN
SOUTH SUDAN**

OCTOBER 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

TEC INTERNATIONAL CO., LTD.



Location of Project Site

Training Photos (1st Year Term)



Comment for Pre-Test of Purification



Capacity Enhancement for Water Purification Plant (Making Digital Format for O&M record)



Capacity Enhancement for Distribution (Regional problems through socio-condition survey)



Capacity Enhancement for Distribution (Regional problems through socio-condition survey)



Water sampling for backwashing of filtration basins



Seminar for Backwashing of filtration basins to officers of purification department



Water Sampling for daily water quality analysis



Training for water quality analysis to officers of the laboratory



Capacity Enhancement for Stock Keeper Section
(Making Digital Format for Stock Management)



Holes in the Roof of Storehouse



Organizing and Cleaning at the Storehouse



After Organizing and Cleaning at the Storehouse



Training for investigators of survey on public taps stand



Interview to care taker of public taps stand



Focus Group Discussion on public taps stand



Interview to SSUWC officer



Cleaning in the purification plant (1)



Cleaning in the purification plant (2)



Computer Training



Award for Certificate of Computer Training



Practice for Presentation
of the Progress Seminar (1)



Practice for Presentation
of the Progress Seminar (2)



Progress Seminar (1)



Progress Seminar (2)

Training Photos (2nd Year Term)



Training for water purification 2
(Data collection)



Training for water purification 1
(Data analysis)



Training for distribution and transmission 1
(Data Inputting of flow meter record)



Training for distribution and transmission 2
(Protection in cutting asbestos cement pipe)



Training for water quality analysis 1
(Seminar)



Training for water quality analysis 2
(Weekly and Monthly Test)



Cleaning activities for the clear water tank
Before and after the tank inside



Removing the outlet pipe in clear water tank



Pump suction pipe with screen before cleaning in
clear water tank



Pumping water out from the clear water tank



Notice board of backwashing method



Construction of flow meter pit



Installation of flow meter



Construction of pilot public tap stand for trial operation



Cleaning in the purification plant



Training for data analysis and preparation of reports (1)



Training for data analysis and preparation for reports (2)



Training for water purification
(Teaching of Standard Operating Procedures)



Training for water purification
(Preparing Annual Report)



Training for distribution and transmission 1
(Using GPS)



Training for distribution and transmission 2
(Recording of new service pipe installation)



Training for water sampling at tap
(Monthly water sampling)



Training for water quality analysis
(Teaching residual chlorine kit to shift operators)



Construction of pilot public tap stand for trial operation



Submission and discussion of annual report and action plan together with SSUWC HQ



Training in Yokohama, Japan



Training of installation of service connections and pipe repairs in Kenya Water Institute (KEWI)



Reporting of KEWI training to staffs at computer training room



Installation of pressure gauge

Training Photos (3rd Year Term)



Training for water purification
(Cleaning of raw water tank)



Construction flow meter pit



Training for water quality analysis 1
(Jar tester)



Training for water quality analysis 2
(Data input and analysis)



Training for water quality analysis 3
(Inventory Management)



Motor cycles for bill distribution and distribution
network checking



Monthly Report Preparation in Juba station



Annual Budget Plan Meeting in HQ



Public tap stand
(Before installing a 2000 m3 tank)



Public tap stand
(After installing a 2000 m3 tank)



Training for water purification 1
(Turbidity Measurement by Shift Operators)



Training for Water purification2
(Adjustment of Alum Injection Rate by Turbidity Measurement)



Installation of Customer Meter
(Test Meter Field)



Reading Customer Meter
(Test Meter Field)



Training for data analysis of operation and
maintenance



Meeting for financial improvement
(SSUWC Juba-station)



PR activity
(Study Tour of treatment plant with school children)



Seminar for Planning and Design of Water Supply
Facilities (during 7 days)



Installation of chlorine injectors



Installation of electromagnetic flow meter



4th Progress Seminar



4th JCC Meeting



3rd County Training
(Before Leaving Juba)



Training for Supervision of Fence Installation

Training Photos (4th Year Term)



Weekly Meeting



Retraining of Operation and Maintenance for purification plant to Shift Operators



Award Ceremony for high achiever of terminal test



Submission and discussion of monthly report together with SSUWC HQ



Final Seminar



Ceremony of Project Completion

Project Completion Report
on
The Project for Management Capacity Enhancement of South Sudan Urban Water Corporation in South Sudan

Location Map

Photos

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APPENDICES

- Appendix A: Minutes of Meetings on Joint Coordination Committee Meeting
- Appendix B: Agreements on handover of the equipment procured in the project
- Appendix C: Performance Indicators

ANNEXURE (TECHNICAL DOCUMENTS)

VOLUME I: CURRENT STATUS

1. Baseline Survey Results of Juba Station
2. Current Status of Tariff Collection from House Connections
3. Current Management Status of Public Tap Stands
4. Seminar Materials for Understanding of Financial Situation and Introduction of New Water Tariff

VOLUME II: MANUALS

1. Reporting and Planning System
2. Water Quality Monitoring and Operation and Maintenance of Water Purification Plant (Revised)
3. Operation and Maintenance of Transmission and Distribution Facilities
4. Revenue Collection Database
5. Management Models for Public Tap Stands and Tanker Filling Points
6. Roles of Headquarter, Reporting and Planning System and Database of Stations
7. Record Format and Database

VOLUME III: REPORT AND PLAN

1. Monthly Report of Juba Station
2. Performance Indicators
3. Database of SSUWC Stations
4. Pump Operation and Water Distribution Plan
5. Performance Evaluation for March 2011 to May 2012 and Annual Plan for July 2012 to June 2013
6. Performance Evaluation for July 2012 to June 2013 and Annual Plan for July 2013 to June 2014
7. Budget Plan for Juba Station for Fiscal Year 2012/2013
8. Budget Plan for Juba Station for Fiscal Year 2013/2014
9. Report on 2nd Social Condition Survey for Water Supply Service
10. Mid-term Evaluation Report
11. Terminal Evaluation Report

12. Report on the Management Models for Tanker Filling Points
13. Report of the Assessment of the Management and Operation of the Public Tap Stands and Tanker Filling Points
14. Report of the Physical Inspection of the Facilities
15. Report of Test Meter Field and Meter Reading results

VOLUME IV: TRAINING MATERIALS

1. Training Materials for Water Intake and Treatment Facilities
2. Training Materials for Transmission and Distribution Facilities
3. Training Materials for Water Quality Management
4. Training Materials for Management Model for Public Tap Stands and Tanker Filling Points
5. Training Materials for Outline of Planning and Designing of Water Supply Facility
6. Public Awareness Materials

VOLUME V: PRESENTATION MATERIALS

1. 1st JCC Meeting (1st year term)
2. 1st Progress Seminar & 2nd JCC Meeting (1st year term)
3. 2nd Progress Seminar & 3rd JCC Meeting (2nd year term)
4. 3rd Progress Seminar & 4th JCC Meeting (2nd year term)
5. 4th Progress Seminar & 5th JCC Meeting (3rd year term)
6. 6th JCC Meeting (4th year term)
7. Seminar on Cost Recovery, Introduction of Water Tariff, Improvement of Revenue Collection
8. HQ Management 1
9. HQ Management 2
10. Draft Annual Plan and Annual Budget (2012)
11. Final Seminar

LIST OF ABBREVIATIONS

Abbreviation	English
AS	Asbestos
GIZ	Gesellschaft für Internationale Zusammenarbeit
HQ	headquarter
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency Development
MDTF	Multi Donors Trust Fund
O&M	Operation and Maintenance
PDM	Project Design Matrix
PI	Performance Indicator
PS	Pump Station
PTS	Public Tap Stands
PVC	Polyethylene vinyl chloride
SDG	Sudanese Pond (Utilized before independence)
SSP	South Sudanese Pound
SSUWC	South Sudan Urban Water Corporation
SUWASA	Sustainable Water and Sanitation in Africa
TFS	Tanker Filling Station
USAID	United States Agency for International
UWC	Urban Water Corporation
WPP/WTP	Water Purification Plant/Water Treatment Plant

CHAPTER 1 OUTLINE OF PROJECT IMPLEMENTATION

1.1 Background of the Project

In Sudan, after more than two decades of conflict between the government and the Sudan People's Liberation Movement (SPLM), in January 2005 the Comprehensive Peace Agreement (CPA) was signed and the Southern Sudan established an interim government. The population of Juba, the capital of the Southern Sudan, has been rapidly increasing with a bulk of internally/internationally displaced people returning and is now estimated to be around 400,000. As little maintenance work has been conducted for urban infrastructures due to the conflict, many facilities have become old and the service provision function has significantly decreased.

The water supply system in Juba is operated by Juba station (164 staff members) of South Sudan Urban Water Corporation (SSUWC) under the Ministry of Water Resources and Irrigation (MWRI). The corporation operates and maintains water supply facilities that consist of water treatment, transmission and distribution facilities and also collects water tariff. However, it has become difficult to distribute safe water in a planned and efficient manner due to lack of knowledge and skills about the operation and maintenance of water supply facilities, ad-hoc measures taken as a result of insufficient planning of operation and maintenance, lack of inspection and confirmation process of supplied water quality, lack of understanding of the water supply status in the city, lack of water distribution management for equal water distribution, and lack of necessary maintenance materials and budget, in addition to the degraded facilities. Moreover, with over 80% of its expenditures covered by government subsidies, the station is not run autonomously or stably. The revenue collection system with handwritten ledgers is very inefficient and there is no adequate budget or annual plan for operation maintenance. A low flat-rate system has been employed without clear understanding of the water supply cost and the required level of water tariff to cover it. Thus the SSUWC does not generate enough revenue to cover all the necessary expenses for the operation of the corporation.

SSUWC Headquarters (38 staff members) is in charge of securing and preparing necessary budget for the operation of local stations as well as providing guidance and supervision on technical and institutional issues of the stations. However, since there is not enough mutual consultation between the Headquarters and the stations or no clear institutional framework to understand the actual state of the operation of the stations, they are not able to provide appropriate assistance to the stations.

Under these circumstances, there was a request for a technical cooperation project to enhance the capacity of SSUWC Juba station for operation and maintenance of water supply services. In response, the detailed planning survey team organized by JICA visited Southern Sudan from February to March 2010 and reached an agreement on the project overview with the executing organization of the project,

the MWRI, and the target group for capacity enhancement, the SSUWC. In July 2010 the Record of Discussions (R/D) was signed between the Ministry of Finance and Economic Planning, which works as a contact in the government of Southern Sudan for the Project, and the Resident Representative of JICA in Sudan. According to the R/D, the Project was carried out for three years from Nov. 2010 to Oct 2013.

1.2 Project Overview

This project is to enhance the management capacity of the South Sudan Urban Water Corporation. Its overall goals, purpose and outputs are as described below.

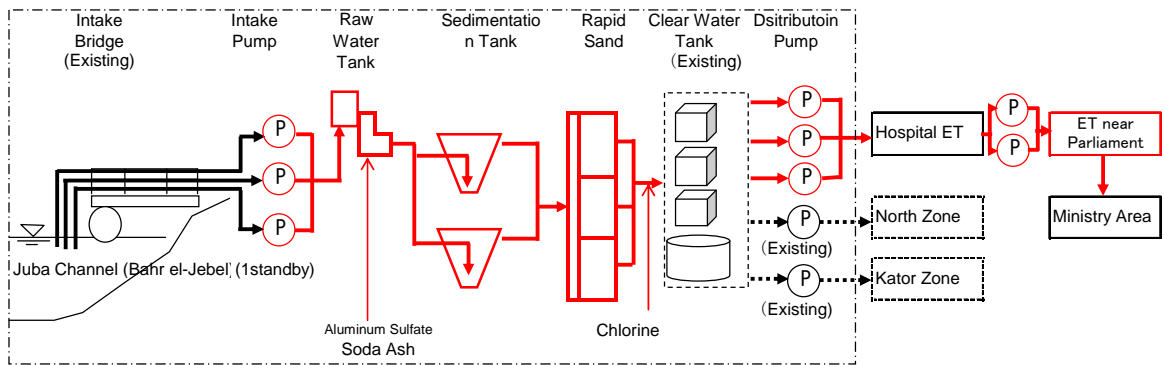
(1) Title of the Project “The Project for Management Capacity Enhancement of South Sudan Urban Water Corporation in South Sudan” (hereinafter referred to as "the Project")
(2) Overall Goal 1) The quality of water supply service provided by SSUWC Juba station is improved. 2) Support provided by SSUWC Headquarters to other stations than Juba station is increased.
(3) Project Purpose The management capacity of SSUWC Juba station is enhanced through capacity development on operation and maintenance of water supply facilities.
(4) Outputs 1) Capacity of SSUWC Juba station with respect to operation and maintenance of water intake and treatment facilities is improved. 2) Capacity of SSUWC-Juba with respect to operation and maintenance of water transmission and distribution facilities is improved. 3) Capacity of water quality management of SSUWC Juba station is improved. 4) Understanding of financial conditions of SSUWC Juba station is enhanced. 5) Capacity of SSUWC Headquarters to support SSUWC Juba station is enhanced.
(5) Target Project Area Juba, South Sudan
(6) Government Ministry Concerned Ministry of Water Resources and Irrigation (MWRI), Government of South Sudan
(7) Counterpart Organizations SSUWC Headquarters and Juba station
(8) Beneficiaries Direct Beneficiaries: SSUWC Juba station personnel (164) and Headquarters personnel (38) Indirect Beneficiaries: Residents in the area served by SSUWC Juba station (approx. 400,000 people)

1.3 Target Facilities for Operation and Maintenance

The major existing water facilities targeted by the Project are the facilities rehabilitated with MDTF (Multi Donor Trust Fund) whose operation started in May 2009. The systems and rough layouts are as shown in Figure 1-1. The gap between the water demand and the supply capacity of the existing facilities is huge as the capacity of the water treatment plant repaired with MDTF is 7,200m³/day and it covers only part of the total demand. Moreover, most of the existing distribution pipes (total length: approx. 60 km) are old asbestos cement pipes. The leakage rate is estimated to be around 40% based on the high frequency of leakage, and regular cutoff of water supply and water shortage have become issues. The target facilities for operation and maintenance are as follows.

Table 1-1 Overview of Target Facilities for Operation and Maintenance

Facilities	Facilities	Composition
Production	Water treatment plant 7,200m ³ /day	<ul style="list-style-type: none"> - Water intake and transmission facilities - 2 suspended solids contact clarifiers, 4 filter basins, a clear water basin - Building for chemicals, building for chlorine sterilization - Transmission pumping station (via pumping station near hospital to elevated water tank near Parliament building) - Distribution pumping station
Water transmission and distribution	Transmission and distribution pumping stations	<ul style="list-style-type: none"> - Distribution pumping station in water treatment plant - Transmission pumping station near hospital (to elevated water tank near Diet building) - Kator pumping station
	Elevated water tanks	<ul style="list-style-type: none"> - Elevated water tank near Diet building: 250m³ - Elevated water tank in Kator area - Elevated water tank near hospital
	Distribution basin	<ul style="list-style-type: none"> - Kator distribution basin (approx. 500m³)
	Water transmission pipes	<ul style="list-style-type: none"> - Diameter 300 mm x approx. 5 km (Water treatment plant – pumping station near hospital – elevated water tank near Diet building)
	Water distribution pipes	Approx. 60 km (mainly asbestos pipes)
Service	Connection to each house	Approx. 3,000 households, no water meter



Note: Red and black colors indicate the water supply facilities constructed by MDTF fund and the existing facilities, respectively.

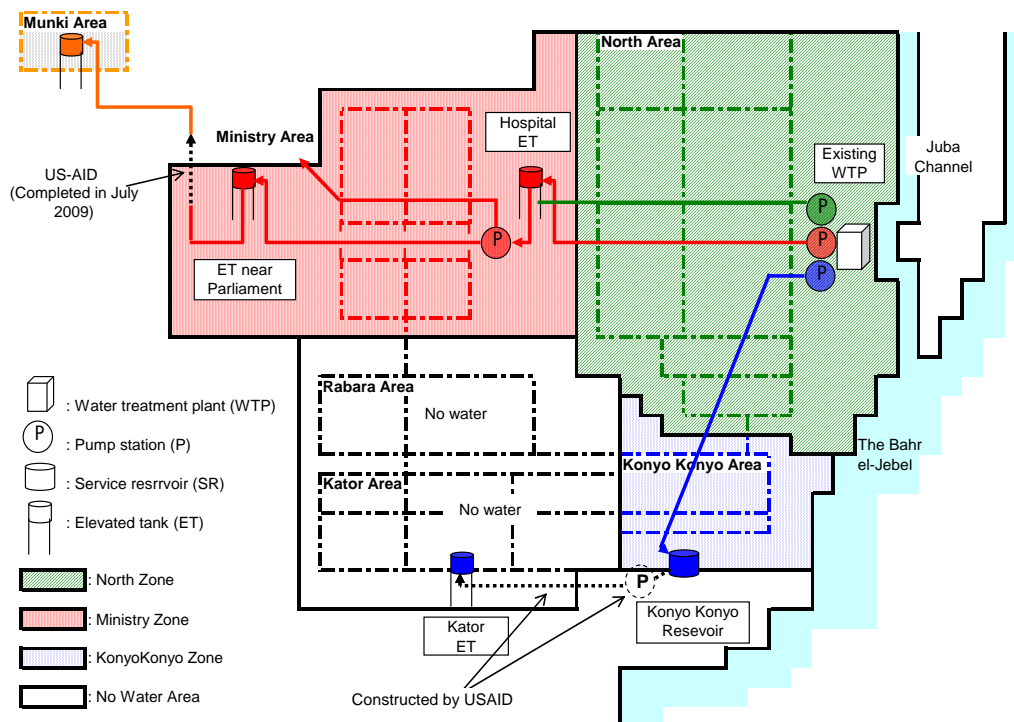


Figure 1-1 Overview of Water System

The office of UWC Juba station is on the site of the existing water treatment plant. There is also a building built as a constructor's office that was constructed and used when the MDTF water treatment plant was constructed. There is another office that was newly constructed for a construction supervising consultant. The office for the building constructor can be used for training room, and part of the consultant's office can be used as experts' office. However, according to the layout plan for facility expansion that is now being studied in the grant aid project, the constructor's office that is to be used as a training room will be removed. The Project will have discussion about training facilities with JICA and SSUWC when it starts the Project.

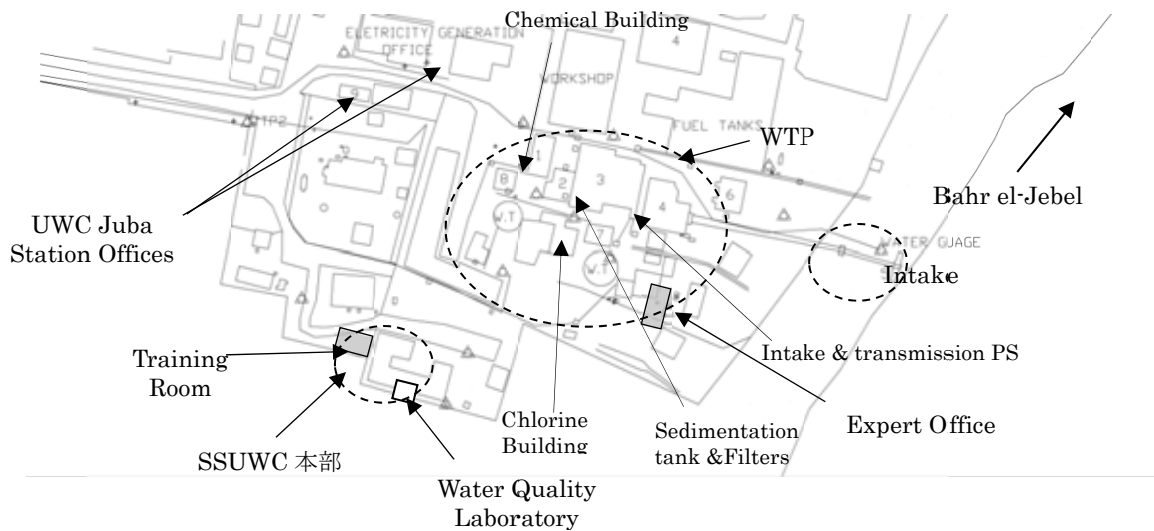


Figure 1-2 Training Facilities

1.4 Issues to be Solved and Approach

As a result of the detailed planning survey, various issues of SSUWC Juba station have been summarized into the following three major issues.

1. Water facilities of water intake, treatment, transmission and distribution is not operated or maintained in a proper and planned manner, and therefore water supply is not appropriate.
2. Water tariff is not collected in an efficient and effective manner, and therefore stable business operation is hindered.
3. Juba station does not get appropriate support from SSUWC Headquarters.

The government of Southern Sudan originally requested this technical cooperation project for the purpose of strengthening the financial conditions of the SSUWC through improvement of revenue collection. However, as a result of analysis, investigation and discussion during the detailed planning survey, it has been concluded that the initial goal should be the supply of safe water in a planned and appropriate manner, which is the basis for a water supply corporation, because users refuse to pay for insufficient and unsatisfactory water supply service and improving the revenue collection system would not produce enough effect when a sufficient quantity of water is not supplied. Capacity development on operation and maintenance is essential to the implementation of the grant aid that was requested at the same time as the Project and for which an outline design survey is now being conducted.

On the other hand, considering that the improvement of water supply infrastructures in Juba will be completed in 2013 if the Japanese grant aid is conducted, improvement of the revenue collection

system is also an urgent task to conduct operation and maintenance of the facilities in a sustained manner. Therefore it has also been agreed that preparation for the system development needs to be started at an early stage.

For the reasons stated above, it has been decided that the Project should be carried out for capacity enhancement of SSUWC Juba station, mainly for proper operation and maintenance of water facilities, and that the activities to strengthen the financial conditions including revenue collection would be limited to assessment of existing financial conditions and recommendation for future institutional reforms. Considering the significant role of SSUWC Headquarters, who supports Juba station, it has also been decided to make efforts to further optimize the management of the water supply business of Juba station by enhancing the support capacity of the Headquarters, although the direct beneficiary of the Project is Juba station. Based on the result of the detailed planning survey, the following two approaches should be taken when conducting the above-described management capacity enhancement.

(1) Acquisition of Basic Knowledge and Behaviors through Combination of Lectures and OJT

Personnel of SSUWC Juba station, the beneficiary group of the Project, have not mastered necessary knowledge or operation methods because they have not received consistent and systematic training for appropriate operation and maintenance of water facilities. Such knowledge and operation methods are to be shared at the same level among all the personnel involved so that the water corporation can stably provide homogeneous services. Therefore, the Project first plans to conduct lectures about necessary knowledge so that the trainees will acquire knowledge and operation methods. After that the staff will actually conduct operation and maintenance of water treatment, transmission and distribution facilities by On-the Job training (OJT). In this process experts will provide practical training and advice so that practical operational capabilities will be acquired. As the existing facilities are old and not always efficient, the water supply status is not likely to improve dramatically. However, it is hoped that the learned knowledge and skills will take root after repeatedly practiced.

For the training, operation and maintenance manuals, which are mainly compiled from teaching materials, will be prepared so that common understanding will be continuously confirmed among those concerned even after the termination of the Project. The following shows a training procedure.

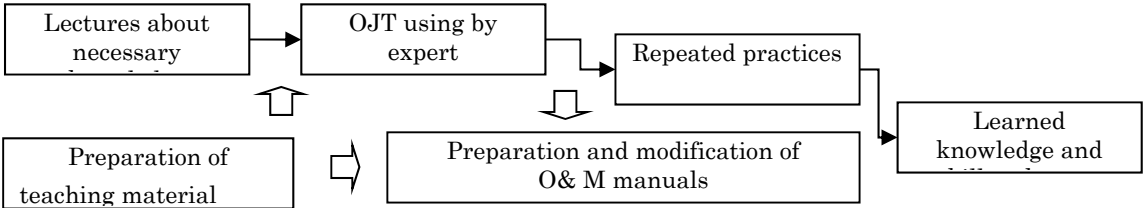


Figure 1-3 Training Procedure

(2) Familiarization with Planning, Implementation and Feedback Processes based on Records

One of the major issues of SSUWC Juba station is that there is no operation record at all and they cannot identify or take actions on operational issues. Therefore, the Project will try to improve operations of SSUWC Juba station with the following two steps:

First step: the Project assist it in keeping such records of operating hours of the facilities, operating costs, incomings and outgoings of equipment and materials, results of water quality tests and water distribution status.

Second step: the Project provides support to analyze accumulated records, and identify problems, and find solution and make a plan for solution, and implement the plan so that the staff will be able to manage concrete processes for problem solving.

In the second step, the Project will also provide support to establish an operation and maintenance plan for securement of budget, and timely procurement of spare parts etc., based on the actual performance and records accumulated, aiming at changing the pattern of the current behaviors, e.g., ad-hoc actions or unplanned measures taken each time when there is a failure with equipment and lack of materials.

Moreover, the Project will aim to establish a system for sharing these records and identified issues between SSUWC Headquarters and local stations and to help the Headquarters establish a support function for local stations so that they can provide appropriate guidance on operation to stations. Specifically, the Project will provide support for institutionalization of preparation and submission of regular reports from local stations to the Headquarters and for holding of regular consultations between the Headquarters and local stations so that the Headquarters will fully understand the actual situation of the stations.

CHAPTER 2 INPUT OF PROJECT IMPLEMENTATION

2.1 Implementation Schedule

The operation flowchart for project output is given in Figure 1-1. The implementation schedule of each activity is shown in Figure 1-2.

2.2 Input of Project Implementation

2.2.1 Input of Man-month

Planned input of man-month is shown in Table 2-1, and actual input is shown in Table 2-2.

2.2.2 Input of Equipment

Input of equipment in each year term is shown in page 2-6.

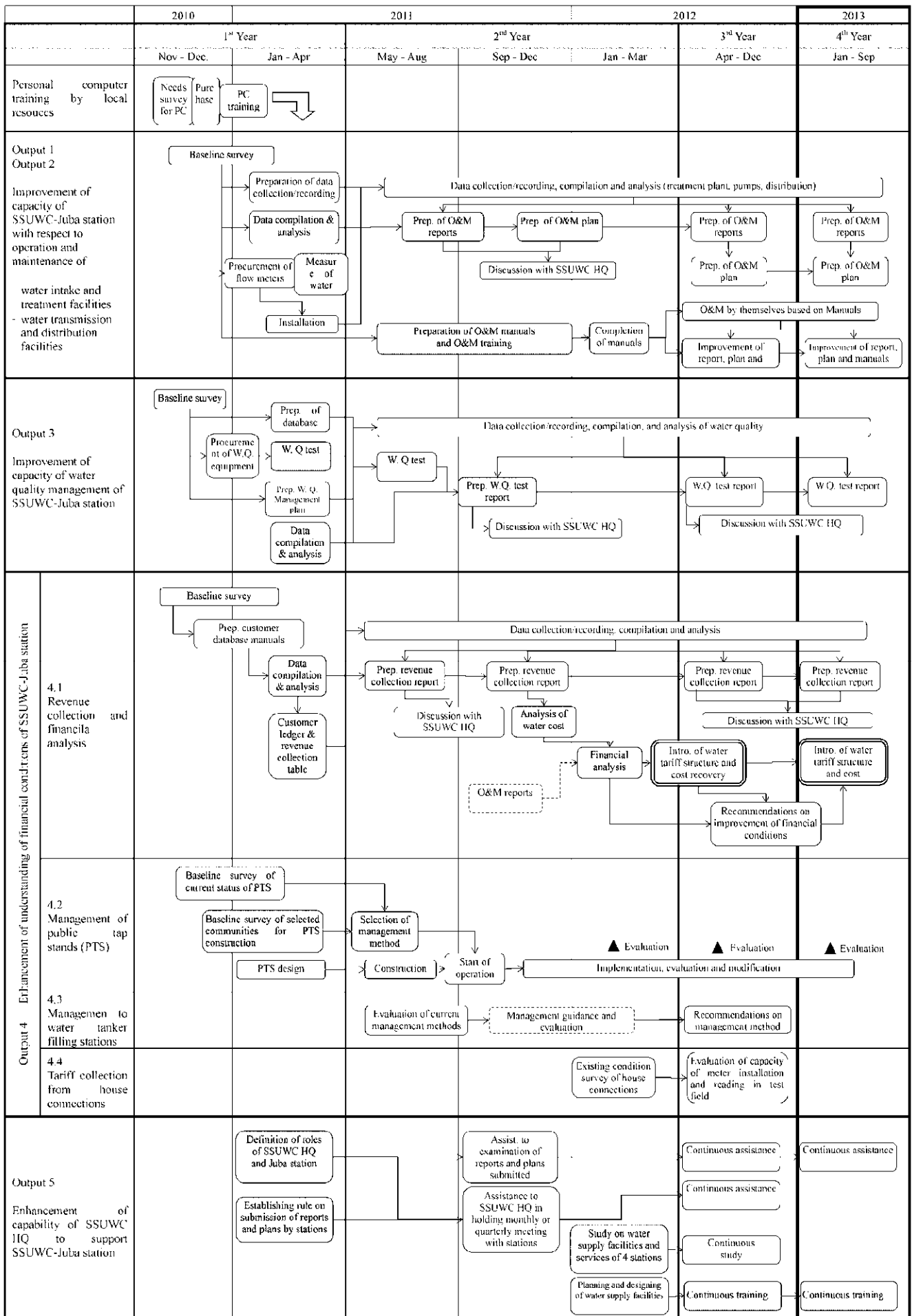


Figure 2-1 Operation Flowchart for Each Project Output

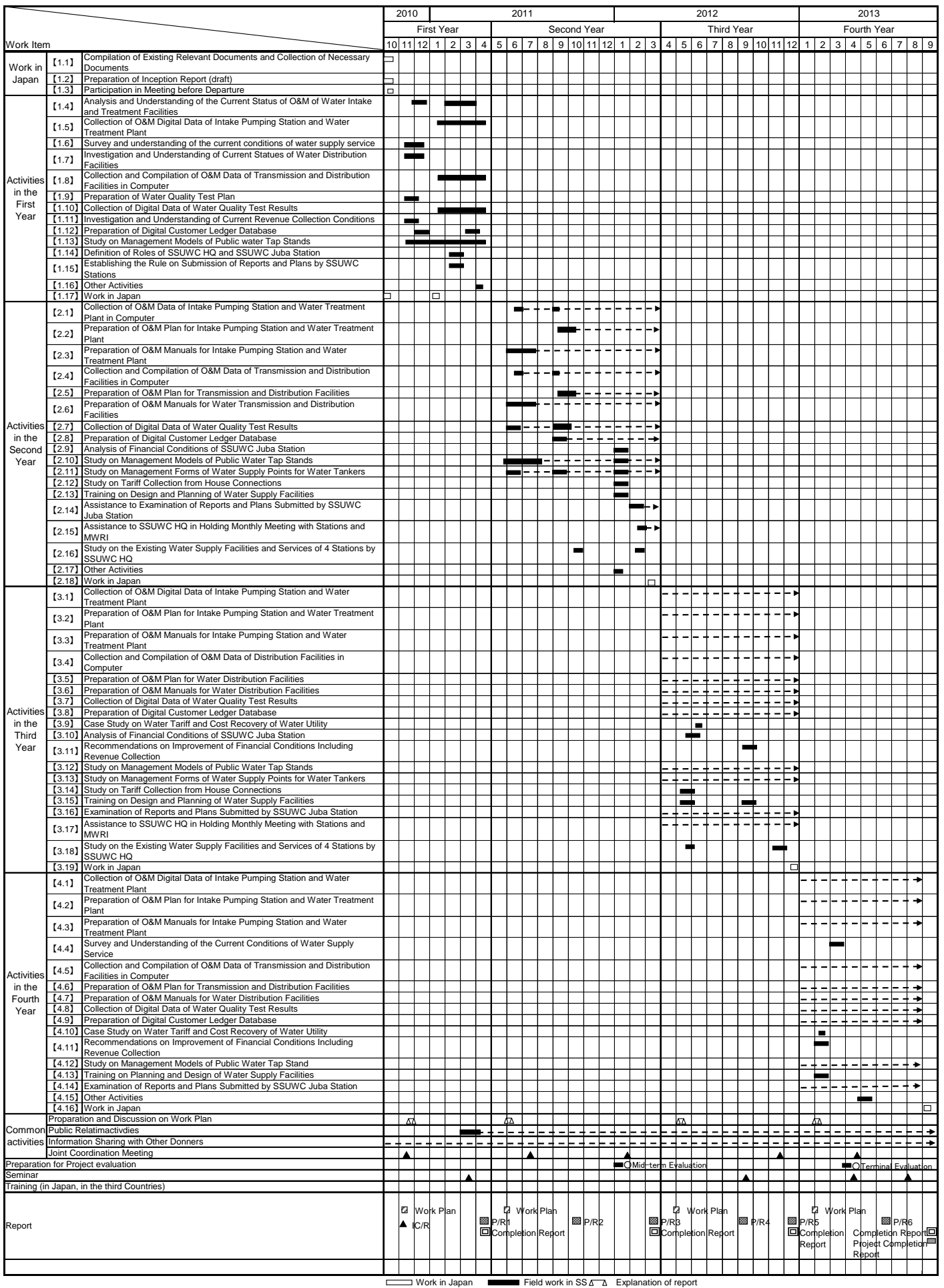


Figure 2-2 Implementation Schedule of Each Activity

Table 2-1 Input of Man-month (Plan)

Assignment	Name	1st Year				2nd year				3rd Year				4th Year				1st Year		2nd Year		3rd Year		4th Year		Total																																																
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Field	Japan	Field	Japan	Field	Japan	Field	Japan	Field	Japan																														
																														Field	Japan	Field	Japan	Field	Japan	Field	Japan	Field	Japan	Field	Japan	Field	Japan																															
Chief Advisor/Water Utility management	Hiroataka Sato	□	■	■	□	■	■		■	■		■	■	■		■	■	■		■	■		■	■						■	■		■	■		3.33	0.67	4.00	0.50	3.50	0.17	2.00	0.33	12.83	1.67																													
Water Treatment Plant /Pumping Facilities Operation and Maintenance	Yarai Sato	□	■	■	□	■	■		■	■		■	■		■	■		■	■		■	■							■	■		■	■		2.83	0.67	4.00	0.50	2.00	0.17	2.00	0.33	10.83	1.67																														
Transmission and Distribution Facilities Operation and Maintenance	Masashi kawamura	□	■	■	□	■	■		■	■		■	■		■	■		■	■		■	■							■	■		■	■		2.83	0.67	4.00	0.50	2.50	0.17	2.00	0.33	11.33	1.67																														
Water Quality Management	Moriji Yanagimura		■	■	□	■			■					■																				2.00	0.33	2.00	0.00	1.00	0.00	1.00	0.00	6.00	0.33																															
Financial Evaluation/ Water Tariff	Atsuo Ohno		■	■	□	■			■					■																				2.50	0.33	2.50	0.00	2.50	0.00	2.00	0.00	9.50	0.33																															
Community Development	Mukibi Steven		■	■		■	■		■	■		■	■																					3.33	0.00	2.50	0.00	1.00	0.00	1.00	0.00	7.83	0.00																															
Coordinator/ Community Development (2)	Hayato Nakazono		■	■	□	■			■					■																				2.33	0.67	2.00	0.00	1.00	0.00	2.00	0.00	7.33	0.67																															
																														19.17	3.33	21.00	1.50	13.50	0.50	12.00	1.00	65.67	6.33																																			
Reports	Report																																																																									
	Work plan	IC/R ▲	□						■					■						■																																																						
	Progress report																																																																									
	Completion report																																																																									
Evaluation of the Project																																																																										
		Baseline survey, data format and analysis				Preparation of O&M report, O&M plan, O&M manual (Establishment of O&M system)								Implementation, Monitoring, Improvement & Modification and Implementation																19.17	3.33	21.00	1.50	13.50	0.50	12.00	1.00	65.67	6.33																																			
																														(22.50)	(22.50)	(14.00)	(13.00)	(72.00)																																								

Legend:  Field work
 Work in Japan

Table 2-2 Input of Man-month (Actual)

Assignment	Name	1st Year				2nd year					3rd Year					4th Year					1st Year			2nd Year			3rd Year			4th Year			Total																												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Field	Japan	TEC Fund	Field	Japan	TEC Fund	Field	Japan	TEC Fund	Field	Japan	TEC Fund											
Chief Advisor/Water Utility management	Hirota Sato	10	42		5		56					5	30			36	33			35														25			30		30				22	5	3.27	0.50		4.47	0.17		2.83	0.00		2.33	0.17		12.90	0.83	0.00		
Water Treatment Plant /Pumping Facilities Operation and Maintenance	Yarai Sato	10	24		5		56																															30			30			21		2.67	0.50		3.00	0.00		2.00	0.00		2.97	0.00		10.63	0.50	0.00	
Pumping Facilities Operation and Maintenance (2)	Yoshiki Sugiyama													30																																	0.00	0.00		1.00	0.00		0.00	0.00		0.00	0.00		1.00	0.00	0.00
Transmission and Distribution Facilities Operation and Maintenance	Masashi Kawamura	10	35		5		55	1									52	42			41	5														45			45		5				20		3.00	0.50	0.03	4.50	0.17		3.00	0.17		1.13	0.00		11.63	0.83	0.03
Water Quality Management	Moriji Yanagimura		30		5		34	11					45				30	14																	30			30						31		2.13	0.17	0.37	2.50	0.00	0.47	2.00	0.00		2.03	0.00		8.67	0.17	0.83	
Financial Evaluation/ Water Tariff	Atsuo Ohno		30		5		45										40	43																					46			24			27		2.50	0.17		2.77	0.00		2.33	0.00		2.00	0.00		9.60	0.17	0.00
Community Development	Mukibi Steven		18	6			52							30			15	18			22															15			15						16		2.53	0.00		2.83	0.00		1.00	0.00		1.23	0.00		7.60	0.00	0.00
Coordinator/ Community Development (2)	Hayato Nakazono		35				25	31					20	26			20	23			20	15													27	10			23	10					31		2.00	0.00	1.03	2.00	0.00	2.13	1.67	0.00	0.67	1.80	0.00		7.47	0.00	3.83
																																																18.10	1.83	1.43	23.07	0.33	2.60	14.83	0.17	0.67	13.50	0.17	69.50	2.50	4.70
Reports	Report	IC/R ▲																																																											
	Work plan	☑																																																											
	Progress report																																																												
	Completion report																																																												
Evaluation of the Project																																																													

Legend: Field work Field work (TEC own budget) Work in Japan

(1) Equipment in 1st Year Term

1) Major Equipment

Equipment/Materials	Specifications	Quantity
1) Pipe Material, Valve, Accessories		
Flange adapter for PVC	8 inch, PVCXF, PN16, with bolts and nuts	8
Flange adapter for GI	8 inch, GIXF, PN16, with bolts and nuts	4
Flange adapter for GI	6 inch, GIXF, PN16, with bolts and nuts	8
Flange adapter for PVC	4 inch, PVCXF, PN16, with bolts and nuts	4
Rubber gasket	for 8 inch	6
Rubber gasket	for 6 inch	4
Rubber gasket	for 4 inch	2
Bolts & nuts	M20	144
Bolts & nuts	M16	32
Washers	for M20	144
Washers	for M16	32
Flexible pipe	2", L=10m	10
Anchor bolt		40
Electro cabinet	40cmX40cmX20cm	10
Seal tape	for pressure gauge	30
Valve	1/2"	20
Iron pipe	1/2", L=15cm	8
2) Tools for plumbing and operation and maintenance		
Welding machine	DC60A-140A, 2.0-3.2mm	1
Electrode	3.2mm, 10kg	10
Electrode holder		1
Earth grip		1
Welding cable	20-30m	2
Welding goggles		2
Welding globes		2
Blade for pipe cutting by grinder		10
Code reel		3
Slide calipers		3
Claw bar		3
Tapping machine		1
Vice		3
Working platform	to install vice	1
Circuit tester		1
insulation resistance tester	500/1000V, double range	1
Clamp tester/meter	power voltage, electric flow, frequency, resistance, temperature	1
Jumper cable	for 5A	5
Rotating meter		1
Vibration gauge		1
Noise level meter		1
Bar thermometer		1
3) Water Quality Equipment		
Water Conditioning Laboratory	CEL/850	1
Pocket Colorimeter	Chlorine Free + Total	3

Equipment/Materials	Specifications	Quantity
Pocket Colorimeter	Iron	1
Pocket Colorimeter	Manganese	1
Pocket Colorimeter	Ammonia	1
Pocket Colorimeter	Nitrate	1
Pocket Colorimeter	Fluoride	1
Pocket Colorimeter	Dissolved Oxygen	1
Conductivity Starter Kit	Conductivity Starter Kit	1
Portable Turbidimeter	2100Q	1
Turbidity/Colormeter	2100AN	1
Still Water Automatic	Still Water Automatic	1
Handbook	Standard Method	1
Beakers	Glass 1000ml, 6/pk	2
Beakers	Glass 250ml	12
Flask Erlenmeyer Wide Mouth	Glass 250ml	12
Bottle Amber Glass	Amber 237ml, 6/pk	2
Bottle Amber Polyethylene	Amber 500ml, 6/pk	1
Bottle Amber Polyethylene	Amber 1L, 3/pk	1
Cylinder Glass	100ml	10
Cylinder Glass	250ml	10
Polyethylene Bucket	10L Handle	3
Sampler Dipper	500ml 12ft handle	2
Jar Tester	Six paddle lab stir, 220V 50Hz	1
4) OA Equipment etc.		
Projector	VPL-EX100, SONY Standard Resolution: XGA	1
PC (Desktop)	HP S2031a(Monitor), HP500B MT(CPU), OS:Windows 7 Professional Office:Microsoft Office 2010 Professional CPU: Core 2 Duo or more than 2.0GHz HDD: 150GB, Memory 2GB 17 inch screen, Internal DVD-RW, CD-RW Keyboard, Mouse, including Anti-Virus Software	19
	HP S2031a(Monitor), HP500B MT(CPU), hp OS:Windows 7 Professional Office:Microsoft Office 2010 Professional CPU: Core 2 Duo or more than 2.5GHz HDD: 250GB, Memory 4GB 17 inch screen, Internal DVD-RW, CD-RW Keyboard, Mouse, including Anti-Virus Software	1
PC (Laptop)	HP G62, hp OS:Windows 7 Professional Office:Microsoft Office 2010 Professional CPU: Core 2 Duo or more than 2.0GHz HDD: 150GB, Memory 2GB Internal DVD-RW, CD-RW Keyboard, Mouse, including Anti-Virus Software, software	1
	HP G62, hp OS:Windows 7 Professional Office:Microsoft Office 2010 Professional CPU: Core 2 Duo or more than 2.0GHz HDD: 250GB, Memory 2GB A4 or equivalent, Internal DVD-RW, CD-RW Mouse, Anti-Virus Software, Soft case	1
UPS	Back-UPS CS 650, APC for Desktop PC mentioned above	19
	for Desktop PC mentioned above	1

Equipment/Materials	Specifications	Quantity
Equipment for Intranet	iBOOK 1110, WD External HDD 1TB	2
	DIR615, D-Link Hub with 4 channels	2
	DES-1008D, D-Link Hub with 8 channels	4
	LAN cable (5m)	22
	Other necessary accessories for intranet (set)	3
Printer (A4 laser)	HP Color Laserjet CP2025 Laser printer, color	6
Toner (A4 laser)	for laser printer (No.11), color	18
Printer (A4 laser)	HP Laserjet P2055dn Laser printer, black and white	6
Toner (A4 laser)	for laser printer (No.13), black and white	18
Printer (A3 inkjet)	HP Officejet 7000 Inkjet printer, color	1
Ink Cartridge (A3 inkjet)	for inkjet printer (No.15), a set of all colors	3
Drum Cartridge	Canon Laser Base MF8180C	1
USB memory stick	imation Memory 2GB	13
Plotter	HP Designjet T1200&T770 printer series Maximum size A0, color 3 sets of ink cartridges(all colors) 3 sets of cartridge head 3 roll-papers	1
Copy Machine	Kyocera TASKalfa 250ci Black and white & color, A3, A4, letter size Duplex Printing, Loader parts for auto feeding Feature: Copying, Printer, Scanner (All in one)	1
Photocopy machine table	For Kyocera TASKalfa 250ci	1
Digital Camera	DSC-W310 More than 10 Mega Pixels LCD-display, Zoom&Focus fuction, Self-timer, SD card, File format(JPEG), Video Function	1
Video Camera	DCR-SR68E LCD-display, Zoom&Focus fuction, Optical Sensor Type(CCD), Remote Control, TV Tuner, SD card, connection for USB, Microphone	1
GPS (Global Positioning System)	Mobile Mapper 6, ashtech GPS receiver with GPS antenna, OS: Microsoft Windows Mobile, Bluetooth Wireless Technology, Accuracy (SBAS): 2~5m With Arc Pad 10	1
Book Shelf	Wooden with 1/2 cabinet	5
	Open bookshelf	5
Desk	Computer desk	2
Chair	Computer chair	18
Files	Record filing for data management	60
Drainage Pump	Automatic Water Pump, BLT30CX including 10m pipes	1
Air conditioner	LG Model: HS-C1865SA4	1
5) Manual, Book		
1. Water Distribution System Operator Training Handbook; Third Ed. :AWWA 2. Water Distribution System Operation and Maintenance: A Field Study Training Program, Fifth Edition : AWWA 3. Water Treatment Plant Operation Volume I: AWWA 4. Water Treatment Plant Operation Volume II: AWWA		1 each

Equipment/Materials	Specifications	Quantity
5. Water Supply Operations: Textbook Set: AWWA Water Operator Training Textbooks (5 books)		
5.1	Water sources (No. 1955)	
5.2	Water Treatment (No. 1956)	
5.3	Water Transmission and Distribution (No. 1957)	
5.4	Water Quality (No. 1958)	
5.5	Basic Science Concepts and Applications (No. 1959)	

(2) Equipment in 2nd Year Term

1) Major Equipment

Equipment/Materials	Specifications	Quantity
1) Flowmeter		
	Turbine type (diameter 8 inch)	5
	Turbine type (diameter 6 inch)	1
	Turbine type (diameter 4 inch)	1
	Turbine type (diameter 2 inch)	1
2) Pipe Materials, Valve		
	PVC pipe 225mm x 5000mm	4
	PVC pipe 160mm x 5001mm	2
	Flange valve 200mm	5
	Flange valve 150mm	1
	Flange valve 100mm	1
	Flange valve 50mm	1
3) Special Fittings		
Flange adapter for GI	8 inch, GIXF, PN16, with bolts and nuts	4
Flange adapter for PVC	8 inch, PVCXF, PN16, with bolts and nuts	16
Flange adapter for PVC	6 inch, GIXF, PN16, with bolts and nuts	4
Flange adapter for PVC	6 inch, PVCXF, PN16, with bolts and nuts	4
Flange adapter for PVC	4 inch, PVCXF, PN16, with bolts and nuts	4
Flange adapter for PE	2 inch, PEXF, PN16, with bolts and nuts	4
Coupling	6 inch	4
Coupling	4 inch	8
Rubber gasket	for 8 inch	20
Rubber gasket	for 6 inch	4
Rubber gasket	for 4 inch	4
Rubber gasket	for 2 inch	4
Bolts & nuts	M20	144
Bolts & nuts	M16	32
Washers	for M20	144
Washers	for M16	32
4) Water Quality Equipment		
Microscope	Ultra compact handy inverted type (synophthalmia: 10×) (objective : 4×, 10×, 40×)	1
5) Manual, Book		
1. Making Public Enterprises Work: From Despair to Promise: A Turn Around Account		1 each
2. Water Rates, Fees, and the Legal Environment, 2nd Edition		
3. M1 Principles of Water Rates, Fees and Charges, 5th Edition		
4. M6 Water Meters-selection, Installation, Testing, and Maintenance, 4th Edition		
5. M5 Water Utility Management, 2nd Edition		
6. M20 Water Chlorination and Chlorination Practices and Principles, 2nd Edition		
7. M22 Sizing Water Service Lines and Meters, 2nd Edition		
8. M23 PVC Pipe—Design and Installation, 2nd Edition		
9. M37 Operational Control of Coagulation and Filtration Processes, 3rd Edition		
10. Teach Yourself VISUALLY Access 2010		
6) Others (TECI own payment)		
6-1) Pump Accessories		
Hourmeter		7
6-2) Pipe Materials, Tools		
Flange adapter for PVC		4

