THE REPUBLIC OF SOUTH SUDAN
MINISTRY OF WATER RESOURCES AND IRRIGATION (MWRI)
SOUTH SUDAN URBAN WATER CORPORATION (SSUWC)

THE PROJECT FOR MANAGEMENT CAPACITY ENHANCEMENT OF SOUTH SUDAN URBAN WATER CORPORATION PHASE 2 IN SOUTH SUDAN

FINAL COMPLETION REPORT (ANNEX)

FEBRUARY 2022

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

TEC INTERNATIONAL CO., LTD. (TECI)

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List of Annexes

Technical cooperation deliverables

Annex-1: Guideline for Water Tariff Setting

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Annex-3: SOP for Updating GIS Mapping for Facilities and Customers

Annex-4: Manual for Non-revenue Water Management/O&M of Distribution Facilities

Annex-5: Water Treatment and Water Quality Monitoring O&M Manual (revised edition)

Annex-6: Material and Equipment Inventory Management Manual

Annex-7: Study Report on Management of Taker Filling Station and Public Tap Stand

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Guideline for Water Tariff Setting

(Draft ver.5)

JICA Expert Team

Guideline for Water Tariff Setting

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1. Principles for Tariff Setting

SSUWC shall harmonize and secure the following principles for water tariff setting.

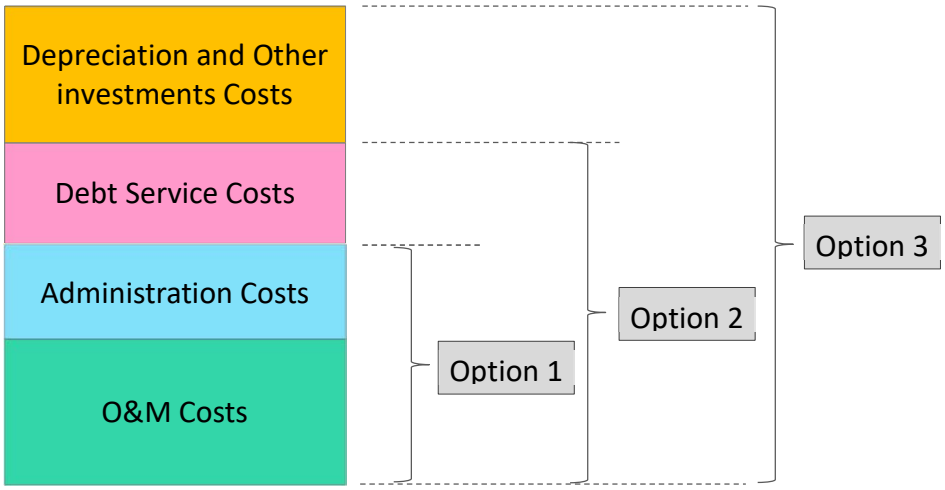
- Cost Recovery
- Management Efforts
- Accountability
- Consideration of People's Affordability
- Pro-poor tariff

1.1. Principle 1: Cost Recovery

Cost recovery is key element for financial sustainability of utility. The cost for water service shall be securely covered by the revenue of water services.
Type of cost recovery can be divided into 3 levels:

Option 1: Revenue recovers Operation & Maintenance (O&M) costs (incd. Admi. costs)
Option 2: Revenue recovers O&M costs and debt service costs (loan payment+ interest) costs
Option 3: Revenue recovers O&M costs, debt service costs and depreciation costs

In the long-term, Option 3 is ideal state of water utility. In the short- and mid-term, a step-by-step approach needs to be taken for SSUWC, hence tariff policies of SSUWC follow Option 1.
This option is need to be reviewed as necessary.



1.2. Principle 2: Management Efforts

In new tariff rate setting, utility shall show their management efforts to residential people in order to obtain their understanding on new tariff setting or tariff revision. From the accountability viewpoints, it is important to explain management efforts to the people in parallel to cost recovery.

1.3. Principle 3: Accountability

Level of tariff rates, tariff structure and setting process shall be accountable for the customers such as domestic, industrial and commercial, public institutions and so on.

1.4. Principle 4: People's Affordability

Tariff structure and level of tariff rates shall be affordable price not only for ordinary households but also for low-income households. It can be the benchmark that annual water expense of household does not exceed 4% of annual household income according to international practices.

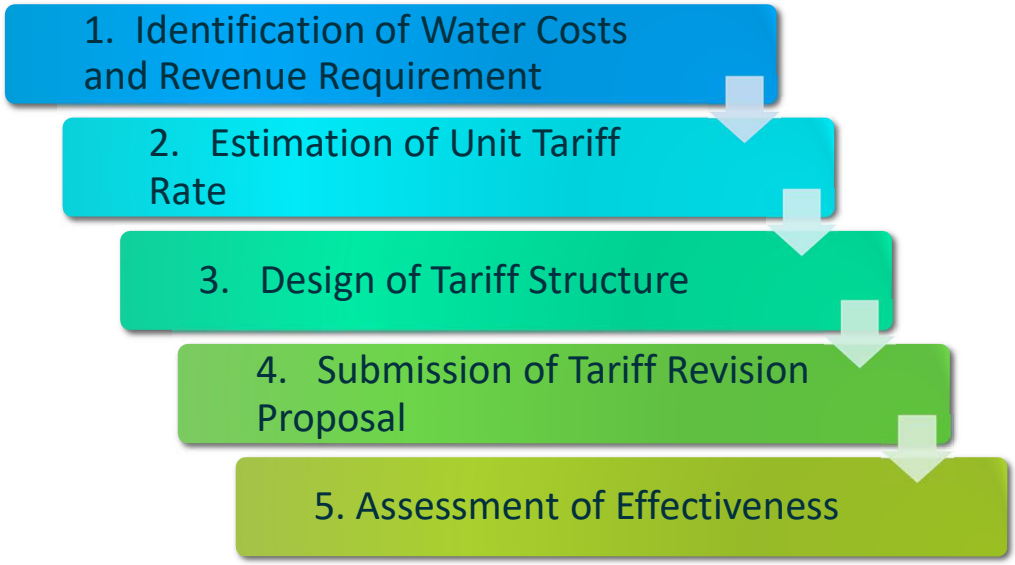
1.5. Principle 5: Pro-poor Tariff

Related to section 1.2, water tariff rates should not be set out from the aspect of utility's economic consideration. Utility should pay attention to the tariff rates for low-income households from the social aspect, especially in those areas where subsidy scheme is not sufficiently established.

2. Basic Steps for Tariff Setting

A basic process for water tariff setting can take the following steps:

(1) Identification of water costs and revenue requirements
(2) Estimation of unit tariff rate
(3) Design of tariff structure
(4) Assessment of effectiveness
(5) Submission of tariff revision proposal

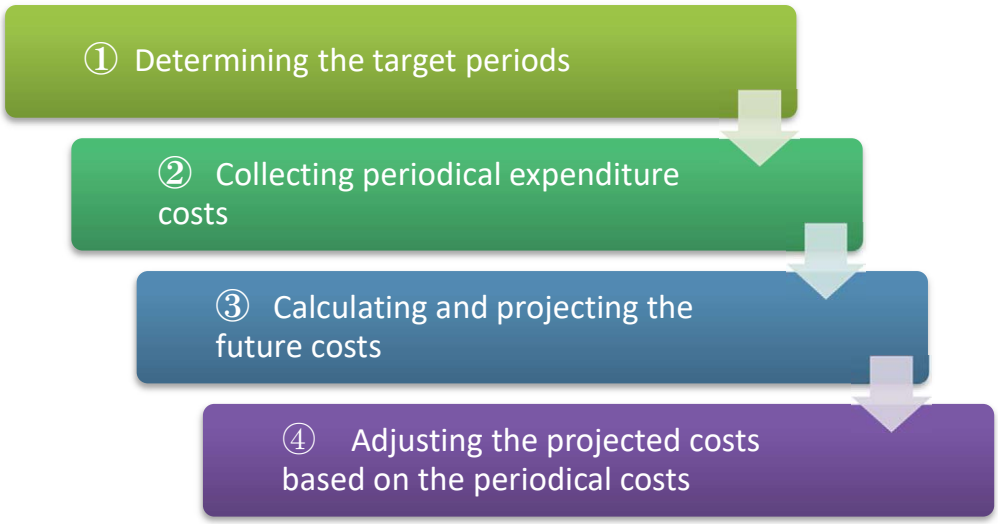


3. Identification of Water Costs and Revenue Requirements

3.1. Overall Process of Estimation of Revenue Requirement

The process of development of revenue requirement is shown as follows:

(1) Determining the target periods
(2) Collecting periodical expenditure costs
(3) Calculating and projecting the future costs
(4) Adjusting the projected costs based on the periodical costs



3.2. Estimation of Revenue Requirement

3.2.1.Determining the Target Periods

Before calculating the future costs, the base year for projections shall be determined. Then, the projection period needs to be set up.

3.2.2.Collecting Periodical Expenditure Costs

Periodical expenditure costs are collected from a recent typical year.

3.2.3.Calculation and Projection of the Future Costs

Future costs during the target period are calculated and projected with adjustment based on periodical base.
The main cost items for periodical expenditure are shown as follows:

Fixed costs	● Administrative overhead costs ● Personnel costs etc.
Customer costs	● Customer billing and collection costs ● Meter reading costs etc.
Variable costs	● Operation & Maintenance costs - Electricity and power costs - Chemical costs - Equipment, materials and parts costs etc.

Cost projection shall be summarized in the following table.

O&M Costs Projection Summary

	Year1	Year2	Year3	Year4	Year5	YearX	Total	Average
Operation Electricity and power costs Chemical Personnel Others								
Maintenance Civil works Pipe lines Electrical & mechanical Materials & parts								
Total								

3.2.4.Simplified Tariff Estimation

For the estimation of revenue requirement, it will be helpful to use "Work Sheets for Simplified Tariff Estimation", as the Attachment of this guideline.

The sheet is designed to estimate revenue requirement only for one year. If the latest figures are input in the cell colored in Pink, the necessary estimation can be carried out. In addition, unit tariff rate which will be described in Chapter 4 can be also calculated.

It is recommended to collect the latest information before using the sheet.

4. Estimation of Unit Tariff Rate

4.1. Category for Unit Tariff Rate Estimation

Before making detail tariff design by cost allocation, the estimation of unit tariff rate for cost recovery is important. In the Chapter 3, the necessary future costs were calculated. And the management fee as usually several percentages is added on the necessary future costs, then the total revenue requirement can be calculated.

The necessary unit tariff rate per m3 is categorized into three; (A) production and (B) distribution and (C) overall, as shown in Table3. By this calculation, we can know on how much unit tariff rate is necessary to cover the production costs and distribution costs. The category (C) is combined (a) with (B) and it needs to cover all O&M costs.

In order to estimate the unit tariff rate, the first step is to estimate each necessary costs both in production and in distribution, then next step is to divide these costs either by production volume or by supply volume. As the result, the unit costs per m3 in each category can be obtained.

Separate calculation between production and distribution might be difficult in case of SSUWC due to limitation of available information. Also, the allocation of indirect costs such as administration costs might be difficult to define clearly. In that case, the overall O&M costs calculated in Chapter3 theoretically covers all costs, so that it can be applied. In this case, the calculation gives us unit tariff rate for overall water supply service.

A. Production Costs	• Production expenditure to produce a treated safe quality cubic meter, from the inlet (raw water from the river) to purifications, without leaving out any cost incurred: Pumps, power (generator/electricity (assets & equipment and fuel), fuel, administrative cost (From the station and HQ as well), social cost/ personal cost, etc.
B. Distribution Costs	• Water distribution to reach the final consumer (customers) expenditures: connection fittings and accessories, administrative costs; social/personal cost; (any SSP/USD spent must be considered including casual laborers, transport & communication, feedings, treatment, insurance (if feasible), etc. All the cost should include both the station and HQ
C. Overall	• This is combined A with B. all O&M costs should be covered in this category.

4.2. Formula for Estimation of Unit Tariff Rate

In order to estimate necessary unit tariff rate, the following formula can be applied in case of SSUWC. If separation of production costs and distribution costs is possible, each unit tariff rate per m^3 can be calculated. If the separation is not possible, overall unit tariff rate per m^3 can be calculated.

Formula of Estimation for Unit Tariff Rate

Production

$$Twp = ICwp / Qws,$$

where
Twp – draft tariff for water production (SSP/m3) or USD/m^3
ICwp – full costs included in the draft tariff for water production (SSP or USD); and
Qws – the quantity of water supplied to the water supply network (m^3).

Distribution

$$Tws = Icws / Qws,$$

where
Twss – draft tariff for the water supply service (SSP/m^3)
Twp – draft tariff for water production (SSP/m^3); and
Tws – draft tariff for water supply (SSP/m^3).

Overall

$$Twss = (Iwp + Iws) / Qwp ,$$

where
Twss – draft tariff for the water supply service (SSP/m^3) or (USD/m^3)
Iwp – full costs included in the draft tariff for water production (SSP or USD);
Iws – full costs included in the draft tariff for water supply (SSP or USD); and
Qwp – the quantity of water supplied to customers (m^3).

5. Design of Tariff Structure

Design of tariff structure means to consider on how different costs of water are charged to the different customers.

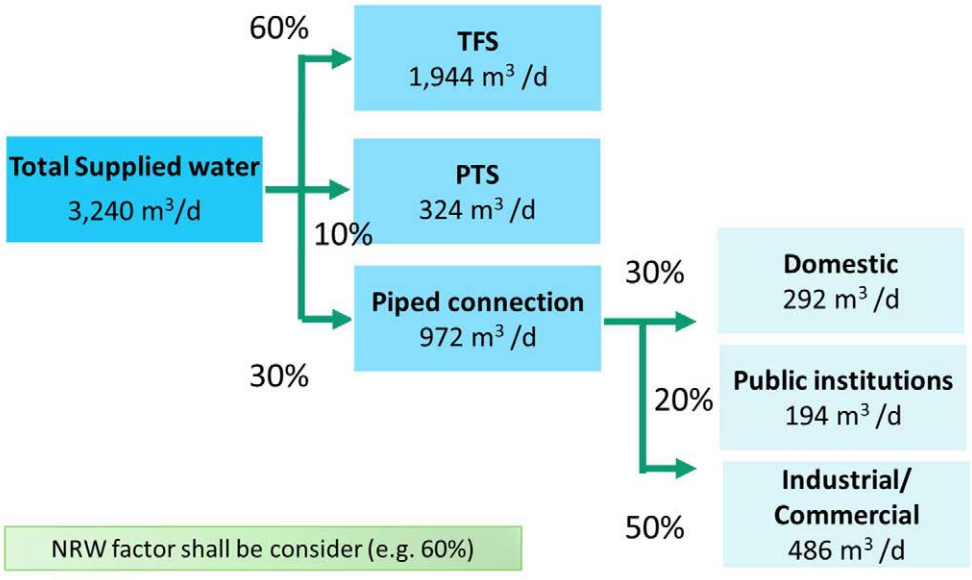
5.1. Concept of Cost Allocation

There are some different methods of cost allocation for tariff setting. We suggest the simplified methods for SSUWC considering the limitation of accurate supplied volume by supply means and by customer types.

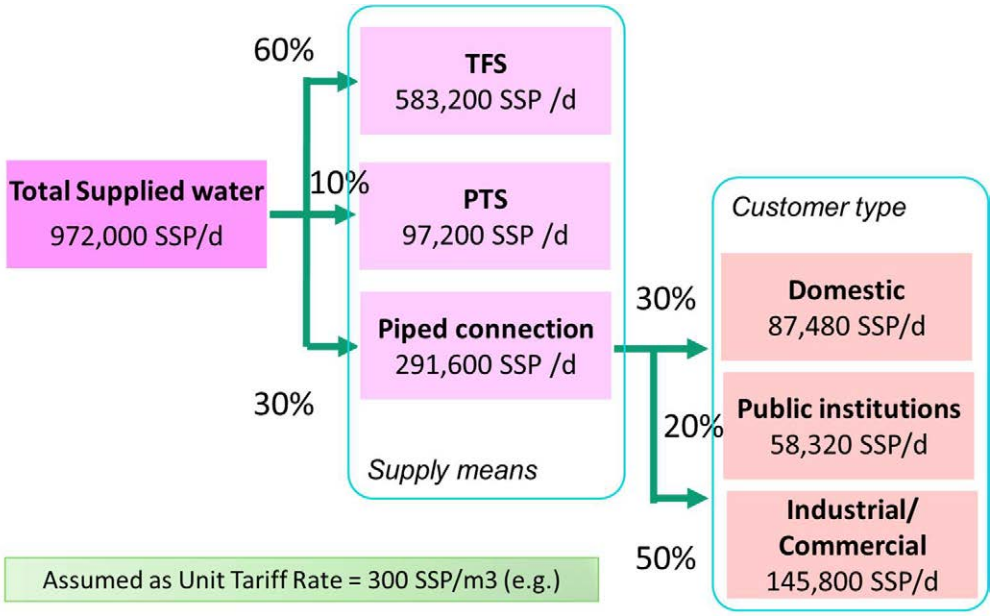
As the first step, expected supply water volume is assumed and allocated to the existing supply means, such as individual piped supply, tanker filling station (TFS), public tap stand (PTS) and so on. Then, in case of individual piped supply, the expected supply volume is allocated to each customer category.

As the second step, the revenue requirement amount is allocated according to the same ratio as the percentage of expected water volume. This cost allocation could be a basic case of tariff design. If the information on water consumption by pipe diameter types is available, tariff setting by pipe diameter is possible.

An example of allocation of water volume and revenue requirement are shown as below.