Equipment/Materials	Specifications	Quantity
Flange adapter for PVC		2
Grinder		1
Blade		2
Chisel		1
Hammer		1
Screwdriver		1
Sawtooth		2
Couling		1
Bolts & Nuts		4
Other connection materials		3 set
6-3) Water Quality Equipment		
Fuse with cover	for water still	2
Dissolved Oxygen AccuVac® Ampules	High Range, pk/25	4
FerroVer® Iron Reagent Powder Pillows	10 mL, pk/100	3
Manganese Reagent Set	LR, 10 mL	3
Hardness (Total) Reagent Set	LR, Digital Titrator	1
pH Pocket Pal Tester		1
TDS Pocket Pal Tester		1
DPD Free Chlorine Reagent Powder Pillows	10mL, pk./100	12
6-4) Drain Pump, Accessories		
Pipes for Drainage Pump		1
Spare parts for Drainage Pump		1
Net for Drainage Pump		1

(3) Equipment in 3rd Year Term

1) Major Equipment

Equipment/Materials	Specifications	Quantity
1) Electromagnetic flow meter		
Electromagnetic flow meter	ELECTROMAGNET. FLOW METER KROH NE IP57 DIAM.300 230V OBTIFLUX2000	1
	3*1,5mm ² cable between flowmeter and readout unit	15m
2) Turbine flow meter		
Turbine flow meter	FLANGED WATER METER WOLTMANN PN 10/16 EPOXY COATED DIAM. 150	3
	FLANGED WATER METER WOLTMANN PN 10/16 EPOXY COATED DIAM. 100	1
3) Sluice Valve		
Sluice Valve	CI FLANGED HAND WHEEL GATE VALVE ND 150 CLOCKWISE CL.PN10-16	3
	CI FLANGED HAND WHEEL GATE VALVE ND 100 CLOCKWISE CL.PN10-16	1
4) Level Gauge		
Level Gauge	Water level gauge piezometer , submerged type, to be set in UPVC pipe. With 3m cable model Hydrobar 2000 from Krohne	1
	Monitor model NANODAC : reading and saving of water level and flow simultaneously trough 4/20 mA . Export of data via USB	1
	Control panel for setting of monitor and Warning tone for high level of water	1
	3*1,5mm ² cable for level gauge, display and datalogger	30m
5) Chlorine injection		
Chlorine injection by gravity	GRAVITY DOSING SYSTEM OD 25mm scale 10-100L/H	2
6) Transportation Means		
Motorcycle	SENKE CG 125cc	6

2) Consumable

Equipment/Materials	Specifications	Quantity
1) Water service materials		
Female Adaptor	brass for HDPE OD 20 threaded 1/2 " BSP with insert	60
	brass for HDPE OD 25 threaded 3/4" BSP with insert	90
	brass for HDPE OD 20 threaded 1 " BSP with insert	30
Saddle for asbestos	Main pipe: Asbestos 4", Outlet pipe: PE 1/2" with sockets, rubber ring, bolts & Nuts	2
	Main pipe: Asbestos 4", Outlet pipe: PE 3/4" with sockets, rubber ring, bolts & Nuts	3
	Main pipe: Asbestos 4", Outlet pipe: PE 1" with sockets, rubber ring, bolts & Nuts	1
	Main pipe: Asbestos 6", Outlet pipe: PE 1/2" with sockets, rubber ring, bolts & Nuts	2
	Main pipe: Asbestos 6", Outlet pipe: PE 3/4" with sockets, rubber ring, bolts & Nuts	3
	Main pipe: Asbestos 6", Outlet pipe: PE 1" with sockets, rubber ring, bolts & Nuts	1
Combines ferrulle saddle for Pvc	Main pipe: Pvc 3", Outlet pipe: PE 1/2" with sockets, rubber ring, bolts & Nuts	2
	Main pipe: Pvc 3", Outlet pipe: PE 3/4" with sockets, rubber ring, bolts & Nuts	3
	Main pipe: Pvc 3", Outlet pipe: PE 1" with sockets, rubber ring, bolts & Nuts	1
	Main pipe: Pvc 4", Outlet pipe: PE 1/2" with sockets, rubber ring, bolts & Nuts	2
	Main pipe: Pvc 4", Outlet pipe: PE 3/4" with sockets, rubber ring, bolts & Nuts	3
	Main pipe: Pvc 4", Outlet pipe: PE 1" with sockets, rubber ring, bolts & Nuts	1
	Main pipe: Pvc 6", Outlet pipe: PE 1/2" with sockets, rubber ring, bolts & Nuts	2
	Main pipe: Pvc 6", Outlet pipe: PE 3/4" with sockets, rubber ring, bolts & Nuts	3
Ball Valve	1/2"	20
	3/4"	30
	1"	10
Valve Box	Ø 75, H =500 -600mm, cover FCD body, Pvc	20
	Ø 75, H =700 -900mm, cover FCD body, Pvc	10
Elbow for PE Pipes 90°	1/2" including in -core 20mm	40
	3/4" including in -core 25mm	60
	1" including in -core 32mm	20
Male Socket	1/2" 20mm	20
	3/4" 25mm	30
	1" 32mm	10
Female Sockets	1/2" 20mm	20
	3/4" 25mm	30
	1" 32mm	10
Sockets	1/2" 20mm	10
	3/4" 25mm	15
	1" 32mm	5
2) Bolts and nuts		
Bolts and nuts	FOR FLANGE DN 100 PN 16 COMPLET SET 8 ZN BOLT M16X80 MM AND 5 MM TICKNESS GASKET	4 set
	FOR FLANGE DN 150 PN 16 COMPLET SET 8 ZN BOLT M20X80 MM AND 5 MM TICKNESS GASKET	12 set
	FOR FLANGE DN 300 PN 10 COMPLET SET 12 ZN BOLT M20X110 MM AND 5 MM TICKNESS GASKET	2 set
Flanged Adaptor	6", OD of PVC 160mm DIN (Pvc Made)	7
	4"	2
3) Gasket		
Gasket	12"	2
	6"	10
	4"	3
Coupling	6" -Outer dia of Pvc 160mm DIN	3
	4"	1

(4) Equipment in 4th Year Term

1) Major Equipment

Equipment/Materials	Specifications	Quantity
Walkie-Talkie	Base Station	1
	Radio	6
	Amplification equipment	1

Equipment/Materials	Specifications	Quantity
Motorcycle	SENKE CG 125cc	2

Equipment/Materials	Specifications	Quantity
Waterproof equipment of raw water flow meter		1 set

2) Consumable

Equipment/Materials	Specifications	Quantity	
Laboratory	DPD Free Chlorine Reagent Powder Pillows, 10mL, pk./100	20 packs	
	Dissolved Oxygen AccuVac® Ampules, High Range, pk/25	4 packs	
	Nitrogen-Ammonia Reagent Set, Salicylate Method, 10 mL	1	
	Nitrogen-Nitrate Reagent Set, LR, 10mL, Cadmium Reduction	1	
	FerroVer® Iron Reagent Powder Pillows, 10 mL, pk/100	2	
	Manganese Reagent Set, LR, PAN, 10mL	2	
	Zinc Reagent Set, Zincon, 20 mL	1	
	CuVer® 1 Copper Reagent Powder Pillows, 10 mL, pk/100	1	
	Alkalinity	Bromocresol Green / Methyl Red Indicator	1
		Phenolphthalein Indicator	1
		Sulfuric Acid Cartridge	1
	Hardness	Hardness Indicator	1
		EDTA Cartdge	1
	Tube of 90 degree bend		3
	Burette stand		1
	Clamp holder		1
Extension Clamp		1	

2.3 Overseas Training

(1) Training in Japan

- Training : Administration of Water Supply Management
- Term: 9th to 16th December 2011
- Trainees:

Chamjok Chung Wiitour

Managing Director, SSUWC HQ

Santorino Tangun Roben Unkey

Area Manager, SSUWC Juba Station

Albert Eluzai Moni

Director of Rural Water Supply and Sanitation /Rural Water Quality Sanitation and Hygiene, Ministry of Water Resources and Irrigation

➤ Schedule:

Date		Lectures	
		AM 9:30~12:00	PM 13:30~16:00
Dec.04	Su	Moving	
Dec.05	Mo	Moving(Visa acquisition)	
Dec.06	Tu	Moving(Visa acquisition)	
Dec.07	We	Moving(Visa acquisition)	
Dec.08	Th	Moving	
Dec.09	Fr	Arrive in Japan Transfer to Yokohama	Briefing by JICA Program orientation by TEC Presentation of country report Explanation of preparation for Action Plan
Dec.10	Sa		
Dec.11	Su		
Dec.12	Mo	[1] Japanese experience on water supply system [History and Development], Administration [Roles of central and local governments, Regulation and laws] [2] Water supply development history in Yokohama, Overall organization and O&M organization in Yokohama [3] Leakage prevention, Non-Revenue Water: NRW Reduction [4]Leakage survey, Leakage repair(Nishiya Pipeline Training Yard)	
Dec.13	Tu	Site observation to water supply facilities in Yokohama, Water source – conveyance – treatment – transmission and distribution Work of Water Quality Laboratory Kosuzume Water Treatment Plant, Samukawa Intake Office	
Dec.14	We	Water tariff collection for sound Waterworks management Public Relations and Awareness campaign	Water meter maintenance Water meter structure, Water flow volume inspection (Nakamura Meter Yard) (
Dec.15	Th	Efficient management of facilities: Mapping System Water distribution control (Nishiya WTP Branch Office)	Water supply facilities and supply system planning in Yokohama Monitoring of waterworks management by Performance Indicators Preparation of Action Plan
Dec.16	Fr	Preparation of Action Plan	Presentation of Action Plan Evaluation Closing ceremony
Dec.17	Sa	Departure from Japan	

(2) Third Country Training in Kenya

Field	Training Term	No. of trainee	Contents
Operation and maintenance distribution network	15 th to 21 st January 2012	5	Installation of service pipe, leakage repair, and connection of asbestos, steel PV and DI pipes
Operation and maintenance of electro-mechanical equipment	22 nd to 28 th January 2012	4	O&M of pump, generator and blower
Operation and maintenance of water purification plant	15 th to 28 th January 2012	3	On-site training in purification plant
Operation and maintenance distribution network	23 rd to 27 th July 2012	7	Installation of service pipe, leakage repair, and connection of

			asbestos, steel PV and DI pipes
Training for customer meters	30 th July to 3 rd August 2012	5	Installation of customer meters
Administration and human resources management	23 rd to 27 th July 2012	8	Performance evaluation, basic administration
Inventory management	30 th July to 3 rd August 2012	4	Inventory management of tool, spare parts etc.
Customer service	30 th July to 3 rd August 2012	6	Customer service, customer satisfaction, and PR activities
Operation and maintenance of electro-mechanical equipment	19 th to 23 rd November 2012	5	Installation of electromagnetic flow meter, O&M of pump, generator and blower
Total		47	

2.4 Actual Operating Cost in each year term

The local operation cost and local consultants cost are shown in table below. The cost of the fourth year is indicative (contract cost) because it is not finalized.

Item	1 st Year	2 nd Year	3 rd Year	4 th Year
Local operation cost	¥2,707,000	¥5,565,000	¥8,418,000	¥3,527,000
Local consultants cost	-	¥7,432,000	¥2,313,000	-

CHAPTER 3 BASELINE SURVEY

3.1 Current Conditions of Operation and Maintenance of Intake and Purification Plant

3.1.1 Functions of Purification Plant

(1) Location of Facilities

Juba purification plant is consisted of the old plant which was constructed in 1982, 29 years ago and the new plant which was constructed in 2009 by using MDTF. Operating facilities are classified as the table below.

Table 3-1 Existing facilities

Facility	Tank & House	Equipment
New Plant	Raw water tank	
	Mixing channel	
	Sedimentation tanks	Troughs
	Rapid sand filter tanks	Valves
	Elevated tank	Level indicator
	Pump house	3 Raw water pumps, 3 High lift pumps, 2 Package blowers
	Coagulant house	5 Dosers, 5 Mixers, 5 dissolved tanks
Chlorine house	4 Dosers, 4 Mixers, 4 dissolved tanks	
Old Plant	Intake facility	3 Conducting pipes
	Old pump house 1	2 Old pumps (one is out of order)
	Old pump house 2	2 Old pumps (one is out of order)
	Clear water tank 1,2,3,4	Valves

(2) Functions of Facilities

Functions of facilities are shown as the table below.

Table 3-2 Function of Facilities

Name	Function
Raw water tank	To receive raw water to control water volume fluctuation
Mixing channel	To mix coagulant and raw water rapidly To coagulate in the roundabout channel
Sedimentation tank	Raw water is flocculated passing through the sludge blanket that exists in the hopper bottom of sedimentation tank. Supernatant water separated from flocks overflows into troughs and flow into the rapid sand filters.
Rapid sand filter	Sand filter catches micro flocks inside of the sand and reduces turbidity rapidly. As upper part of sand filter is stuck by fine grains to block water seepage, backwash process is needed once a day.
Chlorination	Bacteria existed in filtrated water is killed of hundred-percent by chlorine. Chlorine is mixed with filtrated water in the channel flowing into clear water tanks.
Clear water tank	Treated water is stored in clear water tanks about 2.4 hours.
Pump station	New high lift pumps send treated water to Hospital elevated towers. Old pumps send treated water to Malakal, Konyokonyo PS and Juba Town.

(3) Design Values of Facilities

Design values of facilities are shown as table below.

Table 3-3 Design Values of Facilities

Name	Design Items	Design value
Design intake flow	Daily flow rate	7,560 m ³ /day
	Hourly flow rate	315 m ³ /hour
Raw water tank	Detention time	0.27 hour
Sedimentation tank	Number	2
	Surface area	Over flow rate: 1.5 m ³ /m ² /hour
		Required: 105 m ² /one * 2=210 m ²
		Actual: 210 m ²
	Tank volume	Retention time: 2 hours
		Required: 630 m ³
Actual: 910 m ³		
Rapid sand filter tank	Number	4
	Surface area	Surface overloading rate: 5 m ³ /m ² /hour=120

Name	Design Items	Design value
		m ³ /m ² /hour
		Required area: 63 m ² (15.75 m ² * 4)
		Actual area: 65.3 m ² (16.32 * 4)
		In case of backwash : 3 number, 6.43 m ³ /m ² /hour
	Filter media	Depth of gravel : 450 mm Depth of sand : 750 mm
	Backwashing process	Backwash rate: 50 m ³ /hour/m ²
		Backwash time: 10 min, once a day
		Required volume: 136 m ³ /one * 4=544 m ³ /day
Clear water tank	Detention time	2.4 hours
Transmission pump (new facility only)	Daily flow rate	7,200 m ³ /day
	Hourly flow	300 m ³ /h

3.1.2 Current Operation and Maintenance

(1) O&M Method

1) Filter backwash

Regular backwash of each filter tank is done once a day. However in rainy season raw water has more turbidity, so backwash must be done twice a day in case of sludge blanket surface coming up to trough and overflowing. Backwash composes both air bubbling and backwash water. It is instructed by JICA expert team that air bubbling duration is 5 minutes and backwash duration is 10 minutes.

2) Cleaning of facilities

Cleaning of sedimentation tank is done frequently, twice a month. Cleaning of filter tank is done rarely and cleaning of elevated tank, raw water tank, mixing channel and four clear water tanks have never been done since new plant was commissioned in 2009.

3) Sedimentation Tank Sludge removal

Regular sludge removal is done every 10 days. However in rainy season raw water has more turbidity. In case that sludge blanket surface comes up to near the trough, sludge removal should be done immediately.

Operators don't use the sludge dry bed when the sludge removal is done and sludge is discharged to Bahr el-Jabel River directly. Although the sludge dry bed has been used once in the past, water

seepage into the ground was very slow and it took long time until sludge is dried. It becomes tough work for operators to use sludge dry bed.

4) Chemical dosing

Aluminum sulphate powder (contents of Al_2O_3 :17 %) is used as the coagulant. Amount of 300 kg of powder is solved everyday in one of three tanks with mixers of which volume is 3.3 m^3 . In case treated water volume is $6,200 \text{ m}^3/\text{day}$, dosing flow rate of liquid Aluminum sulfate is 137.5 L/hour and its dosing concentration is 40 mg/L (6.8 mg/l as Al_2O_3 equivalent)

Calcium Hypochlorite Hydrated (available chlorine: 70 %) is used as the chlorination. Amount of 45 kg of Calcium Hypochlorite Hydrate powder is solved every two days in one tank of two tanks with mixers of which volume is 1.3 m^3 . In case treated water volume is $6,200 \text{ m}^3/\text{day}$, dosing rate of liquid Calcium Hypochlorite is 27.1 L/hour and free chlorine dosing concentration is 2.54 mg/L.

5) Generator

There are many power failures in Juba station. All day long power failure often happens. One of two generators is not function since the new purification plant, which was designed and constructed by SPENCON in 2009 using MDTF, was commissioned. As short of fuel often happens and only one generator cannot cover all of power failures, the disruption of producing supply water must be avoided. Average operation duration time of generator in March 2011 is 4 to 5 hours a day and sometimes over 7 hours.

There is one generator at Hospital station and Konyokonyo station respectively. As there isn't normal power at Konyokonyo station, new two pumps is operated by generator only. Average operation time is around 5 hours a day. As the power failure occurs at rare interval around the hospital area, the generator of Hospital station operates rarely. Fuel consumption of each generator doesn't be grasped by both operators and finance department. They don't have custom for recording fuel consumption.

6) Pump operating

Pumps are classified new pumps and old pumps. New pumps are three raw water pumps and three high lift pumps of Juba station, three of Hospital and two of Konyokonyo station. Old pumps are four of Juba station and two of Hospital station. New pumps have new main panel board with voltages, ampere meters and hour meters respectively, but old pumps don't have hour meter and some of them have panel board with no functional voltage and ampere meter. There are four old pumps at Juba station, but two of them are not function.

(2) Operation Time of Purification Plant

Operation time of main facilities of Juba purification plant including Hospital and Konyokonyo is shown as Table 3-4. Data show that Juba Purification plant is operating over 22 hours a day working together Hospital station and Konyokonyo station.

Table 3-4 Plant facilities operation time

Location	Name of facility	Number	Average operation time (hrs)
Juba station	Generator	2(1+1)	4.0
	Raw water pump	3(2+1)	22.2
	High loft pump	3(2+1)	7.5
	Old 1	2 (1+1)	8.9
	Old 2	2 (1+1)	8.1
Hospital station	Generator	1	0.6
	New pump	3 (1+2)	5.4
	Old	2 (1+1)	6.5
Konyokonyo station	Generator	1	5.7
	New pump	2 (1+1)	5.4

(3) Understanding of Water Balance in Purification Plant

The difference from raw water intake volume and treated water volume in Juba purification plant is shown as Figure 3-1.

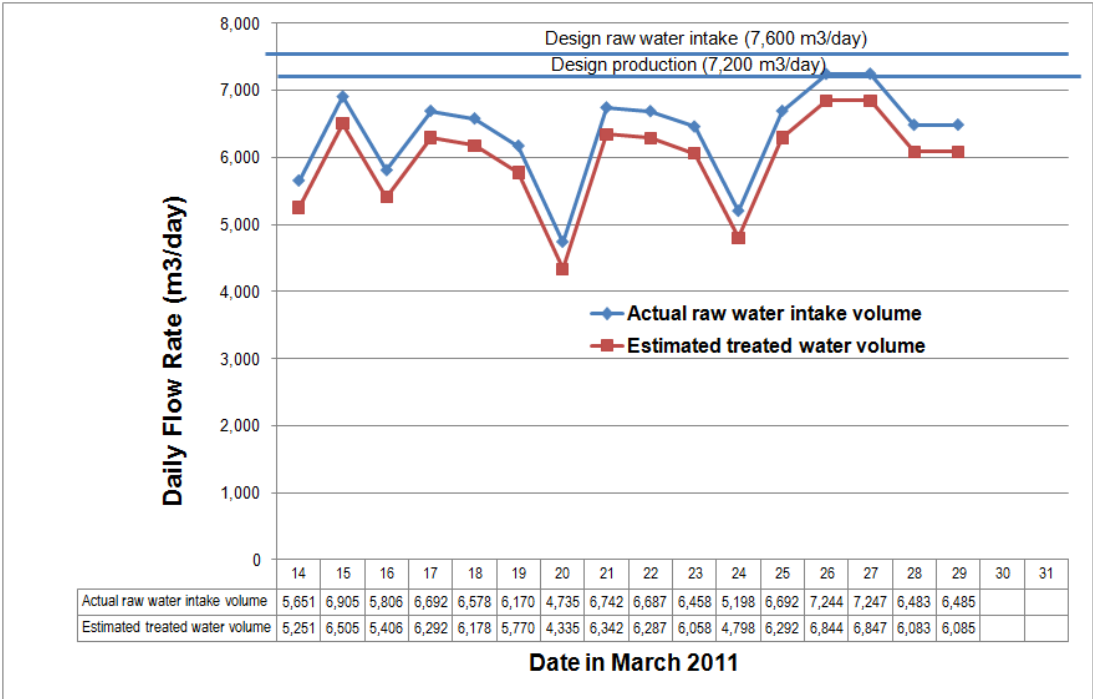


Figure 3-1 Difference from Raw Water and Treated Water Volume

The average intake water volume in March 2011 is estimated at about 6,200m³/day based on estimated pump discharge and operating hours as shown in Table 3-5.

Table 3-5 Intake Water in Juba Station

Estimated Pump Discharge		Operation hours	Estimated Intake Water Volume	
m ³ /hour		hour/day	m ³ /day	
Pump No.1		19.7	2,752	
Pump No.2	139.7	8.4	1,173	6,203
Pump No.3		16.3	2,277	

The average treated water volume is found 5,800m³/day. The difference of 400m³/day is estimated as the backwash water. The water balance of transmission water in Juba station is shown as Figure 3-2.

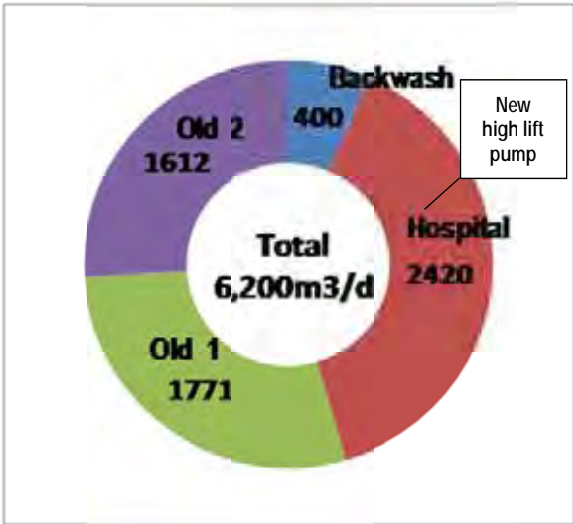


Figure 3-2 Estimated Transmitted Water Balance in Juba Station

3.1.3 Organization Structure and Capacity

Purification department is consisted of 64 staffs including Hospital and Konyokonyo station staffs. The purification plant of 64 staffs composes general engineers, mechanics, electricians, generator operators, laboratory technicians and labors.

Labors compose the plant operation shift members. Shift cycle of Juba station is consisted of 8 staffs and one shift has two staffs. They take their turns under the regular rotation. Hospital station has the same system as Juba station. Konyokonyo shift cycle is consisted of 5 staffs and one shift has two

staffs. Shift time is as below.

- First shift: from 8.00 to 16.00
- Second shift: from 16.00 to 24.00
- Third shift: from 0.00 to 8.00

Only a few staffs have the education background such as university and college. Most staff didn't graduate high school or secondary school. Even if some staffs who graduated secondary school didn't study at full length in school age. Most labors cannot calculate duration of facility's operating time.

3.1.4 Challenges to O&M of Purification Plant

There are a lot of challenges they are facing now. Challenges are described as below.

- ◆ Engineers and technicians who operate a water purification plant (hereafter referred to as WPP) should have at least knowledge regarding water purification technology. They don't have any knowledge about it.
- ◆ Engineers and technicians who operate a WPP should have at least knowledge regarding chemistry. They don't have any knowledge about it.
- ◆ Engineers and technician who operate a WPP should be well grounded in basic mathematics. Most labors are not good at addition, subtraction, multiplication and division.
- ◆ The Government has decided the official language of South Sudan is both English and Arabic. However most staff in Juba station cannot read and write both English and Arabic. They communicated each other with their mother tongue. They can only speak English or Arabic which they have learned through ears. Language issue would be a barrier to learn and acquire knowledge effectively and efficiently.
- ◆ A few staffs have their own desks and chairs in their office. Most staffs have a meeting under mango trees.

3.2 Current Conditions of Water Supply Service and Operation and Maintenance of Transmission and Distribution Facilities

3.2.1 Results of Socio-condition Survey on Water Use

The objective of the socio-condition survey is to investigate social living condition and awareness of people regarding the water supply service through questionnaire. The targeted area of the socio-condition survey is Juba town and surrounding areas. The number of households selected for the questionnaire survey is 444 households in five (5) communities, i.e. Juba town, Kator, Munuki, Lologo and Gumbo.

The interviewed households were selected at random representing a fair distribution between the different area of Juba and the surrounding area.

The survey method is described below.

- Survey team is composed of men and women in consideration of culture, tribe and custom of the study area.
- Fields survey is carried out by visiting and interview investigation of target household by the surveying team.
- Surveyors are provided with all the necessary items for carrying out the survey such as transportation, identification as a surveyor, letter for request of cooperation and questionnaire sheet.

The socio-condition survey for a household was planned December 2010 and field work was carried out from 3rd to 11th December 2010. The result of the socio-condition survey is summarized below.

(1) Actual Conditions of water use

Figure 3-3 shows main water source. Approximately, 20% of respondents are using UWC piped water as a main water source. It means that they are supplied water by house connection. In addition, approximately 13% of respondents are supplied UWC water by public tap and approximately 3 % of respondents are purchasing UWC water from water tanker. However, the percentage of water tanker which transports “river water” is largest value with approximately 33%.

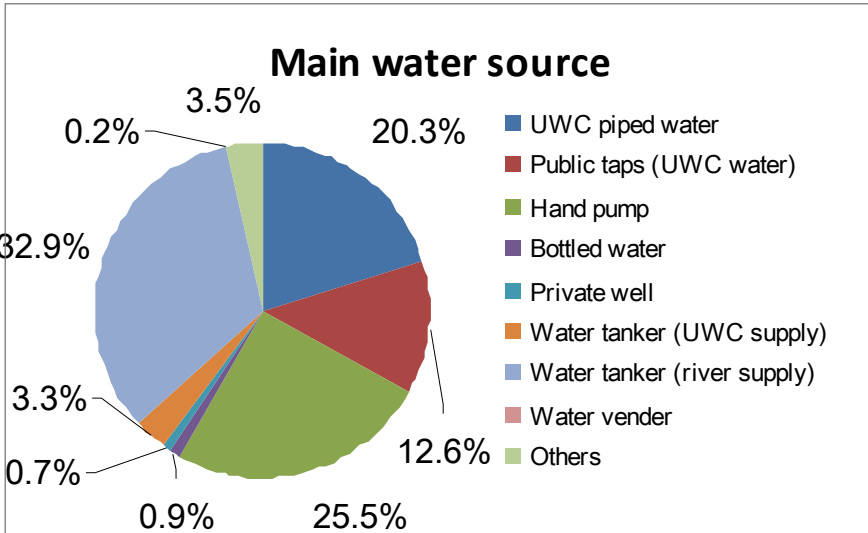


Figure 3-3 Main Water Sources

Figure 3-4 shows water consumption in dry season and rainy season. It consists of amount from all water sources. The estimated unit amount of water consumption per capita surveyed is 33.2 liters per day in rainy season and 27.5 liters per day in dry season.

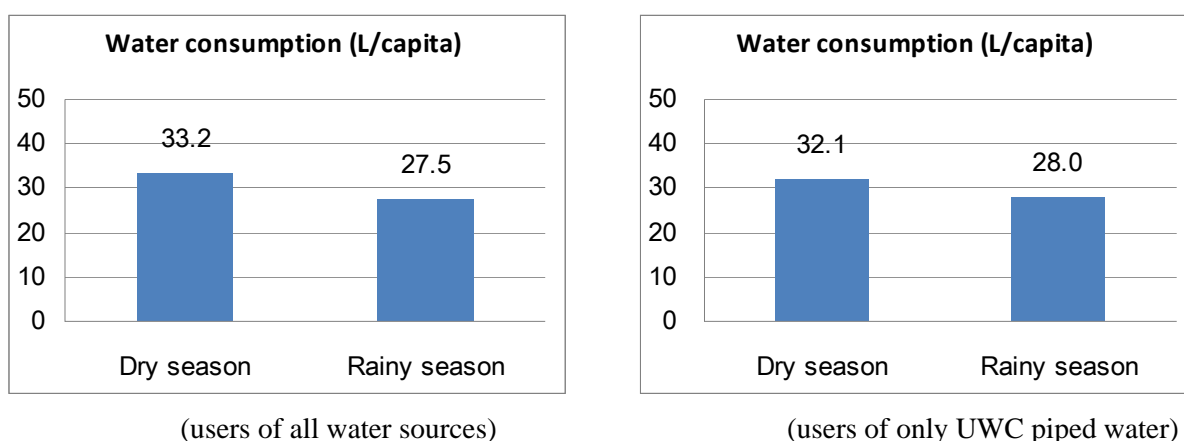


Figure 3-4 Water consumption (L/capita/day)

Figure 3-4 also shows water consumption for UWC piped water users. Comparing with the previous figure, difference of water consumption is not indicated. It is estimated value by assumption from the answer of consumed number of jerry can and drum tank because of no flow meters fixed on the main pipe line and no water meter in household.

Table 3-6 shows main water source for "Cooking and Drinking". The percentage of user for water tanker (river water) and hand pump represents large value and they are approximately 65% and 46% respectively. Its trend is applied to main water source for another purpose such as "Washing and Cleaning", "Shower and Bathtub" and "Toilet".

Table 3-6 Main water source for "Cooking and Drinking" (Multiple answer)

Items	no.	%
UWC piped water	100	23.5%
Public taps (UWC water)	71	16.7%
Hand pump	195	45.9%
Bottled water	38	8.9%
Private well	13	3.1%
Water tanker (UWC supply)	31	7.3%
Water tanker (river supply)	276	64.9%
Water vender	27	6.4%
Others	15	3.5%
Total no. of respondents	425	

Figure 3-6 shows the percentage of water supply on regular basis. Approximately 80% of respondents are not supplied water on regular basis.

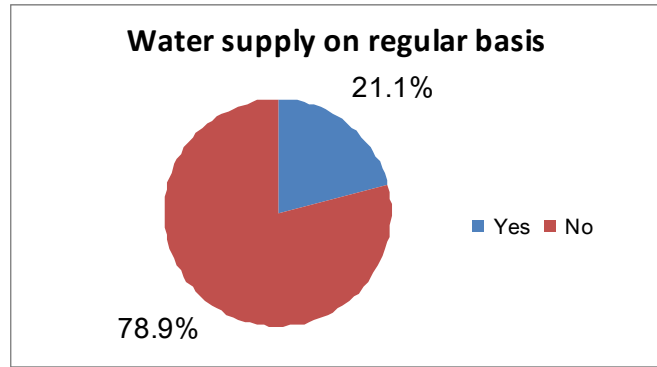


Figure 3-5 Water Supply on Regular Basis

Figure 3-6 shows water supply hours for the users who are supplied water on regular basis. It ranges 7.5 hours to 10.1 hours.

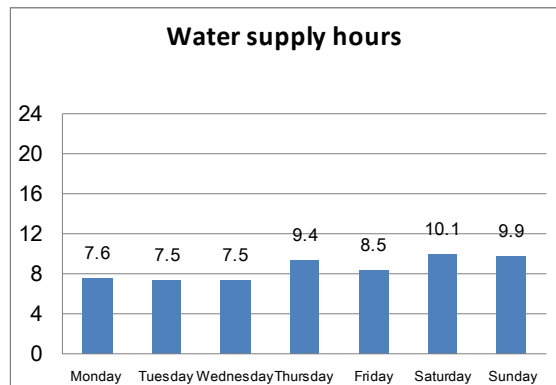


Figure 3-6 Water Supply Hours

On the other hand, Table 3-7 indicates that frequency of water supply is 3.6 days per week and 6.1 hours per day for users who receive irregular water supply.

Table 3-7 Frequency of water supply

Items	Value
Days per week	3.6 days per week
Hours per day	6.1 hours per day

(2) Problems of water supply service

Table 3-8 shows main problem of UWC piped water. It indicates that approximately 78 % of respondents answer "Irregular supply", followed by "Few service hours" and "Insufficient amount".

Table 3-8 Main problems of UWC piped water (Multiple answer)

Items	no.	%
Insufficient amount	34	43.6%
Few service hours	54	69.2%
Irregular supply	61	78.2%
Low water pressure	20	25.6%
Water quality (color)	12	15.4%
Water quality (taste)	23	29.5%
Water quality (unclean)	18	23.1%
Water tariff	3	3.8%
Others	1	1.3%
Total	78	

(3) Degree of satisfaction

Figure 3-7 shows the degree of satisfaction for UWC piped water. Approximately 78% of respondents are not satisfied with UWC piped water. This trend corresponds to the percentage of users who are not supplied water on regular basis.

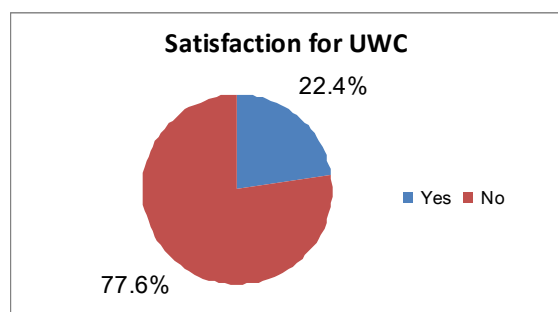


Figure 3-7 Satisfaction of UWC Water

(4) Willingness to pay

Figure 3-8 shows willingness to pay for the current condition and satisfactory condition of water supply. Willingness to pay for current condition and satisfactory condition are approximately 55SDG/month and 67SDG/month respectively.

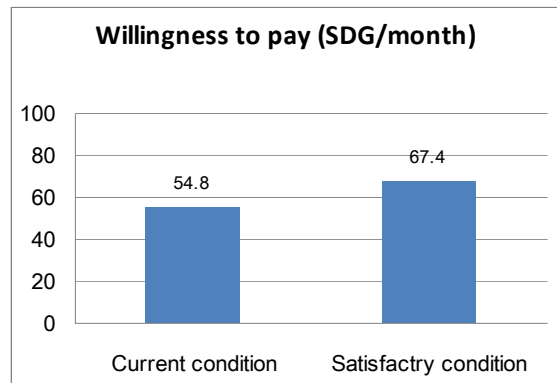


Figure 3-8 Willingness to pay

Meanwhile, Table 3-9 shows monthly expenditure of household and the amount of water expense in a month is approximately 196 SDG/month. It is equivalent to 11% of the total monthly expenditure. Comparing with current average water expense, the willingness to pay of 67.4 SDG/month/household with satisfactory water supply condition is about one third.

Table 3-9 Monthly Average Household Expenditure

Items	no.	Average expenditure (SDG/month/household)
House expenditure	65	295.2
Meals expenditure	109	377.2
Clothing expenditure	94	193.5
Education expenditure	99	419.8
Electricity	89	134.8
Water expense	108	195.7
Fuel expense	90	63.1
Others	31	31.8
Total		1,711.1

3.2.2 Current Conditions of Transmission and Distribution Facilities

- (1) UWC service area, zoning and facility locations

Figure 3-9 shows the existing water supply system in Juba city.

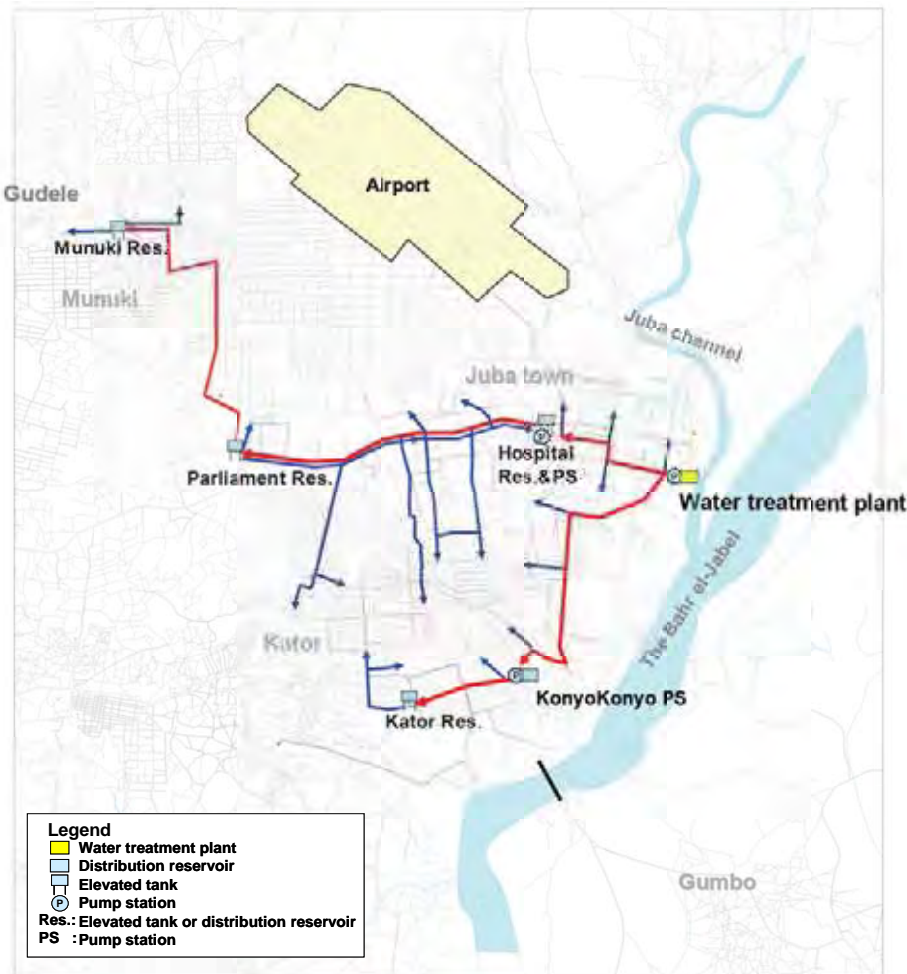


Figure 3-9 Existing water supply system in Juba city

Water treatment plant is located at the eastern part of Juba city and takes raw water from Juba channel which is tributary of the Bahr el-Jebel river. The treated water is distributed to house connection in Juba town, Malakia, Hai Cinema and Konyokonyo, and transmitted to Hospital elevated tank & pumping station and Konyokonyo pumping station. Hospital elevated tank & pumping station distributes the water to the area between parliament and hospital by gravity flow and pump, and transmits water to Parliament elevated tank. From Parliament elevated tank, the water is distributed to parliament building, ministries and Juba University and transmitted water to Munuki elevated tank. Meanwhile, Konyokonyo pumping station transmits water to Kator elevated tank and water is distributed to Kator area by gravity flow.

Therefore, the UWC service area covers Juba town except for Airport, the populated area in Kator payam, and north and east part of Munuki payam.

In distribution network of UWC, distribution zone by valve control has not been set and water supply often stops in the time of water leakage in main pipelines.

In addition to these facilities, there are 3 tanker filling points which are located at north of water treatment plant, hospital elevated tank & pump station and near parliament. Currently, only one tanker filling points which is located at north of water treatment is operating properly. Water tanker with capacity of 4 m³ or 10m³ spends about 10 minutes for water filling into tank. The water tariff of 4m³ and 10m³ are 12 SDG and 30SDG respectively. Tanker filling point doesn't have any drain facilities; therefore, road condition is very bad because of drench.

(2) Network pipe statistics and conditions

Table 3-10 shows length of existing network pipe. The total length of existing network is approximately 71km and 69% of the total length is asbestos cement pipe. Most of asbestos cement pipe was installed in 1970's. The earth covering depth of the aged asbestos cement pipe is less than 50cm and water leakage occur many places due to heavy traffic and excavation work in construction activities. Recently, the PVC pipe has been adopted in new installation and rehabilitation work instead of asbestos cement pipe and the adopted rate of PVC pipe in the total pipe length has increased.

Table 3-10 Length of the existing network pipe in Juba city

Diameter	Pipe length (m)				
	AS	GI	PVC	ST	Total
25	0	523	0	0	523
50	10,173	0	0	0	10,173
75	10,936	0	2,054	0	12,990
100	14,698	772	1,628	0	17,098
150	4,155	0	6,736	0	10,891
200	9,079	0	5,985	0	15,064
250	0	0	0	0	0
300	0	0	0	4,575	4,575
Total	49,041	1,295	16,403	4,575	71,314
%	69%	2%	23%	6%	100%

AS: Asbestos cement, GI: Galvanized iron pipe, PVC: Polyvinyl chloride pipe, ST: Steel pipe

3.2.3 Current Operation and Maintenance of Transmission and Distribution Facilities

(1) Understanding of distribution flow balance in the service area

Figure 3-10 shows distribution flow balance in the service area in Juba city.

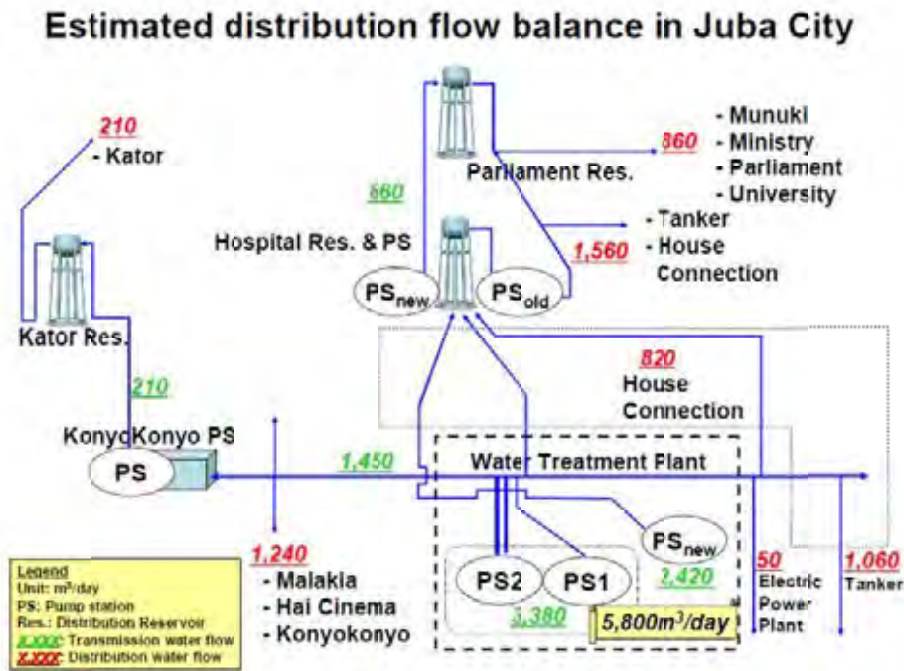


Figure 3-10 Distribution flow balance in Juba city

Based on the monitored water flow data, the actual transmission and distribution capacity is 5,800m³/day. In water treatment plant, there are 3 pump stations. The actual average capacity of “pump station 1&2” and “pump station new” are 3,380m³/day and 2,420m³/day respectively. From water treatment plant, 1,450m³/day is transmitted in the direction of Konyokonyo pumping station and 1,240m³/day is consumed in Malakia, Hai Cinema and Konyokonyo. The remaining 210m³/day is transmitted to Kator elevated tank through Konyokonyo pumping station and distributed to Kator area. On the other side of direction to Konyokonyo area, 2,420m³/day is transmitted to Hospital elevated tank & pump station and 820m³/day is distributed to house connection in Juba town. The amount of water consumption in electric power plant and tanker filling point are 50m³/day and 1,060m³/day respectively. From Hospital elevated tank & pump station, 1,560m³/day is distributed by old pump or gravity flow to the area between hospital and parliament, and 860m³/day is transmitted by new pump and consumed in Munuki, Ministries, Parliament and University area. Figure 3-11 shows daily flow rate in the main transmission pipeline.

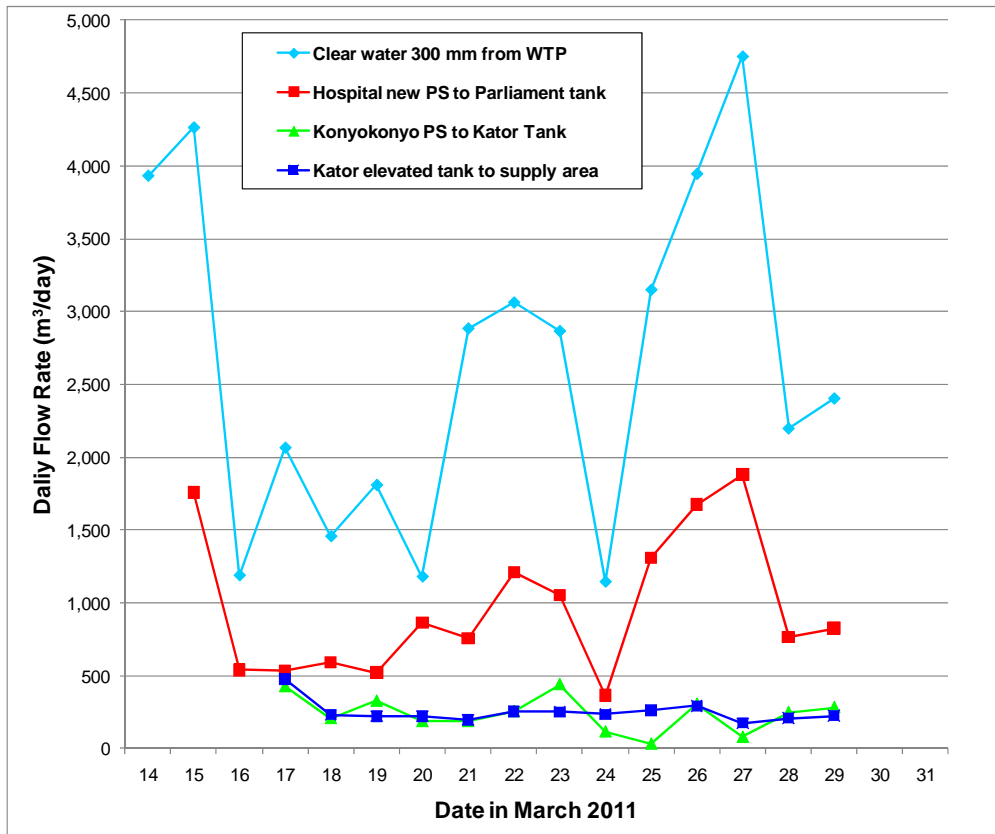


Figure 3-11 Daily flow rate in the main transmission pipeline

The daily flow rate from clear water reservoir with diameter of 300mm in water treatment plant and Hospital new pump house which is in Hospital elevated tank & pump station has large daily variation because electric power supply is unstable and pump operation schedule is not determined. During the power outage, UWC operates generator; however, it is often stopped due to shortage of fuel. UWC shall secure a sufficient amount of fuel in consideration of fuel consumption for generator.

(2) Pump operation hours

Based on the distribution flow balance and specifications of pump equipment, the pump operation hours are estimated. Figure 3-12 shows pump operation hours in each pump.

Estimated pump operation time

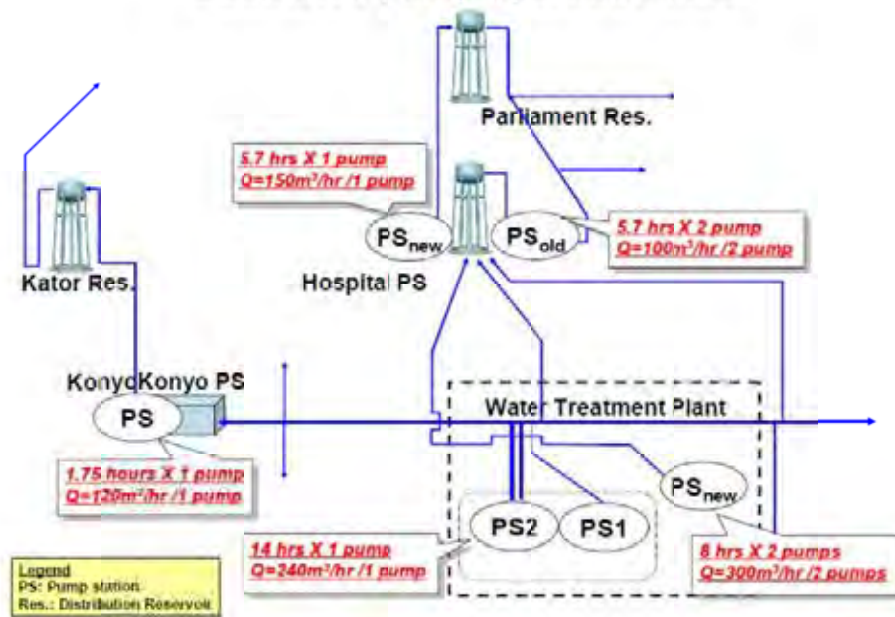


Figure 3-12 Estimated pump operation time

In water treatment plant, PS_{new} (new pump house) has 2 pumps which are operating for 8 hours and 1 pump is stand-by. The total capacity of 2 pumps is 300m³/hour. In PS 1 & 2 (old pump house), the number of pumps is one each and it is estimated that one of two pumps is currently operated for 14 hours in a day. However, operation schedule of PS 1 & 2 is not fixed and has been monitored from March 2011. The capacity of each pump in PS 1 & 2 is 240m³/hour.

In Konyokonyo pump station, it is estimated that one pump is currently operated for 1.75 hours in a day and other one is stand-by. The capacity of a pump is 120m³/hour.

In Hospital elevated tank & and pump station, there are 2 pump houses, i.e. new pump house (PS_{new}) for water transmission and old pump house (PS_{old}) for water distribution. In new pump house, it has 3 pumps (1 stand-by) and it is estimated that one of them is currently operated for 5.7 hours in a day and the capacity of each pump is 150m³/day. From old pump house, it is estimated that 2 pumps are currently operated for 5.7 hours in a day and the total capacity of 2 pumps is 100m³/hour. Therefore, it is assumed that 570m³/day is distributed by pump and remaining 990m³/day is distributed by gravity flow.

(3) Problem areas from view point of SSUWC

SSUWC has been facing the problems regarding water supply condition. Especially, interruption of water supply and unstable water pressure are occurred in some areas. This is because the appropriate operation and maintenance has not been implemented in each facility. The problem areas where have

serious interruption of water supply from view point of SSUWC are described below.

- Hai- Jalaba
- Nimira Talata

(4) Water leakage record and repair

The number of water leakage accidents is increased due to spreading part of reconstruction activity. Labor or construction machine breaks distribution pipe during construction for other purpose such as building, road and telecommunication. Because the location of pipelines is not recorded in SSUWC and the process which the party in charge of construction for other purpose shall confirm underground facilities is not existence. Despite water leakage accidents occurs frequently, distribution department in SSUWC is facing an acute shortage of repair parts and it takes few days to complete repair of pipelines. At this time, distribution department of SSUWC doesn't make any records of repair condition for water leakage and its experience of repair is not utilized for the appropriate construction management in the future. Therefore, establishment of a recording process and preparation for a repair record format are necessary for the appropriate operation and management for transmission and distribution facilities.

3.2.4 Organization Structure and Capacity

(1) Functions and activities

Distribution department in SSUWC has 3 functions which are repair of water leakage, connection of new service pipe and the extension work of distribution pipe to new service areas.

As for repair of water leakage, the initial reaction of distribution department gets delayed. Because it is begun formulation of the repair team after SSUWC receives report from users. In the stock yard of SSUWC, repair parts such as fittings and accessories of pipe operation and maintenance are stored, however, these items don't meet needs for repair work because SSUWC doesn't make any procurement plans for repair parts. Therefore, repair process including the procurement plan of repair parts is required to establish in distribution department.

As for connection of new service pipe, it is begun construction after SSUWC receives application and connection fee is paid from new customer. The connection work of new service pipe is implemented in the time without the occurrence of water leakage. SSUWC doesn't record any information on the detail of connection of new service pipe such as diameter of pipe, length of pipe, existence of water meter, owner of pipe and coordinates of branch etc. Toward to the appropriate customer management, the record format of new service pipe shall be formulated.

As for the extension work of distribution pipe to new service areas, distribution department has been

requested to extend distribution pipeline to army base area which is located at the south of Kator payam. However, the extension work has not been implemented due to shortage of budget and pipe material.

(2) Organization structure

The total number of staff in distribution department of SSUWC is 51 persons. This number includes staff of purification department because administration department arranged the necessary staffing. In the official process of staffing, SSUWC requests the ministry of public service to register the required staff's name into database and approve a staffing. However, after registration in the ministry of public service, the title of each staff is temporary renamed as needed by administration department of SSUWC. Therefore, the same organization structure shall be rearranged and shared with ministry of public service.

3.2.5 Challenges to O&M of Transmission and Distribution

The challenges to improve current water supply condition are indicated based on the result of baseline survey such as socio-condition survey, existing facilities survey and measurement of water flow. The challenges to be implemented in distribution department of SSUWC are described below.

- Establishment of the monitoring system for water flow; Water flow data will be utilized for distribution management, non-revenue water control and rehabilitation plan.
- Distribution management plan including water supply schedule and distribution zoning; Distribution management actualizes water supply with regular basis and improves correspondents of water supply to the unrelated area during repair work of water leakage.
- Establishment of an appropriate repair process of water leakage; It is necessary to set repair process of water leakage for minimizing of damage such as interruption time of water supply and water quality deterioration.

3.3 Current Conditions of Water Quality Analysis

3.3.1 Existing Water Quality Management

(1) Organization and Duties

Water Quality Laboratory section belongs to Purification Plant Department and currently 3 staffs are assigned. However, only 2 staffs are currently working in daily operation of water quality monitoring. The duties of the section include sampling, water quality testing and reporting the results.

(2) Current conditions of equipment

Under the Multi Donor Trust Fund (MDTF) project, few equipment and tools have been provided for carrying out basic water quality tests. A list of these equipments available in existing condition is given in the table below. Most of the equipments are not functioned well. In addition to the equipment above, the JICA development study team donated their equipments used for the master plan study as follows and these are still in working conditions.

- Turbidimeter
- Residual chlorine meter
- TDS, pH, Conductivity meter

Table 3-11 List of Available/Required Equipment/Tools in Laboratory

Equipment/Tools	Total Number
pH meter	1
Turbidity meter	1
Residual Chlorine Meter	1
Spectrophotometer	1
Stirrers	1
Vacuum Flask	1
Electronic Weighing Balance	1
Electric Distiller	1
Vacuum Pump	1
Refrigerator	1
Oven	1
Burettes	1
Durham Tubes	1
Filter Funnel	1
Sampling Bottles	3
Beakers	26
100ml	9
250ml	7
600ml	10

(3) Drinking water quality standards

Proposed Drinking Water Quality Guideline Value (GV) for South Sudan in terms of physical, chemical and Microbiological parameters have been established by the relevant authorities concerned. The major parameters and their guideline values are shown as below.

Table 3-12 Major Parameters for Drinking Water Quality and Guideline Value

Parameter	WHO GV (mg/l)	S. Sudan (mg/L)
Colour (NTUs)	≤15	≤15
Turbidity	1	≤5.0
pH	6.5 - 8.0	6.5 - 8.5
TDS	≤600	≤1000
Conductivity	NS	1500
Copper	2	1.5
Iron (Total)	0.3	0.5
Manganese	0.4	0.4
Total Hardness as CaCO ₃	200	200
Zinc	3	3

(4) Current water quality test

During the operation of the plant by the Contractor (SPENCON), water quality tests had been carried out by the Contractor on daily basis for essential parameters such as pH, color, turbidity, residual chlorine, etc. Also, weekly testing is carried out for Total Alkalinity and Total Hardness.

In the time of contractor's operation, the water in the Hospital Tank was sampled weekly and tested but this activities has not continued by the laboratory staff due to lack of transportation. Currently, the sampling points are only at a clear water tank in the purification plant.

Jar tester has been broken since taking over the operation from the Contractor. Therefore, jar test has not been exercised. In addition, chlorine demand test has not been exercised. As a result of pointing out by the project team, the jar tester was just repaired recently and is in working conditions.

(5) Current chemical dosing rates

The followings are the current dosing rate of chemicals:

- Chlorine: 65 kg/day
- Aluminum sulfate: 300 kg/day (6 bags times 30 kg)

These rates should be confirmed with jar tester and chlorine demand test in the next stage.

3.3.2 Previous Results of Water Quality Test

The sampling points are at a clear water tank and hospital tank. Following are summary of the previous results of water quality test by the Contractor. After November 2010, the water quality test results are not available. Since 3rd October 2010, water quality test for the hospital tank has not been

carried out.

(1) Turbidity

The turbidity was measured and recorded in actual values before June 2010, but after July 2010 it was recorded as only less than 5 NTU and no numeric values are recorded. The numerical values range from 0.1 to 3.0 NTU before June 2010.

(2) Residual chlorine:

The range of residual chlorine in the clear water tank and the hospital tank was between 1.5 to 0.2 mg/l.

3.3.3 Issues on Current Water Quality Management

- Sampling system is prepared by the Contractor for only new facilities constructed by the Contractor. Therefore, it is not complete. The sampling points are only two points: the clear water tank in the plant and the tank near the Hospital.
- No record has been found since 14th November 2010. The analysis of the data of results have not been done and not interpreted.
- Most of the equipments are not operable when the project team arrived here.
- The chemical dosing rates are not sure whether it is correct or not. The dosing rates are fixed at 300kg/day for aluminum sulphate and 65 kg/day for chlorine although jar test has not been carried out since long time and chlorine demand test never carried out.
- The laboratory does not have any transportation mean to take water sample from outside of the plant.

3.4 Current Conditions of Revenue Collection and Financial Conditions

3.4.1 Organization of Financial Department and Roles

Accounting department is holistically responsible for revenue collection of SSUWC-Juba station.

(1) Organization Structure of Accounting Department

The accounting department consists of 2 sections as account section and revenue section. Total number of staffs in the accounting department was 17 peoples, 2 staffs in account section, 13 staffs in revenue section, 2 staffs in store section. Five staffs was reduced from 22 staffs after personnel revisions in February 2011, thereby the acting director of the accounting department has been transferred. The

storekeepers belong to account section. The revenue section consists of ledger keepers and meter readers. The chief of account section serves as the acting director of the accounting department due to an empty seat. The chief of the revenue section is also an empty and the senior inspector of meter reader plays as the acting chief.

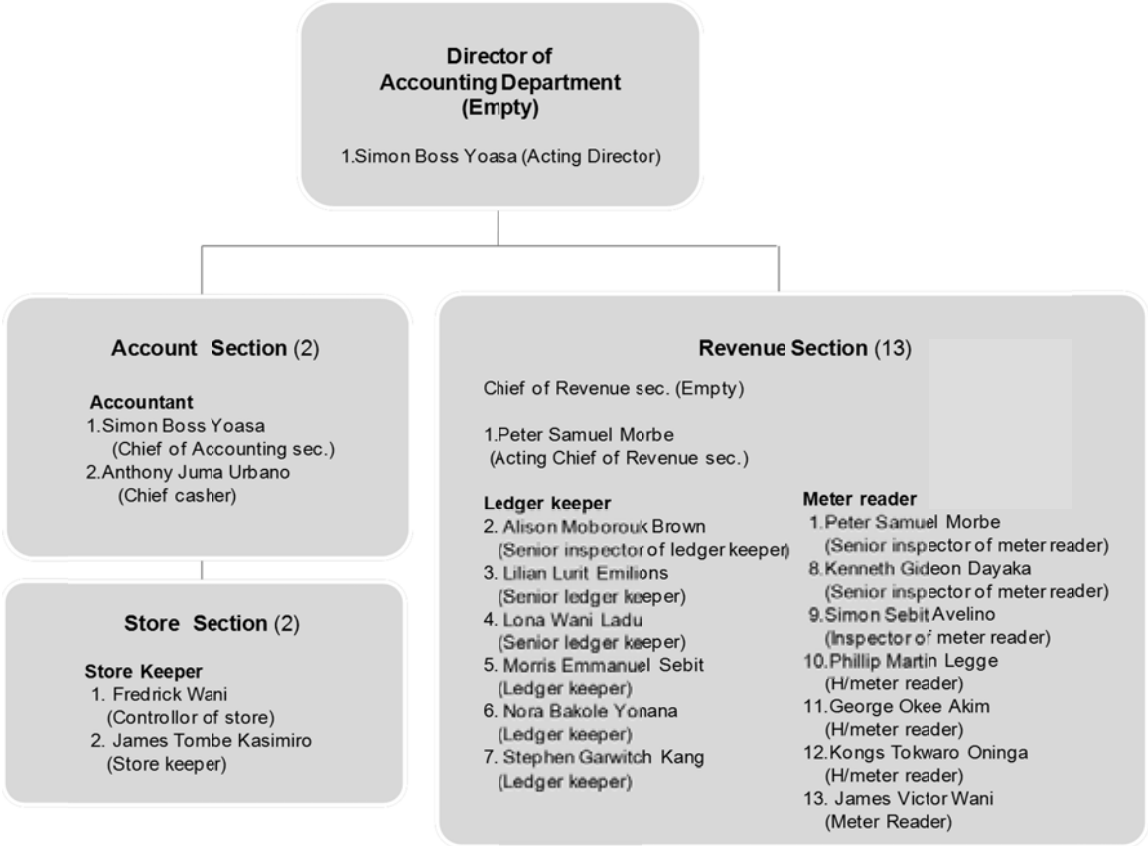


Figure 3-13 Organization Structure of Accounting Department

The roles and the responsibilities of the area manager and each director are defined by a corporate letter, as Ref 50-A-3/1726/01/2009. The roles and the responsibilities of each section were confirmed through a series of interviews due to no official defined letter. Although the director of the accounting department and the chief of revenue section have been transferred after the letter, a new corporate letter defined the new roles and responsibilities are not issued. Main roles of each section are shown as follows.

(2) Account Section

Main tasks of the account section are to receive and record customer’s payment at SSUWC-Juba station, to record financial balance and the reporting, remittance of the collected revenue, an estimation of employee’s salaries and wages.

a) Main Activity of Account Section

Main activities of the account section are shown as follows.

Type of Job	Main activities
Chief of Accounting section	<ul style="list-style-type: none"> • To implement Daily accounting matters of the SSUWC Juba station • To make payments after approvals of the Area Manager • To make advice the Area Manager on financial matters • To manage remittance of collected revenue to the block account of the MOFEP-GOSS • To check financial balance
Accountant	<ul style="list-style-type: none"> • To summarize financial information on revenue and expenditure • To report financial information to the Area Manager and the HQ • To prepare a financial report at the end of a fiscal year and to report • To estimate employees' salaries and wages monthly and to make payments • To prepare application forms for budget demand for purchasing materials and equipment

b) Monthly and Yearly Works

Monthly works of accountants are to summarize monthly financial records on revenue and collection, and to report to the area manager and to the HQ of SSUWC. Also the account section monthly estimates salaries and wages for employees including allowance and applies to the MOFEP. The accountants prepare application forms for budget demand for purchasing materials and equipment as necessary after an approval from the area manager.

At the end of a fiscal year, the account section prepares a financial report and submits to the area manager and the HQ. The financial report is a quite simple style compiling monthly revenue and collection.

c) Daily Works

The daily workflow of the account section is that: (1) an accountant receives customer's payment with cash or cheques, (2) he records the payment in customer ledger books and issues receipts. In principle, the accountant summarizes the daily revenue collected yesterday and today's morning, and submits it to a cashier with cash. The cashier closes the account at 12 p.m. in the weekdays, and remits the 80% of cash revenue to the block account of the Ministry of Finance, Planning and Economy (MOFEP). In case of cheques, the cashier exchanges the cheques into cash in a bank, then he remit the 80% of total revenue to the block account of the MOFEP. Because revenue and expenditure are recorded by hand-writing and documents are poorly stored and managed efficiently, sometime it is difficult to find necessary documents.

(3) Store Section

Store keepers are stationed at warehouses located five minutes away from SSUWC-Juba station by a

vehicle. Main activity is to manage entry and dispatch of materials and equipment.

The warehouse site belongs to the property of the Ministry of Infrastructure, SSUWC-Juba leases the land for a stockyard of materials and equipment. In the site, there are 3 warehouses and 3 containers, some small purification plants not in use are thrown away and pipes are stored outside.

a) Storage Condition of Equipment and Materials

Record sheets writing down entry and dispatch of materials and equipment exists, however inventory count has been not implemented. The arrangement and the cleaning of warehouse are not implemented, it is difficult situation to confirm the existence of old items out of 4,107 items recorded in the record sheets. Some equipment and materials was provided by the MTDF project, however, these are scattered randomly at the backside of warehouses without arrangement.

In other warehouse, coagulant chemicals for water treatment are stored and stacked under the inappropriate environment for storing chemicals where rain directly comes in from the holes of roofs. They also have a stock site for PVC pipes which stacked outside. The half of PVC straight pipes was bent with direct sun light under the bad storage condition. Nearly twenty small purification Reverse Osmosis (RO) plants provided a several years ago, but not in use, are thrown away outside.

b) Main Activities of Store Section

Main activities of storekeepers are shown as below.

Type of job	Main activities
Storekeeper	<ul style="list-style-type: none"> • Entry and dispatch of materials and equipment at warehouse • Recording entry and dispatch of materials and equipment on the sheet

(4) Revenue Section

Main activities are to make invoices for water users, to distribute water bills, to manage and update customer ledger records when SSUWC-Juba station collects customer’s payment. The number of staffs in the revenue section is 13 people as of March 2011, which is the largest section in the accounting department.

a) Main Activities of Revenue Section

Main activities of revenue section are shown as below.

Type of job	Main activities
Chief of revenue section	<ul style="list-style-type: none"> • Collecting revenue from customers • Supervising the works of ledger keepers and meter readers • Distributing water bills properly • Reporting troubles to an area manager if happened
Ledger keeper	<ul style="list-style-type: none"> • Making and issuing water bills based on customer ledgers monthly • Summarizing and reporting total collected amount monthly • Updating and managing customer ledgers according to customer's payment
Meter reader	<ul style="list-style-type: none"> • Distributing water bills to customers monthly • Checking water supply status at customer's places

b) Daily and Monthly Works of Ledger Keepers

Daily works of ledger keepers are to make and issue water bills, and to manage and update the customer ledgers. They write down total billing amount and customer information in the format of water bill by hand-writing every month. After filling up with the formats, they put the corporation seal on the water bills and issue them officially. Then the water bills are hand over to meter readers.

In addition, ledger keepers summarize the total amount of revenue collection in the table monthly in principle, and submit and report it to the director of accounting department. The total billed amount, however, is not calculated and is not reported. Thereby it is currently difficult to figure out the total account receivable. In order to know the account receivable, they need to check every customer's billing records in the ledgers one by one.

An annual report is not especially prepared in the end of a fiscal year, and the revenue section only submits the summary table of revenue collection by month currently.

c) Daily and Monthly Works of Meter Readers

Main activities of meter readers are to distribute water bills to customers and to confirm water supply status. Presently, meter reading and recording works of water meters are not necessary and are not conducted because flat rate system of water tariff is applied.

Meter readers directly distribute water bills to customers by hand, usually within a couple of weeks. To leave water bills at customer's place without meeting is not allowed by the corporation rule when the customers do not stay their houses or buildings, therefore meter readers continuously need to visit customer's houses or buildings several times until meeting. They also check water supply status of customer's place sometime by collecting information from customers and by opening taps in the houses.

Meter readers visit customer’s place by foot, the section does not have their own transportation means such as vehicles and motorcycle. According to interviews with them, some staffs insisted a necessity of motorcycles with high mobility. Coverage areas by meter readers are shown as the following table.

Table 3-13 Coverage Areas by Meter Readers

Meter reader No.	Coverage area
1	1st class (up to Ministry line)
2	1st & 2nd class (commercial & school), 3rd class (Buluk, Thourah, Nyakama)
3	2nd class (Prison line, Police line, Part of Cinema, Juba market)
4	2nd class (Maloleal, Part of Cinema)
5	3rd class (Kosti, Mlafia, Konyokonyo)
6	3rd class (Nim, others)
7	New 3rd class, Mayo, Atlabara

3.4.2 Water Charge Billing and Revenue Collection System

(1) Number of Customer

The registered number of customers is 3,108 as of December 2010, which is a total sum of registered numbers in the newly prepared customer ledgers since 1991. Many unconfirmed and non-existent customers due to removal and death are included in the numbers. The revision and the updating are particularly not done.

The accurate number of customers by customer types is presently not available. In order to do so, it is necessary to check every customer’s records in the ledgers one by one. The confirmed number of customers by customer types is shown as below.

Table 3-14 Number of Customers

Indicators	No./ %
No. of Registered Customer (Oct,2010)	3,108
No. of Billed Customer	693
Domestic (confirmed)	445
NGOs	26
Hotels	12
Banks	14
Companies	22
Gov. Units-GOSS	56
Gov. Units-CE5	23
Militaries	7
Stand-Pipe	7
Restaurants	16
Hospitals	2
School	16
Polices	11
Prisons	2
Others	47
Collection Ratio (%)	Not available

(2) Water Tariff Structure

a) Revision of Tariff Rate

Flat rate tariff system is applied by SSUWC-Juba as of March 2011. The water tariff rate approved in 2004 was utilized for six years, then new tariff rate was applied since October 2010. SSUWC-Juba prepared a proposal of new tariff rate, and submitted it to the HQ and the Ministry of Water Resources and Irrigation (MWRI), however the issue is still pending under consideration as of March 2011 and they are waiting for approvals from the Council of Ministers and the parliament. The revenue section received many customers' complaints on the new tariff, especially just after their applying the new tariff rate in October, because of the sudden application without official approvals, insufficient notification activity and relatively large increase percentage of tariff rate.

Previously metered rate was utilized until 1996, however flat tariff rate has been applied since the Sudan Government of National Unity (GoNU) was established. Water meter installed under the metered rate system was currently not used.

b) Water Tariff Structure in Use

The new tariff rate is categorized into 17 customer types. The tariff rate for domestic is divided into 3 classes, class 1-3, depending on the living areas. In new tariff structure, the customer types of hotels and stand-pipes are more precisely categorized and the new categories such as factories, military,

public latrines, petrol stations, new construction building, churches and mosques are newly established. The background of this revision is that SSWUC-Juba wanted to increase their revenue and also charge appropriate rates according to the consumption volume even under the flat rates and that new service such as public latrine was launched.

In terms of Stand-Pipes, flat rate system is continued to apply to old stand-pipes established by SSUWC. The tariff rate was divided into small and large by the new tariff rate structure. In case of old stand-pipes, SSUWC-Juba charges the flat rate monthly, 100 SDG for ordinary small stand-pipes and 1,000 SDG for stand-pipes for tank lorry.

In case of newly established stand-pipes funded by foreign donors like JICA and USAID, SSUWC-Juba collects 30% of the revenue from the public stand-pipes at Munuki and Katol by JICA and 80% of the revenue from the stand-pipe for tank lorry in principle.

Table 3-15 Water Tariff Rate

Old Tariff Rate (2004-2010) Proposed Tariff Rate in Use (October, 2010 -)

Customer type	Unit price	%*1 increase	Customer type	Unit price	% increase
1. Domestic			4. Governmental units	300	+300%
Class 1	30	+67%	5. NGOs	300	+300%
Class 2	25	+67%	6. Restaurant	300	+300%
Class 3	15	+67%	7. Companies	700	+700%
2. Stand-Pipes			8. Factories	700	+700%
Ordinary stand pipes	100	0%	9. Military (Mess)	250	+250%
Large stand pipes for lorry	1,000	-	10. School	250	+250%
3. Hotels			11. Public latrines	500	+500%
Hotel (Small)	750	-63%	12. Ptroleum station	300	+300%
Hotel (Medium)	1,200	-	15. Tower buildings	1500	-
Hotel (Large)	1,440	0%	16. Chaurches & Mosques	*2	-
			17. Hospitals	*3	-

*1 an increase percentage compared with the previous tariff rate

*2 According to the area located.

*3 2nd class rate is applied. According to the number of taps.

c) Level of New Tariff Rate

The increase percentage of tariff rate is 67% for domestic, 250% for schools, 300% for NGOs, governmental institutions, these increase rates could be relatively high percentages in general due to no rate change after 2004. The minimum monthly rate is 15 SDG for domestic class 3 and the monthly maximum rate is 1,500 SDG for tower building which is 100 times more expensive than the minimum rate.

d) New connection and Reconnection Fee

Customer's new connection fees consist of deposit, connection fee, saddle fee, labor fee, contract fee. The connection fees differently charges depending upon the diameter of supply pipes and the distance between main distribution pipe and each taps. The charge amount is determined by the area manager after the contract and the site inspection by staffs of distribution department.

On the other hand, customer need to pay material costs such as supply pipes, fitting, socket, elbow pipe, nipple pipe in addition to connection fees paid to SSUWC-Juba. SSUWC-Juba usually does not have such stocks, thereby customers have to procure and prepare these materials by themselves. However, it requires additional works and time to customers and not in an efficient way.

e) Water Tariff Setting Procedure

Tariff setting procedure in general of SSUWC-Juba is indicated as follows, according to the information from the accounting department:

- The accounting department and the administration department make a basic idea for proposal through discussions
- The proposal is submitted to the HQ after an approval of the area manager
- The HQ submit it to the Council of Ministers for consideration
- The Council of Ministers send it to the parliament
- After the approval of the parliament, the tariff will be implemented officially

In the tariff setting procedure, SSUWC mentioned that the affordability to pay particularly for poor people is generally considered. In the recent tariff proposal submitted in October 2010, SSUWC-Juba took into account the salary level of governmental officials, but not consumer price index and the result of socio-economic survey.

f) Customer Ledgers

Customer ledger could be divided into 2 types. First type is to record customer's contract information (hereafter, customer ledger A) and second type is to record billing and revenue collection information by customer (hereafter, customer ledger B). In here, we distinguish ledger A with ledger B, since the recorded contents are different each other.

There are 6 customer ledgers respectively for ledger A and ledger B, which cover the total number of registered customer, 3,108.

The indicated items in ledger A are serial number, customer name, deposit amount, contract number, receipt number, house number, contract date, regions, remarks. All these are based on the information indicated in a customer’s contract.

Ledger B is general billing and revenue collection information including billing and collection status and amount monthly. The indicated items in ledger B are serial number, arrears, customer type, billed amount in present month, total billed amount, and all these information is filled up by hand-writing of ledger keepers.

The customer ledger books commercially available are made for billing and collection management, the formats of ledger A and B is completely same. In case of ledger A, the printed items are not directly related to customer basic information, therefore ledger keepers need to write the necessary items by hand-writing. This inefficient way makes record reading difficult. Even in case of ledger B, the indicated items are not really matched, thereby only a part of the items are actually used. Moreover, the coverage customers categories of meter readers and ledger keepers are not consistent and be mixture. The improvement for practical formats is expected. Current utilized items of the customer ledgers are shown as below.

Table 3-16 Record Items Indicated in Customer Ledger

Folio	Area/ House No	Out standing	Credit			Arrears	Meter Reading		Consum ption	Charges				Remark
			Date	Receipt No.	Amount		Allow ance	Last		Pre sent	Fixed	Reconn ection	Miscell aneous	

Coverage area categories by customer ledgers are shown as follow.

Table 3-17 Coverage Customers by Customer Ledgers

Ledger No.	Customer type	Coverage area	Remark
1-a	Non-domestic	Not specified	Gov institution, NGO, Bank, Company, SPLA, Restaurant, Hospital
1-b	Domestic	1st class 2nd class (Gov official's privat house, Part of Cinema) 3rd class (Prison line, Police line, Part of Cinema)	
2		2nd class (Juba town, Gabat, Hai jalaba)	
3		2nd class (Hai Marakal, Mahad)	
4		3rd class (Kosti, Mlakia, Konyokonyo, Buluk)	Customer's acronym (A to J)
5		3rd class (Kosti, Mlakia, Konyokonyo, Buluk)	Customer's acronym (K to Z)
6		3rd class (Munuki, Kator)	

g) Billing and Revenue Collection System

Water bills are made by ledger keepers in the revenue section based on revenue collection records. In concrete terms, each ledger keeper checks customer's account receivable recorded in customer ledger B and calculates the total bill amount by adding water tariff rate in the present month. Then they prepare water bills and issue every month in principle.

The monthly billing date to produce water bill and to handover them to meter readers is not specifically defined. The reason is that the preparation of water bills for all customers takes time due to checking necessarily customer ledgers customer by customer and hand-writing bills. Thus, ledger keepers produce water bills during a month areas by areas, and hand over them to meter readers in prepared order.

h) Distribution of Water Bill

Coverage customers are categorized by address and customer types and so on into six parts covered by 6 meter readers. In principle, 6 meter readers distribute water bills to each responsible customer monthly. The distribution takes generally two weeks. Meter readers monthly prepare distribution records of water bills after receiving water bills from the revenue section. The record items are customer name, bill amount, remarks, and meter readers tick the mark in the remark column after distributing the bills. It could take much time to make same distribution record sheets and put down customer names by hand-writing in every month, in an inefficient way and needs to be improved. Meter reader need to directly hand over water bills to customers in principle. They bring back water bills if they are not able to meet customers, and try to visit until meeting. Currently they go to customer by foot or public bus because there is no transportation means.

i) Revenue Collection of Water Tariff

Revenue collection is done by an accountant at SSUWC Juba office. Customer comes to visit the SSUWC-Juba office with cash and make a payment to an accountant. The accountant receives the revenue from customer by cash, and records the collection information such as collected amount, collected date in the collection record sheet by hand-writing. The accountant give it to ledger keepers and the customer's collection record will be updated. Non-domestic customers such as NGOs and governmental institutions are allowed to pay water tariff by cheque. In this case, customer needs to bring the cheques and give it to the accountant, similarly as a case of cash.

The revenue from the stand-pipe for lorry, established by USAID is collected from the consigned companies who need to visit the SSUWC-Juba office by cash.

With regard to the revenue collection of these customers, the staffs of SSUWC-Juba do not need to

visit customers directly in principle. Meter readers are, however, asked to bring cash for payment from customer in some cases. On the other hand, in case of public tap stands funded by JICA, meter readers visit the person in charge of operation and maintenance of facilities to collect revenue.

j) After Collection

The collected revenue at SSUWC-Juba office is stored in a cash box by cashier. Generally, cashier closes the account at 12 p.m. in weekdays. The cashier directly remits the 80% of collected revenue to the block account of the MOFEP after an approval of the director of accounting department and the area manager. In case of cheque, the cashier withdraws cash and remits the divided amount respectively to the block account of the MOFEP and to the account of SSUWC-Juba.

k) Workflow on Billing and Revenue Collection

The flowchart of billing and revenue collection system is shown as below.

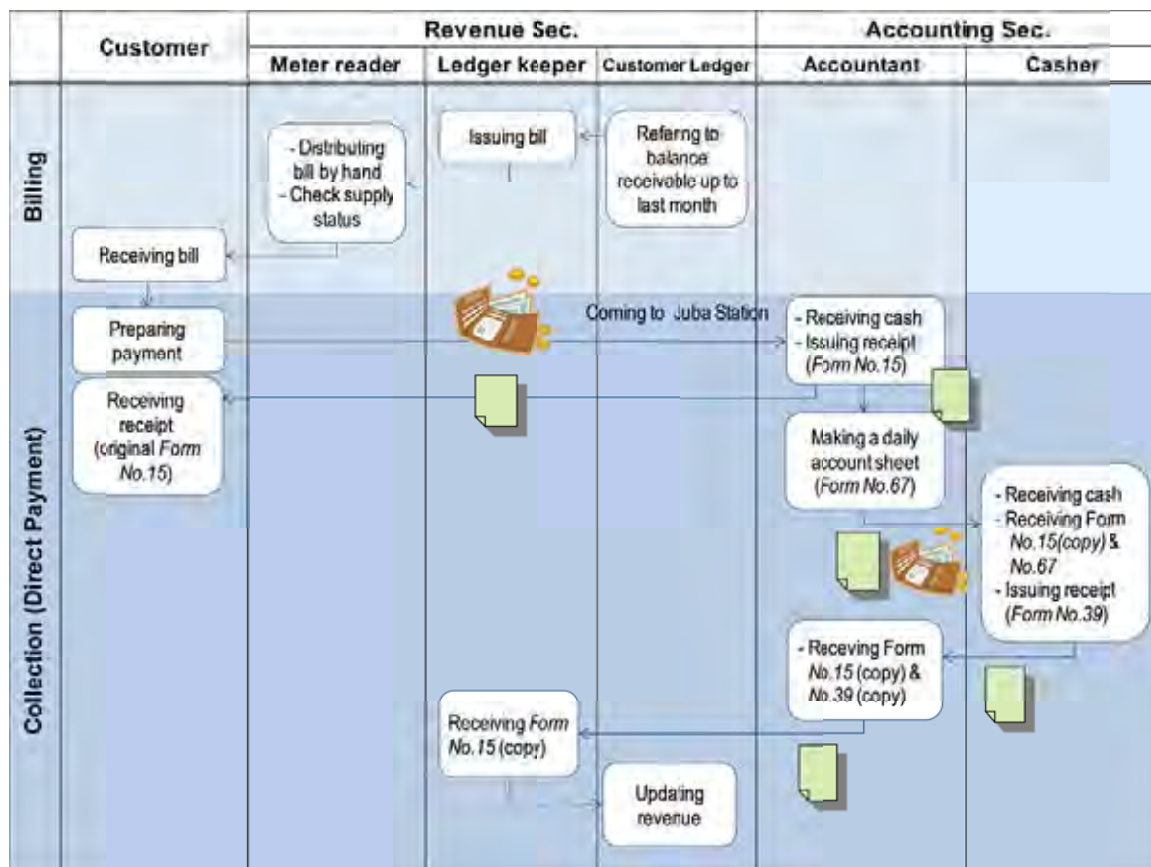


Figure 3-14 Flowchart of Billing and Collection System

l) Current Status of Revenue Collection

Monthly collected amount is summarized and reported to the director of accounting department. While,

the total billed amount is not calculated and not reported. In order to do so, it needs to check customer ledgers customer by customer, thereby the calculation is not conducted.

A few customers come to pay every month and most of customers pay a good round sum of the billed amount or a part of that in many cases. In terms of the payment status by customer type, a large outstanding is existing for governmental institutions including the government, officer's houses, military offices and facilities, police, and for hospital, companies, domestic and so on. It is assumed that the revenue collection ratio could be low for these customers.

Additionally, a part of customers reject the payment due to frequent supply cut, in that case, SSUWC-Juba discounts the billed amount after negotiations in some cases.

3.4.3 Water Service Contract for Customer

(1) Outline of Service Contract

SSUWC-Juba makes a water service contract with customers who received water by pipeline. The contract is a simple format as A4 including customer name, address, occupation, organization name, contact address of organization. Customer submits it to SSUWC-Juba office after filling up their information.

After receiving contract, the staffs of distribution department visit an actual site and specify the distance between main distribution pipe and customer's place and the diameter. Based on the information, the area manager determines the connection fees such as deposit, saddle fee, labor cost, contract fee. The customer is officially registered after the payment of the new connection fees. If customer prepares the necessary materials, the connection work will be started.

In the contract, customer needs to agree the "duty of customer" and to make a signature. However the "duty of customer" describes only that "customer needs to respect the conditions indicated in the contract and need to pay water tariff with your responsibility", the violation rules and the penalty fees are not clearly defined and mentioned.

(2) Countermeasures for Non-payment Customer

The billing amount for non-payment customer is calculated by adding the outstanding amount on water tariff every month. According to the SSUWC's rule indicated backside of the water bill, a countermeasure of disconnection will be done if outstanding exceeds more than three months. Disconnection is practically implemented for non-payment customers over 6 months to a limited extent. The revenue section does not have information on the exact number of disconnections.

Disconnection with pipe cut is practically done by the staff of the distribution department.

3.4.4 Financial Situation of Waterworks Management

(1) Revenue

a) Breakdown of Revenue

Accounting items for revenue is categorized into eights. Water service is the revenue for selling water collecting by cash at SSUWC-Juba office. Deposit is a fund that customer provide sin advance, and the amount is determined by the area manager and customer before receiving water service. New/Reconnection fees are the customer’s payment for connecting pipe newly or again. Labor cost is the customer’s payment for civil works of new/reconnection. Saddle cost is a cost of saddle pipe bored by customer if necessary. Water service by cheque is the revenue for selling water collecting by cheque. Water service by Kiosk is the revenue from the stand-pipe for tanker filling funded by USAID.

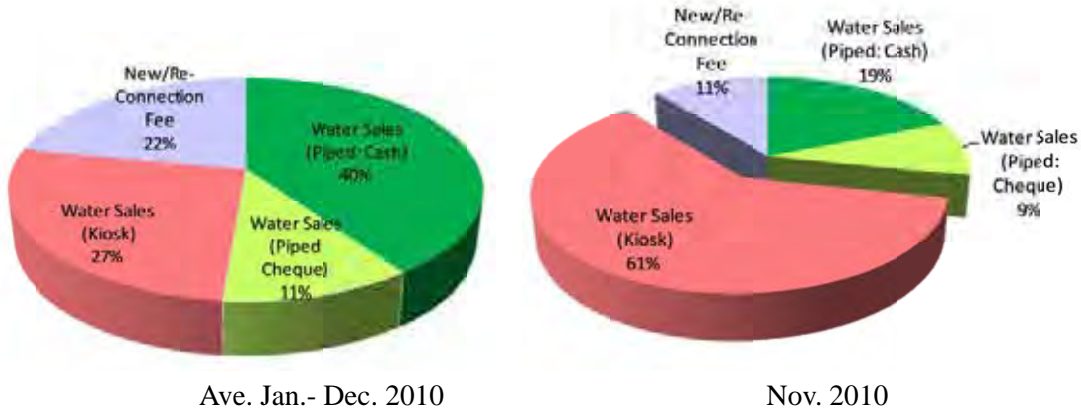


Figure 3-15 Breakdown of Revenue in 2010 and Nov. 2010

b) Revenue Trend

Total revenue of SSUWC-Juba in 2010 accounts for approximately 700,000 SDG. Monthly revenue is variable between months from 250,000 SDG to 100,000 SDG.

SSUWC-Juba launched revenue collection from non-domestic such as governmental institutions, NGOs, hotels and restaurants by cheques since July 2010. Also they started water supply service by stand-pipe for tank lorry established by the USAID fund since September 2010. These revenues are accounted in the revenue statement separately from ordinary items after the starting. It is remarkable that revenue from stand-pipe for tank lorry shared about 60% of the total revenue at maximum on November 2010. It largely contributes to increase revenue since September 2010.

The eighty percent of the total revenue is remitted to the block account of the MOFEP, as the result the remaining 20% is accounted for the revenue of SSUWC-Juba. Staff's salaries and wages and overtime allowance are provided by the governmental subsidies, however these money is accounted not for revenue but expenditure.

Table 3-18 Revenue Trend by Month in 2010

(unit: SDG)

2010 Month	Water Service (by cash)	Water Service (by cheque* ¹)	Kiosk* ²	Deposit	New/Re-Connection	Rec. fee	Labour cost	Saddle cost	Total
Jan.	26,207	0	0	4,250	3,950	55	5,900	1,850	42,212
Feb.	7,613	0	0	4,950	4,550	25	5,500	2,050	24,688
Mar.	45,046	0	0	3,700	3,550	0	4,550	700	57,546
Apr.	26,500	0	0	4,050	3,650	5	3,400	0	37,605
May	40,711	0	0	5,100	4,750	105	7,050	0	57,716
Jun.	36,646	0	0	3,750	3,750	0	5,550	450	50,146
Jul.	11,020	11,094	0	2,700	2,700	0	3,250	0	30,764
Aug.	15,417	21,812	0	2,550	2,550	0	2,350	0	44,679
Sep.	20,714	3,280	45,523	5,400	5,500	0	6,000	0	86,417
Oct.	18,535	7,320	40,433	4,600	4,600	0	3,200	0	78,688
Nov	16,800	8,360	54,156	3,000	3,000	0	3,750	0	89,066
Dec	17,080	24,347	46,606	4,000	3,800	0	3,750	0	99,583
Total	282,289	76,213	186,718	48,050	46,350	190	54,250	5,050	699,110

*1 SSUWC started to collect water charge by cheque from July 2010.

*2 Revenue from filling stations for water tanktruck, constructed by USAID.

(2) Expenditure

a) Breakdown of Expenditure

Expenditure composes of five cost items: (1) staff's salaries and wages, (2) Overtime allowance, (2) fuel, lubricants and power, (3) materials, spare parts and maintenance, (4) other expenditure. Salaries and wages, over times, accommodation allowance out of five are subsidized by the government. Other allowances except for the aforementioned are covered by SSUWC-Juba.

In the breakdown of expenditure during 2010, salaries and wages shared about 48% of the total as the largest expenditure. The second largest expenditure was others as 41% followed by allowances as 6%, fuel, lubricants and power as 3%, materials, repairs, maintenance and spare parts as 2%. Approximately 90% of the total expenditure is subsidized from the government.

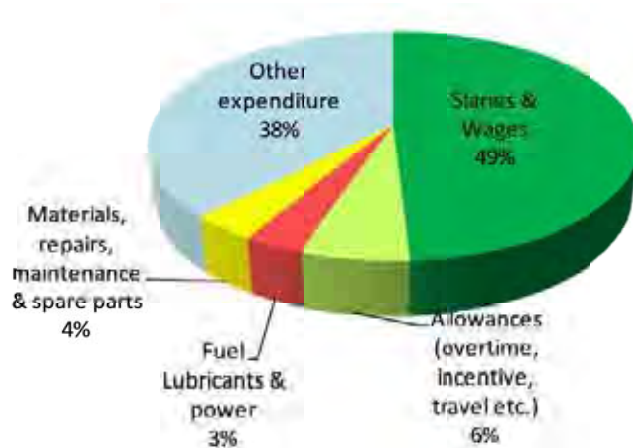


Figure 3-16 Breakdown of Expenditure in 2010

With regard to salaries and wages, the account section estimates the total sum of salaries and wages in 15th every month in general, and applies to the government. Over time allowance is calculated approximately every two months and applied. However the governmental subsidies are frequently delayed. Thus it is difficult to say that the salaries and wages of staffs are regularly paid. The payment of salaries and wages for June was delayed for six months, and provided in December 2010. The accounting department is not able to predict the day of salaries and wages payment.

b) Expenditure Trend

Expenditure is not accounted every month but every two or three months due to taking time for calculation. The actual expenditure is reported after three months from closing the monthly account and the accounting is not timely implemented.

Table 3-19 Monthly Expenditure

(unit: SDG)

2010 Month	Salaries & Wages	Allowances (overtime, incentive, travel etc.)	Fuel Lubricants & power	Cost of materials, repairs, maintenance & spare parts	Other expenditure	Total
Jan.	139,017	25,206	4,249	9,976	4,890	183,338
Feb.	140,805	17,136	3,150	3,240	7,200	171,531
Mar.	140,805	13,638	6,806	14,158	765,720	941,127
Apr.	140,805			960	15,453	157,218
May	140,805			1,500	20,670	162,975
Jun.					25,232	25,232
Jul.	139,387	29,430	3,515	9,604	5,078	187,014
Aug.	139,387	29,187	41,040	5,299	1,500	216,413
Sep.	96,120	18,300	13,730	13,730	86,976	228,856
Oct.	96,120	18,300	13,730	13,730	86,976	228,856
Nov.	88,376	6,974	2,500	10,986	9,117	117,953
Dec.	86,556	6,542	3,750	15,771	13,141	125,760
Total	1,348,183	164,713	92,470	58,954	1,041,953	2,746,273

(3) Financial Balance

In this section, we check financial balance of Case A: Financial Autonomy and Case B: Subsidy Dependence based on the available data for revenue and expenditure in 2010.

Table 3-20 Financial Balance (Case A, case B)

(unit: SDG)

Month	Case A			Case B		
	(1) Revenue	(2) Expenditure	(3) Balance	(4) Revenue ((1) x 20%)	(5) Expenditure ((2) - Gov. subsidies)	(6) Balance
Jan.2010	42,212	183,338	▲ 141,126	8,442	29,200	▲ 20,758
Feb.	24,688	171,531	▲ 146,843	4,938	19,161	▲ 14,223
Mar.	57,546	941,127	▲ 883,581	11,509	20,964	▲ 9,455
Apr.	37,605	157,218	▲ 119,613	7,521	16,413	▲ 8,892
May	57,716	162,975	▲ 105,259	11,543	22,170	▲ 10,627
Jun.	50,146	25,232	24,914	10,029	25,232	▲ 15,203
Jul.	30,764	187,014	▲ 156,250	6,153	24,367	▲ 18,214
Aug.	44,679	216,413	▲ 171,734	8,936	49,789	▲ 40,853
Sep	86,417	228,856	▲ 142,439	17,283	26,256	▲ 8,973
Oct	78,688	228,856	▲ 150,168	15,738	26,256	▲ 10,518
Nov	89,066	117,953	▲ 28,887	17,813	22,603	▲ 4,790
Dec	99,583	125,760	▲ 26,177	19,917	32,662	▲ 12,745
Total	699,110	2,746,273	▲ 2,047,163	139,822	315,073	▲ 175,251

*1 Average amount of expenditure is applied to Sep & Oct due to unavailable data.

a) Case A: Financial Autonomy

The financial balance of Case A is estimated in accordance with the result of revenue and expenditure statements of SSUWC-Juba. The salaries and wages, and allowances subsidized by the government are accounted not for revenue but for expenditure. Meanwhile, 20% of the total revenue remitted to the block account of the MOFEP is not accounted for expenditure. It means all revenue is counted in the revenue statement without deduction. Therefore, it could be said that the revenue and expenditure statements monthly created by the account section indicates the financial balance for financial autonomy case. However, the costs of electricity, chemicals and fuel for generator are not taken into account in this calculation.