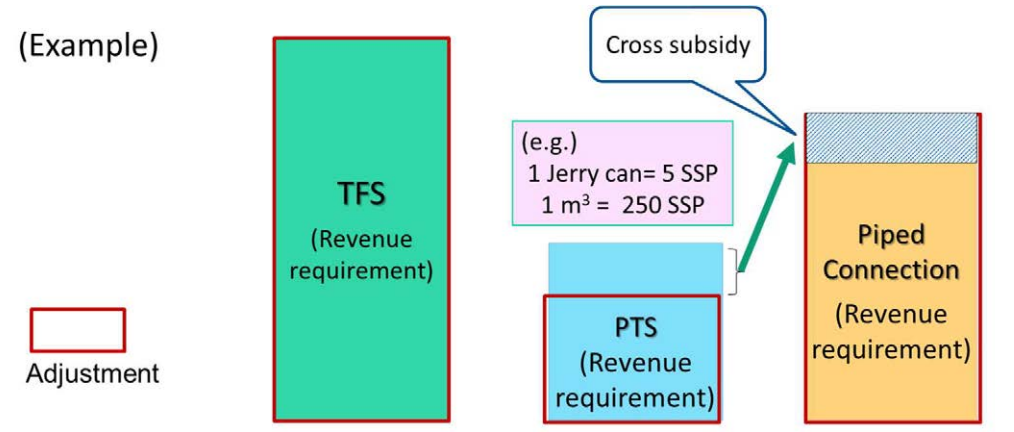
Allocation of Expected Water Volume



Allocation of Expected Revenue Requirement

5.2. Tariff Design and Adjustment

As the third step, the amount of allocated revenue requirement is adjusted within supply means and also within customer category. For instance, the customer of TFS is assumed to be relatively middle- and high income residents, so that the allocation of revenue requirement amount could be set at larger amount. While, the customer of PTS is assumed to be basically low income people, so that the allocation of revenue requirement could be set at less amount. Similarly, the adjustment of the allocation by customer category is designed.
Example of adjustment of revenue requirement is shown as below.



Revenue Requirement	583,200 SSP	97,200 SSP	291,600 SSP
After adjustment	583,200 SSP	81,000 SSP	307,800 SSP
Difference		- 162,000 SSP	+ 162,000 SSP

5.3. Fixed Charges and Variable Charge

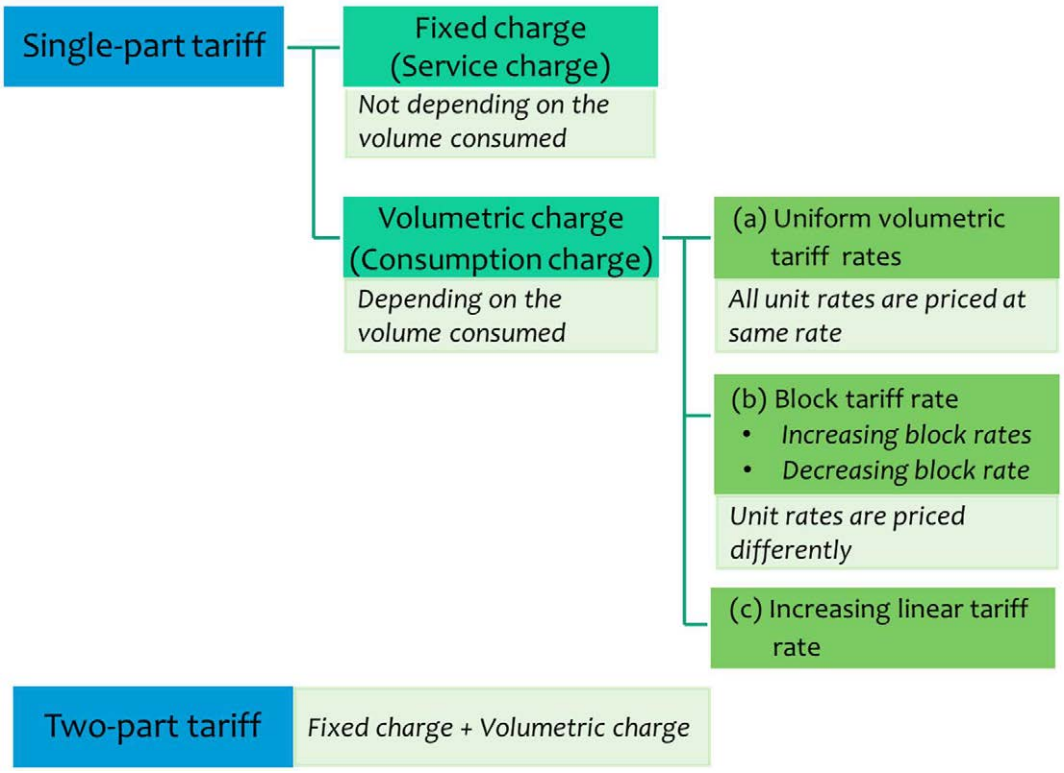
Combination of two parts of tariff such as fixed charge and variable charge may be appropriate in long-term. Fixed charges cover fixed costs such as administrative overhead costs, customer billing and collection costs and so on. Variable charges cover variable costs such as O&M costs which are variable service charges.
An example of those charges is shown as below.

Fixed Charges	Fixed Charge covers the fixed costs we associate with operating and maintaining water assets • Customer charges ✓ Recovers costs per account basis ✓ Charges not differentiated by meter size • Service charge by meter size ✓ Recovers costs proportionately based on meter size • Capacity charge ✓ Recovers costs proportionately based on meter flow capacity • Minimum charge ✓ Includes an allowance for a minimum level of consumption
Variable charges	Variable Charge covers the costs directly related to the amount of water supply • Recover all costs not covered from the service charges ✓ Water production, treatment, delivery

5.4. Basic Type of Tariff Structure and Increasing (progressive) Block Tariff (IBT)

5.4.1. Basic Type of Water Tariff Structure

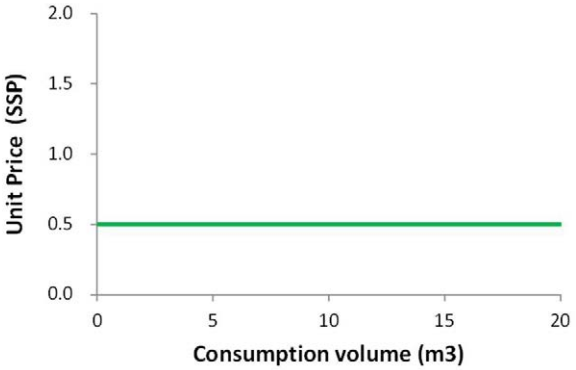
Basic type of water tariff structure is shown in the next figure.
There are several types of tariff structure which have respective merits and demerits.



5.4.2.Uniform Volumetric Tariff (IBT)

This tariff is designed to apply same unit price even water consumption is increased. Different rates also can be applied to different customer types. This type is basically adopted by SSUWC for metered customer. This tariff structure is simple and is easy to calculate the billing amount if the integrated billing system is not applied. Because the progressive tariff is relatively complicated and SSUWC has simple billing and collection system, this type is still recommended. If the capacity of ledger keepers is more upgraded and the sophisticated system is installed, progressive tariff can be better to be adopted.

Pricing concept is shown as below.



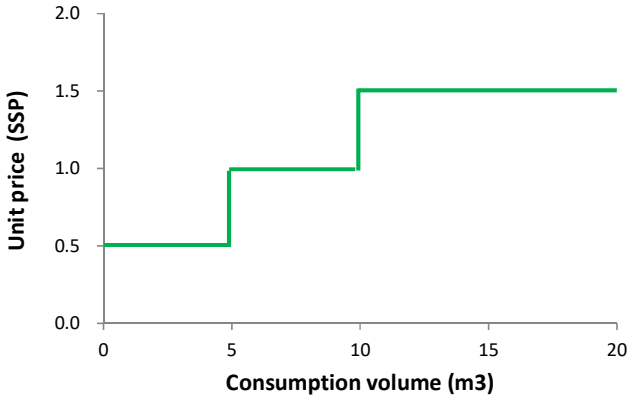
5.4.3.Increasing Block Tariff (IBT)

According to international practices, Increasing block tariffs are popular and desirable to enhance customer's incentive on saving water resource. Higher tariff apply for relatively large consumers. Also, an increasing block tariff is particularly suitable for where a functioning subsidy scheme for low-income households is absent.

Block tariff rates of each consumption blocks are calculated by using different ratio. The ratio of each block is determined by considering current water consumption trends and overall balance of revenue requirement. The example tariff ratio between blocks popularly used and pricing concept are shown as below.

Customer category	Tariff Structure Blocks (cubic meters/month)			
	<4.5	4.5-20	20-30	30<
Domestic	1.0 (base)	x 1.0-3.0	x 1.5-4.0	x 2.5-6.0
Public/ institutional	x 1.0-2.0	x 1.0-3.0	x 1.5-5.0	x 2.5-10.0
Industrial/ commercial	x 1.0-2.0	x 1.5-4.0	x 2.0-6.0	x 3.0-12.0

[Note] The figures in the table indicate the ratio range to the base.



5.5. Customer Categories

Costs shall be allocated to the different customer categories in the process of tariff design. In general, customer type is mainly divided into three; (1) domestic, (2) public/ institutional (3) commercial/ industrial. The domestic tariff rate is generally lower than commercial/ industrial tariff rate by the application of cross subsidies within the categories. In addition, customer categories are also revised in the revision process of water tariffs.

In case of SSUWC, there are relatively many customer types, while same tariff rate is applied to different customer categories. For the management efficiency viewpoint, the number of customer categories may be better to be reduced step by step.
Existing major customer categories are shown as below.

1	Domestic - Class1 - Class 2 - Class 3
2	Hospital
3	NGOs
4	Factory
5	Governmental institutions
6	Public Stand Pipe (PSPs)
7	Military

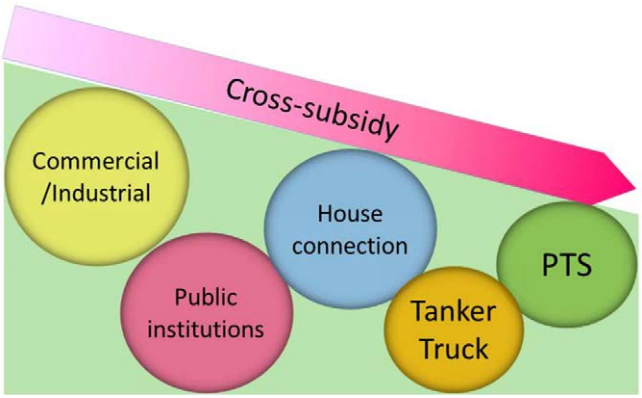
5.6. Indexation Parameter to be Considered

The following parameters will be considered when tariff structure is designed.

- Domestic inflation (Consumer price index (CPI))
- Foreign inflation
- Exchange rate
- Electricity tariff, etc.

5.7. Cross Subsidy and Pro-poor Tariff

- According to the Pro-Poor principle, tariff is generally designed to make cross-subsidy from commercial/industrial, public institutions customers to the low income customers such as PTS and Tanker Truck customers
- The lowest rate as a lifeline tariff is given to customers of PTS and Kiosk



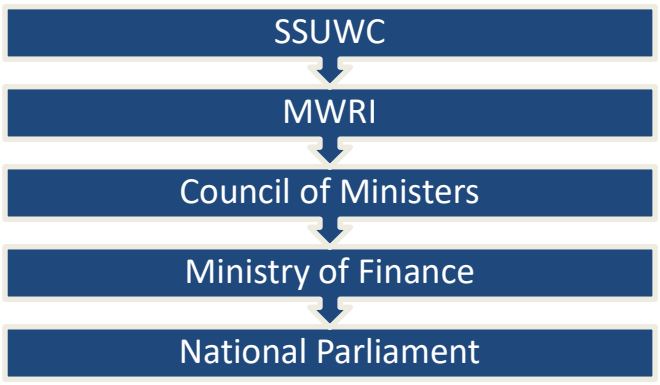
5.8. Importance of Balance "Commercialization" and "Publicness"

"Commercialization" is important for achieving cost recovery according to the principle. On the other hand, a fundamental significance of a public corporation is embedded in "publicness" to ensure everyone's access to safe and adequate supplies. Therefore, careful attentions should be paid to take the balance between "business" and "publicness".

In order to satisfy both of principle, tariff design should be carefully done by not only one way approach from utility side, but also social side. For instance, there is an international benchmark that water expense of household does not exceed 3-4% of household income. This consideration need to be carried out in the process of tariff design, especially for tariff setting for the low income group.

6. Submission of Tariff Proposal

After finalizing tariff proposal by SSUWC, it shall be submitted to the upper institutions and parliament.
Basic process of approval for SSUWC is shown as follows.



7. Assessment of Effectiveness

Effectiveness of rate structure will be monitored and assessed after application of new tariff structure from the following aspects:

- Affordability assessment
- Customer impact assessment
- Compliance on tariff setting principles
- Price elasticity of demand
- Comparison to other communities

7.1. Affordability assessment

Ability of consumers to pay the charges for water service should be examined in a timely manner. Affordability of residential people is generally evaluated by considering proportion of water expenses to household income. Socio-economic survey data, national census data and own customer survey date on household income may be useful information for the assessment.

7.2. Customer Impact Assessment

The impacts of tariff rate newly setting up should be considered. In detail, it is necessary to pay attention on who is winners/ losers after application of new tariff rates, how much large is the impact and what are the mitigation measures of the impacts.

7.3. Compliance on Tariff Setting Principles

It shall be examine whether new tariff rates are complied with tariff setting principles, which is mentioned in Chapter 1.

7.4. Comparison to Other Communities

Level of new tariff rates shall be compared with that of similar cities and neighboring regions. In the comparison, it is notable to select those areas where the socio-economic situation is similar to.

8. Tariff Revision and Adjustment

1. Tariff rates shall be revised and adjusted in accordance with the change of surrounding socio-economic and environmental change.

2. The revision of water tariff shall follow the process below.

   (1) SSUWC will prepare and submit Tariff Revision Proposal when the necessity of tariff adjustment is acknowledged. The Tariff Revision Proposal shall include the necessary information and indicates the appropriate reasons for revision with the rationale.

   (2) The frequency of tariff revision should not be more than one time in a year at least. It will be better to consider stepwise adjustment of water tariff. In a general case, the interval of tariff revision might be every three (3) to five (5) years.

   (3) When SSUWC make Tariff Adjustment Proposals, it should be based on short- and mid-term activity plans and financial projection.

[Attachment]

The Project for Management Capacity Enhancement of Southern Sudan Urban Water Corporation in Southern Sudan (Phase 2)

Tariff Setting Guideline

Work Sheets for Simplified Tariff Estimation

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[Note]

- The sheets can be utilized for the estimation of necessary Revenue Requirement and Unit Tariff Rates/m^3 for one year
- The figures in the this sheet is samples which was utilized in the training of Uganda.
- The figures of the cell colored in Pink should be entered for your estimation by

JICA Expert Team
Atsuo Ohno

Estimated Financial Balance/ Juba Station -Summary-

1. Financial Balance

Overall (Existing + New System)

Items/ Operation hrs		18h		15h		12h	
		(SSP)	(USD)	(SSP)	(USD)	(SSP)	(USD)
A. Operating Income		***18,732,060***	***45,688***	***17,736,030***	***43,259***	***16,740,000***	***40,829***
B. Ope	*[Table of Contents]*	***14,303,556***	***34,887***	***12,286,130***	***29,966***	***10,268,704***	***25,046***
[1]	Chemical costs	4,498,549	10,972	3,771,457	9,199	3,044,366	7,425
[2]	Fuel costs	4,461,210	10,881	3,717,675	9,068	2,974,140	7,254
[3]	Personnel costs	373,000	910	373,000	910	373,000	910
[4]	Material, parts, supplies costs	1,642,938	4,007	1,369,115	3,339	1,095,292	2,671
[5]	Vehicle fuel & Lubricant costs	493,761	1,204	411,467	1,004	329,174	803
[6]	TFS & Kiosk Management Fee	0	0	0	0	0	0
[7]	Other costs	2,834,098	6,912	2,643,415	6,447	2,452,732	5,982
Total		***4,428,504***	***10,801***	***5,449,900***	***13,292***	***6,471,296***	***15,784***

Items/ Operation hrs		18h		15h		12h	
		(SSP/m^3)	(USD/m^3)	(SSP/m^3)	(USD/m^3)	(SSP/m^3)	(USD/m^3)
C. Unit Income & Expenditure							
	Unit Income	**112**	**0.3**	**127**	**0.3**	**150**	**0.4**
	Unit Expenditure	**85**	**0.2**	**88**	**0.2**	**92**	**0.2**

2. Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Whenever you calculate tariff rate, always update the rate

Estimated Income/ Juba Station -Summary-

1. Key condition

Set up the estimated percentage for the calculation in the box

NRW Ratio	60	%
Collection ratio for Piped Custor	35	%
Collection	100	%
Collection ratio for TFS	100	%

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Water Supply Allocation: Prioritize supply for TFS (12h/ day)

This sheet indicates the estimation for 3 options of operation hours

2. Estimation

Input the estimated supply volume

Always update the tariff rates

Operation hrs.	Water Production	Supply Volume		Tariff rates/ Selling price		NRW ratio	Collection ratio	Expected Revenue /day	Expected Revenue /month
18 hrs	5400 m^3/day	**Piped**	1,800 m^3/day						
		Domestic	1,080 m^3/day	*Domestic*	170 SSP/m^3	0.6	0.35	38,556 SSP/day	1,195,236 SSP/month
		non-domestic	720 m^3/day	*non-domestic*	170 SSP/m^3	0.6	0.35	25,704 SSP/day	796,824 SSP/month
		PTS/Kiosk	0 m^3/day	Customer	SSP/m^3	0.6	1.0	SSP/day	SSP/month
		TFS	3,600 m^3/day	Tanker	250 SSP/m^3	0.6	1.0	540,000 SSP/day	16,740,000 SSP/month
								Total	**18,732,060** SSP/month
								Unit Income	**112** SSP/m^3

Always update the suply volume

Always update the tariff rates

Operation hrs.	Water Production	Supplied Volume		Tariff rates/ Selling price		NRW ratio	Collection ratio	Expected Revenue /day	Expected Revenue /month
15 hrs	4500 m^3/day	**Piped**	900 m^3/day						
		Domestic	540 m^3/day	*Domestic*	170 SSP/m^3	0.6	0.35	19,278 SSP/day	597,618 SSP/month
		non-domestic	360 m^3/day	*non-domestic*	170 SSP/m^3	0.6	0.35	12,852 SSP/day	398,412 SSP/month
		PTS/Kiosk	0 m^3/day	Customer	SSP/m^3	0.6	1.0	SSP/day	SSP/month
		TFS	3,600 m^3/day	Tanker	250 SSP/m^3	0.6	1.0	540,000 SSP/day	16,740,000 SSP/month
								Total	**17,736,030** SSP/month
								Unit Income	**127** SSP/m^3