Also the following two assumptions are applied: (1) SSUWC-Juba does not receive any subsidies from the government, (2) while, SSUWC-Juba does not need to pay 20% of the total revenue to the government account. In concrete terms, the expenditure of SSUWC-Juba will increase if they do not receive any subsidies from the government. On the other hand, they will be able to account the total revenue as their own revenue without remitting 80% of the total revenue to the government. These financial situations are envisaged in the SSUWC-Juba statements as Case A.

The result shows the large deficit accounted for about 2,000,000 SDG. It could be interpreted that the cost of salaries and wages, allowances exceeds the revenue even if SSUWC-Juba does not need to pay 80% of the total revenue. Therefore this financial situation is far from covering the costs of staff's salaries and wages, allowances, operation and maintenance at the current level.

b) Case B: Subsidy Dependence

The financial balance of Case B may reflect the current real financial situation depending upon the governmental subsidies. In other words, SSUWC-Juba does not need to pay the costs of salaries and wages, allowances, which are covered by the governmental subsidies. While, SSUWC-Juba provide 80% of the total revenue, as the result only 20% of the total revenue remains in the account of SSUWC-Juba.

The calculation result indicates about 170,500 SDG deficits. Even if SSUWC-Juba relies on the large governmental subsidies, the expenditure exceeds the revenue. In this Case B, SSUWC-Juba remits 80% of the total revenue, about 560,000 SDG, to the MOFEP. Meanwhile, the total subsidies from the government are 2,430,000 SDG which is about four times larger than the remittance revenue. This difference could influence on the deficit situation of the financial balance. In order to make the balance equally, it is necessary for SSUWC-Juba to generate 1,870,000 SDG additionally.

Table 3-21 Financial Balance SSUWC-Juba

(unit: SDG)							
Month	(A) Revenue	(B) Expenditure	(C) Financial balance (without Gov. subsidy, without submission of 80% revenue) (A) - (B)	(D) 20% of Revenue (A) x 0.2	(E) Expenditure covered by Gov. subsidy	(F) Expenditure covered by SSUWC (B) - (E)	(G) Financial balance (with Gov. subsidy, with submission of 80% revenue) (D) - (F)
Jan.2010	42212	183,338	▲ 141,126	8,442	154,138	29,200	▲ 20,758
Feb.	24688	171,531	▲ 146,843	4,938	152,370	19,161	▲ 14,223
Mar.	57,546	941,127	▲ 883,581	11,509	920,163	20,964	▲ 9,455
Apr.	37,605	157,218	▲ 119,613	7,521	140,805	16,413	▲ 8,892
May	57,716	162,975	▲ 105,259	11,543	140,805	22,170	▲ 10,627
Jun.	50,146	25,232	24,914	10,029	0	25,232	▲ 15,203
Jul.	30,764	187,014	▲ 156,250	6,153	152,647	24,367	▲ 18,214
Aug.	44,679	216,413	▲ 171,734	8,936	156,624	49,789	▲ 40,853
Total	345,356	2,044,848	▲ 1,599,492	69,071	1,837,552	207,296	▲ 138,225

3.4.5 Customer Relation

(1) Customer Relation System

There is no section specialized in customer relations in SSUWC-Juba, therefore customer's complaints and requests are not recorded. Most of customer's complaints and request are received by the staff of the revenue section and meter reader section, which have relatively frequent opportunities to meet

customer, or by the area manager directly.

(2) Main Customer's Complaints

According to the interviews with revenue section and meter reader section, most frequent complaints is insufficient water supply such as a limited supply hours or days, unstable and inconstant supply. Main issues on customer's complaints are shown as following.

Table 3-22 Main Issues of Customer's Complaints

Issues		Detail
Water Quality	Smell	<ul style="list-style-type: none"> ■ - Smell of choline is strong. - High turbidity in rainy season
Water Supply Status	Short water availability (supply duration)	<ul style="list-style-type: none"> ■ - Not constant supply due to pipe breaks, frequent power cut, and no material for fixing - Supply hours are short, not stable
	No water at all	<ul style="list-style-type: none"> - Supply pipe is from main distribution pipe is not connected to the areas of Gudele, some of Munuki, Kator. ■ - In Kosti, Malakia, Kelibalak, Akabala areas, people can not receive water supply after pipe breaks more than 3 years. More than 100-200 people is waiting for reconnection.
Maintenance	Low water pressure	<ul style="list-style-type: none"> ■
	Specified leakage	<ul style="list-style-type: none"> ■ - Caused by pipe breaks, no materials for fixing.
	Slow action for connection/ re-connection	<ul style="list-style-type: none"> ■ - Re-connection action is slow.
Tariff & Fee	Expensive water tariff	<ul style="list-style-type: none"> ■ - Many complaints on new tariff rate just after October 2010, but gradually reducing.
	Expensive connection/reconnection fee	<ul style="list-style-type: none"> - For new connection, customer need to buy and prepare pipe, union(joint), socket, elbow pipe, nipple, separately from connection fee to SSUWC. ■
Collection	Limited teller's office (window offices)	<ul style="list-style-type: none"> ■ - Long distance customer is reluctant to come to pay, thereby they ask for meter reader to bring money.
Billing	Incorrect billing amount	<ul style="list-style-type: none"> - Some customer hope to install a water meter, because current rate is not matching their actual usage (from both of domestic and business) ■ - Double bill charges are happend despite customer already paid.
Accountability	Lack of information disclosure on water supply	<ul style="list-style-type: none"> - Before disconnection customers require to receive some announcement. ■ - Before increase tariff rate, customer wanted to have information. Although the announcement was made through radio and TV, people with limited access to media made some complaints.

3.4.6 Issues on Revenue Collection and Financial Conditions

Main challenges on revenue collection and on an improvement of financial conditions can be summarized as below.

(1) Challenges on Revenue Collection

1. Reconsideration of Flat Rate Tariff System

- Charge rate does not match the actual consumption volume in some cases
- Difficult to charge tariff on customers when customer can not receive water supply sufficiently due to leakage, pipe breaks, electricity cut, etc.
- Reconsidering tariff system with metered rate

2. Increase Revenue Collection

- Resolving the issue of large customer's arrears, especially for companies, governmental units, domestic
- Increasing new customer's connection
- Setting up efficient tariff rate for cost recovery
- Raising customer's awareness on payment

3. Metering connections

- Difficult to identify the consumed water volume without meter
- Metering connections encourage efficient water usage and efficient collection, could be one of new strategies

(2) Challenges on an Improvement of Financial Condition

1. Recording and Benchmarking

- Precise accounting, computerized documents, well-compiling, regular reporting could encourage to know accurate financial situation
- Benchmarking using Performance Indicators (PIs) can be a useful tool for the assessment of financial capacity

2. Cost Recovery

- Cost of water service and revenue requirements needs to be identified
- Tariff rate reflecting cost recovery needs to be reconsidered
- Efficient rate encourage sustainability avoiding under- pricing and over-pricing

3. Reduction of Non-Revenue Water

- Physical loss --- Reduction of leakage loss and pipe breaks
- Commercial loss --- Reduction of illegal connection, accurate billing

4. Toward Financial Autonomy

- Costs for electricity, chemicals, fuels, depreciation cost need to be precisely accounted
- Financial autonomy will be achieved after the improvement of financial performance, and the change of dependence and revenue remittance structure

3.5 Summary of Current Status of Management Forms of Public Tap Stands

The rapid growth of the population of Juba poses a major challenge in terms of the provision of safe water especially when it is considered that the water supply system in Juba was built for a much smaller population and had in addition suffered gross neglect during the 20 year of the civil war in Sudan. While some parts of the water supply infrastructure, have been rehabilitated, the supply of clean water is still far from adequate compelling the South Sudan Urban Water Corporation (SSUWC) to ration what is available. Many people in Juba still use untreated river water even though it is forbidden now, posing a serious health risk.

One of the strategies adopted by SSUWC for providing water especially to the newly established communities and the high density areas of Juba is the use of Public Tap Stands (PTS). The combination of Public Tap Stands and Tanker filling Points provides a low investment, low management, high utility channel for the supply of water in Juba. With support from Donors particularly USAID and JICA, a number of such facilities have been set up mainly in Kator Payam¹ and Munuki Payam.

Different approaches to the management of these PTS have been designed and recommended by the donors. At the same time the individuals setting up PTS have also come up with their management approach. There is a need to work out a mechanism for the sustainable and cost effective management of these facilities. This study commissioned by JICA as part of the Project for Management Capacity Enhancement for SSUWC, evaluated and compared the three main management models now in use in Juba with a view to recommending the most appropriate approach for PTSs set up subsequently, given the special circumstances of Juba city.

(1) Outline of the UWC internal Approach to the Management of PTSs

In general there is no special arrangement related to public tap stands in relation to contracting (agreement or account). Each of the PTS has an account like the rest of the customers. The client signatory for the PTS in Munuki is the Payam while for the PTS in Kator it is the chairman of the management committee.

PTS are categorized as 'ordinary stand pipes' in the tariff system of the corporation and are charged a flat fee of SDG 100 per month. However there is a special tariff for the PTS in Kator and Munuki Set up by USAID and JICA respectively because of their pro poor orientation. With these, the charge is 50% of the daily collection and default does not always lead to disconnection.

(2) Characterization of the Different Management Forms for PTS in Juba.

¹ A Payam is an administrative area within the city of Juba with a distinct administrative structure.

In general there are three models of PTS management forms in use in Juba. These are characterized in the table below using a list of relevant attributes.

Table 3-23 Characterization of the different management models

	Characteristic	Payam Management Model	Community Management Model	Private Management Model
a	Ownership	These facilities were built by a donor and they stand on public land. Management and control of the facilities was handed over to the Payam. The donor designed a system of direct Payam management of the facilities and this is what has been in place for the last 3 years.	These facilities were constructed by a donor and they stand on public land. However after being handed over to the Payam, the Payam relegated the management, operation and maintenance of the facilities to neighborhood communities. The communities manage the facilities with varying levels of popular participation.	These have been set up by individuals. While the land they stand on may be public and therefore occupied with official permission, they are owned privately and the owner has the authority to make all decisions relating to their operation and management.
b	Operation	The Payam has put in place a committee picked partly from people living in the neighborhood and partly by people at the Payam headquarters. Among these are two care takers for each of the PTS. These people look after the facility on a daily basis, they sell the water, collect the money and pass it on to the Payam and they arrange in various ways for the security of the facility	The community constitutes a committee for the management of the PTS and this committee selects a caretaker – usually someone in the immediate neighborhood of the facility. This care taker is the one who opens, sells water, collects the money and passes it over to the committee.	The owner appoints a caretaker to do the daily operation of the facility. In some cases it is the owner himself who does this.
c	Maintenance and Repair	The Payam is responsible for maintenance and repair of the facility. Damages and faults have to be reported then the Payam has to find money to buy parts and mend the breakage or damage. The motivation here is service to the people. The problem is that the people who have to effect the repair may be detached from the community and this could lead to a delay in repair.	The management committee has the responsibility for maintenance and repair. Damage is reported to the committee and money is mobilized from the previous collection to execute the repairs. The motivation here is dual. Since the committee members are paid a stipend from the collections they need to effect repair speedily.	The proprietor is responsible for maintenance and repair. His motivation is the loss of income should the facility not be functioning.
d	Revenue Collection and Handling	Collections are eventually sent to the Payam which allocates the income to three causes namely maintenance and repair of the facility, costs of management and operation i.e. fee to the committee members and the caretakers and payment of the bill to the UWC. The thing about this model is that some of the decision makers are	Collection is passed on to the committee. There were cases where the committee was virtually the caretaker and the chair person with the rest having ceased active participation. The committee makes the decisions relating to committing part of the proceeds to repair. The process is faster owing partly to the fact the people making	Revenue is collected by the operator and handed over to the owner. Sometimes the owner is also the operator and he/she directly collects the money. Because time lost is money lost, we noted that repairs are quickly implemented. On the other hand,

	Characteristic	Payam Management Model	Community Management Model	Private Management Model
		detached from the facility. Additionally, when the collection gets into the books of the Payam it becomes subject to Payam red tape which makes the speed of reacting to needs sluggish.	the decisions are at the same time the beneficiaries and due to the relative absence of red tape. However, with the relative informality of the management of the funds there is a chance that when the need arises, there is no money at all. But this is not only confined to this model.	non-essential items especially those that have to do with sanitation and hygiene such as cementing of the surroundings of the facility do not get any attention.
e	Usage and Satisfaction with the service.	In general users are less satisfied with this model than with any other model. The major problem is the fact that there is no water for most of the time. The other problem is the state of cleanliness at the facility though this later issue is of much less concern from the point of view of the users.	The absence of water in the pipes for long periods was also a cause of dissatisfaction here but to a lesser extent compared to the Payam management model.	In spite of the untidiness, people using these facilities had fewer complaints. These privately run facilities seem to have water for longer periods and more frequently. At some of the facilities, the existence of a storage tank helps
F	Design	It so happens that most of the facilities under this management model are designed like this have the same design since the donor also designed the management system. The operators have adapted this design to the circumstances by unscrewing the taps of at the time when there is no water and putting them back when they are selling water so as to avoid vandalism and damage to the taps. The problem is that this process creates loose joints allowing leaks and loss of water. An improvement suggested for this design is the construction of a fence. Another one is the design of a soak pit that is easier to de-silt.	The fact that it is possible to lock the facility reduces damage from children playing with the taps. But respondents also said that the fence sometimes precipitates a struggle at crunch time that leads at times to damage. No significant changes to this design were suggested however we noted that the chamber for the meter was prone to clogging with rubbish as it has no lock and it is placed in such a way (at some facilities) the storm water can get in it and take in rubbish as well.	There is no standard here but since most of the facilities under this model have only the 'bare necessities', lots of improvements are possible.

(3) Criteria for the most appropriate system

This study considered carefully the criteria for assessing the most appropriate model of management. Basing on multiple studies of public tap stands and pro poor water supply approaches, the study identified the following as the key considerations on both the supply side and the demand side for assessing the most appropriate model of management. These are summarized in the table below.

Table 3-24 Criteria for the most appropriate management form

Perspective	Criterion	Description
Supply side	Efficiency	<ul style="list-style-type: none"> - Requires minimal time and financial or other resources to supervise and monitor. - No water theft
	Effective	<ul style="list-style-type: none"> - Optimizes the delivery of an excellent service to the desired target groups - Good model for sanitation and hygiene. - Is able to manage at an affordable price for the user/customer
Demand Side	Effectiveness	<ul style="list-style-type: none"> - Model ensures that users are able to access water in the desired quantity or volume, quality and at the time that they require it. - Constitutes an acceptable social and cultural environment for water delivery - Demonstrates good hygiene and sanitation.
	Efficiency	<ul style="list-style-type: none"> - Direct price of water is acceptable - Time of fetching water is acceptable - Price is able to take care of all costs hence sustainability.

(4) Comparative assessment of the three management forms/models

On the basis of the criteria above, the three models of management mentioned above were compared.

Table 3-25 Comparative Assessment of the three management forms

Management Model	Management by the Local government (Payam)	Management by the Community	Private Management
Criteria			
Efficiency from the side of the WSP <ul style="list-style-type: none"> • Cost of supervision • Ease of supervision • Promptness in the payment of bills. 	<p>Results indicate that of the three this is the most costly and most inconvenient model to supervise. The cost is not so much in terms of money but more in terms of time. Complaints were raised about the lack of compliance with payment of bills. This is perhaps related to the fact that the collections have to enter the Payam books and be subjected to the Payam red tape. Some people in the area served by these PTS also implied that water service is public service that should be paid for by government hence some reluctance to pay</p> <p>(4/10)</p>	<p>Facilities managed under this model are easier to supervise. This is because decision making is faster and money is kept with the committee so that when the bill is raised, it is paid quickly. There is a higher level of accountability here since the people who manage and make decisions also live among the beneficiaries. Accountability compels quick action.</p> <p>(6/10)</p>	<p>The observation in this study is that this is the most convenient and easiest model to supervise and to manage. Failure to pay the bill leads to disconnection and this is loss of income to the operator so usually operators pay promptly.</p> <p>(8/10)</p>
Effectiveness from the side of the WSP. <ul style="list-style-type: none"> • Appropriateness in reaching the poor. 	<p>In this respect, this is model is better than the private operation model but worse than the community management model. The reason is that while the price is comparable, PTS under</p>	<p>Probably the best of three models in this respect. The advantage arises from prompt payment of UWC bills. This seems to arise from the fact that the decision making team is part of the beneficiary</p>	<p>In this respect, this is a neutral management model. On the positive side, the facilities under this model have water for longer times and more frequently than those in the other models. Water at</p>

Management Model	Management by the Local government (Payam)	Management by the Community	Private Management
Criteria			
	<p>this model are often without water due to low priority on them since they have proved difficult when it comes to paying water bills.</p> <p>(6/10)</p>	<p>community. If service is cut off they too suffer and they have to explain to the rest of the community.</p> <p>(8/10)</p>	<p>some of the facilities under this model was cheaper at 100 liters for 1 SDG as opposed to 80ltrs for 1 SDG at PTS under the other two models.</p> <p>But location of facilities in this model bears no correlation with serving the poor.</p> <p>(5/10)</p>
<ul style="list-style-type: none"> • Appropriateness as a model for hygiene and sanitation. 	<p>This model is better than the private operator model but worse than the community management model when it comes to demonstrating sanitation and hygiene. This is probably because the caretakers are poorly rewarded or not rewarded at all. (this complaint was common everywhere under this system)</p> <p>(5/10)</p>	<p>This model (partly because of the design of the current facilities) serves well to demonstrate sanitation and hygiene. Most of the facilities seen during this study were fairly clean. Again the pressure to be tidy arises from the accountability of the managers to the beneficiaries and the fact that the managers are also beneficiaries.</p> <p>(7/10)</p>	<p>Further still the state of hygiene at the facilities under this management model is appalling with the proprietors not willing to spend much on making the place neat and hygienic. There is no demonstration effect from this model. (there is room to deal with this problem if there is regulation and control which is not there at this point in Juba)</p> <p>(3/10)</p>
<p>Effectiveness from the side of the user</p> <ul style="list-style-type: none"> • Access - distance • Quality of water • Quantity • Cultural acceptability • Environmental acceptability • Promotion of sanitation and hygiene 	<p>Most of the variable in this category are really more closely related to design than to management but management does play a role in the final analysis. With respect to access, most of the PTS are located within good proximity to the users but owing to the extended time that these facilities do not have water, real access is limited. The sites under this model were generally dirtier than those under the community management model and the soak pits were clogged. This is attributable to the poor caretaking which can also be attributed to the poor motivation of the care takes.</p> <p>(6/10)</p>	<p>Again if we ignore the design aspects, this study noted that the location of facilities is in close proximity to the users but the designs gains more points due to the fact that it is more likely to have water at any time than the PTS under the Payam management model.</p> <p>Facilities were generally clean and hygienic. The link of this to the management model has been explained above.</p> <p>(8/10)</p>	<p>In terms of location and access, this model responds only to demand. PTS under this model are likely to be located near existing pipe network as it is unlikely that proprietors will invest heavily in new pipe networks. The potential for this model to promote access to water for the poor is limited. Location of the facilities here also hardly considers environmental, cultural or sanitation issues..</p> <p>(3/10)</p>
<p>Efficiency from the side of the user</p>	<p>Water at PTS managed under this model is 80</p>	<p>Water at PTS managed under this model is 80</p>	<p>As noted above water at facilities managed under</p>

Management Model	Management by the Local government (Payam)	Management by the Community	Private Management
Criteria			
<ul style="list-style-type: none"> Cost in terms of money per unit 	liters for 1SDG. This is the same cost as for water at the facilities managed under the community management model. (6/10)	liters for 1SDG. This is the same cost as for water at the facilities under the Payam management model (6/10)	this model tended to be cheaper at 100 liters for 1 SDG (7/10)
<ul style="list-style-type: none"> Cost in terms of time 	With respect to time taken to collect water, if there is water the average time reported here was about 4 minutes. This is was the same time reported at facilities managed under the community management model. (8/10)	Here too, time taken to collect water, if there is water, is about 4 minutes. This was comparable the same time reported at facilities managed under the Payam model. (8/10)	It takes a little longer to get water from facilities managed under this model however it seems that this is not because of the management model but because of the huge demand since these are located in areas of high demand. (5/10)
<ul style="list-style-type: none"> Sustainability considerations. 	The observation of this study is that this is the model that is likely to be least sustainable owing to the fact that the factors associated with sustainability such as cost recovery, repair and maintenance are mitigated by the red tape at the Payam and the tendency to divert the collections to other uses without proper mechanisms for replacement. (5/10)	This model is closer to cost recovery when compared to the Payam management model owing to the mechanisms for handling money and the pressure for accountability from the management (7/10)	By design, this is supposed to be a cost recovery and self-sustaining model. It therefore has the best sustainability potential of all the three models. (8/10)

3.5.1 Recommendation on the most appropriate management system

As noted at various stages in the table above, each of the management models has some merits and demerits. From a purely commercial and sustainability point of view, the private operation model would be the best considering that it meets all the conditions for cost recovery and sustainability.

However beyond considerations of sustainability and cost recovery are considerations of the promotions of good sanitation and hygiene for improved health conditions as well as the concern for reaching the poorer sections of the Juba community with portable water.

When all things are considered there the conclusion of this study is that the community management model seems to be the best as far as bringing all these aspirations together.

We hasten to note, however, that this model also has its own weaknesses which we feel can be corrected or reduced with some measures. These include:

- a) First facilities were without water for lengthy periods of the day because of the low capacity of the Juba treatment plant. Privately set up facilities have on site tanks which alleviate this.
- b) There is an apparent absence of the UWC in the operation of the PTS not only in the community management system but also in the other two models. For sustainability and cost reductions it is important for the UWC to treat the PTS like other private customers but since there is also the motive of serving the poor, the UWC could establish a system of supervision and regulation for all such facilities. The costs for this function could be met through innovative pro poor funding.
- c) One of the challenges with the facilities in this system is the problem of spares. While the money for the purchase of spares may be available the quality and specifications of the spares in the market may be quite different from those originally installed. UWC could arrange for bulk order for parts by the UWC so that the management committees of the individual PTS can procure from this pool of parts.

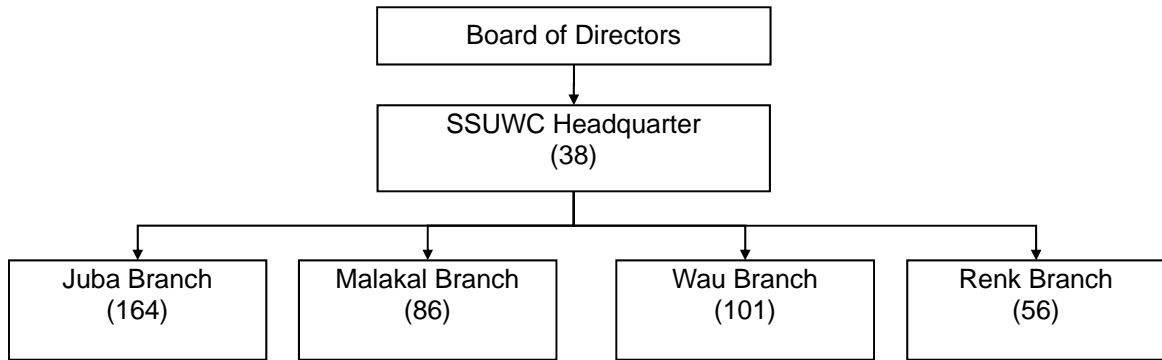
There seemed to be a disjoint between the corporation which supplies the water to the PTS and the management of the facilities. This distance has potential to be exploited by individual from the corporation or the PTS management for individual benefit to the expense of the users. To address this, there is need for a clear policy and operational framework backed up by a supervisory/regulatory mechanism. This will ensure maximum benefit for the users as well as the corporation.

3.6 Existing Conditions of SSUWC Headquarter

3.6.1 Organization Structure and Functions and Activities of SSUWC Headquarter

There was no a fixed organization chart for the SSUWC Headquarter but the existing organization structure of headquarters of SSUWC was identified based on the interview with the staff in the Headquarter, and which is shown in the following figure. There are currently many vacant posts in the structure. In particular, all four senior manager as well as deputy general manager are vacant. The previous Acting Director for Planning was just recently transferred to the Area Manager of Juba Station and now the post is vacant. In Directorates of Development & Evaluation and State Affairs, there is currently no staff. In addition, Director for Administration is currently on leave.

The organization comprises headquarters office (HQ) and four branch offices of Juba, Malakal Wau, and Renk as shown in the figure below (number in parentheses indicate number of staff-members in SSUWC branch of that particular branch). According to the SSUWC Provisional Order, 2008, the Board of Directors is formed above SSUWC HQ to draw general policy and supervise the SSUWC.



Currently, there is no written job description for each title of position. The following are general activities for existing major section

- Account section: Daily accounting for headquarters' expenditure and revenue and salary calculation
- Budget section: Preparation of budget for entire Corporation including headquarter and stations
(There is currently no input on budget preparation from the stations)
- Administration section: Daily administration of headquarter management
- Establishment and personnel section: Human resource management
- Project section: Design, plan, implementation and supervision of projects

The detailed organization chart is shown in the next figure.

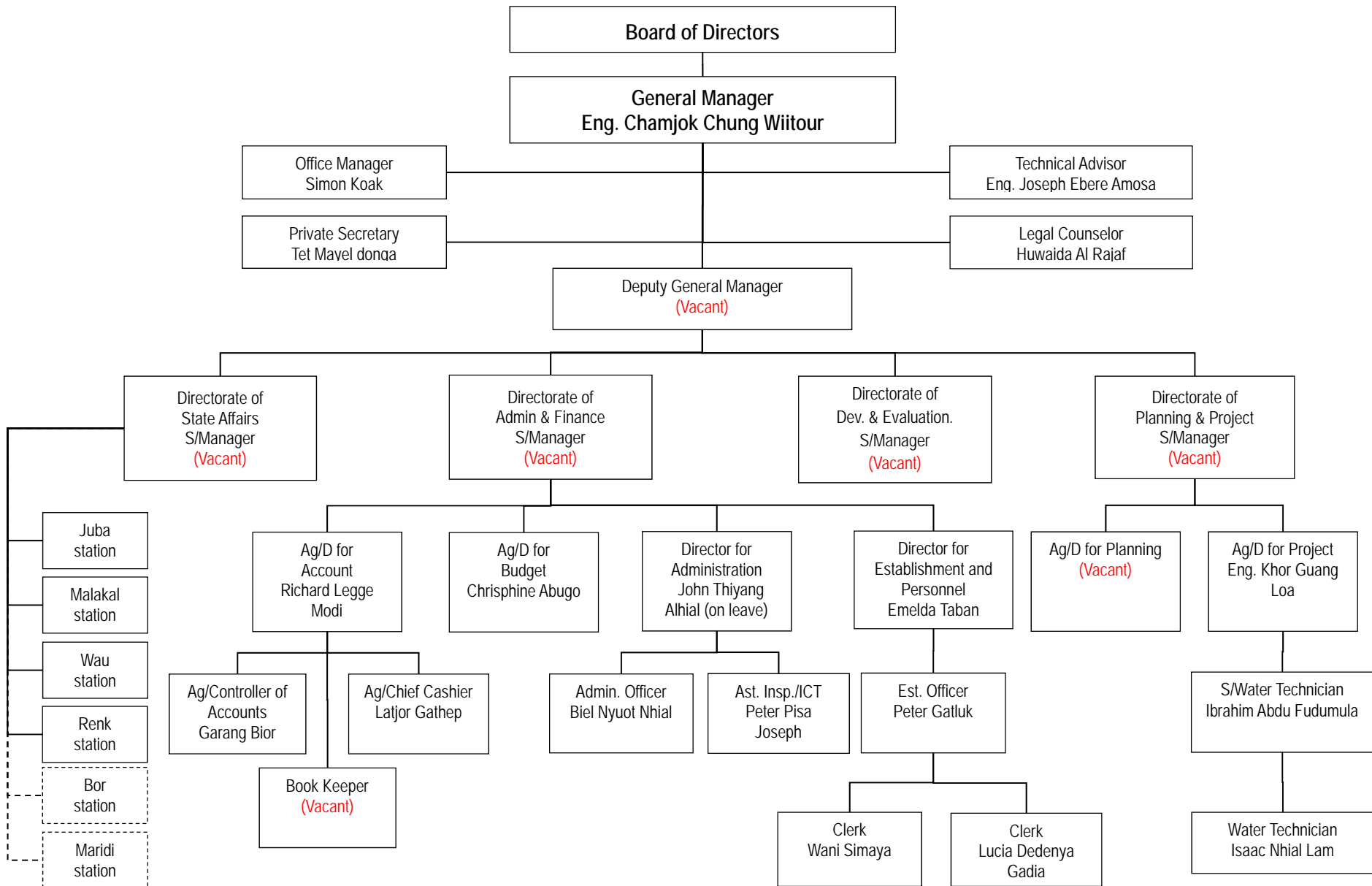


Figure 3-17 Existing Organization Structure of Headquarters of South Sudan Urban Water Corporation

3.6.2 Relevant Regulations and Laws on SSUWC

There is only one regulation and law on SSUWC, i.e., “The South Sudan Urban Water Corporation Provisional Order, 2011”, which was enforced in January 2011. In addition, “Water & Hygiene (WASH) Strategic Framework (draft)” was formulated in February 2011, in which a strategic framework for urban water supply for entire urban area for South Sudan was prepared.

According to “Chapter V” of the Provisional Order, the following are objectives, function and powers of the Corporation.

(1) The Objectives of the Corporation:

The Corporation shall have the following objectives

- (a) Utilize the available water resources economically to provide for the South Sudan’s long and short term water demand and to realize its development in proportion to the growing needs;
- (b) benefit from international development in industry and water supply services to develop the industry and water supply services in South Sudan;
- (c) produce safe drinking water for South Sudan;
- (d) seek water investments that will enhance its efficient running of business and manufacturing of instruments;
- (e) contribute in increasing the South Sudan’s income and improvement of it’s services;
- (f) to realize annual revenues that will enable it execute its development plans at such rates that shall be fixed by the Board;
- (g) concluding contracts with any person in accordance with the provisions of the law on procurement;
- (h) any other objectives required by the nature of its activities or the Council of Ministers.

(2) Functions, Duties and Powers of the Corporation.

- (1) In order to achieve its objectives, the Corporation shall set up and manage the Water Infrastructure in the consumption areas and carry out all assignments and decisions, according to the provisions of this Provisional Order.
- (2) Without prejudice with the generality of the provisions of subsection (1) above, the Corporation shall have the following functions, duties and powers—
 - (a) production of safe drinking water and capable distribution network and sale, to any customer according to the agreements, contracts, tariffs and the conditions of supply;

- (b) provision of the consultancies, professional and technical services in the field of water to the private or public sectors inside or outside the South Sudan on commercial grounds;
- (c) employment of competent staff in accordance with the provision of this Provisional Order to enable it carry out its functions;
- (d) establishment of training and capacity building centers;
- (e) render capacity building services and training, to carders from specified firms or individuals provided that the firms or individual will cover the cost expenses as prescribed by the Corporation;
- (f) upgrade the productive capacity of the workers by the way of qualification, training inside and outside South Sudan and improvement of the work situation and modernization of its means and saving adequate service conditions or the helpful tools of work for plentiful product;
- (g) purchase and possessing of land and real estate on behalf of the Government of South Sudan with approval of the Council of Ministers and in accordance with the Public Financial Management and Accountability law and also constructing and maintaining buildings therein to achieve its objectives;
- (h) manufacturing and producing instruments and water equipment;
- (i) education of the people to use water supply equipment in accordance with the Regulations;
- (j) establishment of companies inside or outside South Sudan to achieve business objectives;
- (k) encouragement of scientific research especially in the development of water supply;
- (l) perform any other functions and duties it may deem necessary for achieving of its objectives.

In the Chapter IX of the Provisional Order, the following reports shall be prepared and submitted to the Board of Director.

- (1) In addition to the Financial Audit Report, required by section 34 above, when required by the Ministry of Finance, the Corporation shall also prepare an Annual Report of its activities during that financial year.
- (2) The Annual Report shall, inter alia, include the following information—
 - (a) a copy of the auditor's report;
 - (b) a statement of financial performance and of cash flows;
 - (c) the budget for the coming financial year;
 - (d) a description of the activities of the Corporation during the previous year;
 - (e) an analysis of the extent to which it has met its objectives of the previous year;
 - (f) an evaluation as to the extent to which the advice and directives of the Corporation have been complied with;
 - its objectives for the coming year; and,
 - (g) any recommendations on the matters governed by this Provisional Order.

- (3) The Corporation shall publish and disseminate widely the Annual Report, along with its audited accounts. In the event the Corporation fails to distribute the Annual Report, it shall be distributed by the Ministry of Finance.
- (4) The Board shall submit to the President and the Assembly such other reports on its activities or any other matter that may from time to time be required.

The purpose of Urban Water Strategy (UWS) is to guide policy makers and service providers on how fast they could accelerate and increase water supply coverage efficiently in urban areas in all states of South Sudan so that disparities of services are addressed.

3.6.3 Issues on SSUWC Headquarter

The following are major issues of the SSUWC Headquarter at a priority basis.

(1) Institutional Aspects (Internal Process Perspective)

- The organization structure is not complete. There are many vacant positions, especially in higher positions. It needs the recruitment for vacant posts with clearly defined job descriptions. Existing positions also need the job description.
- There is no corporate plan. It urgently needs the preparation of an action plan for the Corporation to rebuilding the Corporation and give a momentum toward change of the Corporation. The Corporate plan shall be prepared by the staff of the headquarters and station/areas. Subsequently, the stations/areas should prepare a station/area plan. The components of the plan shall be prioritized for implementation.
- There is not enough coordination between the headquarters and stations/areas and no definition of functions of the headquarters and the stations. These shall be clearly defined and separated.
- There is no reporting system from the stations and any completed report from the stations has not been submitted to the headquarters. In addition, no regular meeting has not scheduled and held. The headquarters hardly understand the situation of the stations/areas. Regular reporting and meeting system are required.

(2) Human Resource Aspects (Learning and Growth Perspectives)

- The human resources in both technical and managerial areas are weak. It shall be strengthen through training by mainly foreign assistance on-going and forthcoming projects.

(3) Financial Aspects (Financial Perspectives)

- Financially it depends on the central government, especially for personnel cost since no financial autonomy is given and the tariff collection capability of stations/areas including low tariff level and higher non-revenue water ratio is low.
- The stations also rely on intervention from headquarter in financial matter.

(4) Customer perspective

- At this stage, no priority issues on customer perspective.

CHAPTER 4 REVISION OF PROJECT DESIGN MATRIX (PDM)

4.1 Revision (2nd JCC Meeting, April 2011)

Based on the collected data in 1st year term, the target values of Project indicators were set up, working together with SSUWC staffs. PDM with the target values was revised as version 2 in 2nd JCC Meeting at the end of 1st year term.

Project Narrative Summary	Objectively Verifiable Indicators
<p>Overall Goal:</p> <ol style="list-style-type: none"> 1. SSUWC-Juba station is managed in a planned way. 2. The management capacity of SSUWC is improved. 	<ol style="list-style-type: none"> 1. The customer satisfaction on water supply service of SSUWC-Juba station is enhanced. 2. The number of day in a month that the quality of supplied water at the sampling points in Juba complies with the water quality standard with respect to turbidity (less than 3 NTU) and residual chlorine (0.2 mg/l ~ 0.6 mg/l) increases from about 90 % to 100 %, and about 10 % to 80 %, respectively. 3. The reports and plans stipulated by SSUWC HQ are periodically submitted by other 3 station(s) and the number of discussions on the reports and plans becomes 4 times/ year.
<p>Project Objective</p> <p>The management capacity of SSUWC -Juba station is enhanced through capacity development on operation and maintenance of water supply facilities.</p>	<ol style="list-style-type: none"> 1. The number of day in a month that the quality of supplied water at the sampling points in Juba complies with the water quality standard with respect to turbidity (less than 5 NTU) and residual chlorine (0.2 mg/l ~ 0.6 mg/l) increases from about 90 % to 100 %, and about 10 % to 70 %, respectively. 2. The number of days in a month that water supply (volume) in a day to the sampling points in Juba complies with the O&M plan becomes 20 days.
<p>Output:</p> <ol style="list-style-type: none"> 1. Capacity of SSUWC-Juba station with respect to operation and maintenance of water intake and treatment facilities is improved. 	<ol style="list-style-type: none"> 1-1 Monthly reports and annual reports in which O&M data is compiled. 1-2 Annual O&M plan on water purification plant. 1-3 The number of staff who acquired adequate O&M skills for WTP increases from 0 to 11 persons. 1-4 The average operation hour of WTP increases from about 22 hours to 23.5 hours/day. 1-5 The ratio that the quality of treated water with respect to turbidity is below 5 NTU increases from about 90 to 100 %. 1-6 The ratio that the quality of treated water with respect to residual chorine falls in the range between 0.7 and 1.2 mg/l increases from about 10 % to 80 %.
<ol style="list-style-type: none"> 2. Capacity of SSUWC-Juba station with respect to operation and maintenance of water transmission and distribution facilities is 	<ol style="list-style-type: none"> 2-1 Monthly reports and annual reports in which O&M data is compiled. 2-2 Annual operation and maintenance plan on O&M of water transmission and distribution facilities. 2-3 The number of staff who acquired adequate O&M skills for transmission and distribution increases from 0 to 10 persons. 2-4 The operation hour of pumps falls in the range of plus or minus 10 % of the planned pump operation hours in the O&M plan prepared in the project on

Project Narrative Summary	Objectively Verifiable Indicators
improved.	average of all pumping stations.
3. Capacity of water quality management of SSUWC-Juba station is improved.	3-1 Water quality management report (monthly and annual) in which water quality monitoring data is compiled. 3-2 The number of staff who acquired adequate water quality test skills increases from 0 persons to 2 persons.
4. Understanding of financial conditions of SSUWC-Juba station is enhanced.	4-1 Revenue collection reports. 4-2 Recommendations on revenue collection improvement. 4-3 Establishment of management method of public water tap stands.
5. Capability of SSUWC HQ to support SSUWC-Juba station is enhanced.	5-1 The number of monthly reports that SSUWC HQ examined becomes 18 months. 5-2 The number of annual reports and plans that SSUWC HQ examined becomes 2 each. 5-3 Database of SSUWC HQ on the existing water supply facilities and services

4.2 Revision (Mid-Term Evaluation, March 2012)

A revision of PDM was made as version 3.0 on 22nd February 2012 based on discussion among SSUWC, JICA project team and mid-term evaluation team in the mid-term evaluation. The followings are contents of the revision.

Items	PDM (ver. 2.0)	Revised PDM (ver. 3.0)	Reasons
Project name & Target group	<u>Southern</u> Sudan Urban Water Corporation	<u>South</u> Sudan Urban Water Corporation	After the Independence in July 2011, "Southern Sudan" became "South Sudan".
Project Period	August 2010 – August 2013	November 2010 – September 2013	To reflect actual period of the Project.
Following Objectively Verifiable Indicators (OVIs) and Means of Verification are modified.			
Overall Goal	(OVI 2.) ...water quality standard with respect to turbidity (less than 3 NTU) ...increases from 90% to 100% and about....	(new OVI 2) ...water quality standard with respect to turbidity (less than 3 NTU) ...increases from 76% to 100% and about.....	Baseline data was on the basis of dry season. The ratio was revised into the average annual ratio in 2011.
	(OVI 3) The reports and plans stipulated by SSUWC HQs are periodically submitted by other 3 stations and the number of discussions on the reports and plans became 4 times/year.	(new OVI 3) Reports and plans submitted from all area stations are assessed and guidance is given back to them. <u>Additional MOV</u> (3.2) Views from the area stations on the support from SSUWC HQ	Periodical submission of reports and plan from other stations would not be foreseeable since the Project does not have such activities. Instead, the indicator focused the capacity of SSUWC HQ.
Project Purpose	(1 and 2) Two indicators set in the PDM 2.0 are revised into the one OVI in the right column.	(New OVI) 80% of 25 essential performance indicators set in the annual plan which are measurable by the SSUWC Juba station is improved compared to the 2011 average.	OVIs are revised to reflect the meaning of the Project Purpose, which is to improve <u>management capacity</u> of Juba station. The current indicators are focusing on output level. Besides, OVIs of quality and volume of water have been set in the Output 1 (1.5 and 1.6).

Items	PDM (ver. 2.0)	Revised PDM (ver. 3.0)	Reasons
Output	(Means of verification) (1.3, 2.3, 3.2) Test results (training report)	(new MOV 1.3, 2.3, 3.2) Test results (training report) and evaluation by experts	To supplement the viewpoints.
	(OVI 1.4) The average operation hour of WTP increases from 22 hours to 23.5 hours/day.	(new OVI 1.4) The average operation hour of WTP increases from 17.9 hours (2011 average) to 22 hours/day	The baseline and expected target are changed since the data used for baseline was not correctly reflecting the actual situation.
	(OVI 2.4) The operation hour of pumps falls in the range of plus or minus 10% of the planned pump operation hours in the O&M plan prepared in the project on average of all pumping station.	(new 2.4) Application of a formulated Pump Operation Plan by the Project is started by 2012. (Means of verification) 2.4.1 Pump Operation Plan 2.4.2 Monthly report	The present indicator is heavily depending on the external factor and measure the availability of the electricity, not reflecting the Output 2 appropriately.
	(OVI 4.1) Revenue collection reports	(new OVI 4.1) Revenue collection reports <u>are prepared monthly.</u>	Rephrases are made for clearer meaning
	(OVI 4.2) Recommendations on revenue collection improvement.	(new OVI 4.2) Recommendations on revenue collection improvement <u>are prepared.</u>	
	(MOV of OVI 4.2) Confirmation of recommendations	(new MOV of the above) Annual Plan	
	(OVI 4.3) Establishment of management method of public water tap stand.	(New OVI 4.3) Management of method of public water tap stand is established.	
	(OVI 5.3) Database of SSUWC HQ on the existing water supply facilities and services.	(New OVI 5.3) The existing water supply facilities and services are inputted in to the established database.	
	(OVI 5.1) The number of monthly reports that SSUWC HQ examined becomes 18.	(new OVI 5.1) SSUWC HQ examines the monthly reports submitted by SSUWC Juba station every other month.	Number of monthly reports is not reflecting the capacity of HQ. It is important to see whether the assessment is done regularly by HQ.

Twenty five (25) performance indicators (PIs) was selected as main indicators to evaluate Project Purpose in PDM and the average values of these indicators in 2011 was prepared as follows.

Table 4-1 25 Main Performance Indicators

N	Symbol	Indicators	Unit	Average Value in 2011
Production				
1	P1	Average daily production volume (estimated)	m3/day	5208
2	P2	Plant average operating hour per day (estimated)	hours/day	17.9
3	P3	Clear water pumping station daily average operating hours	hours/day	28.2
4	P4	Gap between design capacity and actual production	m3/day	1,992
5	P5	Operating ratio (actual average production/design capacity)	%	72
6	P6	Operating ratio (actual average operation hours/24 hours)	%	74
Distribution				
7	D1	Average daily pump operation hours of Hospital PS	hours/day	5.8
8	D2	Average daily pump operation hours of Konyokonyo PS	hours/day	1.5
9	D3	Total transmission and distribution flow from WPP	m3/day	4,928
10	D4	Percentage of No. of leakage repaired in No. of leakage reported	%	55
11	D5	The number of days of pipe management records per month	days/month	0
Water Quality				
	Daily Sampling (purification plant)			
12	W1	Compliance ratio of turbidity	%	79%
13	W2	Compliance ratio of residual chlorine	%	31%
	Weekly sampling (tank in the city)			
14	W3	Ratio of actual sampling days to required total weekly sampling days	%	43%
15	W4	Ratio of actual samples to required total weekly samples	%	19%
16	W5	Compliance ratio of turbidity	%	77%
17	W6	Compliance ratio of residual chlorine	%	13%
	Monthly sampling (tap in the city)			
18	W7	Ratio of actual sampling days to required total monthly sampling days	%	63%
19	W8	Ratio of actual samples to required total monthly samples	%	42%
20	W9	Compliance ratio of turbidity	%	76%
21	W10	Compliance ratio of residual chlorine	%	14%
Sales				
22	S1	Number of bills delivered	num	545
23	S2	Amount of bills delivered	SSP/month	249,348
24	S3	Billing ratio in number	%	16%
25	S4	Billing ratio in amount (SSP)	%	21%

4.3 Revision (29th November 2012)

A revision of PDM was made in the Seminar on 29th November 2013 in the 3rd year as result of discussion with SSUWC and JICA project team. The modified PDM was issued as version 4.0 with following modification.

Items	PDM (ver. 3.0)	Revised PDM (ver. 4.0)	Reasons
Output: 1. Capacity of SSUWC-Juba station with respect to operation and maintenance of water intake and treatment facilities is improved.	1-6 The monthly average ratio that the quality of treated water with respect to residual chlorine falls in the range between 0.7mg/l~1.5 mg/l increases from 10% to 80 %.	1-6 The monthly average ratio that the quality of treated water with respect to residual chlorine falls in the range between 1.5 mg/l and 2.0 mg/l increases from 10% to 80 %.	The guideline of residual chlorine at the water purification plant is adjusted and increased so as to meet the residual chlorine guideline at tap based on the measured results at taps in the city.

The revised PDM (version 4.0) is shown below.

Project Design Matrix (PDM) for the Project for Management Capacity Enhancement of South Sudan Urban Water Corporation

Ver. 4.0 (29 November 2012)

Name of Project: The Project for Management Capacity Enhancement of South Sudan Urban Water Corporation		Period: November 2010 ~ October 2013	
Target Area: Juba, South Sudan	Target Group: South Sudan Urban Water Corporation (SSUWC) Headquarter and Juba Station Staff		
Project Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Overall Goal:</p> <ol style="list-style-type: none"> The quality of the water supply service extended by SSUWC-Juba is improved The management capacity of SSUWC HQ is improved. 	<ol style="list-style-type: none"> The customer satisfaction on water supply service of SSUWC-Juba station is enhanced. All essential performance indicators are further improved from the final date of the Project. All reports and plans submitted from area stations are assessed and guidance is given back to them. 	<ol style="list-style-type: none"> Baseline and impact survey (household sample interview survey) Monthly and Annual reports Evaluation checklist by SSUWC HQ Views from the area stations on the support from SSUWC HQ 	
<p>Project Objective</p> <p>The management capacity of SSUWC-Juba station is enhanced through capacity development on operation and maintenance of water supply facilities.</p>	<ol style="list-style-type: none"> <u>80% of 25 essential performance indicators</u> set in the annual plan which are measurable at the SSUWC Juba station is improved compared to the 2011 average. (Essential performance indicators is attached with baseline data of average value in 2011) 	<ol style="list-style-type: none"> Monthly and Annual reports 	<ul style="list-style-type: none"> Adequate budget of SSUWC is disbursed. The trainees completing the courses do not leave SSUWC. SSUWC HQ starts to extend support to other SSUWC stations as it extends to SSUWC-Juba.
<p>Output:</p> <ol style="list-style-type: none"> Capacity of SSUWC-Juba station with respect to operation and maintenance of water intake and treatment facilities is improved. Capacity of SSUWC-Juba station with respect to operation and maintenance of water transmission and distribution facilities is improved. 	<ol style="list-style-type: none"> 1-1 Monthly reports and annual reports in which O&M data is compiled. 1-2 Annual plan on water treatment plant. 1-3 The number of staff who acquired adequate O&M skills for WTP increases <u>from 0 to 11 persons.</u> 1-4 Plant average operating hour per day increases <u>from 17.9 hours (2011 average) to 22 hours/day</u> 1-5 The monthly average ratio that the quality of treated water with respect to turbidity is below 5 NTU increases <u>from 90% to 100%.</u> 1-6 The monthly average ratio that the quality of treated water with respect to residual chlorine falls in the <u>range between 1.5 mg/l and 2.0 mg/l</u> increases <u>from 10% to 80 %.</u> 2-1 Monthly reports and annual reports in which O&M data is compiled. 2-2 Annual operation and maintenance plan on O&M of water transmission and distribution facilities. 	<ol style="list-style-type: none"> 1-1 Confirmation of monthly and annual reports 1-2 Confirmation of annual O&M plan 1-3 Test results (training report) and evaluation by experts 1-4 Monthly and annual reports 1-5 Water quality management report 1-6 Water quality management report 2-1 Confirmation of monthly and annual reports 2-2 Confirmation of annual O&M plan 2-3 Test results (training report) and evaluation by experts 2-4.1 Pump Operation Plan 2-4.2 Monthly report 	<ul style="list-style-type: none"> Any significant damage to water supply facilities is not caused. Raw water quality is not deteriorated significantly. Raw water flow is not decreased significantly.