Always update the tariff rates

Always update the tariff rates

Operation hrs.	Water Production	Supplied Volume		Tariff rates/ Selling price		NRW ratio	Collection ratio	Expected Revenue /day	Expected Revenue /month
12 hrs	3600 m^3/day	**Piped**	0 hrs	0 m^3/day					
		Domestic		0 m^3/day	*Domestic*	170 SSP/m^3	0.6	0.35	0 SSP/day	0 SSP/month
		non-domestic		0 m^3/day	*non-domestic*	170 SSP/m^3	0.6	0.35	0 SSP/day	0 SSP/month
		PTS/Kiosk		0 m^3/day	Customer	SSP/m^3	0.6	1.0	SSP/day	SSP/month
		TFS&Kiosk	12 hrs	3,600 m^3/day	Tanker	250 SSP/m^3	0.6	1.0	540,000 SSP/day	16,740,000 SSP/month
									Total	**16,740,000** SSP/month
									Unit Income	**150** SSP/m^3

Input operation hours for the estimation of new system

Input the estimated supply volume

Always update the tariff rates

Operation hrs.	Water Production	Supply Volume		Tariff rates/ Selling price		NRW ratio	Collection ratio	Expected Revenue /day	Expected Revenue /month
18 hrs	8100 m^3/day	**PTS/Kiosk**	0 m^3/day	Customer	SSP/m^3	0.6	1.0	SSP/day	SSP/month
		TFS	0 m^3/day	Tanker	250 SSP/m^3	0.6	1.0	0 SSP/day	0 SSP/month
								Total	**0** SSP/month
								Unit Income	**0** SSP/m^3

Input operation hours for the estimation of new system

Always update the tariff rates

Always update the tariff rates

Operation hrs.	Water Production	Supplied Volume		Tariff rates/ Selling price		NRW ratio	Collection ratio	Expected Revenue /day	Expected Revenue /month
15 hrs	6750 m^3/day	**PTS/Kiosk**	0 m^3/day	Customer	SSP/m^3	0.6	1.0	SSP/day	SSP/month
		TFS	12 hrs 0 m^3/day	Tanker	250 SSP/m^3	0.6	1.0	0 SSP/day	0 SSP/month
								Total	**0** SSP/month
								Unit Income	**0** SSP/m^3

Input operation hours for the estimation of new system

Always update the tariff rates

Always update the tariff rates

Operation hrs.	Water Production	Supplied Volume		Tariff rates/ Selling price		NRW ratio	Collection ratio	Expected Revenue /day	Expected Revenue /month
12 hrs	5400 m^3/day	**PTS/Kiosk**	0 m^3/day	Customer	SSP/m^3	0.6	1.0	SSP/day	SSP/month
		TFS	12 hrs 0 m^3/day	Tanker	250 SSP/m^3	0.6	1.0	0 SSP/day	0 SSP/month
								Total	**0** SSP/month
								Unit Income	**0** SSP/m^3

Expenditure 1:

Estimated Water Costs/ Juba Station -Summary-

1. Key condition

Existing system

Water production volume:	5,400	m^3/day
[Table of Contents]	18	hrs/day

Input the operation hrs

Input the operation hrs, if new system is included in the

New system

Water production volume:	0	m^3/day
Operational hours:	0	hrs/day

2. Estimated Operating Costs/ month

Item		Monthly Expenditure (SSP)	Monthly Expenditure (USD)
A. Operating Expenditure			
[1]	Chemical costs	4,498,549	10,972
[2]	Fuel costs	4,461,210	10,881
[3]	Personnel costs	373,000	910
[4]	Material, parts, supplies costs	1,642,938	4,007
[5]	Vehicle fuel & Lubricant costs	493,761	1,204
[6]	TFS & Kiosk Management Fe	0	0
[7]	Other costs	2,834,098	6,912
	Total	**14,303,556**	**34,887**

85	**0.21**
SSP/ m^3	**USD/ m^3**

Always update the rate

3. Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Expenditure 2:

Cost Projection of SSUWC Juba Station

[2] Chemical Costs				Remark
0 Precondition				
Existing system	Production vol.	5,400	m^3/day	Design=7200 m^3/day
	Operation hours	18	hrs/day	For chemical calculation:
				7,584m^3/day(Intake water volume)
[Ta ***New System***	Production vol.	0	m^3/day	Design=10,800 m^3/day
	Operation hours	0	hrs/day	For chemical calculation: /
1 Chlorine				
	Unit price	3.15	USD/kg	Always update unit price
	Unit price	141.75	USD/bag	1 bag=45kg
Existing system	Consumption	0.7	bag/24h	
	Consumption (above con	0.5	bag/Condition hrs	
New system	Consumption	0.7	bag/24h	
	Consumption (above con	0.0	bag/Condition hrs	
Existing system	Cost (above condition)	2,270	USD/month	
New system	Cost (above condition)	0	USD/month	
2 Alum		0		Always update unit price
	Unit price	0.67	USD/kg	
	Unit price	30	USD/bag	1 bag=45kg
Existing system	Consumption	12	bag/24h	
	Consumption (above con	9.0	bag/condition hrs	
New system	Consumption	18	bag/24h	
	Consumption (above con	0.0	bag/condition hrs	
Existing system	Cost (above condition)	8,370	USD/month	
New system	Cost (above condition)	0	USD/month	
3 Reagent				Always update unit price
Existing system	Cost	136,000	SSP/month	
New system	Cost	0	SSP/month	

		USD	SSP
Existing system			
	1. Chrorine	2,270 USD/month	930,849 SSP/month
	2. Alum	8,370 USD/month	3,431,700 SSP/month
	3. Reagent	332 USD/month	136,000 SSP/month
New System			
	1. Chrorine	0 USD/month	0 SSP/month
	2. Alum	0 USD/month	0 SSP/month
	3. Reagent	0 USD/month	0 SSP/month
		10,972 USD/month	4,498,549 SSP/month

Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Expenditure 3:

Cost Projection of SSUWC Juba Station

[3] Fuel Costs for Operation				Remark
0 Precondition				
Existing system	Production vol.	5,400	m^3/day	Design=7200 m^3/day
	Operation hours	18	hrs/day	
[Ta ***New System***	Production vol.	0	m^3/day	Design=10,800 m^3/day
	Operation hours	0	hrs/day	
1 Fuel costs				
Case A: Subsidized fuel	Fuel unit price	0.78	USD/L	Always update unit price
Case B: Market fuel	Fuel unit price		USD/L	If calculate the case of market fuel, input the unit price
Existing system	Consumption	600	L/24h	
	Consumption (above conditio	450	L/Condition hrs	
New system	Consumption	1350	L/24h	
	Consumption (above conditio	0	L/Condition hrs	
Existing system	Cost (above condition)	10,881	USD/month	
New system	Cost (above condition)	0	USD/month	

	USD	SSP
Existing system	10,881 USD/month	4,461,210 SSP/month
New System	0 USD/month	0 SSP/month
	10,881 USD/month	4,461,210 SSP/month

Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Expenditure 4:

Cost Projection of SSUWC Juba Station

[4] Personnel Costs				Remark
0 Precondition				
Existing system	Production vol.	5,400	m^3/day	Design=7200 m^3/day
	Operation hours	18	hrs/day	
[Ta ***New System***	Production vol.	0	m^3/day	Design=10,800 m^3/day
	Operation hours	0	hrs/day	
1 Personnel Costs				
Existing system (current costs)				
	Juba Station	143,000	SSP/month	
	HQ	230,000	SSP/month	HQ=Salary costs
	Total	373,000	SSP/month	
New system				
	Juba Station	27,624,354	SSP/month	
	HQ		SSP/month	
	Total	27,624,354	SSP/month	

Always update the current personnel costs.
This estimation includes personnel costs which is actually provided by Ministry of Finance.

Always update the personnel costs for new system, if necessary

Expenditure 5:

Cost Projection of SSUWC Juba Station

[5] Material, Parts, Supplies Costs				Remark
0 Precondition				
Existing system	Production vol.	5,400	m^3/day	Design=7200 m^3/day
	Operation hours	18	hrs/day	
[Ta ***New System***	Production vol.	0	m^3/day	Design=10,800 m^3/day
	Operation hours	0	hrs/day	
1 Material, parts, cupplies costs (base year)				
Existing system (current costs)		1,642,938	SSP/month	Always update the expenditure
New system		0	SSP/month	Always update the expenditure, if
[Estimation]				
Past info (2020)		13,761,948		
Production (2020)		45,233	m3/year	
		304	SSP/m3	

	USD	SSP
Existing system		
Vehicle Fuel & Lubricant	4,007 USD/month	1,642,938 SSP/month
New System		
Vehicle Fuel & Lubricant	0 USD/month	0 SSP/month
	4,007 USD/month	1,642,938 SSP/month

Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Expenditure 6:

Cost Projection of SSUWC Juba Station

[6] Vehicle Fuel and Lubricant Costs

Remark

0 Precondition

Existing system	Production vol.	5,400	m^3/day
	Operation hours	18	hrs/day
New System	Production vol.	0	m^3/day
	Operation hours	0	hrs/day

Design=7200 m^3/day

Design=10,800 m^3/day

Always update the expenditure

Always update the expenditure, if necessary

1 Fuel and Lubricant Costs

Existing system	493,761	SSP
New system		SSP

[Estimation]

Past info (2020)	4,135,950	SSP/year
Production (2020)	45,233	m3/year
	91	SSP/m3

	USD	SSP
Existing system		
Vehicle Fuel & Lubricant	0 USD/month	493,761 SSP/month
New System		
Vehicle Fuel & Lubricant	0 USD/month	0 SSP/month
	0 USD/month	493,761 SSP/month

Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Expenditure 7:

Cost Projection of SSUWC Juba Station

[7] TFS & Kiosk Management Fee				Remark
0 Precondition				
Existing system	Production vol.	5,400	m^3/day	Design=7200 m^3/day
	Operation hours	18	hrs/day	
[Ta ***New System***	Production vol.	0	m^3/day	Design=10,800 m^3/day
	Operation hours	0	hrs/day	
1 Other costs (Management fee of TFS&Kiosk)				
Existing system	TFS supply volume			
fee%		0	%	
New system	TFS supply volume			
fee%		0	%	
[Estimation]				
Total revenue (24h)			SSP/month	
Total revenue (appied)		0	SSP/month	
Manegement fee		0	SSP/month	
Total revenue (24h)			SSP/month	
Total revenue (appied)		0	SSP/month	
Manegement fee		0	SSP/month	

		USD	SSP
Existing system			
Other costs	*(Management fee for TFS&K*	0 USD/month	0 SSP/month
New System			
Other costs	*(Management fee for TFS&K*	0 USD/month	0 SSP/month
		0 USD/month	0 SSP/month

Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Expenditure 8:

Cost Projection of SSUWC Juba Station

[8] Other Costs

Remark

0 Precondition

Existing system	Production vol.	5,400	m^3/day
	Operation hours	18	hrs/day
[Ta ***New System***	Production vol.	0	m^3/day
	Operation hours	0	hrs/day

Design=7200 m^3/day

Design=10,800 m^3/day

1 Other costs (conventional costs)

Existing system	Juba Station	1,144,098	SSP
	HQ All except salary	1,690,000	SSP
	sub-total	2,834,098	SSP
[Estimation]			
Past info (2020)		9,583,456	SSP/year
Production (2020)		45,233	m^3/year
		212	SSP/m^3

New system	Juba Station	0	SSP
	HQ All except salary	0	SSP
	sub-total	0	SSP
[Estimation]			
Past info (XXXX)		0	SSP/year
Production (XXXX)		3	m^3/year
		0	SSP/m^3

Always update the expenditrue.
This estimation is based on the past costs.

HQ all costs except for Salary cost

Input the all administration expenditure of HQ for

Input the administrative expenditure of HQ for new system.
If separation is difficult, input it either in Existing system or New system.

	USD	SSP
Existing system		
Other costs	6,912 USD/month	2,834,098 SSP/month
New System		
Other costs	0 USD/month	0 SSP/month
	6,912 USD/month	2,834,098 SSP/month

Exchange rate

1 USD=	410	SSP
1 SSP=	0.0024	USD

Past Information (Operating Expenditure & Production volume)

0. Pre-condition

Actual year in calculation: FY2017

Exchange rate:

1 SSP=	0.004	USD
1 USD=	[Table of Conter	SSP

1. Operating Annual Expenditure (Juba stateion only)

	Item	FY2020 (SSP)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
[1]	Salary	0	0	0	0	0	0	0	0	0	0	0	0	0
[2]	Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0
[3]	Chemicals by Juba Station	143,000	0	0	0	0	143,000	0	0	0	0	0	0	0
[4]	Fuel lubricant	4,135,950	593,000	189,100	1,008,000	739,500	143,000	88,250	4,000	11,600	165,500	95,600	240,900	857,500
[5]	Materials	13,761,948	194,400	617,220	238,850	434,700	415,250	1,328,690	1,577,588	2,072,450	1,541,380	1,660,750	1,859,770	1,820,900
[6]	Others (motivation, stationaries)	9,583,456	526,948	177,326	370,000	390,658	326,240	1,684,120	692,290	1,329,520	1,062,859	744,390	1,063,254	1,215,851
[7]	Expenditure for UWC HQ	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	27,624,354												

2. Water Production Volume

	Average daily treated water production volume (estimated	45,233	3,699	3,180	3,480	2,055	5,145	5,250	4,208	4,208	3,506	4,575	4,578	1,350

3. Unit Water Production Costs

	Item	(SSP/m^3)	(USD/m^3)
[1]	Chemical costs	0.00	NA
[2]	Electrical & Power costs	0.00	NA
[3]	Personnel costs	3.16	NA
[4]	Fuel and lubricant costs	91.44	NA
[5]	Material, parts, supplies costs	304.25	NA
[6]	Other costs	211.87	NA
[7]	Total (SUM [1] - [6])	610.72	NA

Annex-2: Materials for Public Awareness and Customer Service Manual

Public Awareness Materials

Table of Contents

1. Customer Service Operation Manuals

Water is Life الماء هو الحياة

Customer Section Operational Manual

April 2019
Version 2

South Sudan Urban Water Corporation/Juba

مؤسسة المياه في المناطق الحضرية جنوب السودان مدينة جوبا

Contents:

1. Forward

- Definition of Customer's section

The customer is:

- Handling customers suggestions, complaints and customers related services and providing customers with the necessary information about the water services
- Is to access handling the Customers problems and Complaints
- It's a section which handling consumer complain/information suggestion and they complains can be address in a good manner.

2. Background/ Rational and Purpose

(1) Background/ Rational

- *South Sudan Urban Water Corporation is working for water supply for the citizen of JUBA. and*
- *(History, Milestone of SSUWC)*
- *SSUWC was established in 1937 and in 2013, after the independence・・*
- *Central Electricity and Water cooperation*
- *Currently supplies water* to 3 Areas (blocks) namely; Juba, Amarat and Munuki blocks Area of the population,

The mission of South Sudan Urban Water Corporation (SSUWC) is to provide safe and clean water to the citizens of South Sudan. The Juba Station is covering 3 areas (blocks) namely; Juba, Kator and Munuki blocks.

However, due to the uncontrollable reasons, our water filtering system is not functioning well and we are worrying if we can provide the clean water to Juba citizens regularly. If we cannot provide satisfactory service to our customers, they may be reluctant to pay the bill, and in the result, we would face further difficulties to keep providing good services to citizens.

We, therefore, would like to have customers' relations office to listen to customers' voices and to take care for them. The customers' feedbacks are important to us as it help us improve our services and keep providing good services to our citizens.

(2) Purpose

- From the customers' point of View

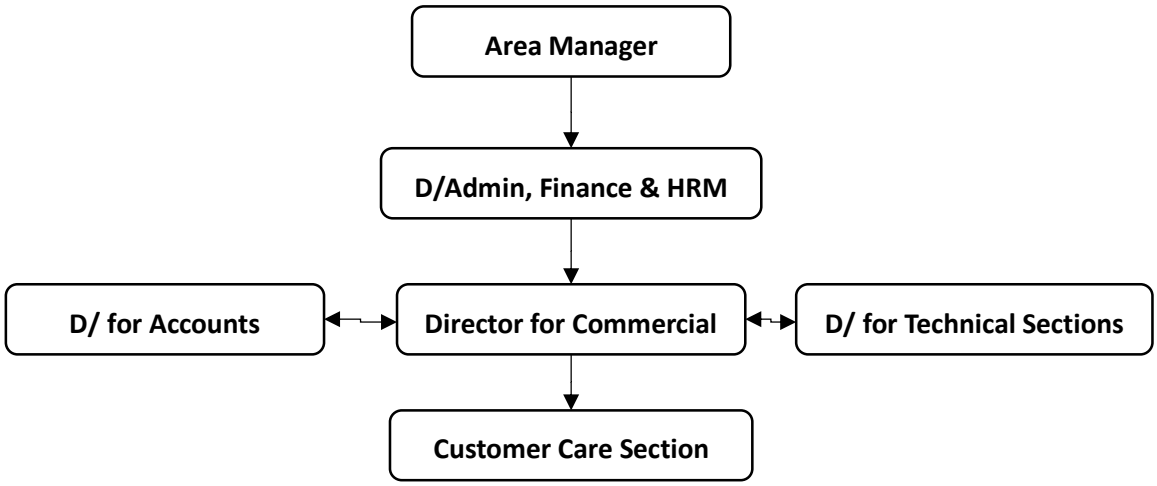
- To register complaints or suggestions
- To give feedback on the water services
- To obtain the correct information about the water services , availability, reliability and billings
- Is to make the customers aware that SSUWC is providing clean and safe drinking water to the public and their water can be paid in time, and customers should report to SSUWC.

- From the providers' point of View

- To carry out an awareness campaign to increase the general Consciousness and understanding of SSUWC activities and services among Juba Citizens.
- To help improve services
- To build trust on the customers
- Promotes awareness as it's the face of the company
- Helps solve problems and complaints
- Handling customers suggestions, complaints and customers related services
- Providing customers with the necessary information about the water services
- currently no customer care office, the customers call individual staffs for any issues. Issues include generator repairs, water pipe bursts etc
- Reduce customer dissatisfaction especially on paying bills after water shortages

3. Who we are:

Structure:



Our Customer care section is under the Division of Commercial, however we are always linked to all the department of SSUWC

Operation Hours:

Office hours: 8:30 am to 5 pm, Monday to Friday,

However, our water service is no holiday (24 hours, 365 days)
Now we expand the service From 7 am up to 2 am

4. The service the customer care provides

(1) Contact points for inquiries (Customer Service Centers)

- New Installation / Connection
  For those who want to start using the service
- We provide the Customers with Contract form for the Customers to fill and sign the contract.
- For those who have some complaints for the water service
- Notification service
- When water service may suspend
- Report system
- leakage

(2) Water meter reading

- Meter Installation /setting
- Who (engineer) is assigned to go by what time etc.
- How to read the meter bill.
- Billing

(3) Payment of water charges,

- Method of payment
- Explanation of the tariff
- For those who do not pay

- Clerical tasks i.e recording every occurrence or complaints and also to assisting with awareness creation (Sales and marketing role)
- Providing information through radio, public address system and individuals contacts on the new facilities, billings systems, payment tariffs, deadlines for payments e.t.c (Teaching role)
- Explaining the company's position to the clients providing first line of defense for the organization (the advocates role)
- Reporting the feedback from the clients to the management

5. Basic Attitude and Principle for the Service Providers

As the first Contact points for inquiries (Customer Service Centers)
We work as the principle for

- Customer service and Customer Satisfaction
- Customer's comment can feed back to improving services

The principle Attitude

- Listening to the customers

"How are you? "
"May I help you?"
"What can I do for you?"

- Listen patiently and make the point report back and confirm the customers her/his talk

"So you are saying that your water is getting dirty and cannot use, right?"

- Be Polite and patient individual to care for Customers Concern
- Friendly
- Do not get emotional
- Be fair to all the customers
- Taking them by order
- Don't priorities or allocate longer time for your relatives, neighbors, close friends etc.

Always pay attention to the guests

How to deal with difficult customers

6. Step for handling the various cases (Procedure/Network)

- **When Customers want to apply for the water supply service**
  Ask the customer to fill in the application form
  (record the name: address, phone number and check the ID
  And ask the method of payment)

- **When Customer report the water leakage**

  To identify the location and hear the detail of the situation
  To record the sheet of the leakage
  To arrange to dispatch the investigation to the site
  After the repair, write back the report, analyze the cause of the leakage and share with all the staff

- **When customer come to complain for the water service**
  In the principle of that it is good chance to improve our service, listen to the complaint patiently and taking memo, write down
  Let the customers calm down if she/he is so emotional

- **When there are difficult customers come.**
  - ✓ Complaining a lot
    Basically, we listen to the complaint and let the customers cooldown if she/he is so emotional
  - ✓ If customers yell or shout, or even scaring the staff and harming the others, call the security guard to watch, but not touch nor take her/him out unless she/he get violent

- **When water service may suspend**
  ✓ We explain the reason or/and cause of the suspending and make the customer understand.
  ✓ We try to inform the possible date of reopening or restarting the service to make the customers understanding for the situation
  ✓

7. Frequent asked question

These are the examples of frequently asked questions and we prepare the unified answer and make clear for every staff to respond

1. When the water service restart?

2. How can I get the clean water service?

3. I cannot pay the bill this month, how can I do?

4. Customers say they don’t receive bill.

5. How can I pay bill without any water supply service?

8. Attachment/Information

1. **Structure Tree, Name of the staff**
   Make clear the responsibility, role lines,

2. **Contact Address (Mobile Phone) list**
   All the staffs should know each other contact address. But not showing the list to the customers, just share among the staff.

3. **Tariff**
   Make is visible

4. **Application Form**
   For starting receiving the water supply services

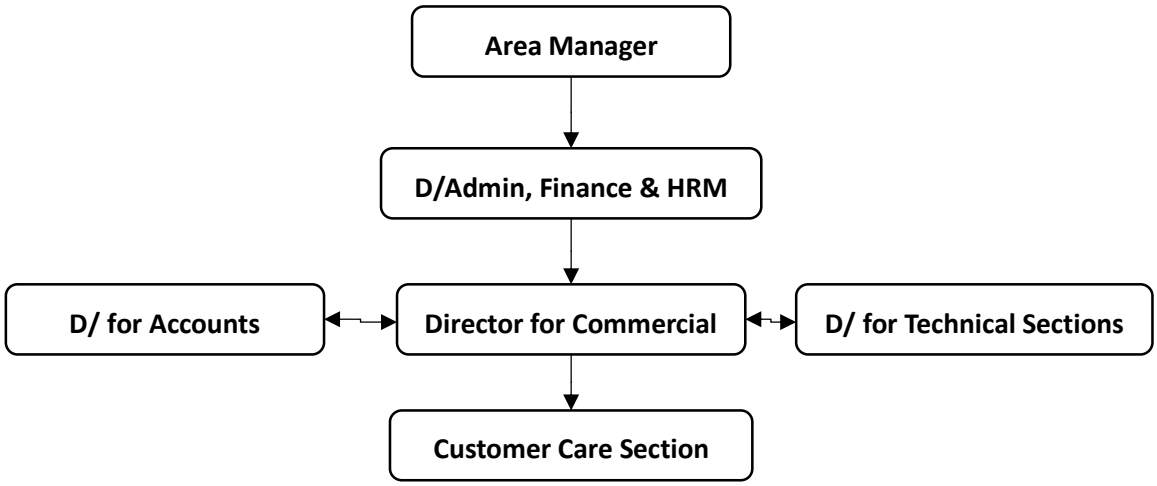
5. **Graph for Explaining the water system**

6. **List of PA Material**

Attachment 1.

- ✓ Structure Tree, Name of the staff
  Make clear the responsibility, role lines,

Structure



Attachment 2.

Contact Address (Mobile Phone) list

All the staffs should know each other contact address. But not showing the list to the customers, just share among the staff.

1. Customer Care Section

	Name	Title	Mobile +211
1	George Okee Aburi/Akim	Meter reader	0925 785 193
2	Christopher Phillip Lado	Senior technician	0921 647 165
3	Kongs Tokwaro Oninga	Meter reader	0920 999 901
4	Jonathan Winston Friday	Senior technician	0921 479 799
5	Pitia Robert Wani Marino	Head Clerk	0916 867 713

Department for Account

	Name	Title	Mobile +211
	Simon Boss	Senior Inspector of Account	092
	Jennifer Aciro	Inspector of Account	0925 644 651
	Hakim Emanuel	Ledger Keeper	0925 654 696
	Diana		
	Peter Loro		

Department for Technical Sections

	Name	Title	Mobile +211
	Christopher Phillip Lado	Senior technician	0921 647 165
	Jonathan Winston Friday	Senior technician	0921 479 799
	Cingan Madin	Technician	0921 292 928

Attachment 3. Tariff

Make is visible

SSUWC tariff as of Jan. 2016

Class 1	**288 SSP**			
Class 2	**192 SSP**			
Class 3	**96 SSP**			

1) Volumetric Use/Cubic meter is SSP 60 per Cubic meter;
2) Flat rate consumption.
   a) 1st Class Area ..... SSP 4, 650 per month;
   b) 2nd Class Area ..... SSP 2, 325 per month;
   c) 3rd Class Area ..... SSP 930 per month;
   d) Hotels ..... SSP 74, 400 per month;
   e) Government Offices ..... SSP 7, 200 per month;
   f) Guest Houses ..... SSP 18, 600 per month;
   g) Schools ..... SSP 4, 650 per month;
   h) Companies ..... SSP 46, 650 per month;
   i) New constructions ..... SSP 93, 000 per month;
   j) Stand pipes ..... SSP 93, 000 per month;
   k) Public toilets ..... SSP 4, 650 per month.

Attachment 4. Application Form

REPUBLIC OF SOUTH SUDAN,
SOUTH SUDAN URBAN WATER CORPORATION,
JUBEK STATE /JUBA.

(A) APPLICATION FORM . BY LAND LORD

Customers Name: ……City

/Town:……..

Postal Address:

…….Occupation:…….

Place of

Work :……..Location:……..

House / Plot

No:……..Class:……...

Customer's Passport Size :…….

Customers Contact Tel:.....

(B) COMMENTS OF SURVEY ENGIEER.

Distance in meters: ……..

Area of the Connection: ……..

***Size of the Pipe*:……..**

(C) TYPES OF CONNECTION.

Domestic ☐ **Commercial** ☐ **Office / Intuition** ☐

Company / Organization ☐

COMMENTENTS OF THE AREA MANAGER REFERNG TO SURVEY ENGINEER:……..Sign:……

…….

(D) PAYMENTS

Deposit SSP…….

Connection Fee SSP ……

Cost of Meter SSP ……

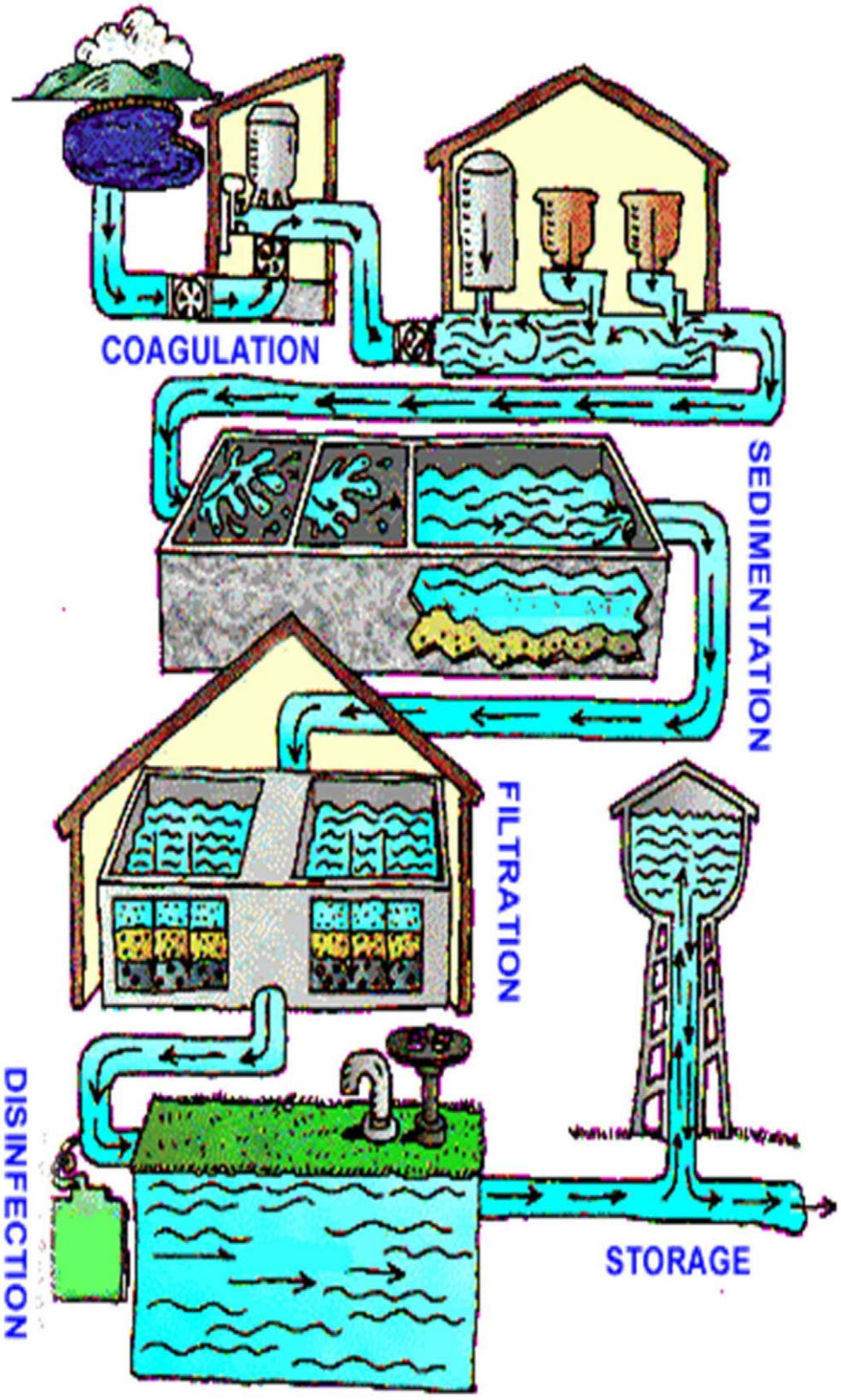
Cost of Contract SSP……

Other Costs SSP:……..

(E) AREA MANAGERS APPROVAL

Date :…… Sign :……..SSUWC/JUBA.

5. Graph for Explaining the water system



✓

Attachment 6. List of PA Materials

- Leaflet,
- Brochure
- T-shirt
- Cap
- Banner and Stickers

Design of Posters, banners and stickers,

2. Proposal of Customer Service Section

Public Awareness (PA)
South Sudan Urban Water Corporation (SSWUC)

Proposal on

Customer Care Office (Customer Service Section)

Background (Rationale for the office establishment)

The mission of South Sudan Urban Water Corporation (SSUWC) is to provide safe and clean water to the citizens of South Sudan. The Juba Station is covering 3 blocks namely; Juba , Kator and Munuki blocks.

However, due to the uncontrollable reasons, our water filtering system is not functioning well and we are worrying if we can provide the clean water to Juba citizens regularly. If we cannot provide satisfactory service to our customers, they may be reluctant to pay the bill, and in the result, we would face further difficulties to keep providing good services to citizens.

We, therefore, would like to have customers' relations office to listen to customers' voices and to take care for them. The customers' feedbacks are important to us as it help us improve our services and keep providing good services to our citizens.

Objective of the Assignment:

- Have a functional customer care office
- Have a well-trained polite and patient individuals to cater for customers concerns
- Set the office to be welcoming to make the customers feel comfortable.
- Follow up every feedback and act appropriately on the concerns raised.
- Appreciating the customers on the feedbacks given
- Make your contacts available to the public for notifications on any emergency.

Staff:

We make maximum use of existing staffs who have a lot of experiences at SSUWC Juba station including billing and meter readers who have been playing the role of customer care services by reporting the feedback to the office

Customer Care Operations:

(Starting and the way forward)

- ✓ We set up the customer's section desk or front at paying bill counters, to take care of customers
- ✓ Keep the record on every comment, questionnaires or complains etc. in the book, and if we have a set of computer, in the computer.
- ✓ First, we provide service during the office hours: 9 am to 5 pm : in the near future, we expand the service to 7 am to 7 pm
- ✓ We plan to respond to the regular phone inquiry or information provision etc.. If budget would be available, we provide toll free hotline service and expand the service hours.
- ✓ We start at Juba station and plan to expand to three blocks; Juba, Kator and Munuki stations

Job Descriptions (Term of Reference):

- Handling the customers problems and complaints- (Helping Role)
- Clerical tasks i.e recording every occurrence or complaints
- Assisting with awareness creation (sales and marketing role)
- Providing information on the new facilities, billings systems, payment tariffs, deadlines for payments etc. (Teaching role)
- Explaining the company's position to the clients providing first line of defense for the organization (the advocates role)
- Reporting the feedback from the clients to the management

Coordination and teamwork:

Quality service improvement programs
Staff surveys to engage the team members and give them a sense of belonging

Customers survey to act as a basis for the service
Customer profile and expectations
Develop service standards

Requirements (by the time of fully functioning):

- 3 Office spaces
- Computers: 2 computers for each office
- Computer software
- Staff: 3 staff working on 2 shift schedules from 7 am to 7 pm
- Toll free line: two service providers
- Field teams
- Repair tool kits for spare parts
- Motorcycles

3. Public Awareness Plan in Juba

Public Awareness (PA)
South Sudan Urban Water Corporation (SSWUC)
Drafted on November 25, 2016, Kampala, Uganda

Customer Awareness Creation Plan

Background

The mission of South Sudan Urban Water Corporation (SSUWC) is to provide safe and clean water to the citizens of South Sudan. Juba Station is covering 3 blocks namely; Juba , Kator and Munuki blocks.

It is very important to keep our citizen informed of our activities and to let them know the importance of safe and clean water.

We have so far campaigned in the project such as promoting the song “Water is Life”. But it is already several years past since we did that campaign last time (2011 and 2012).

Therefore, we propose the new awareness creation campaign for Juba citizen now.