<p>3. Capacity of water quality management of SSUWC-Juba station is improved.</p> <p>4. Understanding of financial conditions of SSUWC-Juba station is enhanced.</p> <p>5. Capability of SSUWC HQ to support SSUWC-Juba station is enhanced.</p>	<p>2-3 The number of staff who acquired adequate O&M skills for transmission and distribution increases <u>from 0 to 10 persons.</u></p> <p>2-4 Application of a formulated Pump Operation Plan by the Project is started by 2012.</p> <p>3-1 Water quality management report (monthly and annual) in which water quality monitoring data is compiled.</p> <p>3-2 The number of staff who acquired adequate water quality test skills increases <u>from 0 persons to 2 persons.</u></p> <p>4-1 Revenue collection reports are prepared monthly.</p> <p>4-2 Recommendations on revenue collection improvement are made.</p> <p>4-3 Management method of public water tap stands is established.</p> <p>5-1 SSUWC HQ examines the monthly reports submitted by SSUWC Juba station every other month.</p> <p>5-2 The number of annual reports and plans that SSUWC HQ examined becomes <u>2 each.</u></p> <p>5-3 The existing water supply facilities and services are inputted in to the established database.</p>	<p>3-1 Confirmation of monthly and annual water quality management report</p> <p>3-2 Test results (training report) and evaluation by experts</p> <p>4-1 Confirmation of revenue collection reports</p> <p>4-2 Annual plan</p> <p>4-3 Pilot project report on public water tap stand</p> <p>5-1 Evaluation checklist by SSUWC HQ</p> <p>5-2 Evaluation meeting minutes</p> <p>5-3 Confirmation of database</p>		
Activities		Inputs		
<p>1-1 Analysis and understanding of the current status of O&M of water intake and treatment facilities</p> <p>1-2 Collection and compilation of O&M data of water treatment plant and intake pumping station in computer</p> <p>1-2-1 Preparation of digital data format using computer</p> <p>1-2-2 Installation of measuring equipment (flow and pressure)</p> <p>1-2-3 Measurement of water flow and pressure data and recording O&M data in database</p> <p>1-2-4 Training on data compilation and analysis</p> <p>1-2-5 Data compilation and analysis</p> <p>1-2-6 Preparation of O&M report (monthly, annual)</p> <p>1-2-7 Discussion on O&M with SSUWC HQ based on O&M report (monthly and annual)</p> <p>1-3 Preparation of O&M plan for water treatment plant and pumping station (including procurement plan and budget plan)</p> <p>1-3-1 Setting of goals for improvement, planning for</p>	<p>[Japanese side]</p> <p>Human resources: Experts</p> <ul style="list-style-type: none"> - Chief Advisor/Water Utility Management - Water Treatment Plant Operation and Maintenance - Transmission and Distribution Facilities Operation and Maintenance - Pumping Facilities Operation and Maintenance - Water Quality Management - Financial Evaluation/Water Tariff - Community Development <p>Local staff</p> <ul style="list-style-type: none"> - Surveyors 	<p>[South Sudan side]</p> <p>Human resources:</p> <ul style="list-style-type: none"> - Project Director - Project Manager - Project Staff <p>Facilities:</p> <ul style="list-style-type: none"> - Training rooms - Office for experts <p>Local costs:</p> <ul style="list-style-type: none"> - Fuel, consumables, etc. - Reagent for water quality analysis - Water meters - Tax exemption 	<ul style="list-style-type: none"> - The current budget of SSUWC-Juba station is not decreased. - Counterparts do not resign from training course and do not get transferred. - Custom clearance process does not significantly delay import of equipment from overseas. - The power supply condition to water supply facilities is not worsened from the current level. - The roles of SSUWC is not changed. <p>Pre-conditions:</p>	

<p>improvement</p> <p>1-3-2 Training on preparation for O&M plan</p> <p>1-3-3 Preparation of O&M plan</p> <p>1-3-4 Discussion on O&M plan with SSUWC HQ based on O&M plan</p> <p>1-4 Preparation of O&M manuals for water treatment plant and intake water pump</p> <p>1-4-1 Preparation of manuals</p> <p>1-4-2 Training on O&M based on prepared manuals</p> <p>2-1 Survey and understanding of the current conditions of water supply service (Area covered, water pressure, water quality, duration of water supply, residence water difficulties, etc.)</p> <p>2-2 Investigation and understanding of existing facility conditions of transmission and distribution facilities</p> <p>2-3 Collection and compilation of O&M data of transmission and distribution facilities in computer</p> <p>2-3-1 Preparation of digital data format using computer</p> <p>2-3-2 Installation of measuring equipment (flow and pressure)</p> <p>2-3-3 Measurement of water flow and pressure data and recording O&M data in database</p> <p>2-3-4 Training on data compilation and analysis</p> <p>2-3-5 Data compilation and analysis</p> <p>2-3-6 Preparation of O&M report (monthly, annual)</p> <p>2-3-7 Discussion on O&M with SSUWC HQ based on O&M report (monthly and annual)</p> <p>2-4 Preparation of O&M plan for transmission and distribution facilities (including procurement plan and budget plan)</p> <p>2-4-1 Setting of goals for improvement, planning for improvement</p> <p>2-4-2 Training on preparation of O&M plan</p> <p>2-4-3 Preparation of O&M plan</p> <p>2-4-4 Discussion on O&M plan with SSUWC HQ based on O&M plan</p> <p>2-5 Preparation of O&M manuals for water transmission and distribution facilities</p> <p>2-5-1 Preparation of manuals</p> <p>2-5-2 Training on O&M based on prepared manuals</p> <p>3-1 Preparation of water quality test plan (location, date, parameters, etc.)</p> <p>3-2 Collection of digital data of water quality test results</p> <p>3-2-1 Procurement of additionally required water quality test equipment</p> <p>3-2-2 Preparation of digital data format using computer</p> <p>3-2-3 Training on water quality test</p>	<p>Training in Japan and other third countries</p> <p>Equipment and materials:</p> <ul style="list-style-type: none"> - For training <ul style="list-style-type: none"> • Flow meters • Pressure gauges • Pipes, valves, fittings and miscellaneous • Plumbing tools set • Additional water quality analysis equipment • Projector • Computers and software • Printers + consumables • Copy machine • Digital camera, video camera • GPS • Vehicles - For administration <ul style="list-style-type: none"> • Computers and software <p>Construction of pilot facilities (public water tap stands)</p> <p>Construction of flow meter pit</p>	<p>Software:</p> <ul style="list-style-type: none"> - Pipes, valves, fittings and miscellaneous - GIS arcview: 1 set (has been procured by JICA development study) <p>Travel expenses:</p> <ul style="list-style-type: none"> - Travel expense and allowance for participants of SSUWC stations other than Juba station in training 	<ul style="list-style-type: none"> - The political situation remains stable. - SSUWC continuously manages urban water supply utilities.
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<p>3-2-4 Implementation of water quality test</p> <p>3-2-5 Training on compilation and analysis of water quality test results</p> <p>3-2-6 Compilation and analysis of water quality test results</p> <p>3-2-7 Preparation of water quality management report</p> <p>3-2-8 Discussion on water quality issues with SSUWC HQ based on water quality management report (monthly and annual)</p> <p>4-1 Investigation and understanding of current revenue collection conditions</p> <p>4-2 Preparation of digital customer ledger database</p> <p>4-2-1 Preparation of digital data format using computer</p> <p>4-2-2 Training on data compilation and analysis</p> <p>4-2-3 Data compilation and analysis</p> <p>4-2-4 Preparation of report (monthly, annual)</p> <p>4-2-5 Discussion on revenue collection with SSUWC HQ based on prepared report</p> <p>4-3 Analysis of financial conditions of SSUWC-Juba station</p> <p>4-3-1 Analysis of existing cost structure and identification of problems</p> <p>4-3-2 Estimation of adequate cost based on prepared O&M plans</p> <p>4-4 Case study on water tariff and cost recovery of water utility</p> <p>4-5 Recommendations on improvement of financial conditions including revenue collection</p> <p>4-6 Study on management models of public water tap stand</p> <p>4-6-1 Investigation and evaluation of existing management system</p> <p>4-6-2 Community survey for construction of tap stand</p> <p>4-6-3 Study and selection of efficient management system for new tap stand</p> <p>4-6-4 Design and construction of public water tap stand</p> <p>4-6-5 Implementation, evaluation and improvement of management system</p> <p>4-7 Study on management models of tanker feeding station</p> <p>4-7-1 Investigation and evaluation of existing management system</p> <p>4-7-2 Study and selection of efficient management system for tanker feeding station</p> <p>4-8 Study on tariff collection from house connections</p> <p>4-8-1 Investigation of current situation</p> <p>4-8-2 Examination of existing capacity of water meter installation and reading in test field</p> <p>5-1 Definition of roles of SSUWC HQ and SSUWC-Juba</p>			
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station 5-2 Establishing the rule on submission of reports and plans by SSUWC stations 5-3 Training on design and planning of water supply facilities 5-4 Examination of reports and plans submitted by SSUWC-Juba station 5-5 Assistance to SSUWC HQ in holding monthly meeting with stations and MWRI 5-6 Study on the existing water supply facilities and services of 4 stations by SSUWC HQ			
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Note: SSUWC staff of other stations and MWRI staff may participate in several activities with mutual consideration in advance.

CHAPTER 5 PROJECT ACTIVITY AND OUTCOMES

5.1 Project Activity

5.1.1 Pre-implementation Activities in 1st year term

The following other activities were carried out in 1st year term.

- Pre-test results and answer explanation
- Computer Training
- Cleaning of stock yard
- Cleaning in the purification plant
- Repair work done during the project
- Preparation of project homepage

(1) Pre-Test Results and Answer Explanation

Pre-tests were carried out to SSUWC staff in Nov. and Dec. 2010 to understand the current level of capacity of the staff in Juba station. The tests are categorized into 3 major subjects: administration and human resource (18 questions), finance including O&M (29 questions) and technical including &M (69 questions). Technical test include subjects of purification, transmission and distribution, water quality management, pumping station and O&M. The numbers of test takers were 9 from Administration and Human Resource section, 19 from Finance section and 28 from technical section composed of purification and transmission & distribution departments. The test was prepared in English and mainly taken by English capable staffs.

The average and maximum scores by category are summarized in the following table. The average scores of technical finance and administration & human resources are 29 %, 30 % and 42 %, respectively.

Table 5-1 Average and Maximum Scores by Category

Test category	Subject	Average score	Max score
technical	Operation & maintenance	18%	50%
	Purification	22%	60%
	Pump	30%	89%
	Transmission & distribution	33%	69%
	Water Quality	36%	63%
	Total	29%	46%
Finance		30%	58%
Administration & human resources		42%	72%

In terms of administration & human resources test, the average scores of administration and human

resources sections are 54 % and 29 %, respectively. In terms of financial test, accounting and finance sections are 28 % and 31 %, respectively. In terms of technical test, purification and distribution sections are 23 % and 37 %.

(2) Computer Training

The computer trainings were carried out 2 times, in order to record the operation and maintenance data and prepare the reports using personal computer. The first training was design for English speakers and the second one for Arabic speakers. Lecturers were invited from the Computer Studies Centre, University of Juba. In case of the 90% attendance rate, a certificate of the completion of computer training was given to the participant.

1) First computer training for English speakers: 44 trainees

a) Training contents

- Beginners course (26 participants)
 - Basic skills for using the computer of “OS: Windows 7 Professionals”
 - Basic skills for using “Office: Microsoft Office 2010 Professional”
 - Microsoft Office Word
 - Microsoft Office Excel
- Intermediate course (13 participants)
 - Skills for making the database by “Office: Microsoft Office 2010 Professional”
 - Microsoft Office Word
 - Microsoft Office Excel
 - Microsoft Office PowerPoint
- Upper course (5 participants)
 - Skills for making the database by “Office: Microsoft Office 2010 Professional”
 - Microsoft Office Access

b) Schedule

Course	Participants	Period	Hours
Beginners	13	12 th Jan to 1 st Feb (15 days)	10:00~12:00 (30 hours)
	13	19 th Jan to 8 th Feb (15 days)	14:00~16:00 (30 hours)
Intermediate	13	12 th Jan to 18 th Jan (5 days)	14:00~16:00 (10 hours)
Upper	5	2 nd Feb to 8 th Feb (5 days)	10:00~12:00 (10 hours)

2) Second computer training for Arabic speakers: 20 trainees

a) Training contents (only beginners course)

- Basic skills for using the computer of “OS: Windows 7 Professionals”
- Basic skills for using “Office: Microsoft Office 2010 Professional”
- Microsoft Office Word
- Microsoft Office Excel

b) Schedule

Course	Participants	Days	Hours
Beginner (A)	10	7 th March – 31 st March (10 days)	10:00 to 12:00 (20 hours)
Beginner (B)	10	8 th March – 1 st April (10 days)	13:00 to 15:00 (20 hours)

5.1.2 Project Activity of Output 1

(1) Electronic Data Format for Purification Plant

1) Operation and Maintenance Data Format

Ten kinds of daily operation & maintenance data formats are made. Ten kinds of monthly data storage format are made.

Table 5-2 Electronic Data Format for Purification Plant

Item	Equipment	Format
Daily recording format	Facility	(A1) generator, (A2) coagulant feeding, (A3) backwash, (A4) chlorine feeding
	Pump	(B1) raw & high lift pump, (B2) old pump, (B3) Hospital, (B4) Konyokonyo, (B6) pump condition.
Monthly storage format	Facility	(A1) generator, (A2) coagulant, (A4) chlorine, (A5) cleaning
	Pump	(B1) raw & high lift pump, (B2) old pump, (B3) Hospital, (B4) Konyokonyo, (B5) blower

2) Facility Data Format

Equipment inventory format including original cost and depreciation cost are made. Damage record and repair record also can be described in those facilities formats.

(2) Capacity Enhancement Activities

1) New roles of section

New roles of Water Purification Department are determined as below.

a) Water quality lab staff

- Sampling of water in the treatment plant, tanks and taps in outdoors
- Analyzing water qualities of sampled water at sites in the laboratory
- Reporting water quality analysis results to Purification Manager and Area Manager

b) Purification operation staff (General)

- Determination of chlorine and alum dosing rates depend on Jar Test and report it to the purification manager
- Operation and maintenance of chlorine and alum dosing facilities
- Backwash of filter tanks
- Cleaning the plant
- Record keeping for backwash, chemicals and tanks cleaning

2) Change of operation method (Filter backwash)

Filter backwash method is changed newly as below.

- Air bubbling duration is 5 minutes from 2 to 3 minutes as usual
- Backwash water duration is 10 minutes from 5 to 6 minutes as usual
*In rainy season, backwash duration is 10 minutes and air wash duration is 7 minutes.
- Backwash interval of each tank is once a day from twice a day
- No.1 & No.4 filter tanks are done in the morning and No.2 & No.3 filter tanks are done in the afternoon.

3) Cleaning plan of facilities

- Cleaning of sedimentation tank is done frequently, but filter tanks are done rarely. On the other hand cleaning of other water tanks has never been done since the new plant was commissioned in 2009.
- Cleaning plan of facilities has to be made newly. Especially clear water tanks are used for storing treated water and water in those tanks is to be drunk by customers. At first staffs should recognize those tanks are so dirty, then they make the cleaning plan by themselves.

4) Chlorine Injection

Residual Chlorine Measurement could be carried out at the chlorine injection point and reservoir in WTP by not only laboratory staffs but also plant operators. And, the chlorine injectors was replaced as appropriate ones which have suitable scales for injection rate.

5) O&M data of intake pumping stations and water purification plants are compiled

The training on water purification process, operation & maintenance database and preparation of monthly report was made from 2nd year term. The training schedule and contents are shown in following table.

6) O&M report is prepared

O&M data was collected and input in electronic database including performance indicators, and analyzed to prepare monthly reports. Monthly reports are prepared by the experts and major counterparts. The database including performance indicators was continuously updated since April 2011 up to now.

Table 5-3 Syllabus of Training for Water Purification Plant

Syllabus of Training for Water Purification Plant						
10:00 am - 12:00 am at Training Room (Computer Room) By Yurai Sato						
Mon.	Date	Wk	Main subject	Sub-title	Original Contents	
Oct.	18 Tue	1st Week	Understanding water treatment process	Role of each facility	1. Understanding of design capacity 2. Understanding of function of pump, purification and reservoir	
	19 Wed			Role of each facility	1. Understanding of design capacity 2. Understanding of function of pump, purification and reservoir	
	20 Thu			Process design calculation 1	1. Designing of flocculation and sedimentation	
	21 Fri			Process design calculation 1	1. Designing of flocculation and sedimentation	
	22 Sat					
	23 Sun					
	24 Mon	O&M manual preparation by Y. Sato				
	25 Tue	2nd Week	Understanding water treatment process	Process design calculation 2	1. Designing of filtration and backwashing 2. Purification process and water quality monitoring a) monitoring items and how to control treated water quality b) relationship between raw water turbidity, dosing rate and treated water	
	26 Wed			Process design calculation 2	1. Designing of filtration and backwashing 2. Purification process and water quality monitoring a) monitoring items and how to control treated water quality b) relationship between raw water turbidity, dosing rate and treated water	
	27 Thu			Excise on recorded data (September)	1. Explanation of O&M using record formats and check lists 2. Planning of cleaning activities 3. How to read recorded data 4. How to calculate basic statistic (monthly total, daily average, operating ratio, etc)	
	28 Fri			Excise on recorded data (September)	1. Explanation of O&M using record formats and check lists 2. Planning of cleaning activities 3. How to read recorded data 4. How to calculate basic statistic (monthly total, daily average, operating ratio, etc)	
	29 Sat					
	30 Sun					
	31 Mon	O&M manual preparation by Y. Sato				
Nov.	1 Tue	3rd Week	Understanding Current O&M using database	Understanding Monthly Report of September	1. How to make monthly data summary and performance indicators	
	2 Wed			Understanding Monthly Report of September	1. How to make monthly data summary and performance indicators	
	3 Thu			Preparation of Monthly Report 1	How to make monthly report for October	1. Preparation of data sheet for October, calculation of monthly summary based on the monthly report format
	4 Fri			Preparation of Monthly Report 1	How to make monthly report for October	1. Preparation of data sheet for October, calculation of monthly summary based on the monthly report format
	5 Sat					
	6 Sun					
	7 Mon	O&M manual preparation by Y. Sato				
	8 Tue	4th Week	Preparation of monthly report 2 (October)	Group work (1 or 2 groups)	1. Preparation of monthly report by group work 1 1. Preparation of monthly report by group work 2	
	9 Wed			Group work (1 or 2 groups)	1. Preparation of monthly report by group work 3	
	10 Thu			Presentation	1. Presentation of monthly report by group	
	11 Fri			Presentation	1. Presentation of monthly report by group	
	12 Sat					
	13 Sun					
	14 Mon	O&M manual preparation by Y. Sato				
15 Tue	5th Week	Basic science education	Hydraulics	1 Follow-ups seminar on basic science		
16 Wed			Physical and chemical education	1 Follow-ups seminar on basic science		
17 Thu		Achievement test				
18 Fri		Seminary of O&M manuals	Seminar	1. Explanayion of O&M manuals by Y. Sato		
19 Sat						
20 Sun						
21 Mon	Achievement test result			1. Announcement of test result 2. Explanation of test answers		

(3) O&M plan are prepared

The data and performance indicators were accumulated from April 2011. Based on these data, training of preparation for annual report and annual action plan was held for 3 weeks in February 2012. The preparation method was shown in Manual for Reporting and Planning System as given in Volume II-1. Then, an annual report and action plan were prepared in February, which is given in Volume III-5, III-6. The action plan includes selection of performance indicators and their targets, critical success factors, activities, target period, and input required (staff, goods, and funds).

(4) Juba station and SSUWC HQ have discussion on the prepared report and plan

The meeting to discuss the annual report and action plan with SSUWC HQ is held. In the meeting, the summary table of Annual Action Plan is submitted and explained by the counterpart. Considering the contents of discussion with HQ, an annual report and action plan are finalized.

(5) Training on facilities O&M is conducted

The trainings were given to the trainees to syllabus above. The topics of training are as follows:

- Understanding water purification process
- Understanding current O&M process using database
- Preparation of monthly report
- Basic science
- O&M Manual explanation

The operators understand the importance of recording daily operation. Some of them have understood the current conditions of operation & maintenance. The daily recording practices has been established and acquired.

Most operators are better at Arabic than English, therefore the communication between experts and operators are difficult. Most operators cannot read and write English properly. Most operators are poor on arithmetic capability, so they aren't good at basic calculation, such as addition, subtraction, multiplication and division. Therefore, the expert has to teach basic calculation in addition to operation and maintenance training. It requires a lot of effort and time. The attendance rate of shift operators was not high since they had shift duty and short leave after the duty.

In rainy season, raw water turbidity was getting higher than that in dry season, which results in higher turbidity of treated water and wide fluctuation of residual chlorine out of the range of control.

Standard operating procedures for purification plant operation were prepared and these were posted on the wall of the old pump station. Using these materials, first, the experts taught the counterpart of the plant, Mr. Rihan, on these adequate operating procedures including exercise on site several times, and he acquired the procedures. Then, Mr. Rihan has been giving training on the adequate operation procedure for shift operators every day.

(6) O&M manuals for intake pumping stations and water purification plants are prepared

Based on the current O&M condition, the O&M manuals was prepared and it consists of following 4

parts. Training of operation and maintenance was carried out through main counterparts based on “Part I: Standard operating procedure.” The main counterparts brought a better understanding of water treatment process gradually, and they taught to plant operators who can’t speak English.

- Part I: Standard operating procedure
- Part II: Operation and maintenance manuals
- Part III: Datasheet
- Part IV: Major drawings of purification.

The manual of Operation and Maintenance of Purification Plant is given in Volume II-2.

(7) Improved procedures in 3rd and 4th year term

The following operating procedures have been improved.

- The JICA team gave training on turbidity tests to operators in order to make them to understand the appropriate dosing of flocculation agent, and discharge method of a rapid sedimentation pond. It will be enhanced that the shift operators regularly hold turbidity tests and change dozing rate of flocculation agent, discharge time and frequency as occasion may require.
- Dosing equipment for residual chlorine was replaced to the one with appropriate scale markings.
- The JICA team gives the oral examination regarding how to operate the purification plant to operators through purification department leaders based on the standard operation procedures prepared. It was aimed not only leaders can understand the process and operation method but also they can exercise leadership to operators. Leaders asked questions to operators both in English and Arabic. Good performers were awarded by Area Manager.
- The standard operation procedure was modified applying in actual field operation.
- Residual chlorine at clear water tanks can be tested by not only laboratory staffs but also shift operators ordinarily to adjust chlorine dosing rate adequately on site.
- Adequate sand filter back wash is instructed through dry and rainy season.
- Adequate sludge removal was instructed through dry and rainy season.

As a result of training, following operations were improved.

- Operators have grasped the details on water purification mechanism (turbidity).
- Operators can adjust dosing rate of coagulant reagent while implementing turbidity tests of raw water.
- Discharge of rapid coagulant sedimentation pond was properly done.
- Operators can adjust chlorine dosing rate for dosing equipment appropriately.
- Operators have grasped the details on general mechanism on water purification.
- Operators have made out plant operation adapting to turbidity variations through dry and rainy season regarding alum dosing rate.

- Operators can adjust chlorine dosing rate using the results of residual chlorine test by them.
- The removing sludge from sedimentation tanks is well done with proper intervals through dry and rainy season.
- The turbidity of treated water is stable through dry and rainy season.

According to the improved procedures above, documents of standards operation procedures (SOP) were revised in the following points.

- Standard Operation Procedure
- Target Residual Chlorine by operators
- Coagulant reagent and dosing rate of residual chlorine (see the table below).
- Standard Operation Procedure
- Target Residual Chlorine by operators

5.1.3 Project Activity of Output 2

(1) Electronic Data Format for Transmission and Distribution Facility

In order to record water supply condition and specifications of existing facilities and repair information, electronic data format shall be prepared. The titles of the prepared formats are shown in below.

- Operation and Maintenance Data Format
- Facility Data Format
- Record format of leakage repair

(2) Distribution Flow Monitoring Plan

1) Objective

Distribution flow data is utilized as basic data for implementation of an appropriate operation and maintenance of transmission and distribution facilities. The main objectives of distribution flow monitoring plan are mentioned below.

- To understand current water supply condition
- To make a distribution management plan including water supply schedule to each area and distribution zoning
- To reduce amount of non-revenue water
- To make a rehabilitation plan for the aged pipeline

2) Selection of flow meter

The typical types of flow meter are “Propeller/Turbine type flow meter”, “Electromagnetic flow meter” and “Ultrasonic flow meter”. The character of each type of flow meter is shown in Table

5-4.

Table 5-4 Character of flow meters

Items	Propeller/ Turbine type	Electromagnetic	Ultrasonic
Detection factor	Rotation of turbine	Super electric power	Flow speed
Accuracy	±0.5~0.2% (turbine) ±2.0~5.0% (propeller)	±0.5~1.0%	±5.0%
Application diameter	40~500mm	25~1200mm	No limit (up to 3,000mm)
Pressure loss	Yes	Non	Non
Necessity length of straight pipe	Upper: 5D Down: 3D	Upper: 5~10D Down: 3D	Upper: 10D Down: 5D
Others	Need construction of flow meter pit	Buried type is available Battery type is available	Need verification Buried type is available

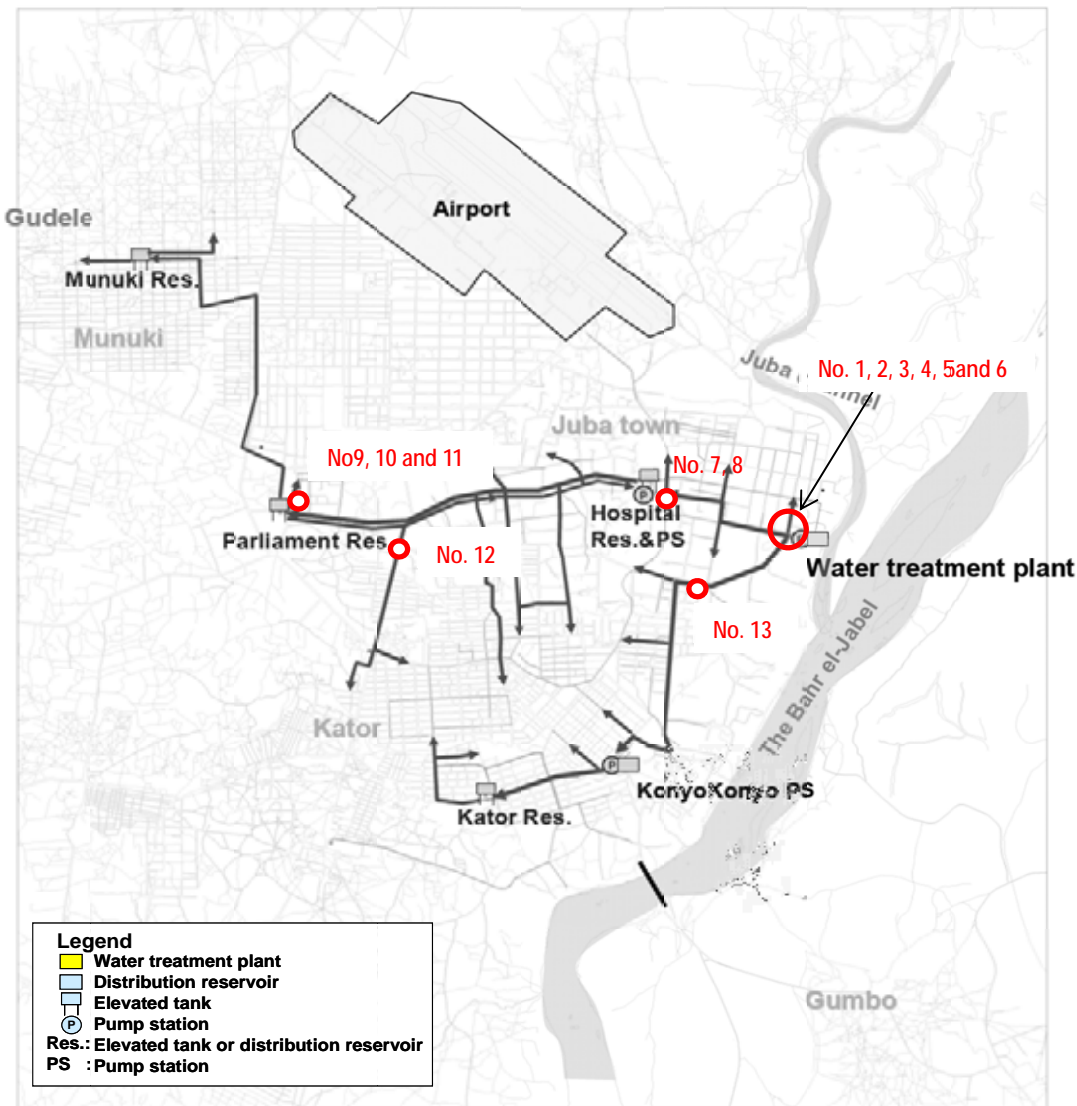
Propeller/Turbine type has been used in the existing pipelines in SSUWC. However, this type generates a certain head loss and needs the flow meter pit by watertight concrete. Considering for construction capacity of flow meter pit in SSUWC, Propeller/Turbine type is objectionable in flow monitoring point.

The flow meter of electromagnetic type detects flow data by super electric power. The accuracy of this type is ±0.5 to 1.0%. It doesn't generate any head loss; therefore, water supply condition is not changed. Electromagnetic flow meter doesn't need flow meter pit because the buried type is available. The flow meter of ultrasonic type detects flow data by flow speed. In order to avoid cutting of pipe with large diameter or asbestos cement pipe, this type is adopted to install. However, in case that air gets mixed in with pipeline, ultrasonic flow meter doesn't detect signal of flow speed and flow data is not measured.

3) Flow monitoring points

Following table shows the detail of flow monitoring points and ground of selection for flow meter type.

No.	Locations		Flowmeter Type
1	Water treatment plant, Juba station, SSUWC	Near the main gate of Head Quarter	Turbine Type
2		Near the main gate of water treatment plant	Turbine Type
3		Near the office of electric power company	Turbine Type
4		Near the "No. 3"	Turbine Type
5		Near Head Quarter Office	Turbine Type
6		Intake Pipe	Electrical Type
7	Hospital Pumping Station	Near the gate of the PS	Turbine Type
8	Outside of hospital pumping station		Turbine Type
9	Parliament area	In front of parking for presidential compound	Turbine Type
10		In front of parking for presidential compound	Turbine Type
11		Near round-about of Parliament Elevated Tank	Turbine Type
12	At road to Juba university		Turbine Type
13	Hi Cinema	Near Juba One Basic School	Turbine Type



(3) O&M data of water distribution facilities are compiled

Training of installation of flow meters, preparation of record formats, recording by the distribution

department staff started from September in 2011 and the data was compiled in November. The collected data includes:

- ✓ Water flow in 15 locations listed below

No.	Location	Pipe Details	Responsible Dept.
1	Water Purification Plant (WPP)	12 inch, GI	Purification
2	WPP	8 inch, AC	Purification
3	WPP	8 inch, AC	Purification
4	WPP	8 inch, AC	Purification
5	WPP	12 inch, GI	Purification
6	WPP	2 inch, PE	Purification
7	Hospital pump station	2 inch, GI	Purification (Sift operator)
8	Hospital pump station	12 inch, GI	Purification (Sift operator)
9	Hospital pump station	8 inch, PVC	Purification (Sift operator)
10	Parliament	8 inch, PVC	Distribution
11	Parliament	4 inch, PVC	Distribution
12	Buluk	6 inch, AC	Distribution
13	Konyokonyo pump station		Purification (Operator)
14	Kator		Distribution (Operator)

- ✓ Water pressure in the outlet pipe of pumps listed below

No.	Location	Pump type	Responsible Dept.
1	Water Purification Plant (WPP)	Raw water pump	Purification
2	WPP	Raw water pump	Purification
3	WPP	Raw water pump	Purification
4	WPP	Transmission pump	Purification
5	WPP	Transmission pump	Purification
6	WPP	Transmission pump	Purification
7	WPP (Old pump house 1)	Transmission & distribution pump	Purification
8	WPP (Old pump house 2)	Transmission & distribution pump	Purification
9	WPP (Old pump house 2)	Transmission & distribution pump	Purification
10	Hospital pump station (Old)	Transmission & distribution pump	Purification
11	Hospital pump station (New)	Transmission & distribution pump	Purification
12	Hospital pump station (New)	Transmission & distribution pump	Purification
13	Hospital pump station (New)	Transmission & distribution pump	Purification
14	Konyokonyo pump station	Transmission & distribution pump	Purification

- ✓ Location of water leakage
- ✓ Water leakage repair
- ✓ Pipe installation/replacement
- ✓ House connection

(4) O&M report is prepared

Based on the compiled data in September and October, the monthly O&M report was prepared by staff of distribution department. The monthly report includes

- ✓ Performance Indicator (PI)
- ✓ Outline of the existing facilities and its current condition: Compiled recording data, existing facilities including tabulated pipe length by material Reservoir/ Elevated tank, Tanker filling point, Gate valve & Flow meter
- ✓ Significant issues of the existing facilities
- ✓ Outline of water leakage in September and October: GIS map and repair condition of water leakage
- ✓ Next month event and Next month target: Installation/Replacement pipeline plan and No. of house connection
- ✓ Request form of materials and tools: Pipe materials and repair tools

(5) O&M plan are prepared

Based on the compiled PI and the result of discussion with staff of distribution department, O&M plan was prepared and compiled as “Annual Report”. Annual Report was prepared through the discussion in the training for distribution department. Annual Action Plan for distribution department includes selection of performance indicators, their target values, critical success factors, activities, responsible person, input required for improvement of repair condition for water leakage, distribution water supply volume and recording condition. Annual Report and Action Plan of the distribution department is included in Volume III-5, 6 and following two tables show the training schedule.

Table 5-5 Syllabus of Training for Transmission and Distribution Facility (1/2)

Syllabus of Training for Transmission and Distribution Facility

14:00 pm - 16:00 pm at Training Room (Computer Room)

By Masashi Kawamura

Mon.	Date	Wk	Main subject	Sub-title	Original Contents	Modify according to your request	
	5 Sat		Holiday	Monthly report	1. Draft monthly report on October		
	6 Sun		Holiday				
	7 Mon		National Holiday				
	8 Tue		Planning of monitoring team	Responsible person	1. Confirmation of responsible person and assistant person		
	9 Wed	1st Week	Explanation of main contents of monthly report and performance indicator		1. Explanation of main contents of monthly report 2. Evaluation of monthly report on previous month 3. Outline of performance indicator for all department 4. Outline of performance indicator for distribution dept.		
	10 Thu		Understanding of GIS and GPS, and recording method	Review of GPS and GIS operation	1. Collection of water leakage location data by GPS (Creating ArcPad data, shapefile of point and route for GPS) 2. Data input from GPS and data input into GIS (input attribute data)		
	11 Fri			Exercise of recording	1. Recording of Installation pipe or Water leakage repair Data input into computer 2. *we will use one format of three formats.		
	12 Sat		Holiday	Monthly report	1. Editing monthly report on October		
	13 Sun		Holiday				
	14 Mon		Weekly meeting and examination for GPS, GIS and Recording				
	15 Tue	2nd Week	Understanding of GIS	GIS operation training	1. Visualization of GIS map (setting of shapefile) 2. Formulation of shape file (point and line)		
	16 Wed				1. Visualization of GIS map (printout) 2. Formulation of shape file (setting of coordinate)		
	17 Thu		Understanding of outline of O&M for transmission and distribution facility	Introduction of O&M for transmission and distribution facility	1. General (Pipeline, Valves, Pumps (purification), Distribution reservoir) Outline of Non-Revenue Water and its countermeasure		
	18 Fri	Application to SSUWC			1. Application of O&M items to Distribution dept. in SSUWC (Pipeline, valve)		
	19 Sat		Holiday	Monthly report	1. Draft monthly report on November		
	20 Sun		Holiday				
	21 Mon		Weekly meeting and examination for GIS and O&M				
	22 Tue	3rd Week	Confirmation of inventory data for distribution network	Confirmation of statistical data for network	1. Export from GIS database to Excel file		
	23 Wed			Calculation of network data	1. Calculation of length by material 2. Calculation of length by diameter 3. Cross calculation of length by material and diameter		
	24 Thu		Understanding of current water supply condition by EPANET	Introduction of water network analysis by EPANET	1. Introduction of EPANET and trial analysis 2. Explanation of constitution of EPANET data (Node, Line, Valve, Pump etc.)		
	25 Fri			Evaluation of the result of analysis by EPANET	1. Explanation of evaluation method of the result of analysis by EPANET		
	26 Sat		Holiday	Monthly report	1. Editing monthly report on November		
	27 Sun		Holiday				
	28 Mon		Weekly meeting and examination for GIS and EPANET				
	29 Tue	4th Week	Review, Q&A, Request and Exercise	Operation of GPS, GIS and EPANET	1. As SSUWC's request, JICA expert will make contents.		
	30 Wed						
Dec.	1 Thu			Preparation of the format for monitoring	Confirmation of recording format, GPS and GIS	1. Print out the format and confirmation of filing	
	2 Fri		JICA expert leaves for Japan				

Table 5-6 Syllabus of Training for Transmission and Distribution Facility (2/2)

Syllabus of Training for Transmission and Distribution Facility							
14:00 pm - 16:00 pm at Training Room (Computer Room)				By Masashi Kawamura			
Mon.	Date	Wk	Main subject	Sub-title	Original Contents	Required materials	
	21	Sat	Holiday				
	22	Sun	Holiday				
Jan.	23	Mon	Preparation of training materials and checking of recording data, weekly meeting		1. Checking GPS equipment, GIS database and recording data		
	24	Tue			2. Preparation of training materials		
	25	Wed		Preparation of training materials and checking of recording data, weekly meeting		1. Checking GPS equipment, GIS database and recording data and discussion of the result	
	26	Thu	Visiting of PKO to SSUWC and preparing manual for transmission and distribution facilities		2. Preparation of training materials		
	27	Fri			1. Explanation of the existing water treatment plant and grant aid project		
	28	Sat	Recording format	Revision work	1. Occasional day for visiting		
	29	Sun	Holiday				
Feb.	30	Mon	Weekly meeting and daily recording		2. Discussion of the improvement method of recording		
	31	Tue	Explanation of the current condition of recording. Lecturer: Christopher, Mujung, Benson, Madding		1. Discussion about the record format and revision		
	1	Wed	Annual plan	Plan of the target area for water leakage	1. Water leakage repair record	Standard Procedure Format	
	2	Thu		Assuming of the number of the required materials and cost estimation	2. Piping work record		
	3	Fri			3. Datainput and GIS mapping		
	4	Sat	Holiday				
	5	Sun	Holiday				
	6	Mon	Weekly meeting and daily recording		4. House connection		
	7	Tue	Annual plan	Activities in 2011 and trend for PI	1. Water leakage repair, piping work and house connection		
	8	Wed		Summary of achievement and issues to be tackled	1. Calculation min., Ave. and Max for each PI		
9	Thu	tapping machine		1. Description of trend			
10	Fri			1. Discussion about achievement in 2011			
11	Sat	Holiday					
12	Sun	Holiday					
13	Mon	Weekly meeting and daily recording		2. Discussion about issues to be tackled in 2011			
14	Tue	Annual plan	Reporting	3. Reporting			
15	Wed			1. instruction of tapping machine			
16	Thu	O&M tools	Preparation	2. checking of parts of tapping machine			
17	Fri		Tapping machine instruction	3. practice of tapping machine			
18	Sat	Holiday					
19	Sun	Holiday					

(6) Juba station and SSUWC HQ have discussion on the prepared report and plan

The summary table of an action plan of the distribution department was submitted and explained by the counterpart. Considering the results of discussion with HQ, Annual report and action plan were finalized.

(7) Training on facilities O&M is conducted

The schedule of the training in distribution department is shown in the previous section. The training mainly includes:

- ✓ Review of recording work

- ✓ Preparation of annual report
- ✓ Instruction of recording tools and repair tool

(8) O&M manuals for water distribution facilities are prepared.

Based on the current O&M condition, the O&M manuals was prepared and it consists of 3 parts, standard operating procedure, detailed instruction and equipment manual. The following table shows contents of each manual.

Manual	Contents
Standard Operating Procedure	<ul style="list-style-type: none"> ✓ Procedure of Recording for Leakage Repair/Installation (By using Format) ✓ Procedure of Recording for Leakage Repair/Installation (By using GPS) ✓ O&M of Flow Meter ✓ Recording of House Connection ✓ Recording of Flow Meter ✓ Checking Procedure of All Recording Work
Detailed instruction	<ul style="list-style-type: none"> ✓ Operation and Maintenance of Transmission and Distribution Facilities <ul style="list-style-type: none"> ➤ Operation and Maintenance of Distribution Reservoir and Elevated Tank ➤ Operation and Maintenance of Transmission and Distribution Pipeline ➤ Prevention of Water Leakage and Its Rehabilitation ➤ Management of Distribution Area Information ➤ Procedure of Recording Work
Equipment manual	<ul style="list-style-type: none"> ✓ GPS (Global Positioning System) manual ✓ GIS (Geographic Information System) manual ✓ Flow meter manual

(9) Improved procedures in 3rd and 4th year term

The following operating procedures have been improved.

- Assignment of a backup member has been done without any delay in case that staff member who is in charge of recording of operation and maintenance work has a long leave, sickness or accident.
- The director of distribution department was guided to evaluate the performance of operation and maintenance record work.
- As for the GIS operation method, the interruption of the daily recording work was dissolved since

staff in the distribution department can solve error of the collected GIS data.

As a result of training, following operations were improved.

- Modification of the format of O&M record
- Preparation of new recording list for the required material of water leakage
- Modification of the format of monthly report
- Modification of GIS database in which transmission and distribution data was input.

5.1.4 Project Activity of Output 3

(1) Water Quality Management Plan

1) Regular Water Quality Monitoring

The following regular water quality monitoring plan was agreed with water quality laboratory section of Purification Department.

2) Type of Water Quality Test and Test Parameters

A. Daily test	Air and water temperature, Water temperature, Turbidity, Color, pH-value, Conductivity, Residual Chlorine
B. Weekly	Parameters of daily test and Alkalinity and Dissolved oxygen
C. Monthly	Parameters of weekly test and Hardness, Suspended Solid, TDS, Fe, Mn, Zn, and Cu

3) Sampling Points and Monitoring Parameters

A. Daily test

a) Purification Plant

- Start Time: 10:00 AM
- Sampling responsibility: Laboratory

Parameter	Raw water	Settled water	Filtered water	Clear water
	River at intake	After sedimentation and before filter	After filter before chlorine injection	In clear water tank
Air temperature	✓			
Water temperature	✓			✓
Turbidity	✓	✓	✓	✓
Color	✓	✓	✓	✓
pH-value	✓	✓	✓	✓
Conductivity	✓			✓
Residual chlorine				✓

B. Weekly test

a) Purification Plant

- Start Time: 9:00 AM, Friday
- Sampling responsibility: Laboratory

Parameter	Raw water	Settled water	Filtered water	Treated water
	River at intake	In trough of sedimentation tank	After filter before chlorine injection	In clear water tank
Air temperature	✓			
Water temperature	✓			✓
Turbidity	✓	✓	✓	✓
Color	✓	✓	✓	✓
pH-value	✓	✓	✓	✓
Conductivity	✓			✓
Residual chlorine				✓
Alkalinity	✓			✓
Dissolved oxygen	✓			✓

b) Water Tanks (4 locations)

- Start Time: 10:00 AM, Friday (same as current schedule)
- Sampling responsibility: Laboratory
- Measurement at site: air and water temperature and residual chlorine

Parameter	Treated water			
	In tank near Hospital	In Konyokonyo tank	Kator elevated tower	Parliament elevated tank
Air temperature	✓	✓	✓	✓
Water temperature	✓	✓	✓	✓
Turbidity	✓	✓	✓	✓
Color	✓	✓	✓	✓
pH-value	✓	✓	✓	✓
Conductivity	✓	✓	✓	✓
Residual chlorine	✓	✓	✓	✓
Alkalinity	✓	✓	✓	✓
Dissolved oxygen	✓	✓	✓	✓

C. Monthly test

a) Treated water

- Start Time: 10:00 AM, Not decided
- Sampling responsibility: Laboratory
- Measurement at site: air and water temperature and residual chlorine

Parameter	Treated water				
	Tank in Purification plant	Tank near Hospital	Konyokonyo tank	Kato elevated tower	Parliament elevated tank
Air temperature	✓	✓	✓	✓	✓
Water temperature	✓	✓	✓	✓	✓
Turbidity	✓	✓	✓	✓	✓
Color	✓	✓	✓	✓	✓
pH-value	✓	✓	✓	✓	✓
Conductivity	✓	✓	✓	✓	✓
Residual chlorine	✓	✓	✓	✓	✓
Alkalinity	✓	✓	✓	✓	✓
Dissolved oxygen	✓	✓	✓	✓	✓
Hardness	✓	✓	✓	✓	✓
SS	✓	✓	✓	✓	✓
TDS	✓	✓	✓	✓	✓
Fe	✓	✓	✓	✓	✓
Mn	✓	✓	✓	✓	✓
Zink	✓	✓	✓	✓	✓
Cu	✓	✓	✓	✓	✓

b) Tap water

- Time: 10:00 AM, Date is not decided
- Sampling responsibility: Laboratory
- Measurement at site: air and water temperature and residual chlorine

Parameter	Supplied treated water						
	Kator area (nearby house)	Juba town (New york hotel)	Tanker filling station in Juba town	Juba town (State house)	Universit y area	Ministr y area (M of PW)	Munuki public taps
	Kator elevated tower	Purification plant		Hospital pump station	Parliament elevated tower		
Air temperature	✓	✓	✓	✓	✓	✓	✓
Water temperature	✓	✓	✓	✓	✓	✓	✓
Turbidity	✓	✓	✓	✓	✓	✓	✓
Color	✓	✓	✓	✓	✓	✓	✓
pH-value	✓	✓	✓	✓	✓	✓	✓
Conductivity	✓	✓	✓	✓	✓	✓	✓
Residual chlorine	✓	✓	✓	✓	✓	✓	✓

Parameter	Supplied treated water						
	Kator area (nearby house)	Juba town (New york hotel)	Tanker filling station in Juba town	Juba town (State house)	Universit y area	Ministr y area (M of PW)	Munuki public taps
	Kator elevated tower	Purification plant		Hospital pump station	Parliament elevated tower		
Alkalinity	✓	✓	✓	✓	✓	✓	✓
Dissolved oxygen	✓	✓	✓	✓	✓	✓	✓

4) Test method

Parameter	Required test equipment
Air temperature	thermometer
Water temperature	Pettenkoher thermometer
Turbidity	Turbidity color meter
Color	Turbidity color meter
pH-value	pH meter
Conductivity	Conductivity meter
Residual chlorine	Residual chlorine meter
Alkalinity	Sulphuric Titration
Oxidation demand	K I method
Hardness	EDTA method
SS/TDS	Evaporation/weight method
Fe	Ferover method
Mn	PAR method
Zink	Zincon method
Cu	Bisinconin method

(2) Electronic Data Format for Water Quality Monitoring

The following formats have been prepared.