Goals

1. To increase the public awareness on water and services of SSUWC
2. To increase the knowledge of the importance of clean and safe water

Activities

1. Road side banners :” Moyo de haya” , Water is life

2. Dispatching officers to homes and schools to create awareness and distribute the leaflets

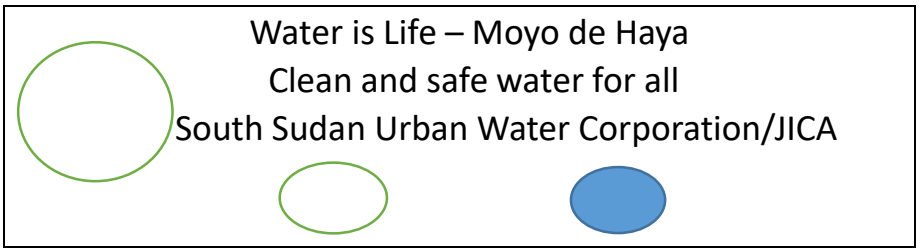
3. Market campaigns:
   Invite local artists to mobilize the people and promote the event
   ”eduitanment” sessions

Detailed Plan

(1) Banner Design

Corporation Name: South Sudan Urban Water Corporation
Slogan: Clean and safe water for all
Logo : Water is life "*Moyo de haya"*
Number : 10 banners
Places for display: 4 offices, Custom Round about, Parliament, Seventh Day Adventist church, Juba B court round about and 2 for market places

Banner Design Example



Draft the design and ask designers

- by Mid December
  - Water is Life – Moyo de Haya
- Image
  - Clean and safe water for all
  - South Sudan Urban Water Corporation/JICA

(2) Dispatching officers to homes, schools, to create awareness and distribute the leaflets

- Meter readers to visit homes and pass the informational brochures as they distribute the bills
- Conduct interpersonal communication
- Visit schools and create dialogue with the administration and pupils on the need for safe water
- Deliver brochures and calendars to schools or based on the brochure contents, WC officer will talk to Children.
- Assessment and evaluation criteria

School project

- The target 5 schools include both primary and secondary schools. Each school has approximately 600 students hence a total of 3000 students will be reached.
  - meet with school administration to get permission to talk to the pupils
  - prepare a 30 minutes session presentation to share information, distribute brochures and answer questions from the students
- (Use school children to sing songs promoting safe water use)
- (Train school children on safe water use)

T-shirt

- Print T-shirts/ caps for campaigns: for all the staff and for rewards for those who answer questions correctly during the ”eduitanment” sessions
- T shirts enhance branding and promotes the project (80 T shirts, 30 for the staff are polo neck while the distributions ones are round necks (50) Caps 30.

(3) Market campaigns:

Invite local artists using Mike Van to mobilize the people and promote the event

- Market Venue: Konyo Konyo Market, Customs Market, Jebel Market
- Campaign Dates: dates will be set 5- 10 January 2017 (Tentatively)
- New Dates: March 22, 2017 World Water Day
- Programs: example
  - ✧ Artists show
  - ✧ (School children song)
  - ✧ Question and answers session (Edutaiment)
  - ✧ Marketing campaign assessment and evaluation
  - ✧ Give water or soda

Time	Content	Person in Charge
8:30-9:00	Move to the activity place	TBD
9:00-9:10	Brief the purpose of the activity	
9:10-9:20	Song “Water is Life”	
9:20-9:40	Quiz about water	
9:40-9:45	Distribution of the brochure	
9:45-10:00	Explanation of the importance of safe water based on the brochure	
10:00-10:15	Explanation of SSUWC’s work and tariff system based on the brochure	
10:15-10:20	Closing Remark	
10:20-	Conduct interview with some participants by questionnaire to assess the impact	

- Materials and equipment
  - Mike van (microphone, public address system, generator, speaker/ MC)
  - Brochures/ flyers/ leaflets/ pamphlets
  - T- shirts/ caps- for all the SSUWC staff and selected participants that answers the questions correctly
  - Activity program
  - Assessment sheet

4. Assessment of Public Awareness

South Sudan Urban Water Corporation (SSWUC) Assessment Sheet

Excuse me. My name is _____at Juba Urban Water Corporation. Do you have time for a few minutes? Please help us by answering a few questions to improve our services.

(Date_____Starting Time_____:_____)

****

1. **Respondent's sex** → ▪Male ▪Female
2. **Area to live** →▪Juba Town, ▪Minitry Area, ▪Hal thous ▪Munuki ▪Other(_____)
3. **Respondent's Age** → ▪<20 ▪20's, ▪30's, ▪40's ▪50's ▪60 and above

4. **Have you heard of SS Urban Water Corporation?** → ▪Yes ▪No ⇒Skip to 7

_ a If "Yes" above, do you currently get water from SSUWC? → ▪Yes ▪No

b If "Yes" above, are you satisfied with the services? → ▪Yes ▪No

If "No" above -"not satisfied", what are your main reasons for dissatisfaction?

Check ✓ among followings if they say

▪Very high bills ▪Constant water shortage and rationing

▪Low water pressure taking long to fill tanks

▪Other(_____)

5. **How many days a week do you receive water?** _____Days a week
6. **Have you ever experienced water shortage or a pump burst?** → ▪Yes ▪No

6-1 If Yes, what did you do? Choose one →

(▪Nothing (giving up), ▪consulted to neighbors ▪Reported to UWC

▪Others (_____)

For Respondents currently not connected

7. If you have not been receiving water from SSUWC, would you tell us the reason why?

Check ✓ among followings if they say

▪ I don't want to pay ▪ I know that water is not supplying now

▪Water point is far away ▪I don't know how to apply ▪Other ( )

8. Now that you are not receiving water from SSUWC, where do you get water for your domestic use? Check ✓ among followings if they say

▪River ▪Water Kiosk ▪Piped water ▪Tank Filling station

▪Bore holes ▪Other _____)

9. **Are you happy with your current source of water?** → ▪Yes ▪No

If No, why? Check ✓ among followings if they say

▪Water is dirty ▪Cannot get water every day ▪Water point is far away

▪Have to pay expensive money for the water ▪Water supply is not functioning/ istributed daily ▪Others(_____)

Thank you for your cooperation

February 6, 2018

Report on Assessment on Knowledge, Attitude on Water Life, SSUWC of Juba Citizen

Reporters:
Christopher Phillip Lado, Kongs Tokwaro Oninga、George Okee Aburi
Jonathan Winston Friday, Peter Loro Onorato

Background

The mission of South Sudan Urban Water Corporation (SSUWC) is to provide safe and clean water to the citizens of South Sudan. Since the independence of South Sudan from Sudan, SSUWC are working with JICA for providing clean water for Juba citizen. However, at the time of end of the year 2017, SSUWC is suspending the water supply service in most of the place due to lack of the power and in the consequence, the motor pipe line is not working. Even in these circumstances, SSUWC PA team is working on keeping our citizen informed of the importance of safe and clean water and we are preparing for the better service when we deliver clean water. For preparing the better service of the water for Juba citizens, we need to know, at this moment how the people are getting water, how they are expecting our service, and they have the “water life now. So, we did the baseline survey targeting JUBA citizen for Assessment on Knowledge, Attitude on Water Life, SSUWC know their Attitude

PURPOSE

The purpose of the assessment is to know the knowledge, attitude of the Juba citizen on Water life and SSUWC at this moment so that we can find the gap and challenge and make it easy to plan Public Awareness strategy

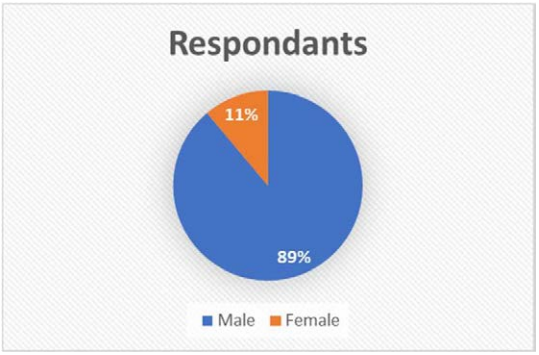
TARGET

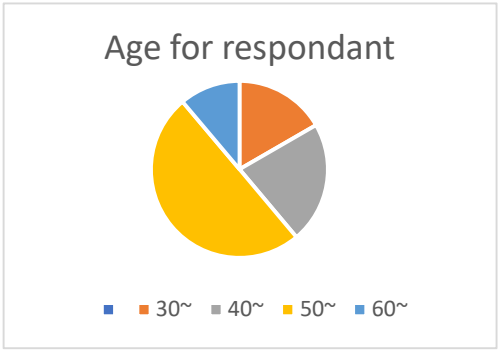
We implemented the Assessments for citizen at Juba town on December, 2017

RESULT

1. Respondents

The total number of the respondents are 36.
Among them male was 32 (89%) and female was only 4 (11%).
The area where they live is that all of them are Juba town, mainly in prison and police Line area.
Half of the Respondents are age 50’s, and follow 40’s 30’s, and 60 and above.

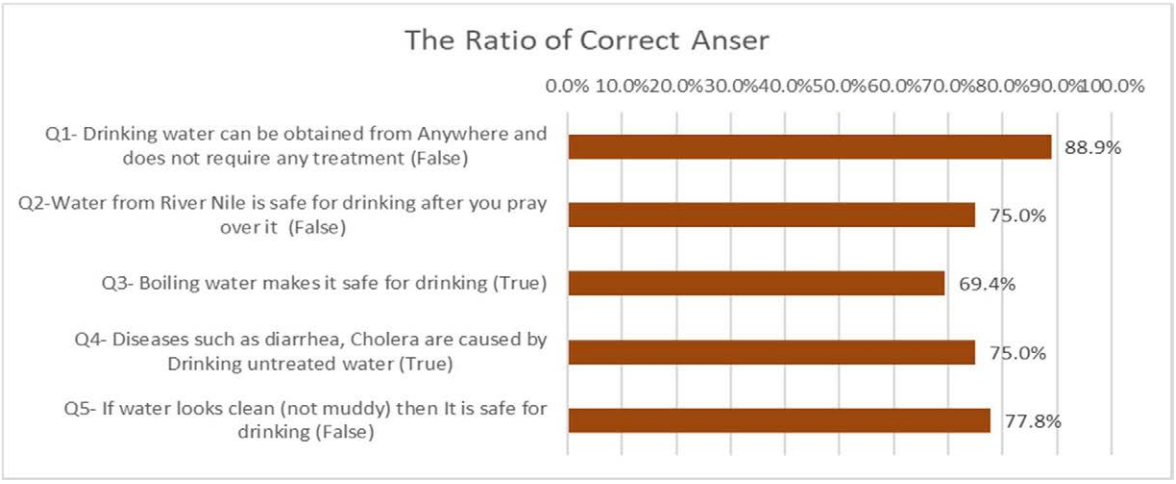




2. Knowledge on Clean and Safe Water

To know the knowledge on clean and safe water of juba citizen, we set up the following five statements, and asked the statement are true（〇） or false（×）

The ratio of correct answer to each question is as follows



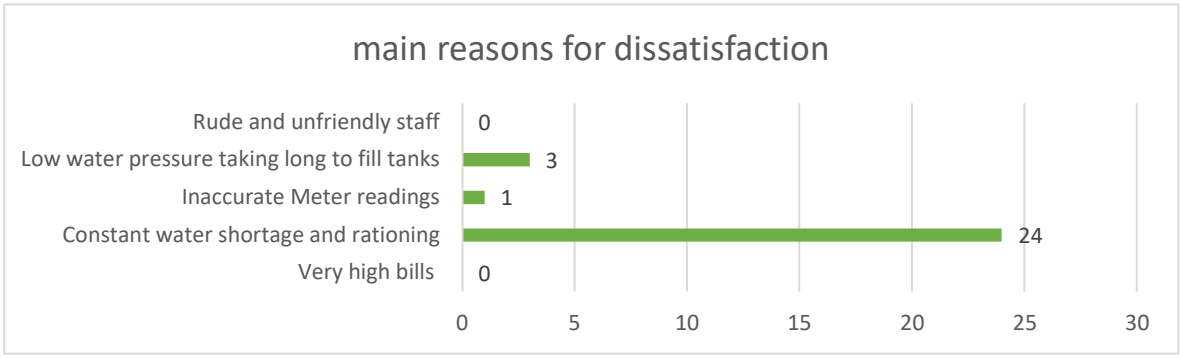
People well understand that “Q1- Drinking water can be obtained from Anywhere and does not require any treatment# is wrong answer (88.9%), however, less understand “Q2-Water from River Nile is safe for drinking after you pray over it (False) (75.0%), and “Q3- Boiling water makes it safe for drinking (True)” (69.4%). Only75% correctly answer that “Diseases such as diarrhea, Cholera are caused by Drinking untreated water”.

3. SSUWC Service

Most of the respondents (35 among36, 97.2%) have heard of South Sudan Urban Water Corporation. Also, many of them (34/46, 94.4%) are currently get water from SSUWC.

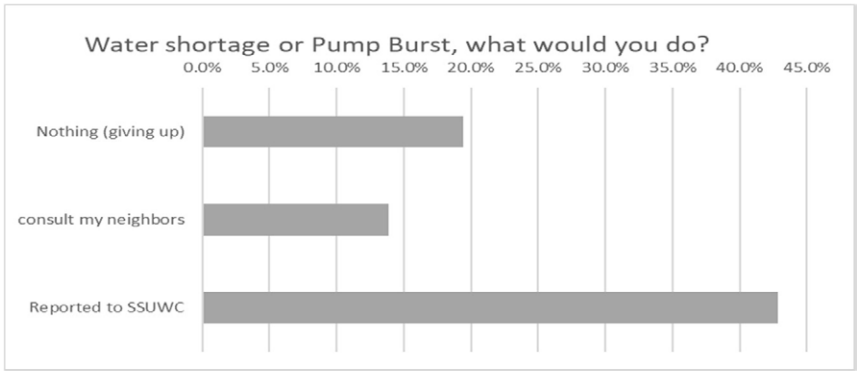
However, the ratio of satisfaction with service is low (7/36, 19.4%)

The main reasons for dissatisfaction is “Constant water shortage and rationing” (24/36, 66.7%) . Another said “Low water pressure taking long to fill tanks” (3/36, 8.3%) .



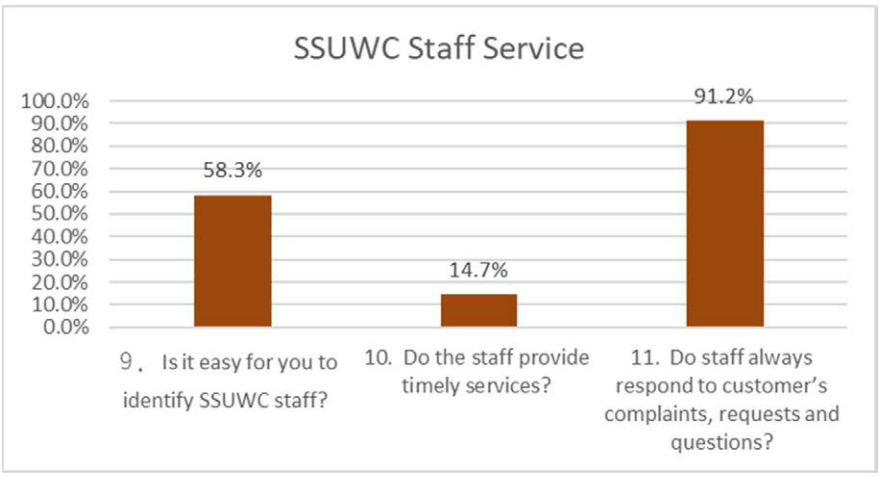
People replied that they are receiving water on average 4.1 days per a week. Many of them say 4 or 5 days.

For the question on if you have ever experienced water shortage or a pump burst, 29 out of 36 (80.6%) responded “Yes”. Then, we asked, “What did you do?”, the most frequent answer was “to report to SSUWC ”, (15/36, 42.9%), and then “to do nothing or just giving up” is the next (7/36, 19.4%), and “consult neighbors (5/36, 13.9%)



For the question if it is easy to identify SSUWC staff, 58.3% (21/36) said “Yes”

Many (91.2%, 31/34) said that staff always respond to customer’s complaints, requests and questions, but the question on “do the staff provide timely services?” was relatively low (14.7%, 5/34)

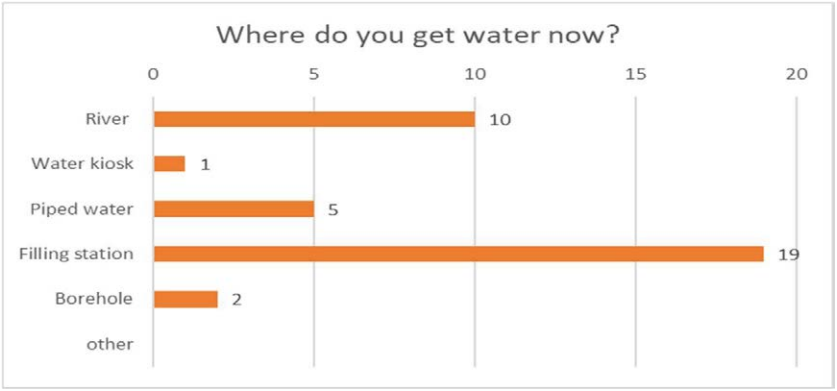


4. Water Life

Following is the question to those who have not been receiving water from SSUWC, we asked the reason why they don't receive service

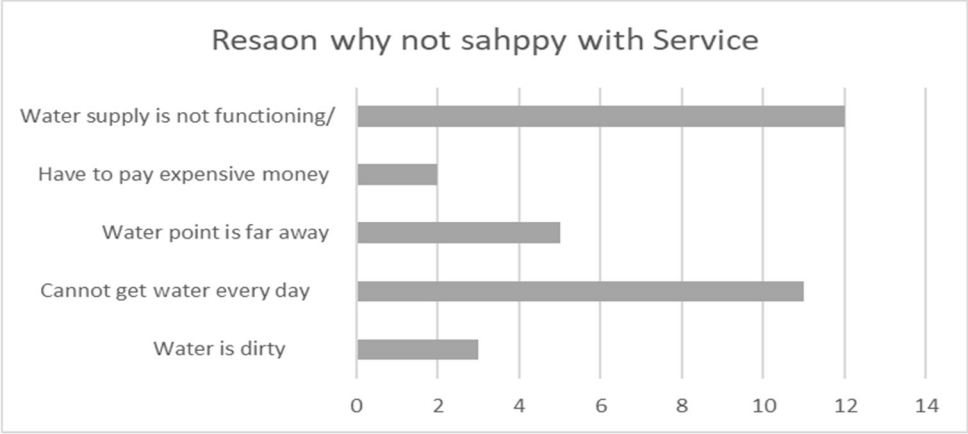
The main reason is "(they) know that water is not supplying now" (28 cases), and then "Water point is far away" (4 cases)

Regarding the question, where are the Juba citizen getting water for your domestic use now is "Tank Filling station" is 19, "River" is 10, "Piped water" is 5 cases each.

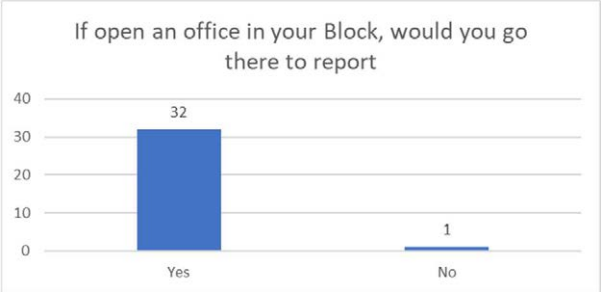


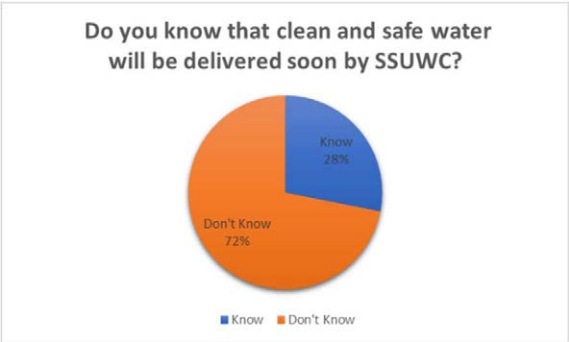
To the question to "are you happy with your current source of water?" there is no one to answer "Yes". 29 answered "No", which means not happy with the current water source.

The reason why they are not happy with the services are ; “Water supply is not functioning /distributed daily”, “Cannot get water every day” are the main reasons. Some are saying “Water point is far away”



When we asked if SSUWC were to open an office in your Block, most of them (32 out of 33) said they would like to go.





The last question is to ask if they know that clean and safe water will be delivered soon, many of them, did not know (23 out of 32, 72%)

DISCUSSION

Although the number of the respondents are relative small number, we could hear and find out the what the Juba citizen are thinking of water supply and how they are managing in this situation.

Regarding the, knowledge, Juba citizens are relatively knowledgeable clean and safe water., but if SSUWC would work on PA activities, we can increase the level of the knowledge.

Toward the service and recognition and attitude for SSUWC, Juba citizen seemed to be basically know SSUWC and our service. However. unfortunately, the ratio of satisfying our water services was low (19.4%)..
The main reason of dissatisfaction is “Constant water shortage”. This is because we don’t have electricity for pumping and cannot supply water without power. We hope when we have power back, we can provide the water, and then the dissatisfaction would be solved.

Most of the people answered said SSUWC Staff are reliable by responding to customer’s complaints, requests and questions, however, they evaluate low on “timely services”. This is because now we have some challenge of vehicle and fuel of them. If those challenges are solved, we would provide the more timey service.

Many people are answering “not happy” with the current water supply situation. This is because we are unable to provide the clean water by pipeline for Juba citizen, however, we will make our effort and we are sure that the day when the water can be provided, people will be very happy and the ration must be improved drastically

CONCLUSION

We have found out that how people are living the water life at these circumstances. Juba citizen are living water life by themselves in those hard situations. People still recognize SSUWC and are expecting our service back. Due to lack of power, we cannot provide the best service right now. But when the power is back, we may deliver the water and good service again.

We hope the water supply will be resume soon and we can provide the clean and safe water for Juba citizen as soon as possible.

5. Public Awareness Materials

Public Awareness Materials

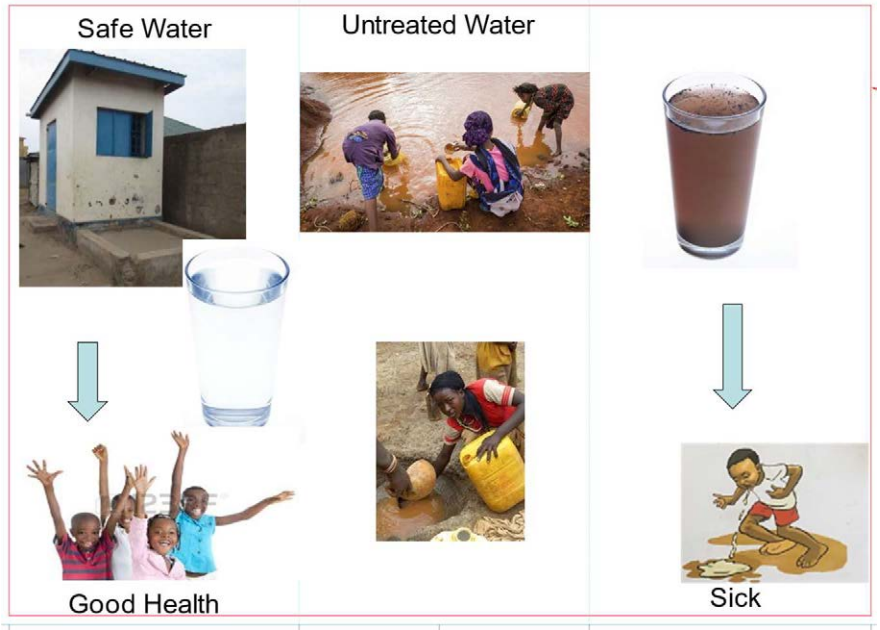
1. List of PA Materials for SSUWC

No.	Items	Quantity
1.	SSUWC Pamphlet (Water is life)	500
2.	Polo sheet	30
3.	T-Shirt T-Shirt (additional)	80 200
4.	Cap	30
5.	Banner (Water is life)	10
6.	Calendar (2021)	200
7.	Calendar (2022)	300
8.	Awareness pamphlet for COVID-19	200 (English) 200 (Arabic)
9.	Hand wash poster (How to wash hands with soap)	6
10.	Handwash poster when do we wash hands	6
11.	Handwash poster why wash hands with soap	6
12.	Let's handwash together by JICA	6 sets
13.	Let's hand wash together by Adija	6 sets
14.	What happens if I don't wash my hands with soap by Adija	6 sets
15.	Movie for awareness of COVID-19 South Sudan Urban Water Corporation / JICA COVID-19 Awareness Campaign YouTube https://youtu.be/BTaATKLP34A	1 set

2. Public Awareness Materials for SSUWC

2.1. SSUWC Pamphlet (Water is life)

Face



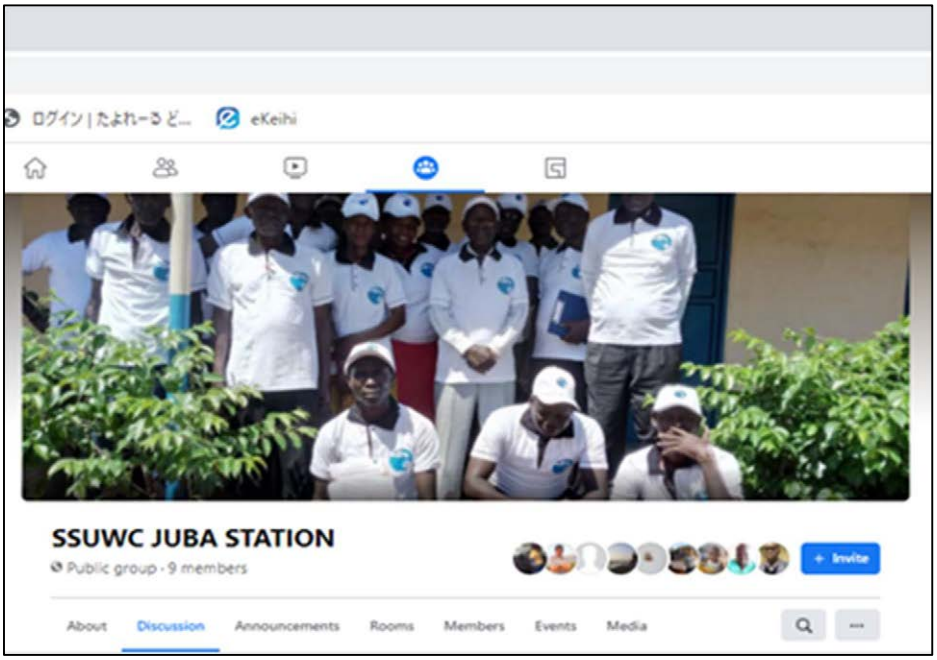
Reverse side

2.2. Polo sheet, T-Shirt and Cap

Polo T-shirt and Cap design

T-Shirt

SSUWC Juba Station Staff wearing T-shirt and Cap

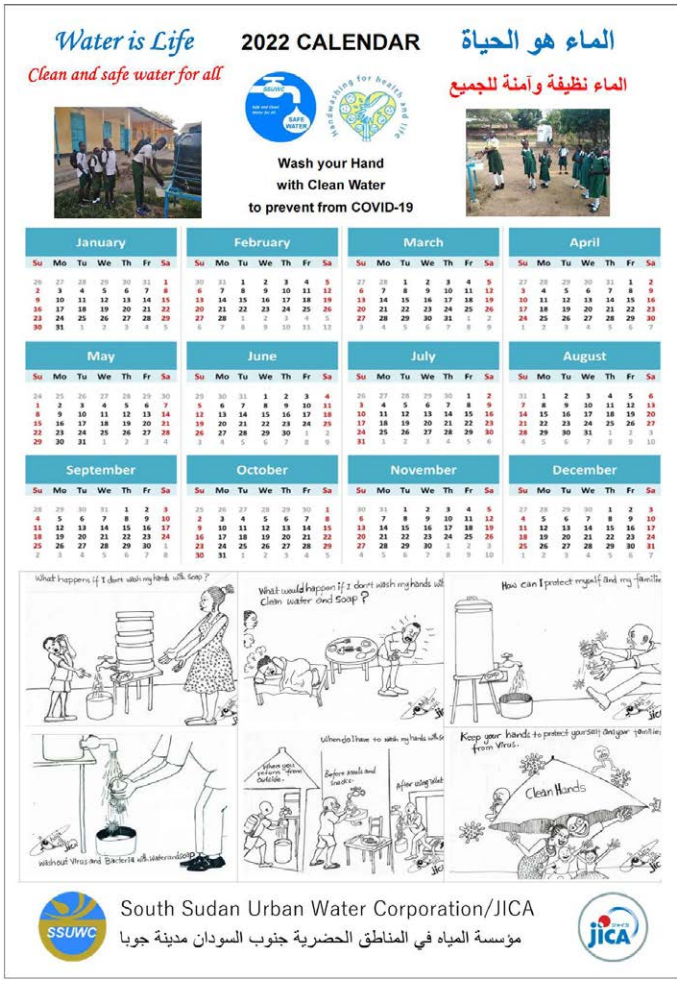


SSUWC Juba Station Facebook

2.3. Banner (Water is life)

2.4. Calendars (2021 and 2022)

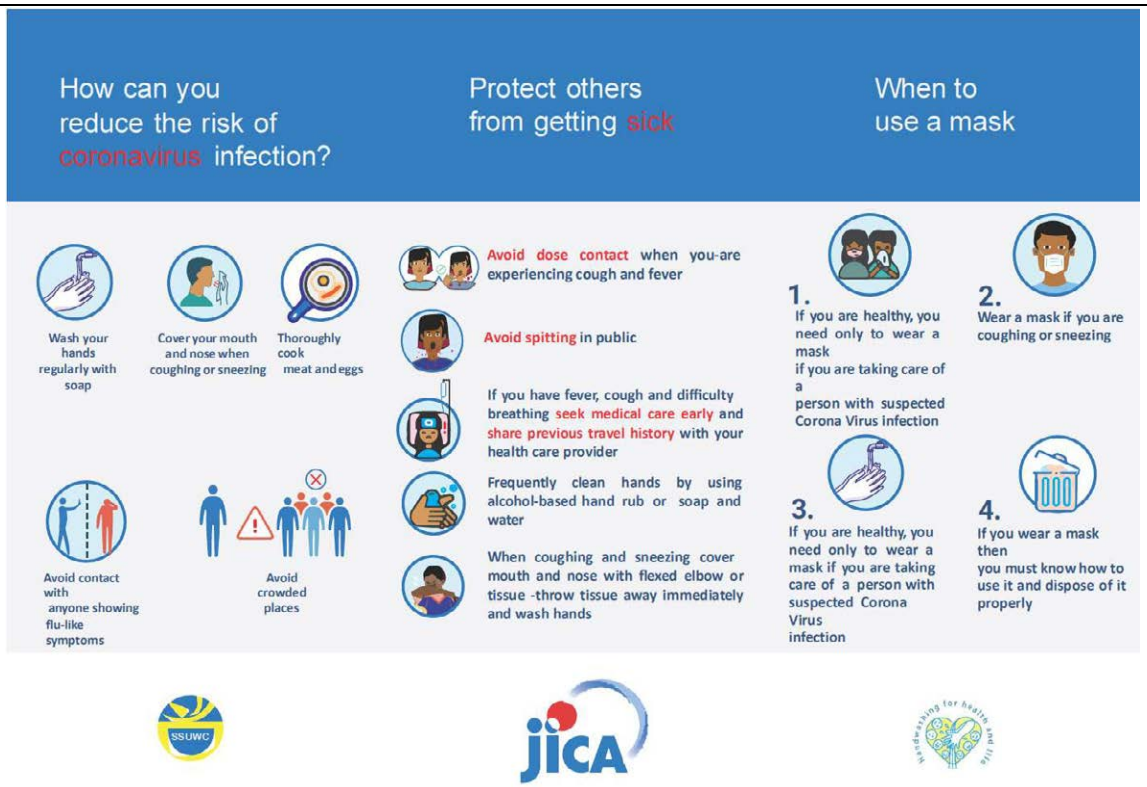
Calendar (2021)



Calendar (2022)

3. Public Awareness Materials for Prevention of COVID-19

3.1. Awareness pamphlet for COVID-19



English Version

Arabic Version

3.2. Handwash poster How to wash hands with soap

3.3. Handwash poster when do we wash hands

3.4. Handwash poster why wash hands with soap

3.5. Let's handwash together by JICA

Question

When do we wash our hands ?

Wash your hands

- **When you return home from outside**
- **After using the toilet**
- **Before meals or snacks**

Question

Why do we wash our hands so much ?

Answer

If you don't wash your hands, a tons of viruses and bacteria remains on your hands.

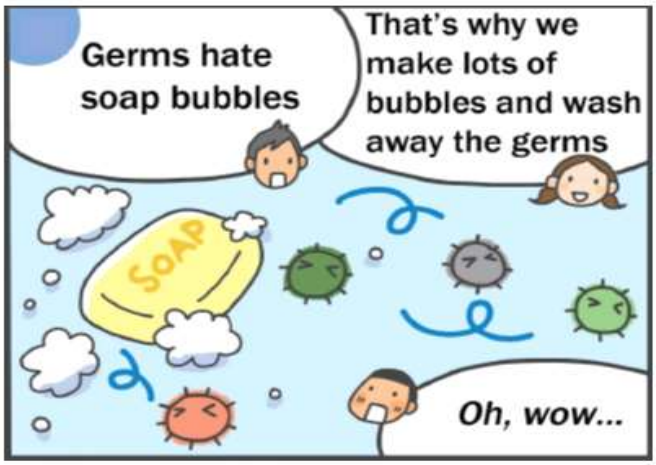
A tons of viruses and bacteria left on your hands can enter your body through food and mouth, eyes and nose.

Question

What happens to you if a virus or bacteria gets into your body?

Answer

Viruses and bacteria that enter your body can make you sick.



Question

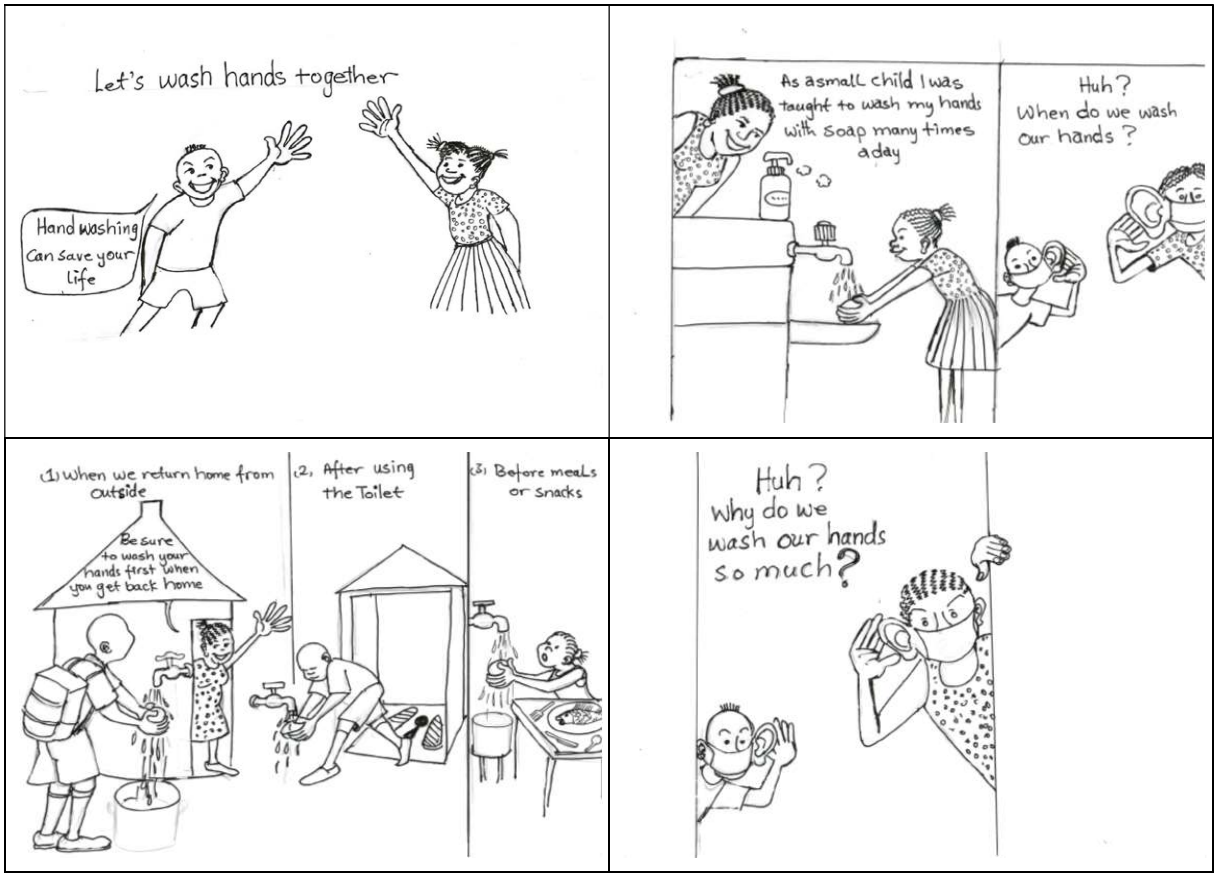
What can you do to avoid getting sick?