- Recording sheet of result of water quality test (daily, weekly and monthly)
- Monthly summary sheet of result of water quality test (daily, weekly and monthly)

(3) Procurement of Water Quality Equipment

The following water quality equipments were procured from Nairobi in Kenya. The procured equipment are shown in 2.2.2 Input of Equipment.

(4) Water Quality Test Trained and Results

The training for following water quality tests were carried out. The parameters are not full parameters due to lack of the equipment.

1) Daily Test

Water was sampled from 4 locations in the processes of the purification plants and water was analyzed in terms of air and water temperature, turbidity, pH value, residual chlorine for 16 days from 10th March to 30th March 2011.

a) Turbidity

The results of turbidity test were visualized in the figure below. The turbidity of raw water is around 20 NTU, which is decreased to the level of 3 to 10 NTU after sedimentation. It is further treated in rapid sand filter, and the treated water becomes below 5 NTU. At the end of the month, turbidity of treated water is around 1 NTU as a result of adoption of a new backwash method for filters.

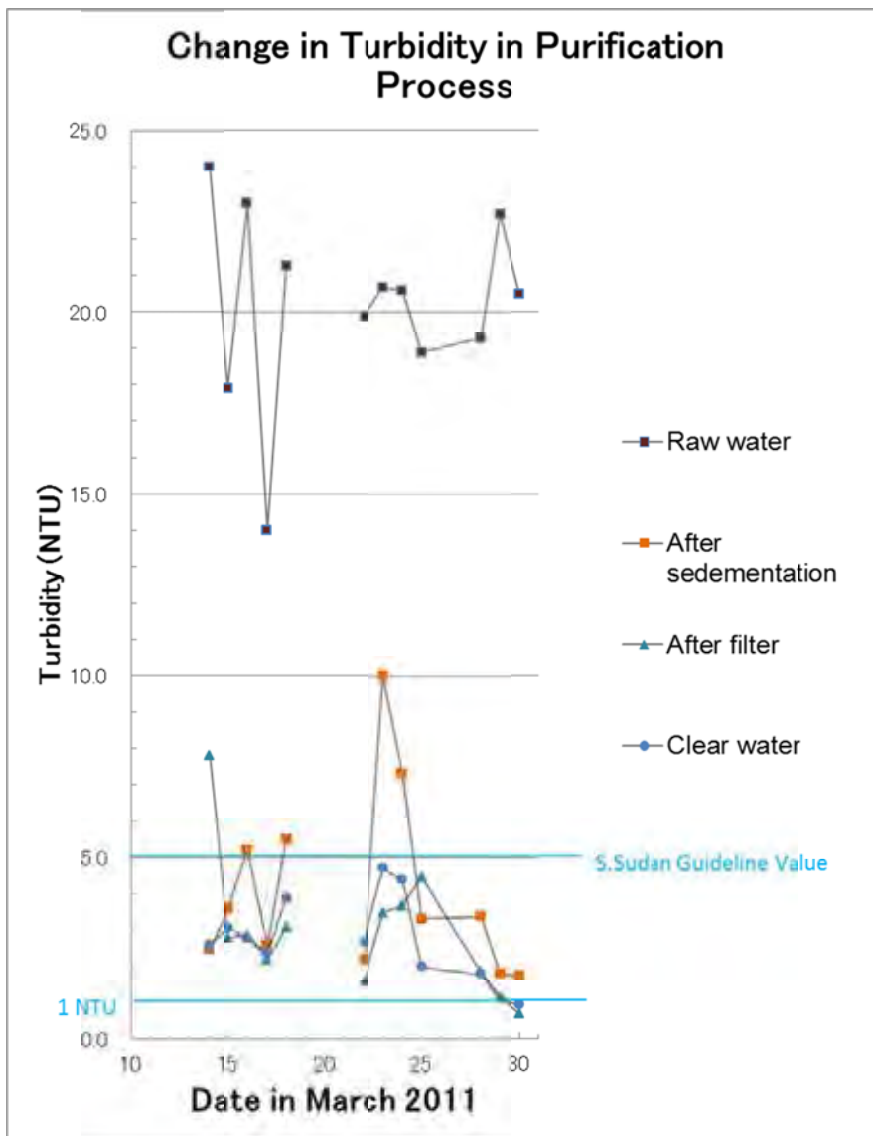


Figure 5-1 Turbidity Change in the Process of Treatment

b) Residual Chlorine

The residual chlorine test analysis for water in the clear water tank in the purification plant is shown in the figure below. The maximum and minimum residual chlorine concentration is 3.6 mg/l and almost 0 mg/l, respectively, with large fluctuation. It indicates the chlorine feeding rate is not controlled appropriately.

In the water quality management plan prepared, residual chlorine of tap water should be controlled within the range between 0.2 mg/l and 0.6 mg/l. To do so, the residual chlorine in the clear water tank should be controlled within the range between 0.7 mg/l to 1.2 mg/l considering the decrease in concentration according to the time past.

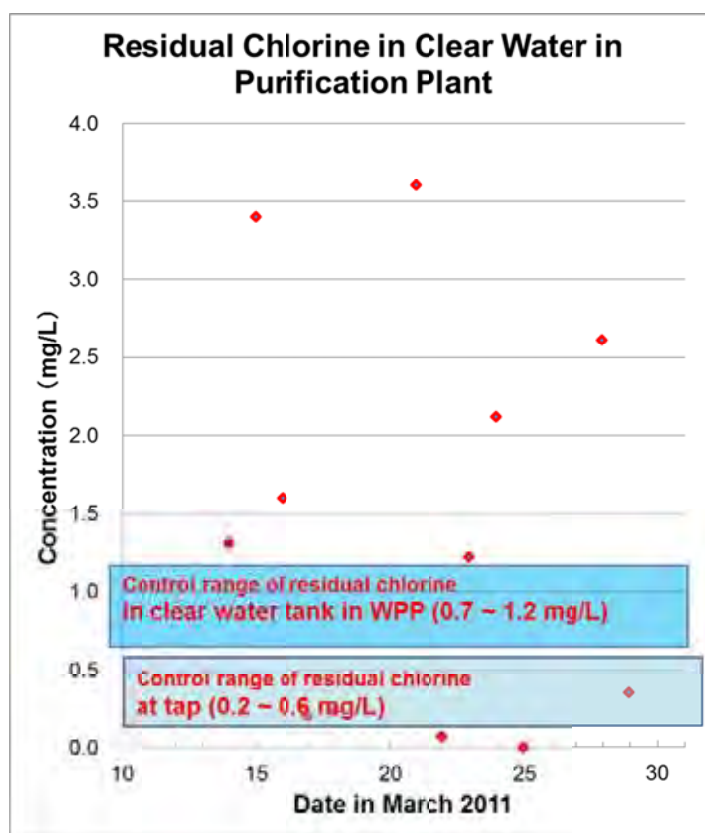


Figure 5-2 residual Chlorine in Clear Water Tank in Water Treatment Plant

2) Weekly and monthly test

Weekly test results are given in Table 5-5. One test was carried out on 24th March 2011 for monthly tests and the results are shown in Table 5-6. As indicated in the table, residual chlorine in water of all the taps except at tanker filling points in Juba Town is less than the standards of minimum concentration of 0.2 mg/L.

Table 5-7 Weekly Test Results (Tanks in the city)

Date	Location	Turbidity	PH-Value	Residual chlorine
	Hospital elevated tower			
11-Mar		2.42	7.8	0.09
18-Mar		3.44	7.8	0.00/0.43
24-Mar		3.72	7.8	0.01
1-Apr	28.5	2.03	7.7	0.00/0.26
	Konyokonyo tank			
11-Mar		2.14	7.8	
18-Mar		3.12	7.8	0.00/0.33
24-Mar		4.24	7.8	
1-Apr	31	2.04	7.7	0,00/0.12
	Parliament tank			
11-Mar		1.36	7.8	
18-Mar				
24-Mar		4.35	7.8	0.08
1-Apr				
	Kator elevated tower			
11-Mar				
18-Mar		54.4	7.8	0.00/0.80
24-Mar		11.55	7.8	0.03
1-Apr	30.5	2.34	7.9	0.00/0.12
	Munuki			
11-Mar				
18-Mar				
24-Mar				
1-Apr				

Note: free chlorine/ combined.

Table 5-8 Monthly Test Results (Taps)

		Month	Mar		
Parameter		Date	11	18	24
Turbidity	New York Hotel		2.42	3.4	3.7
	Near Hospital PS		2.14	3.1	4.2
	Near University		1.36	3.2	
	Near Kator elevated tank			54.4	11.6
	Public Stand in Munuki				3.18
	Tankerfilling Point in Juba Town				2.97
Residual Chlorine	New York Hotel		0.09	0.43	0.01
	Near Hospital Pumping Station		0.00	0.33	0.00
	Near University		0.00	0.01	
	Near Kator elevated tank			0.80	0.03
	Public Stand in Munuki				0.01
	Tanker filling point in Juba Town				0.31
PH-Value	New York Hotel			7.8	7.8
	Near Hospital Pumping Station			7.8	7.8
	Near University				
	Near Kator elevated tank			7.8	7.8
	Public Stand in Munuki				7.8
	Tankerfilling Point in Juba Town				7.8

(5) Examination for Water Quality for Proper O&M of Filters

1) Training Objectives

- Purpose: to find optimum backwash frequency and duration
- Proposed operation change: from twice a day to once a day and adequate backwash duration
- Participants: Purification plant staff for sampling and water quality section staff for analysis
- Training topic: to understand rapid sand filtration mechanism

2) Backwash experiment

To find better method for backwashing filter, the water filtered and backwashed by existing method (old method) is taken from backwashed overflow and filtered water after the resume of the filter operation. After sampling and water quality test of water by the old method for about 1 week, new method for backwashing was exercised and water was taken at the same locations. The following are summary of old and new method of backwash.

Items	Old backwash method	New backwash method
Air backwash	3 minutes	5 minutes
Water backwash	4~5 minutes	10 minutes
Frequency of backwash	2~3 times/filter	1 times /filter

The results of water quality test in terms of backwash overflow water and filtered water after the resume of filtration are shown in Figure 5-3 and Figure 5.4, respectively. As you can see in the figure, the overflow water by new method has better quality than that of old method. The turbidity of old method exceeds more than 60 NTU and on the other hand, the turbidity of the new method falls in the range between 20 to 40 NTU. In the experience in Japan, backwash overflow water should be controlled that of the new method.

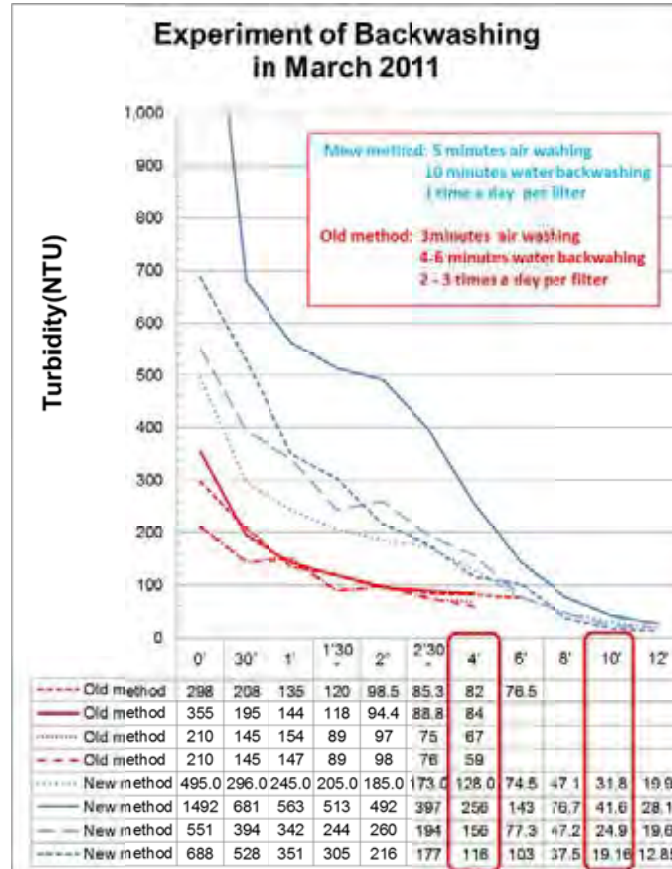


Figure 5-3 Turbidity in Backwashing Water

On the other hand, the turbidity of filtered water by the old method fluctuated at higher concentration but that of filtered water by the new method keeps at the low concentration level even after backwashing. Apparently, the water produced by the new method is superior to the old method. As shown in Figure 5-1, after adoption of new backwash method, turbidity has become around 1 NTU.

(6) Training on water quality analysis

1) Modification of Water Quality Management Planning

The monitoring plan was revised in October, 2011 as seen in Table 5-9. The revised parts are sampling points and monitoring parameters. Moreover, the schedule of sampling for weekly and monthly test was modified to reduce the work load of the laboratory staff for weekly and monthly tests. This revised plan has been adopted since November 2011.

a) Training Activities

* Schedule and contents

Training schedule and contents are shown in Table 5-10 starting on 1st November and completed at the end of November.

* Progress and outcomes

Water quality parameters listed in Table 5-9 of Water Quality Monitoring Plan can be analyzed by the counterpart. Daily test were fully carried out by the counterparts but weekly and monthly tests were partly carried out due to the reason listed in the following reasons.

In December, weekly and monthly samplings were tried but water samples were not obtained in many locations due to lack of water in tank and taps. The main cause of water shortage was severe power supply conditions, especially in November 2011 and shortage of fuel stock of UWC Juba station.

In addition, in December and January, transportation means for sampling was not coordinated in Juba station so that they could not execute samplings. Also sometimes there was no fuel for car to collect water sample. Another reason is shortage of staff in the laboratory since now only 2 staff is assigned in the laboratory. There is no data of color in daily test because of no color test kit, Color test kit is now under procurement.

As for transportation for water sampling, a request to provide a car to use for water sampling has been made to the Area Manager. As for sampling staff in weekly and monthly tests, a request to shift one person each from Distribution and Purification Department to laboratory has been made to the Area Manager.

Training for jar tester and chlorine demand test was carried out to decide aluminum sulphate and chlorine dosing rates. The problem of chlorine dosing is that measuring scale of injector is not adequate, which should be replaced with an adequate scale.

Sampling Points Parameters	Raw Water	Settled Water	Filtered Water	Treated Water (Mainly Tank)							Treated Water (Tap)			
	River (Intake)	After sedimentation and before filter	After filter and before chlorine injection	Reservoir (WTP)	WTP Tanker filling station (in front of JICA)	Tank near hospital	Kenyokonyo tank	Kator elevated tank	Parliament elevated tank (tap instead of tank)	Munaki elevated tank (tap instead of tank)	Kator	New York Hotel	War Veteran Museum	Juba University
Air Temperature	✓	-	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water Temperature	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Turbidity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Color	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
pH-value	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Conductivity	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TDS	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Residual Chlorine	-	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alkalinity	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dissolved Oxygen	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Odor	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ammonium	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	-	-
Nitrate	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	-	-
Hardness	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	-	-
Iron	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	-	-
Manganese	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	-	-
Zink	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	-	-
Copper	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	-	-

Daily Test
 Weekly Test (WTP)
 Weekly Test (TANK)
 Monthly Test (WTP)
 Monthly Test (TANK)
 Monthly Test (TAP)

Table 5-9 Water Quality Monitoring Plan

Date	Mon.	Tue.	Wed.	Thu.	Fri.
		<i>1st Nov.</i>	<i>2nd Nov.</i>	<i>3rd Nov.</i>	<i>4th Nov.</i>
AM		Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)
		Sampling of Weekly(WTP)	Sampling of Weekly(TANK)		
		Sampling of Monthly(WTP)			
PM		Water Quality Analysis(WQA) of weekly, monthly	WQA of weekly		
Date	<i>7th Nov.</i>	<i>8th Nov.</i>	<i>9th Nov.</i>	<i>10th Nov.</i>	<i>11th Nov.</i>
AM	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)
		Sampling of Weekly(WTP)	Sampling of Weekly(TANK)		
			Sampling of Monthly(TANK)		
PM		WQA of weekly	WQA of weekly, monthly		
Date	<i>14th Nov.</i>	<i>15th Nov.</i>	<i>16th Nov.</i>	<i>17th Nov.</i>	<i>18th Nov.</i>
AM	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)
		Sampling of Weekly(WTP)	Sampling of Weekly(TANK)		
				Sampling of Monthly(TAP)	
PM		WQA of weekly	WQA of weekly	WQA of monthly	
Date	<i>21st Nov.</i>	<i>22nd Nov.</i>	<i>23rd Nov.</i>	<i>24th Nov.</i>	<i>25th Nov.</i>
AM	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)
		Sampling of Weekly(WTP)	Sampling of Weekly(TANK)		
PM		WQA of weekly	WQA of weekly		
Date	<i>28th Nov.</i>	<i>29th Nov.</i>	<i>30th Nov.</i>		
AM	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)	Daily Test (Sampling & WQA)		
		Sampling of Weekly(WTP)	Sampling of Weekly(TANK)		
PM		WQA of weekly	WQA of weekly		

Table 5-10 Training Plan for Water Quality Monitoring

(7) Water quality management report is prepared based on the test result.

The data and performance indicators were accumulated in 9 months from April 2011. Based on these data, training of preparation for annual report and annual action plan was held for 3 weeks in February 2012. The preparation method was shown in Manual for Reporting System and Planning. Then, an annual report and annual action plan were prepared in February. The annual plan (action plan) targets four months from March to June in 2012. Annual plan includes selection of performance indicators and their targets, critical success factors, activities, target period, and input required (staff, goods, and funds).

(8) Juba station and SSUWC HQ have a discussion on the above-described report.

The meeting to discuss the annual report and action plan with SSUWC HQ was held in February in 2012. In the meeting, the summary table of Annual Action Plan of the distribution department was submitted and explained by the counterpart. Considering the results of discussion with HQ, annual report and annual action plan were finalized.

(9) Improved procedures in 3rd and 4th year term

The following operating procedures have been improved.

- Chlorine injection rate has been revised according to residual chlorine monitoring in the city, especially in Hospital tank and tanker filling station in front of Hamza Inn.
It was turned up that the residual chlorine in reservoir of WTP should be set as 1.5 to 2.0 mg/L in order to get residual chlorine as 0.2 to 0.7 mg/L in Hospital tank, and as 1.0 mg/L in the tanker filling station in front of Hamza Inn. In case of residual chlorine as 1.5 to 2.0 mg/L in reservoir of WTP, the chlorine injection should be set as 3.5 to 4.0 mg/L according to chlorine demand test.
- Conformance rate of water quality met 89% in August 2012 through turbidity tests by shift operators.

As a result of training, following operations were improved.

- Chlorine injection rates and target residual chlorine at the clear water tank were revised according to the improved procedures above.
- Daily shift water quality test result (Residual Chlorine)

5.1.5 Project Activity of Output 4

(1) Preparation of Digital Formats for Customer Ledger and Revenue Collection

New digital formats was designed and created by the MS Access database in accordance with the digitalization of the existing customer ledgers and revenue collection records, which were mostly

managed by manual recording. The Access database was designed to comprehensively manage the functions of customer management, billing management and collection management, and all formats relevant to the each function were created. The contents included in the formats were determined through a series of discussion with the staff of revenue section. The prepared all formats are shown as following figure.

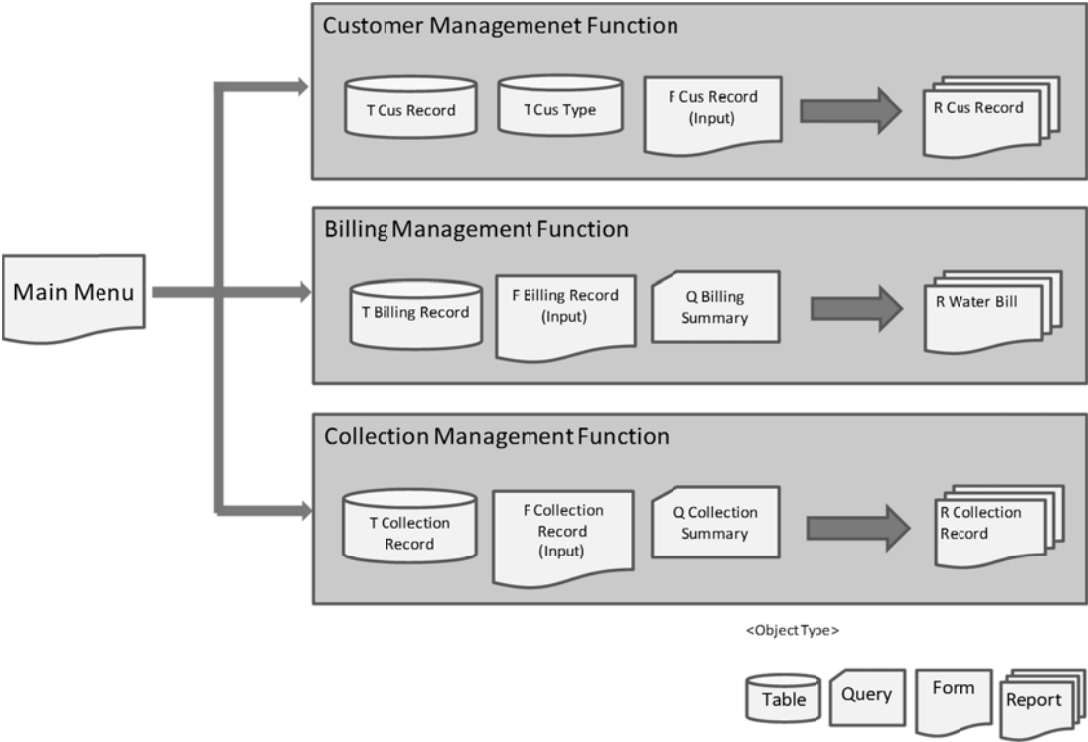


Figure 5-4 MS Access Database for Customer, Billing and Collection Management

(2) Preparation of the Database Manual

A database manual, for the creation of the MS Access database and for the operation was prepared. The manual is attached as a separate volume.

(3) Training on Preparation of Access Database

Training on the preparation of the Access database for customer management, billing management and collection management was conducted to the staffs of revenue section. During the training, the manual aforementioned was utilized as a basic guide and was modified as necessary.

The most part of the training was mainly conducted on-the-job-training (OJT) and the Counter Part actively established the Access database including the creation of format and data inputting.

The data inputting of customer information in the existing customer ledgers was started in April 2011.

The outline of the training is shown as below.

Items	Contents
Trainer	Financial analysis/ Water tariff Expert
Trainees	Staffs of revenue section, Accounting department
Method	Lecture, demonstration and OJT Lectures for introduction were made by the Expert. Actual works for creating MS Access database were mainly done by the counterparts through OJT. The Expert make a supervision of activities and additional guidance.
Training contents	① Lecture on the digital formats and simple manual - Explanation on new formats of customer ledger, billing and collection records - Difference between old and new formats and improvement points - Explanation on input items - Explanation on data inputting and analysis method based on the simple manual
	② Creation of all formats and data inputting partly (OJT) - Creation of the formats for customer management, billing management and collection management - Establishment of the linkage between formats - Appropriate data input of existing customer and preparation of the database
	3) Data analysis and effective usage of the data (OJT) • Analysis on collection records and effective usage of the data

The need for modifying customer database was appeared according to metered tariff rates of Juba station, which was newly approved. Therefore the expert assisted to modify customer database by adding a function for metered tariff system.

(4) Revenue collection report (monthly and annual) is prepared

Monthly report including revenue collection was prepared for September and October, 2012, and the datasheet and performance indicators of revenue collection were updated monthly until now.

Table 5-11 Main Performance Indicators (Sales)

Data	Unit
Data	
Number of days in collection period	days
Number of connections	connection
Number of metered connections	number
Number of bills delivered	number
Amount of bills delivered	number
Number of bills paid	number
Amount of bills paid	SSP/period
Metered consumption	m ³ /month
Number of new/or disconnection	number/ month
Ratio	
Global metering ratio	%
Domestic metering ratio	%
Production per day per served population	l/d/inh.
Production per connection	m ³ /mth/c
Billing ratio in number	%
Billing ratio in amount	%
Collection ratio in number	%
Collection ratio in amount	%
Daily average production during billing period	m ³ /d
Total production in billing period	m ³ /period
Non Revenue Water ratio	%period
Collection period	Days

Based on the accumulated data, an annual report was prepared in February 2012 together with an annual action plan. The annual report and action plan is given in Volume-III-3.

(5) Water cost is calculated

The following training activities were carried out during October to the middle of November on the analysis of financial conditions of SSUWC Juba Station.

Table 5-12 Training Activities on Analysis of Financial Conditions

Items	Contents	
Trainer	Financial analysis/ Water tariff Expert	
Trainees	Staffs of revenue section, accounting section, meter reader section in the Accounting department, Area manager	
Topics		Methods
(1) Preparation of the RC database and Data Compilation - Data input of customer information - Operation of the RC database by using the function of customer management, billing and collection - Adjustment and improvement of the RC database		OJT
(2) Data Analysis and Preparation of Revenue Collection Report (monthly, annually) - Data collection and compilation - Analysis of the collected data - Billing ratio and collection ratio - Non revenue water ratio		OJT
(3) Analysis of Current Water Cost and Understanding the issues - Understanding and calculation of unit production cost - Understanding and calculation of average revenue - Concept of cost recovery - Cost structure - Performance indicators (PIs)		Lecture OJT

As a result of training activities and data collection and analysis, a seminar on financial situation and introduction of new water tariff was held on 15th November 2011. The contents are below and a seminar presentation is given in Volume I-4.

Part 1 Financial Situation: Current Water Tariff and Revenue Collection

- Annual Revenue and Revenue Collection
- Water Tariff Rate in Use

Part 2: Cost Recovery, Revenue Requirement and Tariff Rate Design

- Annual Expenditure
- Cost Recovery and Cost Structure
- Estimation of Unit Operational Cost and Average Revenue
- Revenue Requirement
- Tariff Rate Design

Part 3: Current Situation of Water Meter Installation and Customer Satisfaction

- Current Situation of Water Meter Installation
- Customer Satisfaction

Part 4: Simulation of New Water Tariff

- Uniform Volumetric Rate and Increasing-Block Tariff Rate
- Approach from Affordability
- Final Remarks

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- Current Situation of Water Meter Installation
- Customer Satisfaction

Part 4: Simulation of New Water Tariff

- Uniform Volumetric Rate and Increasing-Block Tariff Rate
- Approach from Affordability
- Final Remarks

The unit production cost and the average revenue of the UWC Juba station per cubic meter were calculated by using monthly Operation and Maintenance data. The calculation procedure and the analysis have been partly trained to the main staffs responsible in revenue and accounting sections.

The following table indicates the unit production cost and the average revenue of the UWC Juba station in 2 simulation types; (A) Current management type, (B) Semi-Autonomy type (all cost will be covered excluding capita cost).

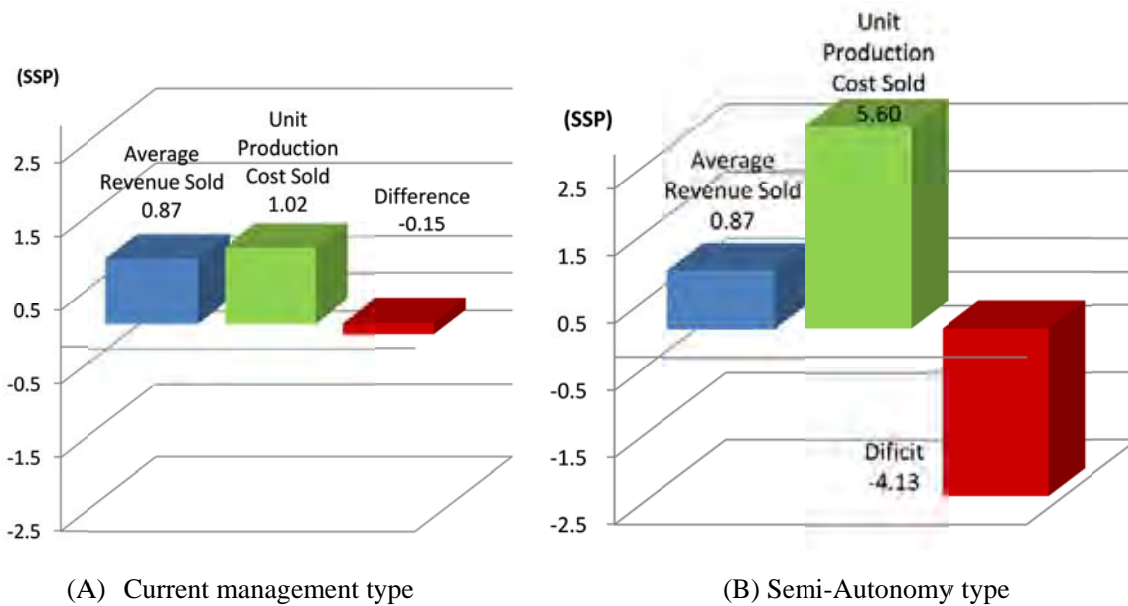


Figure 5-5 Average Revenue Sold and Unit Production Cost Sold

Table 5-13 Preconditions for Calculation

Cost items	(A) * ¹ Current management type	(B) * ² Semi-Autonomy type
Capital cost	×	×
Operation & Maintenance Cost	-	-
Salaries and Allowance	×	○
Electricity	×	○
Fuel for vehicle	Δ	○
Chemicals	×	○
Staff training cost	×	○
Materials, parts, supplies	○	○
Others	○	○
Payback remittance to MOFEP	○	×

[Note]

○ --- Paid by Juba station, Δ--- Partly paid by Juba station, × --- Not paid by Juba station

*1 Calculated according to the current management style.

*2 Calculated with the assumption of semi-autonomy management style

The captioned three seminars were held in October. Main theme, target participants and the number of participants are shown as the following table.

Date	Theme	Target	Total number of participants
10/16	Basics of Cost Recovery	SSUWC HQ	25 persons
10/19	Introduction of Water Tariff and Simulation	Juba station Financial dept. accounting section,	
10/23	Improvement of Revenue Collection	Commercial dept. revenue section, meter reader section	

(6) Public tap stands are constructed in 3 locations and operated based on the prepared management method.

Three public tap stands were completed in Juba town, Munuki and Kator area in November 2011. Two management types of private and community managements have been tested since then based on the management contract and procedure prepared. Then an evaluation was made in January in 2012 and recommendations were prepared. Finally, a Management Models for Public Tap Stands was prepared, which is given in Volume II-5.

After studying the issues pertaining to the existing PTS management approaches and taking into account the community arrangements in Juba, the following were recommended as the main elements of the management approach for the PTS kiosks.

The PTS kiosks are the property of UWC and will remain so. The management of the PTS will be **contracted out to individuals who will operate them on a private basis** but in line with a minimum set of standards that are set by UWC and are captured in the Memorandum of Understanding (MOU) signed between the UWC and the contracted operator.

This approach takes into account the interests of the community but benefits from all the advantages of private management. Contracting to individuals had a number of advantages which make it the most suitable method including, but not limited to the following:

- Kiosks will be operated as a business, this means that contractors will be compelled to be vigilant and to report any faults and failures (including leaks) as they affect their daily income.
- Transfer of responsibility to the contractor will reduce administrative time on the part of the UWC.
- Collection of bills will be easier as there is the threat of disconnection and loss of the contract and associated income.

- The process of contracting and managing the contractor is easier as there is only one individual to deal with.
- Individuals can invest personal money in the facility such as the purchase of a tank and stocking of the kiosk with items for sale. This will add value to the service of the facility.
- Responsibility for damages and repair will be easy to trace.
- Contractors will increase pressure on the UWC to perform efficiently.
- Billing will be based on meter reading leading to better cost recovery.
- Billing based on meter reading will also increase flexibility in case of changes in the tariff.
- This model is more sustainable as there is a profit motive for the contractor.

(7) The Study on Management for Tanker Filling Points

The study on management for tanker filling points was made and recommendations were prepared, which are summarized in Progress Report II and give in Volume II-5.

This assessment set out to review the current management arrangements for the TFP with a view to recommending improvements in the model of management. The report was prepared and notes that the current management arrangements have a lot of merit but that there are also areas which can benefit from improvements. Among these are:

1) Enhancing accountability of the contractors

Contracts need to have a time limit at the end of which the performance of the contractor is assessed. The terms of the contracts need to be very clear as at present the contractors do not seem to know any details about their obligations on the basis of the contracts. The provision of competitive bidding for the management contracts needs to be reinforced. Most of the current contractors did not mention that they did a competitive bidding.

2) Documents

Commendably there are not so many documents or red tape in the management of the TFPs. Still, it appears that the daily Water Sales log which operators spend a lot of time filling serves no clear purpose in its current detail. This log needs to be reviewed and some suggestions to this effect are suggested.

3) Remittance of the money

In the original arrangement, contractors had to remit their weekly payments to a bank account and only deliver the receipts to the UWC. It is not clear why this arrangement was changed so that they have to take cash to the UWC as opposed to banking it. The delivery of cash to the UWC creates

additional costs in the handling of the cash and adds to the possibility of its misuse and possible misappropriation by the various parties involved. This also needs to be discussed.

4) Price of water

The price of water at the facility is 2.5 per cubic meter. Of this UWC retains 2SDP per cubic meter with the contractor taking the remainder to pay for his costs and for his profit. A rough calculation of the cost of producing a unit of water at Juba station indicates that it costs about 4.3 SDP to produce one cubic meter of water. In the long run the price of water at the TFP has to be changed to closely correspond with the cost of producing it. At the same time UWC should aim to increase efficiency so as to reduce the unit cost of producing a unit of water. (Based on this recommendation, the water tariff was raised to 4.0 SSP/m³ in the 3rd year term)

5) Opening and closing time

In the daily management routine, regulation of the opening and closing times should insist only on the hours of opening as opposed to the hours of closing which should be left at the discretion of the contractor. Various monitoring tools can be used to ensure that what happens in the evening hours is acceptable. This will allow for the tanker operators to make use of the low consumption times in the evening to load for the next day so as to reduce the line and congestion at the filling points. There is no clear reason right now why the time of closing is stipulated in the contracts.

6) Documentation of sales

When operators sell water, they are obliged to note down in the water log. The format of the log does not seem to add any value (and this can be discussed) The log should be improved to deal with only the essential elements so as to reduce time and resource expenditure.

7) Physical aspects of the site

While this may not be really a management issue, it is pertinent to the total operation of the site. The sites do not have operational toilets. This leads to problems of hygiene in a place where hygiene is of the essence. Arrangements need to be made to ensure that there are toilets at the sites. In the same way the sites need to be paved and channels for excess water created The sites were also not built with proper paving.

8) On the washing of the tanks

In the absence of a comprehensive mechanism of enforcement, there is little that can be achieved with piece meal measures. There is a proposal to have all the tankers that collect water from the TFP periodically sanitized at the UWC. In the procedure, the cleaned tankers would get a sticker which on expiry would obligate the tanker to report for further cleaning. The problem with this approach is that:

- It does not even take a day for the tanker to become quite contaminated if it is used to carry river water.

- At present the proposal is to have this done at no cost and this is not sustainable in the long run and goes against the objective of cost recovery which is the ultimate objective of the transformation that is being introduced at the UWC.
- When a charge for the cleaning service is instituted, then it will become attractive for the tanker operators to evade or find ways out. Therefore this should only be implemented if there is a comprehensive enforcement mechanism which does not exist at the moment.

Owing to these challenges, this assessment recommends that if the cleaning of the tankers is done, it should not be taken as any form of guarantee of quality for the water. Even then, it should not be done at the UWC headquarters or the Juba station ground due to the mess that it is likely to create at the ground with the many tankers that serve Juba.

9) Repair and maintenance

A comprehensive documentation of repairs and maintenance works carried out on the TFPs should be kept. The cost of repairing damages should be attributable to the one who is responsible for the damages while UWC retains the responsibility for repairs to equipment such as meters that need to be accurate. Part of the job of the supervisors should be a regular check on the condition of the site.

(8) Study on Piped Water Service for Domestic Household

The interview survey was carried out to understand current situation of piped water supply service connected to domestic households. During the implementation, the meter readers in the UWC Juba station cooperated with the interviewers and the Project team, primarily in the sampling and the checking of installed water meters. The survey out line is shown as below.

Items	Contents
Purpose	(1) To research current situation of piped water supply service for domestic users by area (2) To understand user's willingness-to-pay for piped service and for water meter installation (3) To understand the level of importance acknowledged by domestic users and the level of user's satisfaction
Period	10 th – 20 th August, 2011
Methodology	(1) Identifying the coverage area where is receiving water through pipeline (2) Visiting the target areas for sampling together with meter readers (3) Implementing interview survey picking up sample households on random-basis after the introduction of area by meter readers

Items	Contents																																																																							
Sampling	<p><u>Survey areas:</u></p> <ul style="list-style-type: none"> - Coverage areas by piped water supply in 3 Payams, Juba Town (main), Munuki, Kator - The samples were taken from all types of domestic customers, classified into 1st - 3rd class users, across the coverage areas - The piped areas where was not receiving water during recent years were principally excluded 																																																																							
	<p><u>Selection of the samples:</u></p> <ul style="list-style-type: none"> - The samples of 73 household interviews were spread across the 16 areas <table border="1" data-bbox="507 607 1026 1149"> <thead> <tr> <th>Survey Date</th> <th>Sampling area</th> <th>Class</th> <th>No. of samples</th> </tr> </thead> <tbody> <tr><td>8/11</td><td>Munuki</td><td>3</td><td>5</td></tr> <tr><td>8/11</td><td>Kuwait</td><td>3</td><td>4</td></tr> <tr><td>8/12</td><td>Kator</td><td>3</td><td>5</td></tr> <tr><td>8/12</td><td>Mahad</td><td>2</td><td>6</td></tr> <tr><td>8/13</td><td>Buluk</td><td>3</td><td>5</td></tr> <tr><td>8/13</td><td>Thourah</td><td>3</td><td>5</td></tr> <tr><td>8/15</td><td>Atla Bara C</td><td>3</td><td>4</td></tr> <tr><td>8/16</td><td>Prison line</td><td>2</td><td>3</td></tr> <tr><td>8/17</td><td>Police line</td><td>2</td><td>3</td></tr> <tr><td>8/17</td><td>Cinema</td><td>2</td><td>2</td></tr> <tr><td>8/18</td><td>Gabat</td><td>3</td><td>4</td></tr> <tr><td>8/18</td><td>Muajifin</td><td>2</td><td>6</td></tr> <tr><td>8/19</td><td>Jesalem</td><td>2</td><td>4</td></tr> <tr><td>8/19</td><td>Mayo</td><td>3</td><td>6</td></tr> <tr><td>8/20</td><td>Amarat</td><td>1</td><td>5</td></tr> <tr><td>8/20</td><td>Marakal</td><td>2</td><td>6</td></tr> <tr><td colspan="3">Total</td><td>73</td></tr> </tbody> </table>	Survey Date	Sampling area	Class	No. of samples	8/11	Munuki	3	5	8/11	Kuwait	3	4	8/12	Kator	3	5	8/12	Mahad	2	6	8/13	Buluk	3	5	8/13	Thourah	3	5	8/15	Atla Bara C	3	4	8/16	Prison line	2	3	8/17	Police line	2	3	8/17	Cinema	2	2	8/18	Gabat	3	4	8/18	Muajifin	2	6	8/19	Jesalem	2	4	8/19	Mayo	3	6	8/20	Amarat	1	5	8/20	Marakal	2	6	Total		
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8/20	Amarat	1	5																																																																					
8/20	Marakal	2	6																																																																					
Total			73																																																																					

The survey results indicates that majority of domestic customers agrees to install water meters and apply the metered tariff rate in future. The main reason is that water meter can show the accurate volume of consumption without mistrust between customers and the UWC. The willingness to pay for the installation of water meter, in contrast, is low amounted for 68 SSP on average. Willingness to pay for general water supply service was also interviewed, the respondents are willing to pay 4.56% of their monthly household income.

Water meters installed in 1950-80s are generally not functioning due to the aging, meanwhile it was newly found that some water meters were installed in the residential houses for governmental officials, during innovation works by the Ministry of Infrastructure. Because the UWC do not have any information on this fact, it was recommended that the UWC obtain the information as soon as possible before installing water meters in the stockyard.

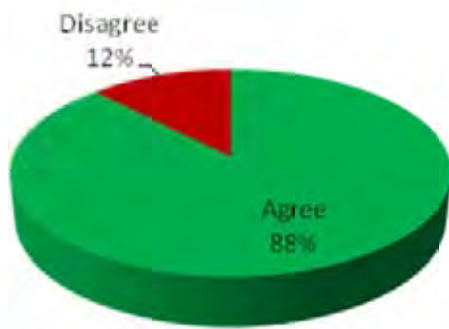


Figure 5-6 Willingness to Installation of Water Meter

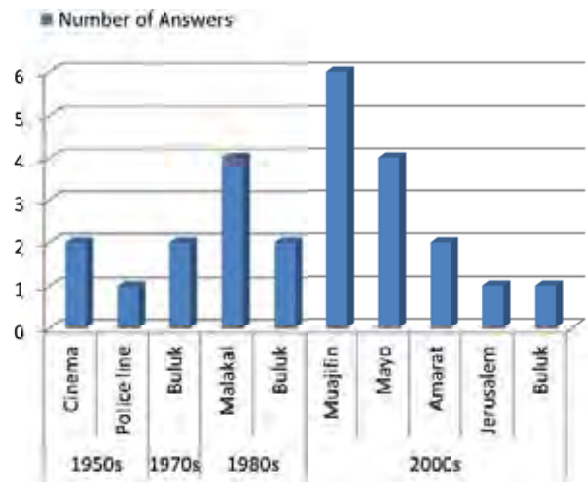


Figure 5-7 Year of Installed Water Meter

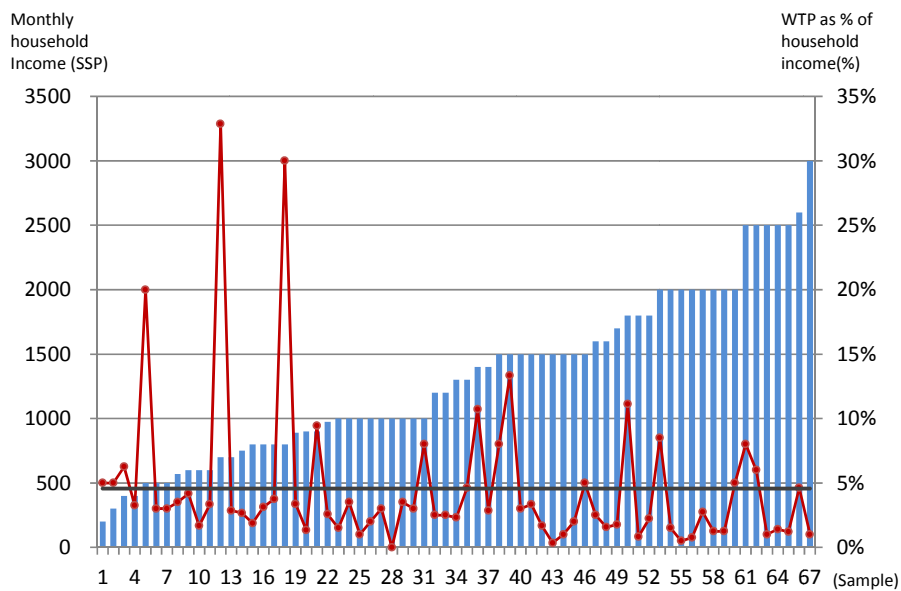


Figure 5-8 Percentage of Willingness to Pay



Photo 1 Water meter installed in the late of 2000s (Jerusalem area)



Photo 2 Water meter installed in 1950s, under the British colonial regime (Police line area)

Additionally, the level of customer satisfaction was clarified in the key aspects of water supply service. Relatively high dissatisfaction can be particularly seen in the factors of “stable and continuous water supply” and “accessibility to teller’s office (Juba station)”. The first issue is assumed to be directly caused by frequent electricity cut, however the UWC needs to take an action to the relevant ministries and the power corporation from the viewpoint of their social responsibility. With regard to the latter issue, it is recommended that the UWC consider opening several teller’s offices in their regional basis points of the coverage areas. The high dissatisfaction may be caused by far distance to the Juba station and also possibly by the current collection system which imposes burden on customer. The overall result is shown the following radar chart.



Figure 5-9 Survey Result of the Level of Customer Satisfaction

(9) Evaluation of Management for Public Tap Stand and Tanker Filling Station

The evaluation for management of PTS was made twice in June and October. The following are summary of evaluation results and recommendations.

The current status of public tap stands installed in this Project and the previous development study, and recommendations are mentioned as below.

State of the New Public Tap Stands (October 2012)

	Facility and location	Operational status	Issues and problems	Recommendations/Actions
1	PTS at Malakia near Kinyokonyo in Kator Payam	Facility is operational. Physical status is good as the facility is clean and well taken care of. UWC reports prompt payment of bills.	Intermittent supply of water due to power problems at the Konyokonyo booster station. Storage tank provided installed in the nearby compound due to security concerns.	The management of this facility is good and the facility serves many people when there is water. Service will improve when water supply is improved. This challenge lies with the UWC.
2	PTS near Juba Market in Juba Payam.	Facility is operational. Due to its location, it has the best water supply of all the PTSs in the study and it serves many people. Payment of bills is regular though UWC officials say that it can improve.	Though the water supply to the facility is good, all of it is taken during the day due to high demand. The only time to fill the tank is at night but there is no one to manage that process.	Storage tanks require a stand, pipe and ball valve. This will allow for night supply to be stored without wastage even if there is no one at the facility. There is also need for security measures to prevent contamination of the water. Arrangement can be made by the operator with UWC for the installation of these. Alternatively, the operator could also invest in this to improve his income.
3	PTS at Munuki in Munuki Payam	Water supply to this facility is intermittent but this is not the problem. The operator contracted for this kiosk is not performing. He does not open the facility.	The main problem with this facility is the operator and the operator has to be changed. It was agreed in June that this operator should be changed but since then no action has been taken by UWC	During this mission, the contract for this operator has been terminated and the process for selecting a new operator has begun.

[Recommendation]

- Two of the contractors are performing well. One has failed. The operator for the new PTYS in

Munuki was not appropriate. However, due to lack of supervision, it was failed to find his replacement in time. The process for the termination of present operator and the selection of new operator has already started.