Answer

Let's wash your hands with soap.

When you have finished washing your hands, wipe your hands with a clean cloth and dry them off.

3.6. Let's hand wash together by Adija




Well, our hands and fingers Look Clean, but
actually, there are tons of virus and germs we can't see ...
If you don't wash your hands before you eat.
Or if you touch your face, germs get into your body via your eyes, mouth, or nose.
you can get a belly ache, or...
it can even make you sick
Germs hate Soap bubbles
That's why we make Lots of bubbles and wash away the germs
soap
oh, wow
How to wash hands with Soap.
1 2 3 4 Let's slowly count to 30 while washing
Lather your hands with Soap
Get hands wet with water
Add soap and make bubbles
palms
Back of hands
Both wrists
under nails
Between Fingers
Both Thumbs
Finally, Completely wash off the soap with water
Wipe them with a clean towel or thoroughly dry them off... and you're done!
Keep your hands to protect yourself and your families from virus.
Clean Hands
Let's wash your hands with soap and protect your health!
Keep clean your hands!!
To protect you and your family from COVID-19 and Water-borne diseases
Supported by
South Sudan Urban Water Corporation
Japan International Cooperation Agency
TEC International Co., Ltd.

3.7. What happens if I don't wash my hands with soap by Adija

6. Water Supply in Tokyo

Water Supply in Tokyo

Bureau of Waterworks
Tokyo Metropolitan Government

Outline of the Metropolis of Tokyo

- Tokyo is the capital and the largest city in Japan.
- Population of 13.63 million (as of January 1, 2018), which is about 10% of the population of Japan.
- The population and the bases of economic activities are concentrated in Tokyo and extend to its suburban areas.

(1) Contact points for inquiries (Customer Service Centers)

- For improvements in services including consolidation of contact points and extension/expansion of office hours, Tokyo Waterworks has established 2 customer service centers.
- Our Customer Centers serve as central reception for telephone calls and online applications from our customers. They handle inquiries via the internet and phones. They also accept and process applications from customers for payment by transfer account or by credit card.

(1)-2 The customer service centers

- The customer service centers open from 8:30 a.m. to 8 p.m. except Sundays and national holidays,
- They respond to emergency events such as water leakage accidents 24 hours a day, 365 days a year.
- Also, information on the contents of contracts with customers concerning water charges, meter reading and charges is managed online by the Bureau's independently-established system so the centers are always ready to quickly respond to inquiries from customers.

(2) Water meter reading

- In Tokyo, for most customers except for major users in certain part of the 23 Wards, the water meters are read every two months and charged the rate for the two month period.
- To enhance efficiency of the work, the meter reading works are entrusted to private sectors.
- Additionally, meter readers carry specialized computers with them to notify customers of water usage and charges as well as issue bills with a single unified form.

(3) Payment of water charges

- payment by account transfer, by using a bill and by credit card. Payment by account transfer is available at 153 financial institutions and Japan Post Bank, which improves the convenience of charge payment.
- Customers who pay by account transfer get a 50-yen (Tax excluded) discount per month.
- Payment using a bill can be made at the Bureau's service stations or the service office counter as well as above-mentioned financial institutions, post offices and convenience stores.

(4) Charge system

- The water charges in Tokyo consist of the minimum charges and the commodity charges.
- Tokyo Waterworks adopts the water rate system based on the diameter size of service pipe (bore diameter), which ensures the fairness in cost burden and the clarity of the rate system.
- Also, out of consideration for the cost reduction of domestic water and the demand restraint by promote reasonable use of water, Tokyo Waterworks adopts the increasing charge system for the commodity charges in which the more the water consumption increases, the higher the unit price becomes

(5) Regional customer service bases (service stations/ service offices)

Tokyo Waterworks has 33 service stations and service offices as the bases for regional customer services. and offer such services as

- accepting various notifications and applications,
- collecting charges at counters,
- giving instructions to the companies entrusted to read meters,
- performing cause investigation in cases of considerable increase/ decrease in water consumption volume,
- collecting and organizing unpaid charges,
- carrying out regional PR activities.

② Measures for Water Supply Facilities with Receiving Tank

- The water supply facilities with receiving tank is a water supply system that uses a receiving tank to store water at first and then supplies the water. Due to the revision of the Waterworks Law in July 2001, the water suppliers must be involved in the sanitary management from the standpoint of supplier.

To supply potable delicious water

- The Bureau of Waterworks set the measures for water supply facilities with receiving tank to supply potable delicious water with the purpose of “achieving proper administration of water supply facilities with receiving tanks” and the “popularization and expansion of the direct water service.”
- In this project, we are implementing the check and examination activities of the water supply facilities with receiving tanks which were installed in our service area from FY2004 (Heisei 16), the advices on maintenance/management and the PR activity of the direct water service.

③ Expansion of the Scope of Direct Water Service

To promote the “popularization and expansion of the direct water service,” the scope and execution standard of the direct water service system was partially relaxed in June 2004.

(1) Expansion of the scope of direct water service to 4th or 5th floor (Exceptional direct water service)

(2) Exceptional provision for changing Water Supply Facilities with Receiving Tanks in Building of Three Stories or Less to Direct Water Service System

(3) Exceptional provision for changing Water Supply Facilities with Receiving Tanks in Building of Three Stories or Less to Direct Water Service System

7. Public Relations of Yokohama Waterworks Bureau (YWWB)

Public Relations of Yokohama Waterworks Bureau

YWWB Mascot
"HAMA PYON"

28 Nov. 2012

Katsutoshi Nakamura (Mr.)

CONTENTS

Public Hearing and Public Relations

[Public Hearing] 広聴

- Includes passive approach toward customers
- Can solve the customer's requests/questions
- Customers opinions are made public and we can learn from them

Information Collection

[Public Relations (PR)] 広報

- Active approach toward customers
- As public water utilities, we are obliged to do PR
- Information should be updated from time to time

Information Provision

■ Public Hearing of YWWB

1.Customer Service Center (Call center)

*Accept calls 24 hours everyday

*Calls are responded, compiled, analyzed and made public

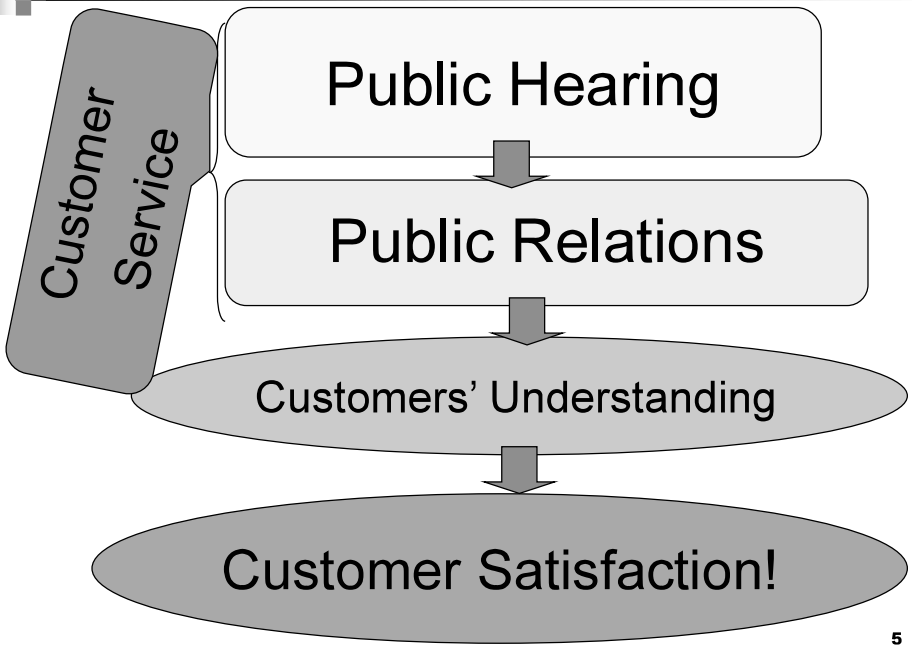
2. Public Hearing System of City of Yokohama

*On-line form, e-mail, letters, call and visit

*Mails are answered and made public.

3. Survey and Questionnaires

* 2 types of regular surveys (questionnaires)
* Internet Monitor(500)
* On-site questionnaires (distributed at events or sent to limited citizens), conducted occasionally



CONTENTS

Yokohama Waterworks Bureau

■ Public Relations of YWWB

Type of information

1 Information customers require

2 Information we must convey

3 Information we want to convey

We should select the effective tools and means of PR depending on the type of information, with consideration for cost.

Yokohama Waterworks Bureau

1 Public Relations (1) Type of Information

Type of Information	Examples	Tools/ Means
Information customers require	Water charge Water quality Countermeasures in case of disasters	Information slip (distributed to all households) Official Bulletin for all households Website Press Release
Information we must convey	Ordinances, rules Water tariff	Pamphlets, leaflets Free papers Poster, flyers Event Radio CM EMail newsletter
Information we want to convey	Managing (financial) status PR of bottled water Event information	

Yokohama Waterworks Bureau

CONTENTS

poster

Tap Water is tasty with safety and plenty !

Famous Classical Singer

2012 PR Poster of Capital Region Tap Water Campaign

Posted in trains in capital region

Official bulletin for all households

Title

Bulletin Yokohama
~Water of Yokohama~

Distributed to all households
Frequency: once a year
No. of copies:1,580,000
Target: All citizens

Information Slip

The reverse side of Information Slip on Water Charge etc. is utilized as advertisement tool.

Please don't cover the meter box! Etc.

Posted to all households
Frequency: once in 2 months
Target: Water users

Pamphlets

Title

Yokohama Water

Given to visitors (or those we visit) *English Version to foreigners
Frequency (updated): once a year
No. of copies:9,500
Target: Those who are interested in Yokohama water

Pamphlets

Title

Tell me, Hama Pyon P!

Distributed on the occasions of events and enclosed in "starters kits"
No. of copies:2,600,000
Target: citizens

Pamphlets

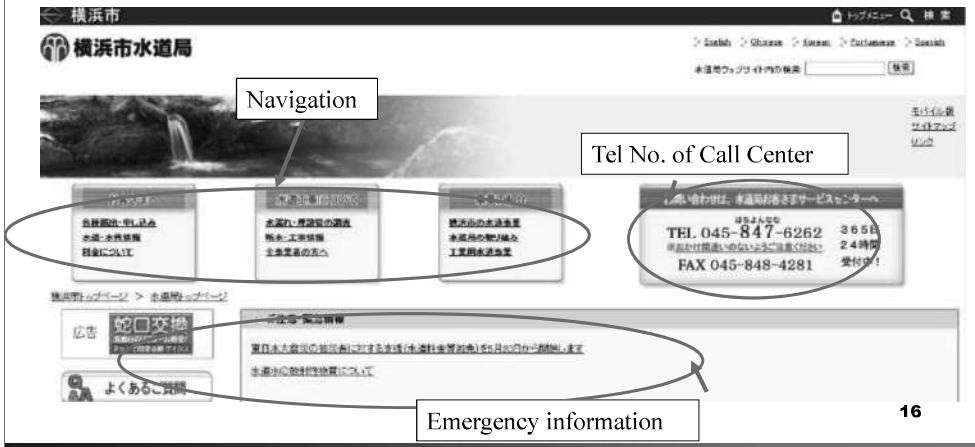
Title

Waterworks of Yokohama

Distributed at elementary schools
Frequency (update): once a year
No. of copies:41,000
Target: Children (in particular, 4th grade of elementary school (age 9-10)

Website

- Annual Access No.: Approx. 470 million
- Monthly Average Access: 424,000
- Opened the website in 1998. The 3rd renewal of the site was done in 2010.

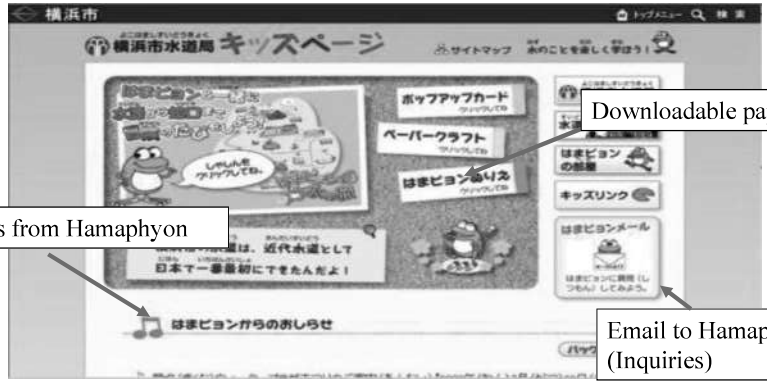


Website

Special Contents (FAQ, Kids page, Event information, PR of bottled water, Asset announcement)

Website Kids Page

- Objectives: Future customers can enjoy learning about the waterworks
- Contents: Introduction of Waterworks with quiz, game & paper crafts
- Design: Unified tone & Easy to understand



Downloadable paper crafts

News from Hamaphyon

Email to Hamapyon (Inquiries)

Profile of Hama-Pyon

- **Name**
  - Hama Pyon
- **Birthday**
  - 1st June * rumored to be born in 1995?
- **Birthplace**
  - Clean river at Doshi Village in Yamanashi
- **Sex**
  - Unknown
- **Characteristics**
  - Looks like a frog, but able to stand with 2 feet and speak Japanese!
- **Activity**
  - Appearing in pamphlets, formed into souvenirs, and starring in video “Please teach me, Hama Pyon”. Sometimes, big Hama-pyon can be observed in events!

Event

Waterworks Week

1st – 7th June (Nationwide)

Hama Pyon, A popular Character

Demonstration by Water Supply Vehicle

Overview of the event venue

Event

Facility Tour - Observatory Tour to Water Resources in Doshi (Yamanashi)

Explanation about the role of the water conservation forest

Experiments of filtering with a miniture model

Event

Disaster Drill (for Emergency Water Supply) by Regional Service Centers

Event For Kids

Waterworks Class at schools

Result in 2011

No. of schools (public elementary schools only):152（446 Classes）

*Approx. 40% of all schools in Yokohama City

No. of pupils participated :16,156

Event For Kids

Water Quality Experiment for Families (Kids & Parents)

Result in 2011

3 Classes at 3 Water Treatment

No. of people participated: 60 (kids and parents)

Others

「Hamakko Doshi **The Water** 」

Bottled water of “Doshi River” water, the water resources of Yokohama.

Advertising the Quality of Water Resources of Yokohama City!!

- Sales target: 200 million bottle per year
- The profit is used as a fund for forestation in the water resources.

125 Anniversary of Yokohama Waterworks~ Special Year for PR!!

Pamphlet

Exhibition

Yokohama Suido (Waterworks)
With your life for 125 years, and toward the future

Event

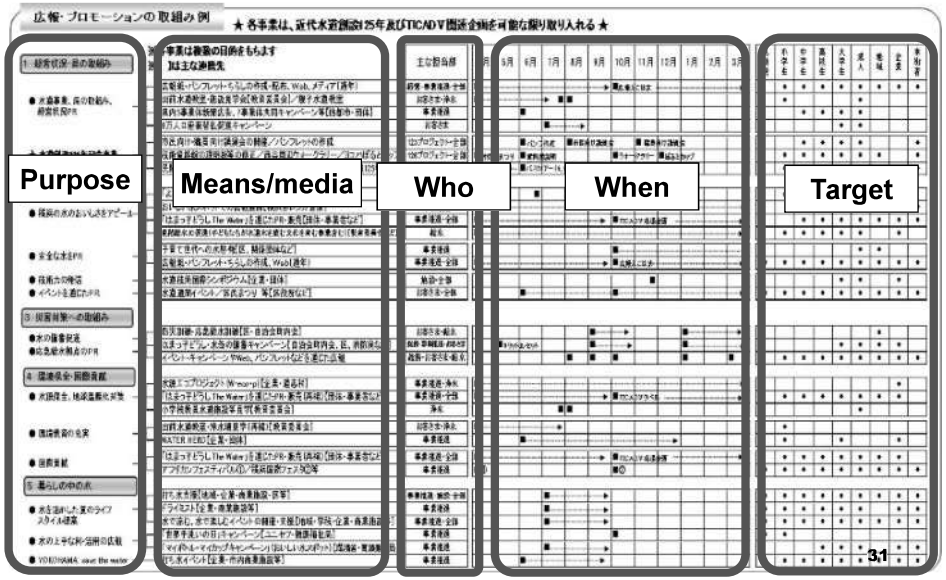
Tour

Product in collaboration with corporations

←Yokohama Beer

CONTENTS

The Whole Plan of PR in YWWB



YWWB's Catch Phrase (Message) to Customer

Use Yokohama's Water Wisely
~ Healthy & rich life comes from taps~

上手に使おう　横浜の水
～健康と豊かな暮らしは 蛇口から～

Annex-3: SOP for Updating GIS Mapping for Facilities and Customers

THE GOVERNMENT OF THE SOUTH SUDAN (GOSS)
MINISTRY OF, WATER RESOURCES AND IRRIGATION (MWRI)
SOUTH SUDAN URBAN WATER CORPORATION (SSUWC)

THE PROJECT FOR MANAGEMENT CAPACITY ENHANCEMENT
OF SOUTH SUDAN URBAN WATER CORPORATION
PHASE 2 TERM 4

GEOGRAPHICAL INFORMATION SYSTEM (GIS)

STANDARD OPERATING PROCEDURE (SOP) FOR UPDATING PIPE NETWORK, WATER FACILITIES, AND CUSTOMER DATA

(MARCH 2021)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
TEC INTERNATIONAL CO., LTD. (TECI)

Table of Contents

This SOP first introduces the most important water supply related GIS layers for Juba (mainly pipe network, water facilities, and customer data) and the process to be followed when updating these layers in the latest available QGIS program (QGIS version 3.4). It also describes how to link customer billing data with the GIS points of customers.