- The declining sense of community and the lack of interest by residents in communal management of water, the community should be left out of the management arrangement completely.
- Community involvement should be omitted from the management system completely.
- The challenges with the tanks at the kiosks suggest that in the final design of the public tap stands, two additional items need to be considered.
 - If tanks are placed with the new PTS, they need to have some locking mechanisms.
 - Second is the right plumbing to allow water to go into the tank at night without someone supervising. This requires a ball valve so that when the tank is full the water can stop automatically.
 - It is recommended that the tank should be placed on top of the kiosk to secure water safety.

The State of the Old Public Tap Stands in Munuki – October 2012

	Facility and location	Operational status	Issues and problems
1	Stand number 1 – (see map and detail below)	This stand is not in use even though the caretaker is available and does take minimal responsibility.	The main issue is the lack of water. There is no water supply to the facility during day time. Water comes at uncertain times late in the night when there is no one to use it.
2	Stand number 2 – near the church	Not operational.	There is no water supply during the day. Supply at night is also uncertain.
3	Stand number 3 – After the church	Minimally operational but it was impossible to find a caretaker as all people denied the responsibility.	Water comes intermittently and pressure is low. Surroundings of the facility are very dirty and there is no one to own responsibility.
4	Stand number 4 next to the main road	Not functional and all the taps are gone.	There is no supply to the facility.
5	Stand number 5	This one also not operational for a long time	There is no supply to the facility.
6	Stand number 6	This one partly operational with water coming occasionally (perhaps twice a week) early in the morning).	Caretaker appointed as part of the original arrangement has gone away. Lady who lives in nearby house now oversees the facility for cleanliness purposes but does not collect money and denies responsibility for bill payment.
7	Stand number 7	This one gets water about twice a week for about an hour each time.	Lady in nearby home oversees but denies responsibility for paying bills. She says she only oversees to ensure that the place is clean as it is near her home. Meter chamber is broken.
8	Stand number 8	This one gets water occasionally (perhaps once in two weeks according to people in neighborhood and only for an hour or so)	The issue here is poor supply.

[Recommendation]

- There is need to improve supply to the facilities.
- Operation of the facilities needs to be vested in an individual who will have a financial benefit from

the operation in a manner similar to what has been described in the model being tried out with the new PTS.

Situation of Tanker Filling Points - October 2012

	Facility and location	Operational status	Issues and problems
1	Facility at the fire brigade sub station near the ministries	Not operational. There has not been any water for a long time.	The problem here is lack of water.
2	Facility near the hospital elevated tank	Facility is not operational. There is no water supply.	This facility is near to a large storage tank. Therefore it is possible for it so be supplied with water. However, due to the network arrangement, when the facility is allowed to have water, the main line to the ministries does not get water. Overall it is a problem of insufficient supply from the treatment plant.
3	Facility near Hamza Inn (near JICA offices)	Operational and very busy.	Congestion at the site. Overflow creating pools of muddy water and un-hygienic conditions. Breakage to the roads and paving as trucks park and turn.
4	Facility inside the treatment plant yard.	Facility is functional and busy	Congestion at the site. Overflow creating pools of muddy water and un-hygienic conditions. Security and water safety risks with so many trucks coming into the compound when there are insufficient security checks as they come in. Wear and tear to the ground and grass at the treatment yard as the trucks park and turn.

[Recommendation]

- The access route and filling points should be paved.
- The filling which is currently inside of the Juba Station treatment plan be located outside of the treatment plant. But since this was not heeded, it is recommended that standards for cleanliness and water safety as well as security be set and enforced as the trucks come into the treatment plant.
- Supervision of the tanker filling points needs to be improved with regular visits by a UWC supervisor as recommended in the management system.

(10) Test Meter Field

To collect the data for the introduction of water tariff revision and meter reading, the meters were set up to customers in Hai Cinema as test meter field. In test meter field, 4 inch flowmeter and 16 customer meter were set in the test meter field as follows.



Photo 5-3 Test Meter Field (Hai Cinema)

Then, meter reading was conducted twice after the installation, and the following issues were confirmed.

- Examination of the existing capacity of water meter installation and reading
- Data collection of water consumption and understanding of water balance in the test field
- Comparison with current tariff rates
- Identification of the problems in meter reading
- Challenges and recommendation

The confirmed issues on the above points are indicated as follows.

Existing SSUWC's capacity of water meter installation and reading

- Mainly two meter plumbers in the meter reader section, out of four, were involved in installation works. It can be evaluated that these two plumber have SSUWC have basic capacity of meter installation works.
- After the meter installation, water leakages were found from the connection points of 3/4 inch meters at two customer sites. In the one case, the main causes were insufficient screwing of connection parts and inappropriate wrapping by seal tapes. After instructions the Expert, plumbers were able to reconnect water meter with connection parts without leakage and the situation was improved. In the another case, the meter has been replaced by a new 1 inch meter because of the loose attachment fitting parts, and difficulty of reading the counter window with water vapor caused by water infiltration.
- No significant problem was found about the meter reader's capacity on meter reading. Because the meters installed were direct-reading type meter, it is considered that meter reading was

relatively easy.

Confirmation of water consumption data and water balance in the test field

- Water volume of distribution and consumption, clarified from meter reading of the flow meter at the entrance point of Hai Cinema area and the customer meters, and the difference are shown as the following table.

Flow meter	Customer meter	Difference
Volume distributed : 1,016.50 m ³	Volume consumed : 130.28 m ³	886.22 m ³

- There is a large difference as 886 m³ between the distributed and consumed volume. The possible two reasons may be assumed: 1) water leakage from pipeline, 2) existence of overlooked customer.

Comparison with current tariff rates

- Monthly total production cost of the test field was calculated to multiply the consumption volume estimated from the actual meter reading by the unit operational cost. The estimated monthly production cost was compared with current monthly tariff rates, and the financial balance was confirmed. As the results, the level of current flat tariff rates are below the estimated monthly production cost in the customers of all domestic (6) and all NGOs (3).
- The average deficits amount was accounted for 160 SSP in domestic and for 52 SSP in NGOs respectively. From the view point of cost recovery, it can be assumed that domestic customer particularly pay the flat tariff rate setting at significantly lower level than the production cost.

Challenges and recommendations

- Since this activity of test meter filed in Hai Cinema is a pilot case, it is important to continuously follow-up next points for the effective transition to application of metered rates.
 - To continue meter reading of the flow meter and the customer meters regularly (e.g. weekly)
 - To record the result of reading and check the consumption volume
 - To continuously research 1) pipe leakage, 2) existence of overlooked customers
 - To newly install customer meters in the sites of overlooked customers if finding out
 - To replace the meter difficult to read due to water vapor in the counter window (2 customers)
 - To continuously research condition of service connection pipe for the customer who have no or limited supply
 - To make new connections to improve supply status if the above customer wishes
- It is necessary for SSUWC to purchase consumable parts for water meter connection such as union, nipple, reducers etc. and stock a certain amount of them in order to make meter installation

smoothly. The Project team checked and purchased these necessary parts in advance before the installation work, however additional purchase was required after starting the work because to change the connection methods and the connection points was frequently occurred. The diameter and types of connection parts for frequent use are seemed to be narrowed, thus it is significant to purchase and stock extra parts more than necessity based on the plan.

- It is expected to ensure billing and collection practice for these customer in the test field if their receiving water, since it is relatively easy to know exact water supply status.
- Continuous analysis on water consumption balance in the test field and the level of current tariff rates is important based on the reading record.

(11) Assistance of preparation of survey sheet for existing meter condition

Water meters were installed in the residential areas of governmental officers by the Ministry of Housing during renovation works. The detail of meter conditions such as installed customers, meter functionality, diameter etc., however, is not known well by SSUWC Juba station. Thus Juba station just launches a research by meter readers from September 2013.

5.1.6 Project Activity of Output 5

(1) Definition of Roles of SSUWC HQ and SSUWC Juba Station

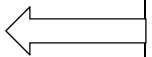
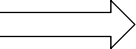
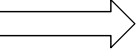
1) Main Functions of Headquarters

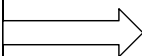

The main functions of the headquarters in SSUWC to assists the stations/areas are summarized as follows.

1. Developing guidelines and standards for stations activities
2. Enforcing rules, guidelines and standards to the stations
3. Overseeing the implementation of policies, strategies and plans
4. Gathering information on performance of stations
5. Monitoring and evaluation of performance of the stations
6. Guiding and directing of implementation
7. Assisting Board of Directors in decision making

The following table indicates activities and functions of the headquarters and stations/areas.

Table 5-14 Activities and Functions of Headquarters and Stations

Stage	HQ's Activities/Functions	To Stations	To HQs	Station's Activities/Functions
<u>Analysis and Planning stage</u>	<u>Developing</u> <ul style="list-style-type: none"> - guidelines on service provision of stations - operational standards for adoption relating to the whole process of development of water services including design, construction, operations and maintenance of water systems. - standards on water quality of drinking water - guidelines for <ul style="list-style-type: none"> ✧ business planning, financial projections, setting of tariffs, annual report, monitoring water quality, accounting, etc. <u>Setting rules, establishing standards and guidelines</u>		Data and information Human resource	<ul style="list-style-type: none"> - Preparation of data and information - Dispatch human resource for analysis and planning
	<u>Planning of overall Corporation's activities</u> <ul style="list-style-type: none"> - Performance targets/Change management - Human resource development (training) - Procurement and contracting - Capital investment - Budget 	Guidance and direction for planning	 Submission of the station's plan to Headquarters	Planning of station's activities <ul style="list-style-type: none"> - Performance targets/change management - Human resource development (training) - Procurement and contracting - Capital investment - Budget
<u>Implementation Stage – Doing (D)</u>	<ul style="list-style-type: none"> - Accounting for the Corporation - Human resource management for the Corporation - Auditing for the Corporation account - Research and development activities - Monitoring of stations performance and give intervention - Capital investment project 	Guidance and direction for implementation		<ul style="list-style-type: none"> - Perform operation and maintenance of facilities - Monitor and conduct water quality test - Maintain standards and specifications (?) - Coordinate with consumers, local government and NGOs - Creating an enabling environment ensuring sound management approaches making it sustainable and developing - Collect and remit revenue
<u>Evaluation stage – Checking (C)</u>	<u>Overseeing the implementation of policies and strategies relating to provision of water services.</u>	Guidance and direction for	<u>Reporting</u> performance to HQs (Monthly,	

Stage	HQ's Activities/Functions	To Stations	To HQs	Station's Activities/Functions
	<p>Gathering information on water services from stations</p> <p>Monitoring and evaluating of the performance of stations</p> <p>Publishing forecasts, projections and information on water services of stations</p>	monitoring and evaluation	Quarterly, Annually)	
				-
Action (A)	<p>Reform initiatives (change management)</p> <p>- Continuous assessment of change management programs and strengthening/developing successor programs to maintain organizational performance momentum.</p>	Guidance direction and for change manement		<p>- Planning change management</p> <p>- Perform change management</p>

2) Activities by Directorate

The following figure summarizes the main activities of the directorate of SSUWC headquarters.

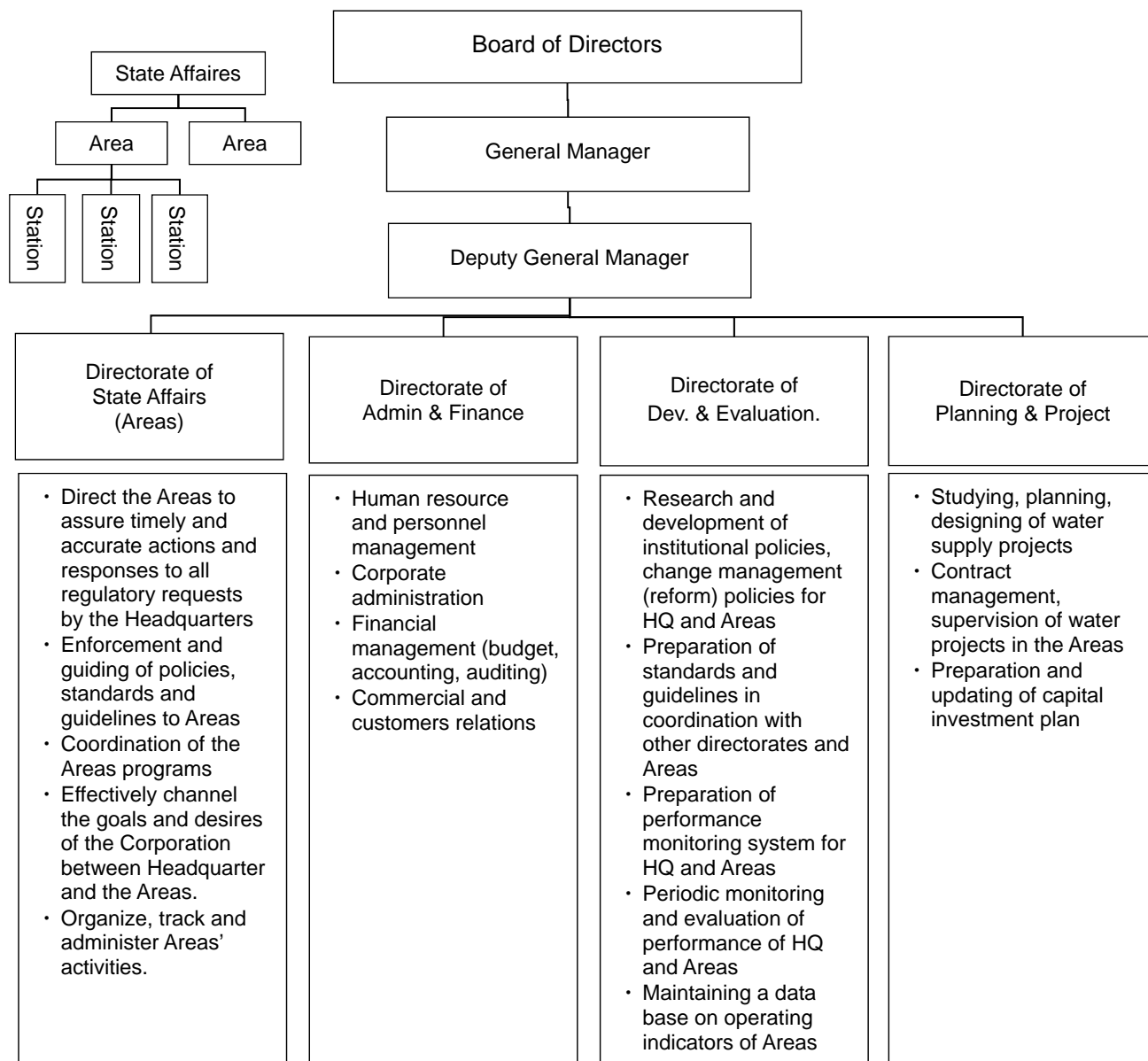


Figure 5-10 Activities of Directorate in SSWUWC Headquarter

Note: Currently, SSUWC has only “Stations” but in future, it would have “Area,” under which stations would be belonged and which is equivalent to a state level of UWC.

Activities of each directorate of SSUWC headquarters were discussed with the counterparts.

(2) Preparation for Contents of Corporate Plan of Headquarters

An example of planning and management methodology for water works was explained to the counterparts..

Firstly the Corporate mid-term plan for headquarters is required as quickly as possible. Under the plan, each station or area shall prepare each mid-term plan. The following are table of contents adopted and modified from the Corporate Plan in National Water Supply and Sewerage Corporation in Uganda in discussion with the key personnel of SSUWC headquarter and Juba station.

1) Overall Contents

Corporate Plan for SSUWC
CHAPTER 1: Background (Water Sector in South Sudan)
CHAPTER 2: Review of Previous and On-going Activities (Capital development, human resource development, etc.)
CHAPTER 3: Situation Analysis (SWOT)
CHAPTER 4: Vision, Mission & Strategic Goals For 2011-2013
CHAPTER 5: Corporate Strategies for 2011-2013

2) Detailed Contents

CHAPTER 1: Background <ul style="list-style-type: none">1.1 The Water Supply Sector in South Sudan1.2 Policy Framework1.3 Legal Framework1.4 Regulations and standards1.5 The South Sudan Urban Water Corporation1.6 The Corporate Planning Process1.7 Justification for the Corporate Plan1.8 The Business Environment
CHAPTER 2: Review of Previous and On-going Activities <ul style="list-style-type: none">1.1 Introduction1.2 Current Operation Review1.3 Capital Development Projects 2006-20111.4 Major Challenges in 2006-2011
CHAPTER 3: Situation Analysis (SWOT) <ul style="list-style-type: none">1.1 The Strength, Weaknesses, Opportunities and Threats (SWOT) Analysis1.2 Strengths1.3 Weaknesses1.4 Opportunities1.5 Threats1.6 Conclusion of SWOT Analysis

CHAPTER 4: Vision, Mission & Strategic Goals for 2011-2013 Corporate Plan

- 4.1 Introduction
- 4.2 Vision
- 4.3 Mission
- 4.4 Core Purposes
- 4.5 Core Values
- 4.6 Corporate Strategic Goals 2011-2013
- 4.7 Area Strategic Goals 2011-2013
- 4.8 The Annual Targets for the FY 2011/2012

CHAPTER 5: Corporate Strategies 2009-2012

This is an example of corporate strategies. These strategies shall be revised according to the SSUWC priority.

- 5.1 Introduction
- 5.2 Internal Reforms and Restructuring
- 5.3 Revenue Maximization
- 5.4 Cost Rationalization
- 5.5 External Services, Research and Development

(3) Establishing the Rule on Submission of Reports and Plans by Stations/Areas

1) Frequency of report preparation and submission

The following reports shall be prepared by stations and submitted to the headquarters at periodical basis.

- 1. Monthly report:
 - Update of monthly operation data and performance indicators
 - The submission shall be within 10 days after the end of the respective month.
 - The first report shall be prepared for the operation in August 2011 and submitted in September
- 2. Quarterly activity reports:
 - Summary of quarterly activities
 - The submission shall be within 15 days after the end of the respective month.
 - The first report shall be prepared for the period of August and September 2011, and the second October to December.
 - In every 6 month, a half year report shall be prepared combining 2 quarterly activity reports, which is required for the national budgetary rule.
- 3. Annual report:
 - Annual report is a summary of 4 quarterly reports.
 - The submission shall be within 30 days after the end of the respective month.
 - The first annual report shall be summarized the activities for the period of August 2011 to June 2012, which shall be prepared in July 2012 and submitted August 2012.

2) Contents of Reports

a) Annual Report in SSUWC

The table of contents of the first annual reports for July 2011 to June 2012 shall be as follows:

Section 1.	Introduction
Section 2.	Targets July 2011- June 2012
Section 3.	Strategies July 2011-June 2012
Section 4.	Performance July 2011– June 2012
Section 5.	Constraints 2011/12
Section 6.	Status of externally funded projects
Section 7.	Appendices
	Operational performance indicators
	Financial data

b) Quarterly Activity Report

The table of contents of the review of performance for the period of August - September 2011 is as follows. Subsequently, the detailed contents of quarterly activity report shall be shown. (At present, SSUWC has not yet prepared quarterly Activity Report.)

Section 1: Introduction
Section 2: Performance Targets for the FY 2011/2012
Section 3: Performance July 2011– September 2011
Section 4: Constraints Encountered During July 2011- September 2011
Section 5: Status of Capital Development Projects as at September 2011
Section 6: Financial Performance July 2011– September 2011
Section 7: Appendices

1.0 Introduction

2.0 Performance Targets for the Fy 2011/2012

3.0 Performance July 2011 – September 2011

3.1 Performance of implemented special strategies

3.2 Operational and Financial Performance for the Period July 2011 – September 2011

3.10.1 Operating Income

3.10.2 Water Production

- 3.10.3 Non Revenue Water (NRW)
- 3.10.4 Staff Productivity Index (SPI)
- 3.10.5 Collection Efficiency
- 3.10.6 Installation of Kiosks/Public Stand posts
- 3.10.7 Extension of Water Mains
- 3.10.8 New Water Connections
- 3.10.9 Metering Status

4.0 Constraints Encountered During July 2011-September 2011

5.0 Status of Capital Development Projects as at September 2010

5.1 Financial status of Capital Development Projects as at September 2011

6.0 Financial Conditions

6.1 The Income Statement for the Period July 2011- September 2010

6.2 Performance of the Cash Budget

3) Monthly Report

The monthly report includes operational and financial data and performance indicators. These data will be itemized by the following categories considering the existing activities of SSUWC Juba station.

1. Production
2. Distribution
3. Water quality
4. Sales, collection and customer data
5. Finance
6. Administration

(4) Establishing Meetings with Stations/Areas

1) The submission of reports and plans to the headquarters is scheduled as shown in the table below.

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
2011									start	QR		
2012	QR			QR	SP		QR	AR		QR		
2013	QR			QR	SP		QR	AR		QR		

QR: Quarterly activity report, AR: Annual report, SP: Station plan

2) Meeting Schedule with Stations/Areas

The meeting will be held in the following guidelines.

a) Frequency: Quarterly and annually

The first meeting with Juba station will be held with Juba station in October, 2011

b) Agenda

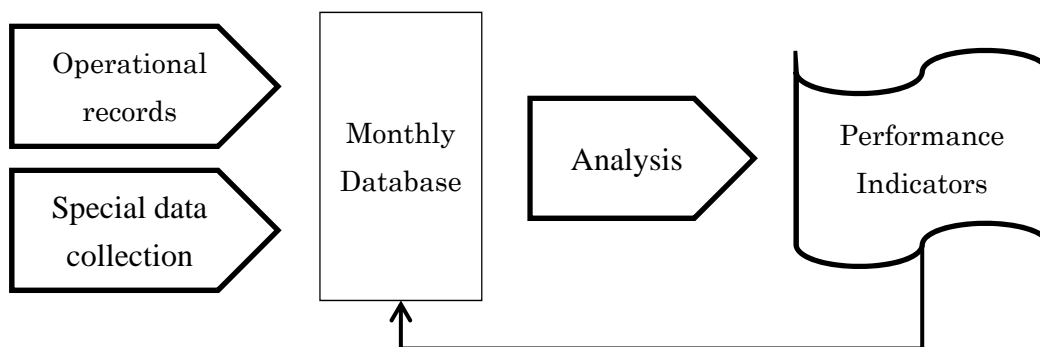
- Explanation of the reports and plans by stations/areas
- Discussions on the contents
- Finding solution for the improvement of the service

(5) Performance Indicators in the Plan and Report

One of the most important items in managing the Corporation and stations/areas and to be included in the report is performance indicators, which enables to track the progress of activities and improvement.

1) Operational data and performance data collection and database maintenance

Operational records including technical and financial data shall be collected by Juba station and stored in the monthly database constructed in Juba station. The same database is kept in the headquarters and monthly it should be updated by station. In the database, performance indicator shall be included and once the data is input, monthly performance indicators shall be automatically calculated.



2) Performance Indicators for Headquarters

The following are possible indicators for the headquarters.

a) Quantitative:

1. The number of activity reports submitted by Stations (Frequency x the number of stations)
2. The number of completed reports out of total number of report submitted

3. The number of meeting held with the areas and attended areas
4. The number of summary reports prepared from areas reports
5. Overall performance of SSUWC (picked up from major performance indicators for areas: see the table below)

b) Qualitative:

6. Preparation of short and midterm Corporate Plan
7. Preparation of guidelines and standards for stations/areas
8. Degree of autonomy (financially) achieved

3) Performance Indicators for Stations

The following table of performance indicators is prepared based on water supply sectors in Uganda and Kenya and IBNET indicators, considering the situation of Juba station, which is proposed for Juba station. In the table, the headquarter indicators are mentioned as major Corporation indicators.

Target Parameters	Perspectives	HQ PIs
- Increase service coverage from XX% to XX%	Customer	Yes
- Install XXX nos./year of new water connections.	Customer	
- Average hours of supply from X to xhours	Customer	Yes
- Water quality supplied (residual chlorine)	Customer	Yes
- Increase of average tariff	Customer	Yes
- Enhance customer care and ensure effective response to customer complaints within XX hours.	Customer	
- Raise turnover from SDG XXX million to SDG XXX million	Finance	
- Achieve a net profit before tax of SDG XX million	Finance	
- Reduce average debt age for arrears from X months to X month.	Finance	
- Increase of average revenue per unit volume of supplied water	Finance	Yes
- Reduction of unit cost of operation per unit volume of supplied water	Internal process, finance	Yes
- Ensure that total staff costs as percentage of operating costs are limited to not more than XX%.	Internal process, Finance	
- Achieve a working ratio (operating costs exclusive of depreciation to operating revenue) of 0.XX.	Internal process, Finance	Yes
- Reduce overall non-revenue water (NRW) from XX % to XX%	Internal process, Finance	Yes
- Increase collections from SDG XXX million to SDG XXX million per month.	Internal process, Finance	

Target Parameters	Perspectives	HQ PIs
- Increase the collection ratio from XX% to XX%	Internal process	Yes
- Increase water production from XXX cubic meters to XXX cubic meters per day.	Internal process	Yes
- Carry out mains extensions of XXX kms	Internal process	
- Metering ratio (global or bulk users)	Internal process	Yes
- Pipe breaks per year expressed per km of the water distribution network	Internal process	
- Maintain staff productivity at X staff per 1,000 connections.	Learning and growth, Internal process	Yes

- (6) Training on necessary skills for supervision of planning and designing of water facility construction is provided to the personnel of SSUWC HQ.

A series of seminars on design and planning of water supply facilities were held given by following details. In seminars the expert made presentation to attendances followed by discussion.

➤ Participants:

- Headquarter: Eng. Joseph Ebere Amosa, Eng. Khor Guang Loa, Mr. Biel Nyuot Nhial,
- Juba Station: Eng. Santurino Tongun, Eng. Hassan Aggrey Yousif, Eng. Ciegen Madding, Mr. Christopher Philip

➤ Time: 10:30 – 12:00 in 30th Nov to 6th Nov.

➤ Venue: SSUWC Training Room

➤ Materials: 1. Juba Urban Water Supply Master Plan

2. Basic Design Report for Juba Water Supply Improvement (Grant aid project)

➤ Agenda: See following table. The detailed seminar presentations on the outline of planning and designing of water supply facilities are given in Volume IV-5.

Table 5-15 Agenda of Seminar on Design and Planning of Water Supply Facilities

S.No.	Date		Topics	Contents
1	30 Nov	Wed	Cancelled	✓ Cancelled due to no attendant
2	1 Dec	Thu	1. Project Cycle 2. Master Planning 1 & 2	✓ Plan, design, construction, operation cycle ✓ Assessment of existing conditions ✓ Target year and population and area served, ✓ Demand estimation
3	2	Fri	3. Master Planning 3	✓ Distribution zoning ✓ Facility capacity calculation ✓ Water supply source and intake site ✓ Design of purification plant ✓ Transmission and distribution system ✓ Implementation plan
4	5	Mon	4. Master Planning 4 (Project Evaluation)	✓ Cost estimation ✓ Financial and economic assessment ✓ Environmental impact assessment
5	6	Tue	5. Basic Design	✓ Design criteria (Area and population served, per capita consumption, etc.) ✓ Scale of project ✓ Outline of facilities ✓ Facility design specifications (Intake, WPP, transmission, reservoir, distribution and PTSs and TFPs) ✓ Operation and maintenance cost

Training on design and planning were held seven times as shown below in 3rd year term.

No.	Date		Topics	Contents
1	19 Nov	Mon	Overall	• Outline of Grant Aid Project
2	20	Tues	Purification 1	• Coagulation process, Design of Sedimentation
3	21	Wed	Distribution 1	• Hydrology for pipe design
4	22	Thu	Purification 2	• Sand Filter Design
5	23	Fri	Distribution 2	• Water demand, Reservoir design, pump design, transmission and distribution, and leakage
6	26	Mon	Purification 3	• Disinfection and Chlorination
7	27	Tues	Distribution 3	• Distribution network analysis and Network design

(7) Evaluation of Reports and Plan prepared by Juba Station

Monthly reports were prepared for September and October in 2011, and submitted to the SSUWC Headquarters. Then, they were evaluated by SSUWC HQ together with MWRI staff. A reporting system and report evaluation method were compiled in a manual. After the examination, following recommendations and comments were made by SSUWC HQ, MWRI and the expert to improve the contents of reports and performance of Juba Station. The monthly report continues has been submitted to SSUWC HQ and evaluated.

A preliminary draft annual report and action plan was prepared by Juba station and the expert and submitted to the Headquarter in February in 2012. A meeting to discuss about the contents was held in the General Manager's Office and a presentation on the contents was made mainly by the counterparts assisted by the experts. Then, a discussion was made between the Headquarter and Juba Station and the final plan was submitted at the end of February in 2012.

(8) Study on the Existing Water Supply Facilities and Services of 4 Stations by SSUWC HQ

The database of SSUWC stations shall be prepared in the SSUWC Headquarter. For this purpose, the contents of the database were discussed among SSUWC Headquarter and Juba Station, MWRI, the expert and GIZ. As a result, database collection formats were prepared including asset data to be collected by a GIZ project and the general questionnaires of MWRI. Then, the database formats were revised based on the results of field survey in Wau and Malakal. The final database format of stations is given in Volume II-6.

The field surveys in Wau and Malakal were carried out with following schedule and participants.

- Purpose: Collection of Data of Local Stations
- Member of party: Mr. Khor Guang Loa, Mr. El-fetech Rihan and H. Sato
- Schedule:
 - (1) Malakal: 1st – 3rd February in 2012
 - (2) Wau: 6th – 8th February 2012

The outline of the database is as follows:

- 1 Summary Sheet
- 2 Existing Assets
- 3 Service Level
- 4 Finance
- 5 Customer Service
- 6 Operation and Maintenance
- 7 Organization
- 8 Status of On-going Project

(9) Additional Works

In order to enhance the capacity related to “Output4 understanding of financial conditions of SSUWC-Juba station is enhanced” and “Output 5 capability of SSUWC HQ to support SSUWC-Juba station is enhanced”, the fence installation works, for land acquisition of tanker filling station by Japanese grant aid project, were carried out.

In order to enhance the capacity related to Output4, after the lands are acquired for water supply facilities by Japanese grant aid project, it is necessary to develop the basis for adequate financial analysis and future financial simulation. Although SSUWC Juba-station should carry out the fence installation works, the capacity of the project supervision is low. Therefore, in order to enhance the capacity related to Output5 as well, the fence installation works were supported by this project.

5.2 Training Activities

The participants and the total number during the Project period (1st Year Term – 4th Year Term) were shown as the following table. 3,105 people have been participated during the period. Since the main activity is not training itself but guidance and improvement through on-the-job training in 4th year term, the number of training itself has been decreased.

Table 5-16 Summary of Training Implemented

Training	Nos. of persons				TOTAL
	1 st Year Term	2 nd Year Term	3 rd Year Term	4 th Year Term	
OUTPUT 1	170	326	37	3	536
OUTPUT 2	47	270	50	13	380
OUTPUT 3	99	191	35	15	340
OUTPUT 4	82	58	29	14	183
OUTPUT 5	27	64	54	0	145
OUTPUT 1-5 (Training for data analysis and preparation of monthly report etc.)	150	154	64	150	518
WEEKLY MEETING	76	256	380	291	1,003
Sub Total	651	1319	649	486	3,105
TOTAL	3,105				-

5.3 Subcontracting Work

The following subcontract works were done.

(1) Flow meter chamber

Eight (8) and four (4) flow meter chambers were constructed in the 2nd and 3rd year, respectively. After completion, meters were installed and reading has been done. Based on the record of meter reading, distribution flow management plan (pump operation plan) has been prepared. The pump operation plans were attached in the technical documents (Volume III-4).

(2) Public tap Stand

Three (3) public tap stands were constructed at Juba town, Munuki, and Kator in the 2nd year. After completion, the facilities have been operated and managed as a pilot based on the established operation model of public tap stand. Finally, an operation model of public tap stand was prepared. The materials is attached in technical documents (Volume II-5)

(3) Temporary fence

To ensure financial sustainability of SSUWC in future, proposed facilities of Japanese grant aid are essential and acquisition of land for these facilities is must. In the 3rd year, the requirement to construct temporary fences surrounding these lands was occurred in coordination with grant aid project. This subcontract work was made for the purpose to construct temporary fences to acquire grant aid facilities and enhance supervisory capacity of SSUWC HQ.

5.4 Achievement of Outcomes

(1) Achievements of Output 1

<p>Output 1: Capacity of SSUWC-Juba Station with respect to operation and maintenance of water intake and treatment facilities is improved.</p>
<p>Objectively Verifiable Indicators (OVIs)</p> <p>1-1. Monthly reports and annual reports in which O&M data is compiled.</p> <p>1-2. Annual plan on water treatment plant.</p> <p>1-3. The number of staff who acquired adequate O&M skills for WTP increases from 0 to 11 persons.</p> <p>1-4. Plant average operating hour per day increases from 17.9 hours (2011 average) to 22 hours/day</p> <p>1-5. The monthly average ratio that the quality of treated water with respect to turbidity is below 5 NTU increases from 90% to 100%.</p> <p>1-6. The monthly average ratio that the quality of treated water with respect to residual chlorine falls in the range between 0.7 mg/l and 1.2 mg/l increases from 10% to 80 %.</p>

Output 1 is evaluated to have mostly been achieved judging from the assessment on the implementation of activities as well as the levels of staff’s capacity in O&M of water intake and treatment facilities.

The capacity of the purification department’s staff in O&M of the water intake and water treatment plant (WTP) has been strengthened by a series of training activities that have been conducted by the JICA Expert Team throughout the Project period as well as the overseas training in Kenya. According to the results of examination, it was assessed that eleven staff out of the 25 trained staff in the

purification department have acquired basic O&M skills for WTP (OVI 1-3).

Under the technical guidance provided by the JICA Expert Team, staff of the purification department have conducted a baseline survey for understanding the status of the intake pumping system and WTP, maintained daily records of O&M, and prepared the O&M plan. In cooperation with C/Ps, the JICA Expert Team prepared O&M manuals and SOP so that staff can conduct proper O&M without an assistance of Experts. Staff have mastered proper O&M methodologies including injecting appropriate amounts of chlorine and carrying out back wash. This has led to an improvement in the water quality; the turbidity of treated water constantly stays below 5 NTU in contrast to the monthly average ratio of 79% in 2011 (OVI 1-5) while the ratio of residual chlorine that falls within the target range (0.7 – 1.2 mg/l) improved from an average of 31% in 2011 to 91% in April 2013 (OVI 1-6).

Staff have become able to use a computer and produce monthly reports from the daily monitoring records of the volume of treated water, chlorine consumption, and operation of generators, which is a substantial improvement from their original skill level and understanding about O&M (OVI 1-1). The department staff fully understand the importance of daily monitoring, with the thorough checking and cleaning of facilities having become their routine activities. With the support by the JICA Expert Team, main C/P developed 3 annual plan for 2011 and 2013, which included the performance targets for water quality, water production, and pump operation, as well as the statements on outstanding problems, activities for addressing the problems, and required resources (OVI 1-2). Although staff can prepare monthly reports on their own through simple calculation and the filling out of the format developed by the Project, their analytical and planning capacity needs further improvement.

As for the operating hours of WTP (OVI 1-4), it is deemed difficult to achieve 22 hours per day by the end of the Project period under the condition in which SSUWC generates its own power by purchasing fuels for generators from collected water bills. When the baseline data was collected, SSUWC was receiving a relatively stable supply of electric power, which allowed WTP to be in operation for 17.9 hours per day on average. The target plant operating hours (22 hours/day, OVI 1-4) was determined at the time of the baseline survey in 2011 based on the assumption that WTP would receive a stable power supply from the city. Although the direct line from the city power was connected in January 2012, the power supply has been unstable and completely stopped since January 2013. Although the current average plant operating hours is 13.7 hours per day, the operating hours is expected to be increased even without external power supply, as a result of the forthcoming increase in bill collection in 2013 following the adoption of the strategy for efficient billing, new water tariff and improved water quality (see (4) “Achievements of Output 4” for details).

(2) Achievements of Output 2

Output 2: Capacity of SSUWC-Juba Station with respect to operation and maintenance of water transmission and distribution facilities is improved.

Objectively Verifiable Indicators (OVIs)

OVI 2-1. Monthly reports and annual reports in which O&M data is compiled.

OVI 2-2. Annual operation and maintenance plan on O&M of water transmission and distribution facilities.

OVI 2-3. The number of staff who acquired adequate O&M skills for transmission and distribution increases from 0 to 10 persons.

OVI 2-4. Application of a formulated Pump Operation Plan by the Project is started in 2012.

Output 2 is evaluated to have mostly been achieved judging from the achievement levels of its indicators.

Survey activities conducted under the instruction of the JICA Expert Team led to an improvement of the understanding of the distribution department staff on the distribution pipelines, the working condition of transmission and distribution facilities, and the transmission water flow. Based on the survey of the water supply service and existing transmission and distribution facilities, the Pump Operation Plan was developed in 2012 (OVI 2-4); however, treating and distributing water according to the plan was difficult due to the unstable power supply. Since January 2013, the city power has been completely suspended. Staff of the distribution department then calculated possible operation hours of electric generators, based on which they revised the Pump Operation Plan, as the station is obliged to use only diesel for its operation.

Staff of the distribution department and other departments had never used a computer for data management and report writing before the Project started. The JICA Expert Team provided hands-on training on the use of a computer, and then the staff became able to compile data by themselves, as monthly and annual reports in the computer (OVI 2-1), on the operation of the transmission and distribution facilities including the volume of water flow, cases of water leakages and repairs, and the number of installations or replacements of pipes. Additionally, the JICA Expert Team has provided practical training in proper O&M in water transmission and distribution. GPS/GIS was introduced for identifying water leakages and recording newly installed distribution pipes. Based on the oral and written examination, the JICA Expert Team recognized that 10 out of the 13 trained distribution department staff have acquired adequate O&M skills for the operation of transmission and distribution facilities (OVI 2-3).

With the support by the JICA Expert Team, staff of the department developed the annual operation and maintenance plan in 2011 and 2012 covering performance targets in water flow and repairs of water leakages as well as outstanding problems, activities for addressing the problems, and required

resources (OVI 2-2). Due to the lack of budget for purchasing necessary materials for proper O&M, the number of repair works against the cases of water leakages has not been sufficient. It is recommended that continuous efforts be made to generate more revenues to secure the proper maintenance of the distribution network.

(3) Achievements of Output 3

Output 3: Capacity of water quality management of SSUWC-Juba Station is improved.
Objectively Verifiable Indicators (OVIs) OVI 3-1. Water quality management report (monthly and annual) in which water quality monitoring data is compiled. OVI 3-2. The number of staff who acquired adequate water quality test skills increases <u>from 0 persons to 2 persons.</u>

Output 3 is evaluated to have been achieved judging from the achievement levels of its indicators. While all training under Output 3 has been conducted as planned, a longer time frame than originally expected was needed for the lab staff to comprehend basic ideas of water quality tests including the concept of unit and simple arithmetic. Continuous On-the-Job Training (OJT) by the JICA Expert Team and repeated experiments have enhanced the water quality test skills of the two lab staff (OVI 3-2).

The water testing lab staff collect samples daily from WTP, weekly from pumping stations and elevated tanks, and monthly from water tap stands and tanker filling stations in Juba City, and conduct water test on turbidity, residual chlorine, pH, conductivity, Total Dissolved Solid (TDS) and color. After training in basic computer literacy and the preparation of the data format, these staff became able to develop monthly reports compiling the results of daily water tests.

The staff members of SSUWC Juba station has frequently requested microbiological laboratory. Given the current limited capacity of the water test laboratory (i.e. the staff and facilities), the training of the existing staff in testing more parameters including microbiology is difficult. Equipping the water test laboratory with qualified staff and proper facilities is essential in order to cater to the need for water quality tests.

(4) Achievements of Output 4

Output 4: Understanding of financial conditions of SSUWC-Juba Station is enhanced.

Objectively Verifiable Indicators (OVIs)

OVI 4-1 Revenue collection reports are prepared monthly.

OVI 4-2 Recommendations on revenue collection improvement are made.

OVI 4-3 Management method of public water tap stands is established.

Judging from the achievement levels of its indicators, Output 4 is evaluated to have mostly been achieved. In cooperation with the staff of the financial department, the JICA Expert Team conducted a study on the actual situation of the revenue collection in the Juba Station. Based on the analysis of the cost structure, recommendations on the improvement of revenue collection and water tariff have been put forth in the budget plan and the annual plan of the Juba Station (OVI 4-1 and 4-2). The recommendations have been reflected in the increase of the water bills. In view of the forthcoming financial independence of the Juba Station, the JICA Expert Team provided training in the concept of tariff setting and cost recovery for the existing operation of the Juba Station.²

Based on this training, Juba station prepared revised with metered tariff rate and sent it to SSUWC HQ and MEDIWR. It has not been approved but Juba station started to exercise it for the purpose of cost recovery.

In consultation with the staff of the financial department, the JICA Expert Team developed a customer ledger database to be used for compiling customers' information and issuing bills, which contributed to an achievement of efficiency in bill collection. Staff of the financial department participated in the training in Kenya on the metered system for house connection and customer services. In addition to the training for the management of customer ledger, the JICA Expert Team has also provided basic computer training for the staff. As a result of a series of these training activities, the staff have acquired skills to prepare monthly reports through extracting data from the database (OVI 4-1); the routine of compiling information to develop reports has been well established. However, there are still four major challenges that could hinder effective revenue collection: (1) the insufficient number of staff who distribute bills; (2) a large number of unidentified consumers using SSUWC's water for free; (3) the lack of a map indicating the location of customers; and (4) inadequate budget for purchasing water meters and other materials required for house connections.

Through the activities of collecting the baseline information, staff of the SSUWC Juba Station have gained better understanding on the station's financial situation, status of installed water meters, and level of customer satisfaction. Following the pilot operation and studies on the management models

² SSUWC developed the interim tariff to maintain the operation and maintenance of existing facilities after the training.

for public taps and tanker filling stations, the JICA Expert Team recommended that the public taps and tanker filling stations be managed by individual operators (OVI 4-3). In preparation for increased public taps and tanker filling stations, the Project has developed a draft contract and data log sheet for site operators. When the JICA’s Grant Aid project, “The Project for the Improvement of Water Supply System of Juba in South Sudan” (2012-2015), is completed, additional 120 public taps and eight tanker filling stations will be in operation in 2015.³ Since the Juba Station will be required to manage a large number of site operators and monitor their activities, the financial staff’s capacity in contract management needs to be strengthened.

(5) Achievements of Output 5

Output 5: Capacity of SSUWC-HQ to support SSUWC-Juba Station is enhanced.
Objectively Verifiable Indicators (OVIs)
5-1. SSUWC HQ examines the monthly reports submitted by SSUWC Juba Station every other month.
5-2. The number of annual reports and plans that SSUWC HQ examined becomes 2 each.
5-3. The existing water supply facilities and services are inputted into the established database.

Output 5 is evaluated to have been achieved judging from the achievement levels of its indicators.

With the guidance and instruction by the JICA Expert Team, SSUWC HQ has been carrying out the evaluation of monthly reports submitted by the Juba Station in accordance with “The Roles of SSUWC Headquarters and Reporting and Planning System”. SSUWC HQ has been holding a review meeting with the management staff of the Juba Station, examining monthly reports submitted by the station, and providing feedback to the station every month (OVI 5-1). SSUWC HQ also reviewed and assessed annual reports and the up-coming year’s plan of the Juba Station in 2011 and 2012 (OVI 5-2). While the structure of providing feedback and guidance to the station has been established, continuous efforts to support the Juba Station as well as other area stations are required for strengthening the newly established organizational structure.

The Project conducted a study on the Wau and Malakal stations to collect information on their facilities and status of service delivery. Along with the information on the Juba Station, the data on the Wau and Malakal stations was compiled in a report (OVI 5-3).⁴ The study presented the current

³ The Juba Station currently manages four out of six public taps and one out of four tanker filling stations. Two public water tap stands and three tanker filling stations are out of order due to insufficient water flow.

⁴ The Project did not conduct survey in other area stations due to safety concerns.

situation of each of the three area stations; however, it is still unclear as to how SSUWC HQ is going to incorporate and reflect the compiled information in its planning and management.

5.5 Achievement of Project Purpose and Overall Goal

(1) Project Purpose

Project Purpose: The management capacity of SSUWC-Juba Station is enhanced through capacity development on operation and maintenance of water supply facilities.
Objectively Verifiable Indicator (OVI)
1. <u>80% of 25 essential performance indicators</u> set in the annual plan which are measurable at the SSUWC Juba Station is improved compared to the 2011 average.

The main 25 performance indicators (PIs) are shown below along with the results of September 2013 and the 2011 average values. Of the 25 main indicators, 23 are higher than the average values of 2011. Target achievement rate has reached at 92%, which is significantly higher than 80% of the target value.

As for average pump operation hours per day of the Konyokonyo pumping station, it is expected to achieve the target in October 2013 since the operation for 4 hours as a target operating hours was started from the middle of September. As for the number of invoices of water tariff, SSUWC had sent the invoices to customers who do not get water supply form SSUWC before, but now, they do not send the invoice to such customers. In addition, the policy of Juba station is to collect large bills from large volume users at first. Now the large volume customers are improving. Therefore, it is expected that the number of invoices to households will increases.

Table 5-17 Essential Performance Indicators

		Indicators	Unit	Monthly average in 2011	Sept in 2013	Evaluation
Production						
1	P1	Average daily production volume (estimate)	m3/day	5,208	5819	OK
2	P2	Average plant operating hour per day (estimate)	hours/day	17.9	19.7	OK
3	P3	Average daily clear water pumping station operating hours	hours/day	28.2	38.9	OK
4	P4	Gap between design capacity and actual production	m3/day	1,992	1381	OK
5	P5	Operating ratio (actual average production/design capacity)	%	72	80.8	OK
6	P6	Operating ratio (actual average operation hours/24 hours)	%	74	82.1	OK
Distribution						
7	D1	Average daily pump operation hours of Hospital PS	hours/day	5.8	6	
8	D2	Average daily pump operation hours of Konyokonyo PS	hours/day	1.5	0.6	OK
9	D3	Total transmission and distribution flow from WTP	m3/day	4,928	6350	OK

		Indicators	Unit	Monthly average in 2011	Sept in 2013	Evaluation
10	D4	Percentage of No. of leakage repaired in No. of leakage reported	%	55	100%	OK
11	D5	The number of days that data on pipe maintenance is recorded per month	days/month	0	30	OK
Water Quality						
Daily Sampling (purification plant)						
12	W1	Compliance ratio of turbidity	%	79	100%	OK
13	W2	Compliance ratio of residual chlorine	%	31	100%	OK
Weekly sampling (tank in the city)						
14	W3	Ratio of days that sampling was conducted to required total weekly sampling days	%	43	75%	OK
15	W4	Ratio of actual samples to the total number of required weekly samples	%	19	85.7%	OK
16	W5	Compliance ratio of turbidity	%	77	100%	OK
17	W6	Compliance ratio of residual chlorine	%	13	100%	OK
Monthly sampling (tap in the city)						
18	W7	Ratio of days that sampling was conducted to required total monthly sampling day	%	63	100%	OK
19	W8	Ratio of actual samples to the total number of required monthly sample	%	42	100%	OK
20	W9	Compliance ratio of turbidity	%	76	100%	OK
21	W10	Compliance ratio of residual chlorine	%	14	100%	OK
Sales						
20	S1	Number of bills delivered	num	545	472	
21	S2	Amount of bills delivered	SSP/month	249,348	288,087	OK
24	S3	Bills issued/ a total number of connection	%	16	69%	OK
25	S4	Collected amount (SSP)/ a total amount billed	%	21	50%	OK

(2) Overall Goals

Overall Goals:

- 1. The quality of the water supply service extended by SSUWC-Juba is improved.**
- 2. The management capacity of SSUWC HQ is improved.**

Objectively Verifiable Indicators (OVIs)

1. The customer satisfaction on water supply service of SSUWC-Juba Station is enhanced.
2. All essential performance indicators are further improved from the final date of the Project.
3. All reports and plans submitted from area stations are assessed and guidance is given back to them.

The prospect for achieving the Overall Goals within three to five years after the project completion is promising judging from the achievement levels of its indicators; however, the limited power supply is likely to hinder the achievement of the Overall Goals.

According to the Social Condition Survey for Water Supply Service conducted by the Project in April 2013, the customer satisfaction rate on SSUWC’s water supply service (OVI 1) has increased from 22.4% in 2010 to 36.4% in 2013. Staff of the Juba Station received comments from customers that water quality had improved. The elements of current dissatisfaction of SSUWC’s water supply service include irregular water supply, short service hours, insufficient water supply and low water pressure. However, water treatment plant becomes a 24-hour operation in September 2013, the operation of the water distribution pumping station is also operating as planned, water supply by area is done on time. Therefore, at present, those customers’ satisfaction is improved further.

Evaluation of 25 main PIs (OVI 2) was made in the previous section and it has achieved 92 percent already in September 2013. In the future, it is expected to be 100%.

Following the evaluation checklist developed by the Project, SSUWC HQ reviews and evaluates monthly reports and annual plans submitted by the Juba Station. Since SSUWC HQ has carried out the reviewing process multiple times, SSUWC HQ is already capable to assess reports and plans from other area stations (OVI 3) as well. However, without proper guidance and attention, area stations other than the Juba Station are unable to prepare and submit reports to SSUWC HQ. There is a need for discussions in SSUWC HQ in relation to how to extend support to other area stations and promote coordination among donors that support respective stations.

5.6 Prepared Documents

(1) Reports and Documents

Year	Output
1 st year	Plan of Operation (1 st year)
	Inception Report (Ic/R)
	Work Plan (1 st year)
	Project Activity Progress Report (1 st issue)
	Completion Report (1 st year)
2 nd year	Plan of Operation (2 nd year)
	Work Plan (2 nd year)
	Project Activity Progress Report (2 nd issue)
	Project Activity Progress Report (3 rd issue)
	Completion Report (2 nd year)
3 rd year	Plan of Operation (3 rd year)
	Work Plan (3 rd year)
	Project Activity Progress Report (4 th issue)
	Project Activity Progress Report (5 th issue)
	Completion Report (3 rd year)
4 th year	Plan of Operation (4 th year)
	Work Plan (4 th year)

Year	Output
	Project Activity Progress Report (6 th issue)
	Completion Report (4 th year)
	Project Completion Report

(2) Technical Reports and Documents

The technical reports and documents prepared in the project are attached in Annex. The list of documents is below.

Annexure (Technical Document)

VOLUME I: CURRENT STATUS

1. Baseline Survey Results of Juba Station
2. Current Status of Tariff Collection from House Connections
3. Current Management Status of Public Tap Stands
4. Seminar Materials for Understanding of Financial Situation and Introduction of New Water Tariff

VOLUME II: MANUALS

1. Reporting and Planning System
2. Water Quality Monitoring and Operation and Maintenance of Water Purification Plant (Revised)
3. Operation and Maintenance of Transmission and Distribution Facilities
4. Revenue Collection Database
5. Management Models for Public Tap Stands and Tanker Filling Points
6. Roles of Headquarter, Reporting and Planning System and Database of Stations
7. Record Format and Database

VOLUME III: REPORT AND PLAN

1. Monthly Report of Juba Station
2. Performance Indicators
3. Database of SSUWC Stations
4. Pump Operation and Water Distribution Plan
5. Performance Evaluation for March 2011 to May 2012 and Annual Plan for July 2012 to June 2013
6. Performance Evaluation for July 2012 to June 2013 and Annual Plan for July 2013 to June 2014
7. Budget Plan for Juba Station for Fiscal Year 2012/2013
8. Budget Plan for Juba Station for Fiscal Year 2013/2014
9. Report on 2nd Social Condition Survey for Water Supply Service
10. Mid-term Evaluation Report
11. Terminal Evaluation Report

12. Report on the Management Models for Tanker Filling Points
13. Report of the Assessment of the Management and Operation of the Public Tap Stands and Tanker Filling Points
14. Report of the Physical Inspection of the Facilities
15. Report of Test Meter Field and Meter Reading results

VOLUME IV: TRAINING MATERIALS

1. Training Materials for Water Intake and Treatment Facilities
2. Training Materials for Transmission and Distribution Facilities
3. Training Materials for Water Quality Management
4. Training Materials for Management Model for Public Tap Stands and Tanker Filling Points
5. Training Materials for Outline of Planning and Designing of Water Supply Facility
6. Public Awareness Materials

VOLUME V: PRESENTATION MATERIALS

1. 1st JCC Meeting (1st year term)
2. 1st Progress Seminar & 2nd JCC Meeting (1st year term)
3. 2nd Progress Seminar & 3rd JCC Meeting (2nd year term)
4. 3rd Progress Seminar & 4th JCC Meeting (2nd year term)
5. 4th Progress Seminar & 5th JCC Meeting (3rd year term)
6. 6th JCC Meeting (4th year term)
7. Seminar on Cost Recovery, Introduction of Water Tariff, Improvement of Revenue Collection
8. HQ Management 1
9. HQ Management 2
10. Draft Annual Plan and Annual Budget (2012)
11. Final Seminar

5.7 Joint Coordination Meeting

Joint Coordination Meetings (JCC) and seminars were carried out as follows. The minutes of the meetings are attached in Appendix A.

Item	Date	Contents	No. of Participants
1 st JCC Meeting	19 th November 2010	Explanation of Inception Report	15
2 nd JCC Meeting	7 th April 2011	Project Progress Report (1 st Year Term)	25
1 st Seminar			
3 rd JCC Meeting	15 th November 2011	Project Progress Report (2 nd Year Term)	27
2 nd Seminar			Same as above Water tariff and financial evaluation
4 th JCC Meeting	22 nd February 2012	Explanation of Mid-Term Evaluation	25
5 th JCC Meeting	29 th November 2012	Project Progress Report (3 rd Year Term)	33
3 rd Seminar			
6 th JCC Meeting	5 th June 2013	Explanation of Terminal Evaluation	32
4 th Seminar			Same as above Final outputs

(1) 1st JCC Meeting

The contents of IC/R including the first year's activities were presented by the Chief Advisor of JICA Project Team. The South Sudan side in principle agreed the contents of the IC/R with the following comments.

- The appropriateness of the counterpart personnel which was agreed between the GOSS and JICA on March 2010 is reexamined by General Manager, SSUWC and confirmed
- The South Sudan side feels that training in the third country is important for the staff of UWC Juba station.
- The South Sudan side would like to have the recommendations and proposals on water tariff structure for individual customers and tanker filling stations. Currently, the water tariff for water tankers is cheap but individual customers pay a lot of money to tanker sellers. In addition, the seminars on water tariff shall be held ahead of schedule. The South Sudan side thinks the seminars in the third and fourth year are late.

It is agreed that the Southern Sudan side will do the required undertakings stated in the IC/R.

(2) 2nd JCC Meeting

In the meeting, the progress of the project and contents of DP/R were presented by the JICA project team members. The Counterpart Team understood the progress of the project and both side shared the

current situation of SSUWC and their problems. The following are comments of the counterpart team.

- To operate the purification plant for 24 hours under the current frequent power cut situation, a hot line from the power supply company to the plant is required. The target values of 23.5 hours for plant operation hours were agreed if 2 generators, one of which was currently under repair, were operational.
- To control water distribution flow in the city and repair leakage without interruption of the purification plant operation, zone valves are required. The counterpart requested the Project Team to consider these valves. The Project Team replied that a plan of water supply zoning will be prepared at the next stage, in which the location of zoning valves will be planned.
- The counterpart of the laboratory section mentioned that micro-biological test was required and the capacity for this would be strengthened in future. The Project Team replied that it was difficult to introduce micro-biological equipment in the existing laboratory. However, test kit might be feasible. In any case, in the first instance, residual chlorine should be strictly controlled so that microorganism was not occurred.
- The counterpart team understood that the leakage control was of most importance for the very old asbestos pipes buried in the city and requested the Project Team to include leakage control program. The project replied that it was difficult to include in the current project. However, we would introduce the adequate process of leakage repair for prompt repair.
- The counterpart team understood that the outcomes of the project were very useful and these should be introduced to the other towns of SSUWC.
- The counterpart understood that once they understood the current conditions of water supply services and the report was prepared, they could sell it and found financial source for further improvement.

In the meeting, the target values of project indicators were also discussed by both sides and decided.

(3) 3rd JCC Meeting

The both sides discussed on the progress and bottlenecks/problems for the project and understood that the project does not have any significant bottleneck to be solved. Only one thing to be solved is the space for training room. The existing training room was recently occupied for other purpose. The General Manager/Project Director promised to find the suitable space for the training room. Finally, the both sides confirmed that the current progress is on track and the project shall continue according to the original plan for the second year term and as scheduled. The outline of the issues discussed is shown below.

- Insufficient English and arithmetic ability of UWC staff were pointed out and acquisition of these abilities requires considerable time. The project team answered we understood the importance of these ability, but these insufficiencies can be supplemented by the team work each together.

Anyway, Juba station will start English training supported by the project team and the project team has been teaching basic arithmetic as far as time is available.

- Multiple management types shall be tried for management of the public tap stands constructed. The project team answered that we will adopt the most suitable type selected based on the evaluation results of existing public tap stand management.
- The current training for the laboratory is to improve chemical and physical analysis ability. The Counterparts understood the capacity building for water quality analysis would be complete when the laboratory acquires chemical, physical and biological analysis abilities.
- MWRI is establishing the urban water database. The data collected from local stations by the project team shall be shared with them for the database.
- The MWRI has the mandate to ensure safe drinking water. MWRI thinks the monthly meeting with SSUWC and the project team is of importance to understanding the performance.
- The both sides confirmed that the target of the Project would be aimed at operation and management of the Japan's grant aid facilities.
- The board of directors for SSUWC will be formed. The project team shall identify the area of development that may be raised in the board meeting.

(4) 4th JCC Meeting

A JCC meeting on the results of mid-term evaluation was carried out and both sides agreed on the contents of the mid-term evaluation report. For details, refer to the mid-term evaluation report.

(5) 5th JCC Meeting

Issues, bottlenecks and major activities were discussed in the meeting. First, change of performance indicators in PDM are discussed and agreed (refer the revision of PDM). Subsequently, Chief Advisor has made following request to SSUWC.

- To promote the preparation of the annual plan (2012/2013), participation in training by the counterparts shall be promoted further and budget management is needed.
- The headquarters shall lead a regular meeting with other stations to discuss the challenges of other stations.
- For the purpose of the advice and supervision, more participation in the management of SSUWC by MWRI is required.

This request was understood to JCC members and the promotion of these items was agreed. In addition, the following recommendations were made by the Chief Advisor .

- In order to ensure the transparency of the water rate and increase of bill collection, metered water tariff shall be promoted.

- The various working procedures and systems prepared for Juba station shall be extended to other stations. At the same, an action plan of headquarters shall be prepared.

In addition, the request of the followings was made by the JCC members.

- Project Manager requested the training of leakage control and training of the detailed design of grant aid projects.
- JCC members want to have the long-term training in Kenya Water Institute at (KEWI)
- JCC members hope a permanent water testing laboratory

Finally, the activities in the following year term were agreed.

(6) 6th JCC Meeting

A JCC meeting on the results of terminal term evaluation was carried out and both sides agreed on the contents of the terminal evaluation report. For details, refer to the terminal evaluation report.

CHAPTER 6 ISSUES AND COUNTERMEASURES DURING PROJECT OPERATION

6.1 Issues and Countermeasures

Public infrastructure and facilities, including the South Sudan Urban Water Corporation (SSUWC) were severely damaged because of the civil war in Sudan. Many of the SSUWC employees have not received adequate basic school education, and cannot read and do basic arithmetic. Political and economic disorders also followed at the end of the civil war. Under such conditions, various issues were encountered during the implementation of this project. A practical approach was adopted for the issues that occurred during the project and a flexible response was taken. The major issues that occurred and their measures are indicated below.

(1) Activating communications

Issue:

Initially, there were no opportunities for communication between departments and between employees. It was not clear what problems occurred and what activities took place in each department. The result was a situation where facility repairs were neglected and only ad-hoc operation and maintenance was implemented as response. Especially, it was difficult to respond to issues and to resolve them by cooperation that transcended the boundaries of a department or a section.

Measure:

Weekly meetings with counterpart were started at 9:00 am every Monday from the beginning of the Project. Initially, members did not assemble on time, the number was very small, and meetings were abandoned many times; however, with perseverance and under the guidance of the Project Team, the meetings continued up to the third year. Gradually, the counterpart led the meeting, and even in the absence of experts in the fourth year, the weekly meetings were held periodically under the guidance of SSUWC staff. Meetings are being held using the format of reports. Now, weekly meetings have reached a count of more than 100. During the meeting, the last week's activities, this week's activities, required resources, and so on, are explained by each department, work is being coordinated and issues are being resolved through discussion among departments. Separate meetings are being held to discuss measures to resolve important issues where concerned staff members assemble. Now the expert team only monitors the meetings and gives guidance when required.

(2) Enhancing basic skills

Issue:

The level of technical training is low because the staff members have not received basic education. Basic education consists of the three elements below.

- Many of the staff members cannot speak and read English, which is the official language
- Staff members who cannot speak English communicate with each other in local Arabic but they cannot read and write the language. (Low literacy rate)
- Many of the staff members cannot do basic calculations. Some staff members cannot even read flow meter values.

Measure:

Although it was evident that imparting English education to staff would incur considerable time, their desire to study the language was strong. Therefore, English training was given, thereby ensuring motivation at the same time. Basic arithmetic operations including counting of objects were taught. Employees were hungry to learn and they attended the classes with great interest. Although the training period was short, the motivation to learn and participate was raised. Since the experts' time was limited, training was given only during the first year. Improvements to education require long-term measures. Henceforth, all staff members need to receive basic education for the water supply companies to develop.

- (3) Fostering leaders and assigning responsibility/efficient and effective training by simplifying formats and using explanatory diagrams

Issue:

Giving the same training to all staff members was difficult because the education level varied from elementary school completed level to high school graduation level. Both education and literacy levels of operators of facilities were low. Appropriate training in the operation of facilities is essential for such operators. It was difficult for the Expert Team to communicate with staff members who understood only Arabic or local language.

Measure 1:

Initially, the target was to give the same training to all, but it became evident that such a target was impractical. Firstly, education and training were given to leaders with a strong desire to learn; subsequently, OJT was given to operators in the local language through the leaders. Enhancing the same skills of all persons was judged to be difficult; responsibilities were assigned such as responsibility of data collection, data entry, analysis and preparation of reports, and so on.

Measure 2:

- Initially, the content included data analysis and reports as in Japan but the trainees could not understand the content; therefore, the substance was reduced and the content was simplified.

Measures were adopted such that when figures were entered in the empty columns, analysis could be performed automatically.

- As far as possible, visual materials were used together with explanatory diagrams, tables and display boards as educational materials since many of the employees could not read. Explanatory diagrams and tables were affixed on the building wall, and at these locations, leaders conducted outdoor training periodically.
- Operation and maintenance manual was prepared, but was not used effectively because this manual was in text form and could not be read by all. For this reason, Standard Operation Procedure giving work procedure was prepared abundantly, and operation and maintenance procedure was taught through OJT using this SOP.
- Display board indicating SOP was installed at important O&M locations and routine inspection locations, and the content was taught to operators on site.

- (4) Efficiency in work and understanding operating status by upgrading computer skills and converting records to digital data

Issue:

At the start of the project, there were only two personal computers at the Juba station. All work was being performed manually. Only a few persons knew how to use the personal computers. It was almost impossible to understand the status of operation and maintenance since data related to operation and maintenance, water tariff collection and financial data did not exist.

Measure 1:

Twenty personal computers were purchased and installed in various departments. One room at the SSUWC Headquarter was used for training and as a personal computer class. For all levels of staff, training was implemented in introductory, basic and mid-level courses depending on computer skill level. The introductory level started with how to switch the personal computer ON and OFF, use of the mouse, and also included the use of WORD and EXCEL. Presently, there are employees that can even analyze data and prepare reports. The ability to use the personal computer also became linked to enhancing the motivation of employees with respect to work.

Measure 2:

Preparation of formats for the collected operation and maintenance data and input of data also started in parallel with personal computer training. Customer database and bill collection system were integrated in the personal computer and hand-written customer data was converted to digital data. Invoices could also be printed out. Formats were modified, added and sometimes simplified during the course as required. Presently, data of about 26 months has been collected. This data is contributing effectively to understanding the operation and maintenance status and to the preparation of

improvement plans.

(5) Ensuring work and training motivation

Issue:

Although staff members were anticipated to participate actively and spontaneously in training, it did not happen. It was also difficult to keep in mind the interests of the staff members toward work and training.

Measure 1 (teaching by repetitive tasks):

Various work report samples (early weekly meeting report, standard operating procedure, performance indicator table, monthly report, plan, etc.) were prepared under the guidance of the experts regardless of whether counterpart could or could not prepare these on their own. At a later stage, repetitive practice was given in preparation of reports by re-using the prepared samples of reports. Also, experts guided the counterparts on how to explain the results at seminars and other occasions. As a result, reports could be prepared periodically by the trained counterparts after about one year of guidance on repetitive tasks.

Measure 2 (giving incentives):

Incentives mentioned below were given to increase motivation toward work and training. Such incentives have also contributed to improving efficiency of work. The Expert Team instructed SSUWC to offer incentives to staff who performed work actively and vigorously, but this could not be implemented due to budget limitations.

- English training
- Personal computer training
- Giving materials and equipment (equipment to inject chlorine appropriately, bikes for operation and maintenance and for water tariff collection)
- Giving wireless radio sets for communication
- Best Performance Award for work, Best Score Award for Tests and so on, announced and conferred during weekly meetings
- Dispatch of staff to training in third country or to Japan

Measure 3: Training in a third country and in Japan

Since the Expert Team found that motivation of staff members was enhanced after they returned from dispatch to a third country for training (Kenya) the first time, this training was continued, and as many trainees as possible were sent to the third country for training. After their return, the motivation of staff members to work was enhanced. Similarly staff members were also sent to Japan for training in the Project and training by JICA. Especially, the motivation and commitment to work of the staff members

sent for training to Japan increased tremendously. Staff members trained in advanced technologies and effective operation and maintenance in Japan are now actively working as core staff at the Juba Station.

Measure 4 (Public Awareness activities):

Actively publicizing of this project and the SSUWC water supply service was proposed during the mid-term evaluation. For this purpose, school awareness activities were implemented in the third year term. Guidance was given to the counterpart, plans prepared for awareness activities, and the actual activities were implemented by the counterpart. The content of the activities is listed below.

- Preparation of “Water is life” the theme song of SSUWC
- Holding the school painting competition with water as the theme
- Quiz related to water at school
- Study tour of water treatment plant for school children
- Explanations of water treatment process using model until treated water is generated (coagulation-sedimentation and filtration tests, water quality tests)
- Question and answer session with school children

All the topics above were implemented by the counterpart. The counterpart explained the definition of safe water and how water supply facilities work using posters to elementary and middle school children visiting the plant during their social study tours. Through preparations and actual activities for such events, the counterpart exhibited leadership, and enhanced their commitment and motivation to work. The social study tours were broadcast by the local TV station.

(6) Inadequate financial resources and unstable power supply

Issue:

At the start of the training, the country was known as Southern Sudan, but , the Republic of South Sudan became an independent state in July 2011. Later, with the outbreak of the oil field conflict, oil revenues to South Sudan were cut off and the nation had to embark on fiscal austerity measures. SSUWC, which was dependent on national finance derived from oil revenues, was also forced to operate on a tightened budget. For this reason, the power supply to water supply facilities became unstable after 2012, and power supply to the city was totally cut off from January 2013. Budget allocation even for fuel for running emergency generators could not be expected from the government.

Measure:

- It became necessary to self-procure fuel for emergency generators. The Finance Department was instructed to raise the water tariff collection rate as far as possible. Application was made to the SSUWC Headquarters and the Ministry of Water Resources and Irrigation to increase the water tariff, based on the water tariff setting that enables cost recovery as calculated during the training

for this project. Although this request has not yet been approved, the Juba Station has been billing on the basis of the new water tariff. The result is that income increased, and it became possible to purchase more fuel than before.

- At the same time, operating time plan for treatment plant and pumps, and proposal for required fuel plan were studied. In accordance with this plan, the treatment plant and pumping station were operated by running the two emergency generators alternately within the bounds of available funds. Moreover, guidance was given on the preparation of a revenue plan with the aim of increasing the revenue from tariff by expanding the water supply areas and the water supply amounts.
- However, one of the two generators failed and repairs had to be carried out. As a result, in a month where water supply was less, the water tariff collection rate also became proportionately smaller. The production of stable treated water and its distribution is still the biggest bottleneck. The city power supply was restored in September 2013, and almost 24-hour operation is underway.

(7) Improvement in awareness to personal hygiene

Issue:

Initially, garbage littered and animals prowled in the treatment plant premises, and the areas outside the fence of the premises became garbage disposal sites. There was no awareness that the plant was a facility producing drinking water. Such a low level of awareness to hygiene affects safety of tap water produced by the water treatment plant significantly.

Measure:

The SSUWC management voluntarily decided to clean up the premises and outside the premises of the water treatment plant after the Expert Team raised the topic “Safe and clean water is produced in a clean water treatment plant” at the weekly meeting. The SSUWC Managing Director, Headquarters staff members, Juba Station staff members totaling about 100 persons cleaned up the entire water treatment plant for the first time. Subsequently, regular cleaning is being carried out every Friday. Moreover, the staff members have voluntarily planted ornamental plants within the premises. Such improvement in awareness to beautification and awareness to personal hygiene has contributed to increasing the awareness of the staff members to produce safe water.

6.2 Increase in Work Processes Established as a Result of the Project

Transfer of technology to individuals is the main purpose of the technical cooperation project. Acquisition of technology is important in the first stage. It is important that a series of organizational processes (procedures) is established in the workflow in the next stage. The technical cooperation

project has constructed and established the processes listed below.

(1) Weekly work improvement process

The weekly meetings are being held at a fixed time every week by representatives of each department. During this meeting, activity reports of the previous week, this week's activities, issues, explanations on required spare parts, discussions and improvement methods are discussed. This has become the work improvement process for each week.

(2) Discussion and work improvement process for each term

Presently, the meetings below are being implemented as work processes. Activity reports and work improvements of all departments are discussed through these meetings. The Joint Revenue Meeting is being held at the rate of once in about two months. Improvement measures for revenue collection are being discussed across departments.

- Weekly meetings
- Monthly report preparation and evaluation meeting
- Joint Revenue Meeting
- Annual report preparation and plan evaluation meeting

(3) Work performance monitoring process

Performance indicators (PI) were set. A series of processes such recording operation and maintenance data, entering data into electronic forms, data analysis, preparing PI values and so on, is being implemented continuously. As a result, the work performance has become visible, improvements to work can be understood and plans can be formulated easily.

(4) Performance evaluation – plan preparation process

Work is evaluated every month by PI. Monthly operation and maintenance report and annual plan are being prepared, and annual process such as evaluation of plans is being implemented by the SSUWC Headquarters.

(5) Water quality control and treated water feedback process

Water quality monitoring plan including sampling locations, frequency, test items, water quality standards was formulated. This plan enabled water quality conditions such as quality of source water, treated water and tap water to be understood. The results of this monitoring plan are fed back and the water treatment process is adjusted. A feedback process was formed for improving the water treatment from a series of water quality control processes.

(6) Water treatment process

Every operator of the water treatment plant is now able to implement a series of water treatment

operating processes on his own.

- Checking of intake facilities (removal of substances blocking intake)
- Optimization of coagulating process (coagulant dosage according to turbidity of raw water)
- Periodic desludging of settling tank
- Optimization of filter basin operations (backwash)
- Inspection of residual chlorine and its adjustment

(7) Formulating water transmission and distribution plan and implementing processes

Operating plan for water transmission and distribution pumps is prepared according to the operating hours of the water treatment plant. This plan is implemented by a series of processes. The plan is announced at the weekly meeting, and subsequently all pumping stations are notified. Pumps are being operated by operators based on this operating plan. As a result, water is being supplied equally to all supply areas at a determined time every day presently. This plan is also distributed to the Sales Section so that the staff members in water tariff collection section can know how much of water has been supplied to which area at what time, which assists the staff members in water tariff collection.

6.3 Change in Awareness of Staff Members

At the start of the project, there was no awareness of targets in any work. Through the technical cooperation project, not only transfer of technology, but change in awareness of the counterpart and changes in various attitudes shown by the actions below (increase in problem awareness and working attitude) became visible.

- Number of employees chatting under the mango trees decreased and so did the time spent there
- Awareness of keeping the water treatment plant clean increased
- Operation and maintenance records began to be maintained every day
- Work processes began to be implemented continuously
- Turbidity and residual chlorine could now be controlled and awareness toward quality of supplied water increased
- Staff members now discuss issues among themselves and resolve them.
- Repairs are now being carried out promptly provided funds are available.
- Water tariff was increased so that operation and maintenance expenses can be covered. Staff members have become self-reliant.
- Commitments made during training and meetings, and timings are being adhered to.
- Employees are now working by coordinating with staff members of other departments.

6.4 Analysis of Factors that Contributed to Achieving the Outcomes

Sufficient outcomes were confirmed after the technical cooperation project. Factors that contributed to the achievement of the sufficient outcomes are discussed here.

(1) Aiming to create a virtuous operating cycle

Public enterprises with unsatisfactory services have often fallen into a vicious cycle. This project has given assistance recognizing the need for SSUWC to break out of the vicious cycle and enter a virtuous cycle so that it can develop on its own in the future.

The project improved the quality of supplied water remarkably, improved the water tariff collection rate by operation according to treated water production plan and water transmission and distribution plan, and raised the water tariff. Consequently, an increase in revenue, purchase of fuel, increase in operating hours of the water treatment plant, increase in water transmission and distribution hours, increase in quantity of supplied water, and furthermore, an increase in tariff collection could be anticipated leading to a virtuous cycle. However, the water supply quantity decreased after power supply to the city stopped. Areas with unsatisfactory water supply increased, so non-payments increased and the virtuous cycle stopped. On the other hand, efforts to increase revenue and improve water supply services are being continued by staff members. Power supply was restored on September 7, after a period of nearly eight months. Re-start of the virtuous cycle can be anticipated henceforth.

(2) Encouraging self-reliance of water supply companies

The Expert Team gave guidance to the construction of operation and maintenance system up to the end of the second year. After the third year, activities were gradually taken over by the counterpart based on the constructed system to encourage self-reliance. Presently, almost all activities are implemented by the counterpart.

Measurement of performance indicators enabled visualization of operations. The staff members began to understand the importance of data and to set targets for improvements. The setting of targets by the counterpart is the first step toward self-reliance.

The skills of individuals need to be continually enhanced, processes established and increased, and systems need to be implemented continuously for self-reliance in operating water supply system. For this purpose, enhancement of skills for making plans continuously and independently, and spontaneously conducting activities and making improvements according to these plans are necessary.

(3) Increasing motivation of staff members

During the project, motivation of staff members dropped frequently because of delay in handing out salaries or handing out half the salaries. The drop in motivation of the staff members is directly linked to the reduction in training participation rate and drop in the desire to make

improvements. The project gave various kinds of incentives, as mentioned earlier, and made efforts to maintain motivation and to enhance it. During events such as social study visits of elementary and middle school students to the water treatment plant, the staff members shared knowledge on matters such as planning the content, preparing the necessary materials, selecting the visitation route, how the water supply system is operated, how important it is for the students to understand the system, and so on. Such activities led to increasing the motivation of the staff members toward their own work. In the future, the SSUWC Juba Station should introduce appropriate personnel evaluation system and incentive system on its own, and should formulate measures to raise the motivation of staff members.

(4) Special nature of cooperation with Japan and confidence building measures

The change in intentions and actions of the counterpart is attributed to the special nature of cooperation with Japan. The cooperative activities have led to confidence building measures for the counterpart, raised common awareness mutually, and laid the foundation for implementing technical cooperation smoothly. Building a trust relationship with the counterpart is an important aspect in Japanese technical cooperation through day-to-day joint work

- Assistance by giving every possible help

Under the Japanese technical cooperation project, the dispatched Japanese experts enter the same site as the counterpart, transfer technology practically through OJT and classroom lectures, and improve the work conditions jointly. That is, the experts are aiming to improve skills by steady teaching through giving every possible help. They are making adjustments to the course to suit the various levels of staff members sometimes lowering the level to the level of individual staff member and guiding them patiently. Japanese style cooperation is a bottom-up method to enhance skills; it differs considerably from the style of many other donors who use the top-down approach for improvements in work. This bottom-up cooperation builds up trust with the counterpart and enhances cooperative effects. Such an approach also plays a useful role in developing friendship between the two nations.

- Importance of communications

Communications with onsite staff members is an essential aspect in the technical cooperation project. Mutual understanding with staff members on site who can understand only Arabic or local languages may be difficult; however, the experts persevered to transfer technology through onsite staff members who could speak both languages and English. Weekly meetings were held, a platform for communications between staff members was established, and sharing of information and joint resolution of problems across departments was attempted. The counterpart's personal computers were placed in the Expert Team's office and work was done here. Calculation of performance indicators and jointly preparing reports were carried out as routine work.

- Flexible response to suit the needs

English ability, computer skills and arithmetic skills of the staff members were limited and became inhibiting factors. The Expert Team however, picked up the needs at various points of time from the counterpart, adopted a flexible approach, and succeeded in enhancing the skill levels of the staff members. This became possible because activities were performed jointly at all times ensuring proper communications.

- Sharing work by Japanese working style

The Expert Team not only improved technical skills but also showed how work should be done. Basic work methods including maintaining cleanliness in the water treatment plant producing drinking water, adhering strictly to start time of training and lectures, and adhering to commitments, were encouraged through weekly meetings and other meetings. The staff members understand and pay respect to the Japanese characteristic of diligence to work.

6.5 Project Impeding Factors

(1) Unsteady supply of power to the city

Minimum operable facilities should be available for enhancing the skills for operation and maintenance of water supply facilities, and these facilities should be operable. This project has been struck by power failures every day, complete stoppage of power supply to the city for eight months (Jan. to Sept. 2013), shortage of fuel for emergency generators due to tightening of budget, and inability to procure fuel from within the city. For this reason, achieving an increase in the operating hours of the water treatment plant, which was the target, became difficult. Moreover, training itself had to be suspended many times because of power failure in the training room and stoppage of operation of the water treatment plant.

(2) Reduction in SSUWC budget due to austerity measures

Finance of SSUWC depends to a large extent on national finance, which is by oil revenues. The national budget accounts for the salaries of staff members, fuel charges, cost of chemicals, and so on. After independence, oil revenues were cut off due to the conflict at the nation's boundaries, and the nation had to embark on fiscal austerity measures. The motivation of staff members decreased because the staff members even in SSUWC had their salaries delayed or cut to half. Moreover, procurement of fuel, chemicals and spare parts was also difficult.

(3) Incorporation of revenue from tariff into the block account of the central government

The national law requires that 80% of the revenue from tariff at each station of the water corporation be remitted to the block account of the central government. This system inhibits motivation with respect to improving the tariff collection rate. However, since the fiscal austerity measures were in place from July 2012, there was no supply of required materials to the site for operation and maintenance. Therefore, the entire revenue from tariff was tentatively

retained in SSUWC for covering the operation and maintenance costs. However, in August 2013, instructions were given to pay 100% of the revenue from tariff to the government.

(4) Making staff members permanent according to the Nominal Law

Job position in SSUWC has been made fixed under the Nominal Law. Job titles not specified in the Nominal Law cannot be used. Consequently, it is difficult to assign the required personnel to work at the required time. The regulations for employment of staff members in the Nominal Law need to be reviewed, and a system that enables the corporation to employ required personnel freely should be established.

6.6 Lessons that can be used in other similar JICA projects

(1) Capacity Development Method in a Post-conflict Country

1) Judge the learning needs and the skill levels of the counterpart and adopt a suitable approach

Public infrastructure and facilities including the SSUWC were severely damaged because of the Civil War in Sudan. Most of the SSUWC staff members have not received adequate basic school education, and cannot read and do basic arithmetic. It is vital to judge the skill level and learning needs of the counterpart at an early stage of the project and adopt a suitable approach in the target group for capacity development in the country to be rehabilitated in order to implement the project efficiently and effectively.

Operation record format, standard operating procedures, monthly and annual report formats were revised frequently in the project to ensure that staff members could perform operation and maintenance (O&M) and prepare reports and plans by themselves. Experts prepared operation and O&M procedures in the form of diagrams and tables expressed as posters, notice boards showing operations, and simplified documents to make all the staff members understand easily regardless of their ability to read or write. Experts also taught staff members correct operating and O&M methods, water quality inspection, tariff collection, and data management repeatedly over an extended period of time. In this way, it is important to understand the skill level of the counterpart and repeat the approach to suit the skill level.

2) Building an organization while creating and establishing work processes

During turmoil in a post-conflict country, organizations are inadequately provided and job descriptions of staff members are often undefined. Generally, the start is made by defining the organization as well as job descriptions of staff members in detail through documentation, but such an approach might be too optimistic. In this project, Standard Operation Procedures were often prepared for each work, and work process was established by slow and steady daily training. Even staff members who could not read or write were able to remember their job

content through actual operations during OJT. Established work processes can be integrated as-is as a part of the organization. Although there are no detailed job descriptions for every individual, work processes can be prepared actually and these can be deployed. This method of building the organization for implementing such work is probably an effective method for a post-conflict country.

3) Aiming to create virtuous operating cycle

Public utilities with unsatisfactory services have often fallen into a vicious cycle. This project has given assistance recognizing the need for SSUWC to break out of the vicious cycle and enter a virtuous cycle so that it can develop on its own in the future. The following cycle was assumed: Water supply service improvements → Increase in revenue → Service improvements → Increase in revenue. In practice, water supply service improvements require purchase of spare parts, fuel and chemicals, incentives for motivating staff members, and so on; this requires improving the financial capacity. Moreover, public awareness activities to acquire the understanding of customers are required for financial success. In a post-conflict country where skills are inadequate in all fields, it is essential to upgrade skills simultaneously in all fields from the beginning.

(2) Creating new work processes and establishing them in the organization

In this project, new work processes were created and many were established in the organization, in addition to giving individual technical training. Individual technical training was the main activity at the start of the project; subsequently, establishment of work processes using transferred technology became necessary in the organization in order to effectively utilize the technology transferred. The transfer of technology to individuals and the establishment of work processes in the organization are considered essential for this technical cooperation project.

(3) Considerations for preparing PDM (Project Design Matrix)

One of the outcome indices of this project is “to increase the operating hours of the water treatment plant from about 17.9 hours per day (average for 2011) to 23.5 hours per day.” As of 2011, power was being supplied to the city for comparatively long periods; therefore, the base line was set at 17.9 hours, and the target value was set as 23.5 hours. However, the power supply to the city became unstable thereafter, and it was finally suspended. The result was that the achieved outcome was insufficient. It is therefore recommended that indices that largely rely on external factors for achieving results should be avoided.

(4) Substantial utilization of training in a third country and in Japan

After the counterparts returned from training in a third country and in Japan, their commitment and motivation to work increased noticeably. Especially, trainees who returned after training from Japan are now active as leaders in water corporations. Actively utilizing training in a third country and in Japan and motivating staff members is likely to be effective in other projects as well.

CHAPTER 7 REMAINING ISSUES AND JICA'S APPROACH

7.1 Remaining Issues

This project was successful in establishing the foundation of the basic water supply services. However, an organization that can operate as a technically and financially self-sustaining organization is yet distant. The following approach needs to be taken henceforth:

- (1) Ensuring the implementation of assigned tasks in accordance with the established procedures and data management system in each department

Before the Project implementation, there were no structured O&M procedures, digital record-keeping and data management system, or regular water quality analysis, all of which have been established by the Project. In order to further enhance the management capacity of the Juba Station for the expected increase of operation hours and water production, it is recommended that staff in the SSUWC Juba Station thoroughly conduct the newly-established O&M, water tests, and billing procedures in accordance with the O&M manual and data management system developed by the Project.

- (2) Planning a structured internal training system

During the course of Project activities, core staff and C/Ps voluntarily started providing informal training for staff in each department. Peer training is effective since trainers can effectively respond to the trainees' learning needs using the already-established rapport and the shared language. Since raising staff's overall technical capacity is still necessary for further enhancing the skill level of O&M and bill-collection activities, it is recommended that the SSUWC HQ and the Juba Station start the planning of a structured internal training system.

- (3) Upgrading education level

Development of water supply services is difficult with the present level of education of staff members. Accordingly, opportunities should be given to all staff members to receive basic education. Candidates for high ranking posts should receive higher education (especially university education). Young staff members who have already received higher education should be moved to higher posts, and new persons with higher education should be recruited as staff members.

- (4) Extending support to area stations

The Project laid out the SSUWC HQ's procedure in providing support to area stations through evaluating the Juba Station's monthly reports and upcoming plans and giving feedback in a systematic

way. Although SSUWC HQ is capable of assessing reports submitted by the Juba Station, other area stations need proper guidance and attention to prepare and submit reports to SSUWC HQ. It is recommended that SSUWC HQ develop effective strategies to extend support to area stations outside Juba City.

(5) Recruiting qualified staff

Recruiting qualified staff in vacant positions is indispensable in enhancing the organizational sustainability. As recommended in the Mid-Term Review, directors' positions (i.e. technical director and commercial director) in SSUWC HQ and staff of the laboratory need to be filled as soon as possible. In addition, increasing staff for delivering bills will be of great help in increasing water bill collection. Appointment of engineers in the Juba Station would further increase the technical capacity of the purification and distribution departments.

(6) Upgrading skills for human resource management

Grading and salary systems for staff members presently are according to the Nominal Law, and these are determined mainly on the basis of seniority and academic background. In practice, high salaries and grading were often given to aged members who were not working. Thus, there are staff members with less motivation to work. Consequently, incentives or promotion should be given to staff members with good performance record. Human resource management to activate motivation to work is necessary. At the same time, staff members with poor performance and poor work attitude must be penalized.

(7) Increasing bill collection

Continuous efforts in increasing bill collection are recommended in order to enhance SSUWC's financial sustainability under the ROSS's uncertain fiscal prospect. While the financial department of the Juba Station is carrying out the billing activities more efficiently than before through the digital customer ledger, a larger number of staff who deliver the bills would increase the income from water bills. The financial department has made efforts to introduce the methods that make customers' payments easier (e.g. payment through a direct deposit into the Juba Station's bank account, payment kiosks throughout the city). Installing meters for house connections and businesses will increase bill collection.

(8) Reducing leakage amounts to increase accounted-for water

The presently high non-revenue water ratio must be reduced in order to improve the tariff collection rate. Within non-revenue water, administration losses must be reduced to improve the tariff collection system. On the other hand, physical losses must be reduced by adopting measures against leakage.

(9) Approach to self-reliance of water corporations

The final target of SSUWC is to become a self-reliant organization not depending on the government for finance. The government's policy was to re-start power supply to water corporations and medical organizations from September 7, 2013. As a result, from the technical aspects, increase in water supply amount, increase in service areas, and equitable water supply have started and water supply services have improved. In practice, the Customer Relations Section has said that citizens had commented on the improvement in water supply condition. If water supply services improve, tariff payment increases and revenue increases. If revenue increases, the O&M budget increases, and water supply service improves further. SSUWC must create this virtuous cycle. Understanding of the water supply services through motivation of the residents, and the willingness to pay water tariff must be increased. Figure 7.1 shows an explanatory sketch of this cycle. The BOX shows preliminary estimate toward financial self-reliance of the Juba station.

(10) Improving the national system toward self-reliance of SSUWC

The national system needs to be reformed in order to promote SSUWC self-reliance. There is a system for incorporating revenue from water tariff collection into the national treasury. According to this system, whatever be the increase in revenue of the water corporation, the entire revenue is to be transferred to the national treasury; this is a system where incentives to increase revenue does not work at all. Henceforth, water corporations must set timeline for the financial self-reliance target as well as review this system.

Employment in SSUWC is bound by the Nominal Law. Composition of the organization and posts of staff members are already determined by this Law. Also, this is a salary system of the entire country. These impede the employment of ideal personnel required for the work and also the formation of an ideal organization. To ensure employment of outstanding staff and flexibility in reorganization so as to promote self-reliance, this Law must be reviewed and SSUWC must be excluded from the scope of this Law.

For the time being, government support for SSUWC including provision of facilities, economic power supply, and subsidies are essential. However, the government support and subsidies should gradually be reduced so that finally this organization is financially and organizationally independent of the government. SSUWC should have the goal of becoming an independent organization finally. See Figure 7-1.

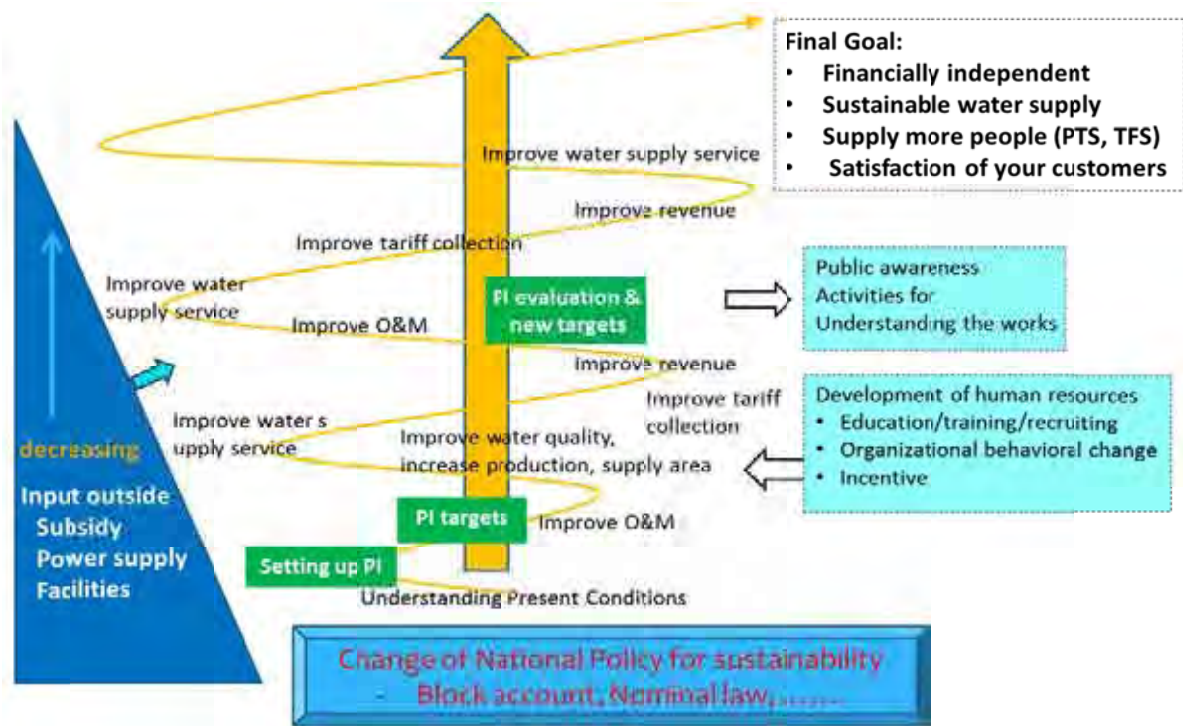


Figure 7-1 SSUWC approach to becoming self-reliant

BOX: Preliminary estimate toward financial self reliance of the Juba station

1. Revenue; 388,800SSP (Water tariff 6 SSP/m³) or 518,400 SSP/month (8 SSP/m³)
 - 24 hours production = 7,200 m³/day
 - Leakage (estimated): 3,600 m³/day and Actual supply: 3,600 m³/day
 - 60 % collection rate = 2,160 x 30 days = 64,800 m³/month
 - Water tariff; 6 SSP/m³ or 8 SSP/m³
2. Total cost = 420,000 SSP/month (salary, power, O&M chemicals)
3. Balance: -32,000 SSP or 100,000 SSP/month

(11) Enhancing skills for operating facilities that will be constructed by Japanese Grant Aid

According to the Japanese Grant Aid program for “The Project for Improvement of Water Supply System of Juba” being implemented until August 2015, the water supply facilities in the SSWUC Juba Station are scheduled for expansion. The facilities to be expanded are as listed below.

- Water treatment plant (10,800m³/day)

- Water transmission and distribution System
 - Treated water transmission pipeline: 5.0km
 - 5,000m³ ground type reservoirs and 540m³ x 1 elevated tank
 - Distribution mains and sub mains 51.2 km
- Water tanker filling station : TFS (8 stations)
- Public tap stands: PTS (120 sites)

The following skills need to be enhanced for the operation and maintenance of the facilities:

- Enhancement of technical skills enabling appropriate operation and maintenance of expanded facilities
- Enhancement of financial skills for ensuring the necessary budget for appropriate operation and maintenance of expanded facilities
- Expansion of organization and increase of required personnel for the appropriate operation and maintenance of expanded facilities
- Construction of management system of tanker filling stations (TFS) and public tap stands (PTS) after completion

(12) Implementing the performance contract according to SUWASA

SSUWC is presently proposing and planning reforms for the corporation based on the performance contract assisted by Sustainable Water and Sanitation in Africa (SUWASA by USA). This work has been implemented from April 2013 by a Ugandan consultant, the former Managing Director of the National Water and Sewerage Corporation of Uganda. Presently, the mission and vision of the corporation are being prepared, baseline data from information received from various stations is being checked and settings are being made. The performance contract visualizes the four levels listed below.

- Managing Director(MD) and Area Stations
- MD and Each Department in SSUWC HQ
- Board of Director (BoD) and MD
- Government of South Sudan (GoSS) and BoD

For managing water supply services sustainably, reforms of the corporation are an essential condition; approach aimed at reforms to SSUWC must be implemented continually.

7.2 Fields for JICA Assistance

Based on the results of the technical cooperation project implemented until now, the fields in which JICA should assist among the issues mentioned above are given here.

(1) Goals

- 1) Capacity of sustainable services offered (including leakage control, operation and maintenance of facilities), financial management, and water tariff collection are strengthened at the SSUWC Juba station.
- 2) The knowledge and skills related to management of water supply system implemented by the Headquarters by training are spread to other stations.

(2) Improvement fields

- **Enhancement of capacity of the Juba Station**

- 1) Improve the financial status of the SSUWC Juba Station
- 2) Improve the leakage control measures at the SSUWC Juba Station
- 3) Enhance the O&M capacity of the newly installed water supply facilities (constructed under the Grant Aid program) of the SSUWC Juba Station

- **Strengthening the capacity of the SSUWC Headquarters and training at other stations**

- 4) Define and improve the functions of the SSUWC Headquarters
- 5) Strengthen capacity of the guidance and supervisory functions for other stations of the SSUWC from technical aspects

With regard to 6) above, cooperative implementation in line with the performance contract to be implemented by SUWASA would be effective.