1. PIPELINE

The Pipe layer of Juba has 11 fields (Field ID from 0 to 10). Name and characteristics of each field are shown below.

Id	Name	Alias	Type	Type name	Length	Precision
123 0	Diameter	Diameter in mm	int	Integer	4	0
abc 1	Material	Material of pipe	QString	String	20	0
1.2 2	Length	Length in m	double	Real	18	6
abc 3	Source	Source of data	QString	String	50	0
4	INS_YEAR	Year of installation	QDate	Date	10	0
abc 5	Status	In use or closed	QString	String	20	0
abc 6	Checked	If we checked this pipe	QString	String	5	0
abc 7	REMARKS	Any remark	QString	String	50	0
123 8	ET_FNode	Starting point	qlonglong	Integer64	10	0
123 9	ET_TNode	Ending point	qlonglong	Integer64	10	0
abc 10	Area	Locality name	QString	String	80	0

1.1 Properties and Attributes of Each Field in 'Pipe' Layer

Properties of each field are given below.

Name of Field	Explanation	Example of data in the field
Diameter	Diameter of pipe in mm	25, 50, 75, 100,125, 150, 200, 250, 300
Material	Material of pipe	AC, uPVC, GI, Steel, HDPE
Length	Length of pipe in m	The length may be calculated by GIS or measured at site and entered directly.
Source	Original source of information	LGB pipe, MDT pipe, PipeClass etc. The PipeClass is the pipe information compiled in the initial stage of collection in around 2011.

Name of Field	Explanation	Example of data in the field
INS_YEAR	Year of pipe installation	2017/7/24 This information is not available for most of the pipelines. The data such as above is the date of compilation and not real installation date. It needs to be checked and confirmed.
Status	In use or closed. This is required for hydraulic modeling.	
Checked	If this pipe is checked or not to confirm its existence and other propertied by a joint team of GIS and distribution.	Yes, No
REMARKS	Any remarks about the pipe	
ET_FNode	Starting point of the pipe, it is required for hydraulic modeling	
ET_TNode	Ending point of the pipe, it is required for hydraulic modeling	
Area	The locality name where the pipe is laid	

Example of pipe attributes are given below.

Diameter	Material	Length	Source	INS_YEAR	Status	Checked	REMARKS	ET_FNode	ET_TNode	Area
200	uPVC	27.20	PipeClass	2017/7/24		Yes		69	70	Juba Town
75	AC	48.36	PipeClass	2017/7/24		Yes		36	29	Hai Jalaba
50	HDPE	16.64	PipeClass	2017/7/24		Yes		22	23	
300	Steel	1467.49	MDTFpipe	2017/7/24		Yes		329	1	Juba Town
32	HDPE	348.31	PipeClass	2017/7/24		Yes	Bends due to tarmac	47	50	
25	GI	123.99	PipeClass	2017/7/24		Yes		114	124	
50	GI	92.88	PipeClass	2017/7/24		TBC		125	126	

1.2 Steps to Update Pipe Information and Alignment

1) *Open QGIS project containing pipe layer, OR create a new QGIS project, select Juba's coordinate reference system i.e., WGS 84 / UTM zone 36N (EPSG 32636).*
2) *Add Pipe layer shape file if you created a new map in Step 1) or Pipe layer was not already added.*
3) *Select the Pipe layer in the GIS map by clicking on the layer at the right-hand side TOC (Table of Contents) window and start editing by clicking on Toggle Editing tool on tool*

bar.

4) *In the map, find the pipe for which you want to update/change information and click on it with Selection Feature(s) tool.*

5) *Open attribute table by right-clicking on the layer and opening attribute table or clicking on Open Attribute Table tool.*

6) *To find the selected pipe easily, you can use filter function at the left-hand-side (LHS) bottom to show selected features only.*

7) *Change the desired attribute of the selected pipe; type directly in the cell of attribute table. For example, if you want to update the status from blank or Null to 'In use', click in the Status field and type 'In use'. Similarly, you can change any other attribute of pipe like pipe material, diameter or installed year and so on.*

8) *For modifying shape of any pipe (e.g., shortening, lengthening, changing route etc) select the pipe and use desired editing tool such as Cut feature, Split feature, Merge features, Move feature, and so on. Since the pipes are line features, only the tools related to line features will be active when you the pipeline layer is active in editing mode.*

If you want to add any new attribute for the pipe, create a new field as follows and add the attributes.

9) *Open attribute table → Start editing (if not already in editing mode) → New Field → Select Name, Type, Length of the field.*

You can also change attribute of several pipes together if they have some common attributes.

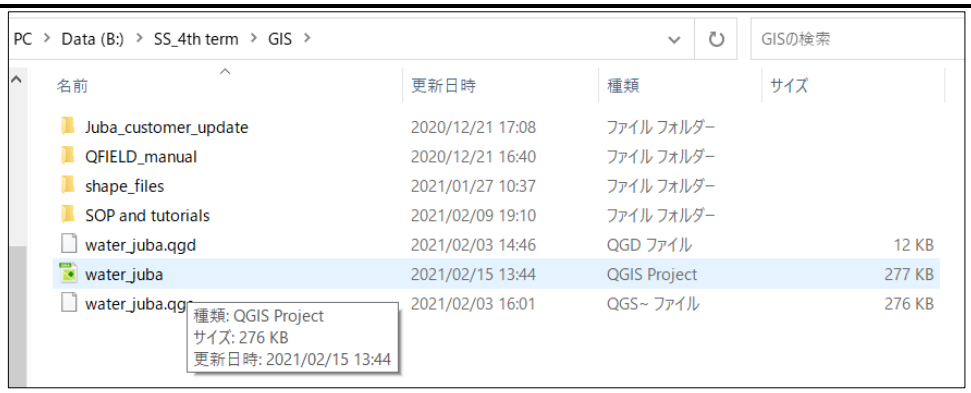
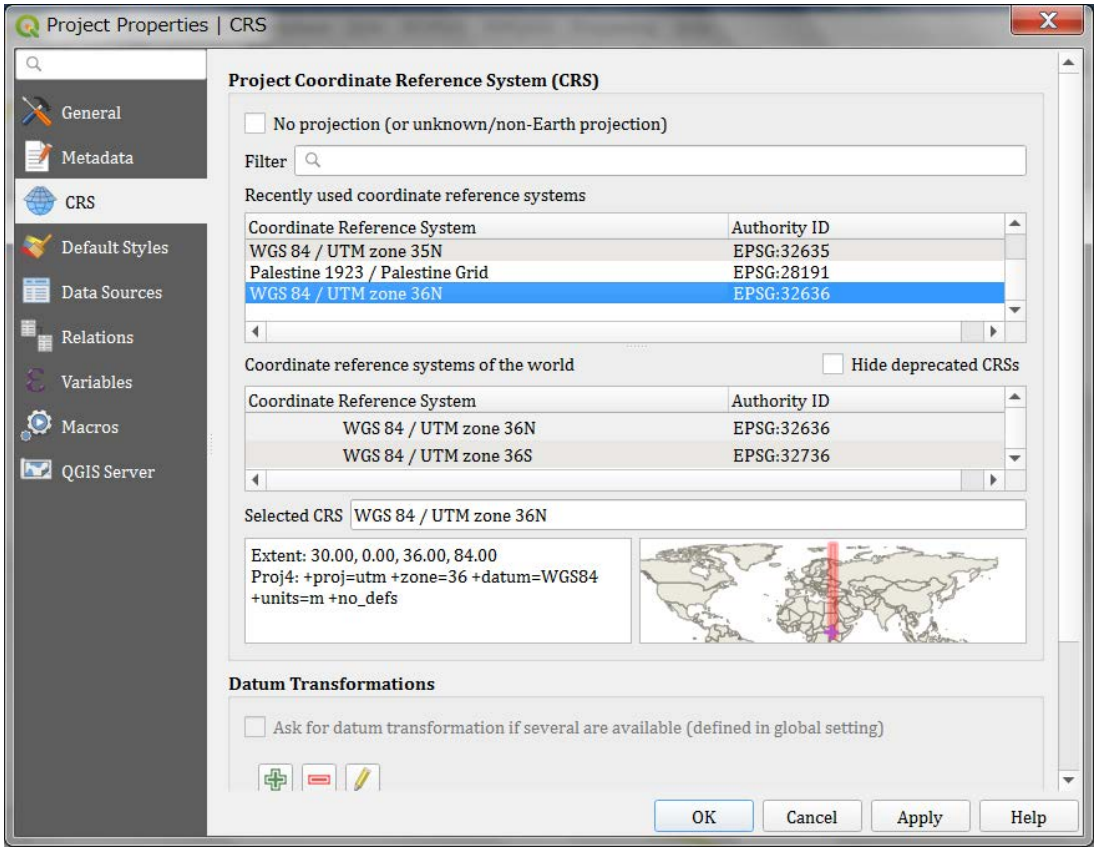
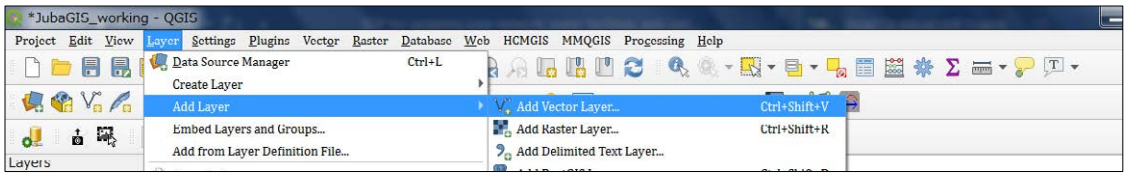
10) *Select all the desired pipes with some common attributes (such as same material) using selection tool while pressing Shift key or using Select Features by Polygon tool and use a modification tool and modify the desired attribute. This will modify the attribute of all selected features.*

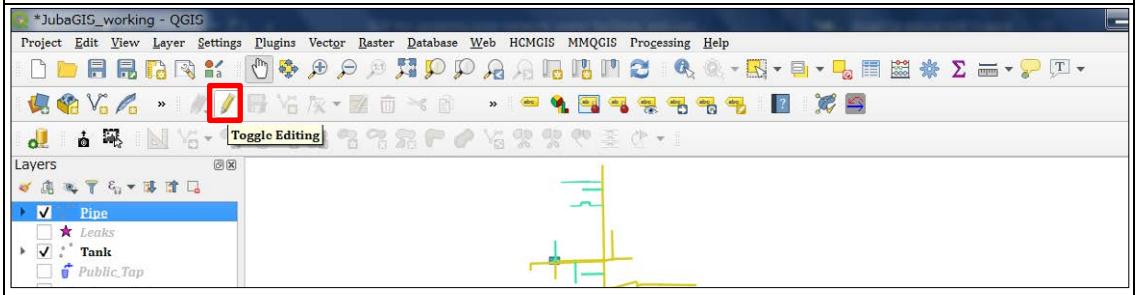
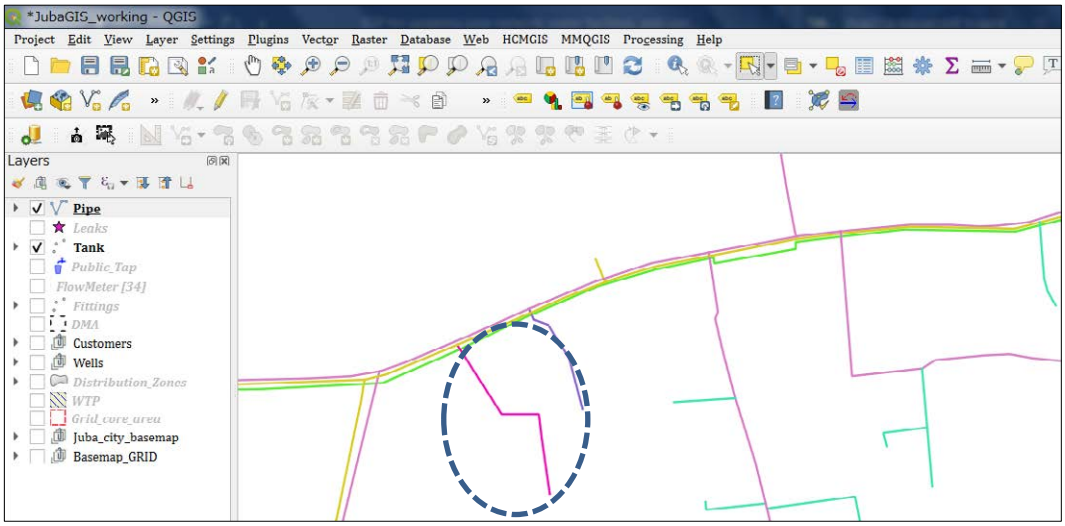
11) *GIS does not automatically calculate length of line. Re-calculate the length of pipeline if you have many any shifting; Start editing (if not already in editing mode) → Open field calculator → Update existing field → Length → Geometry → double-click $length → OK.*

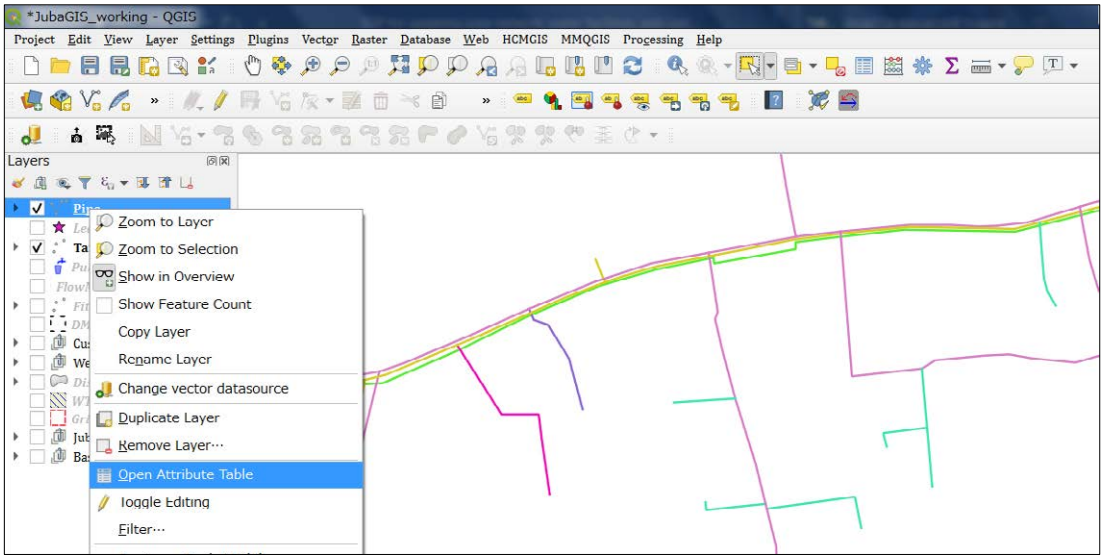
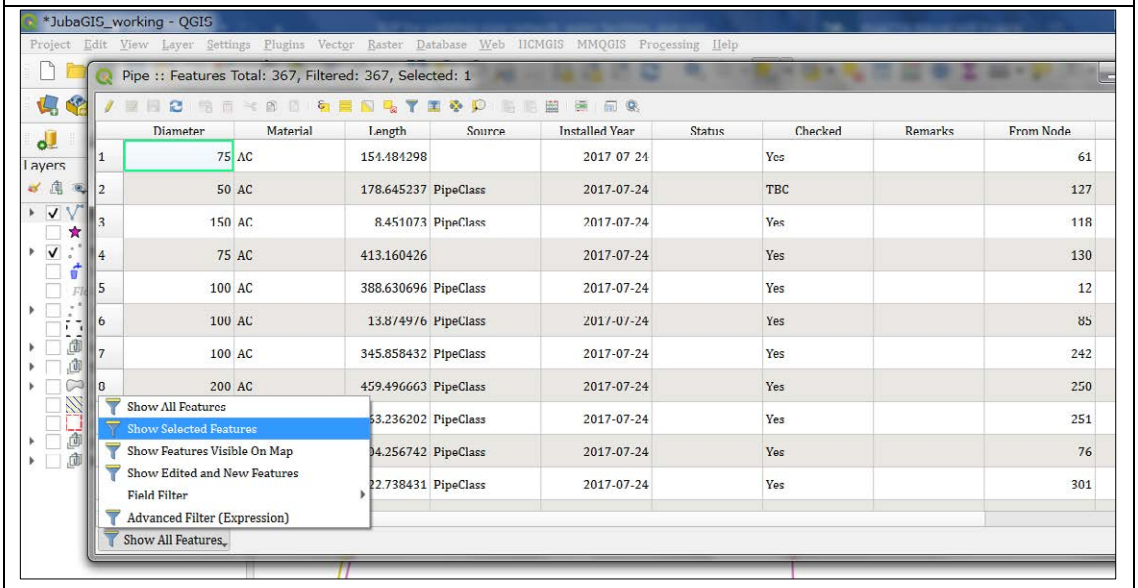
12) *Save your work by clicking on the Toggle editing tool and selecting Save.*

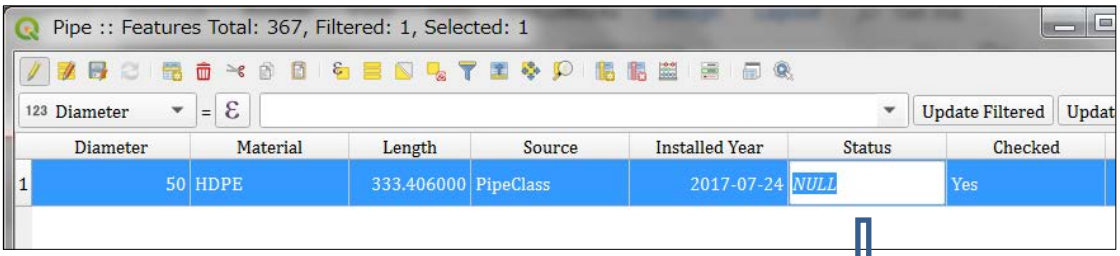
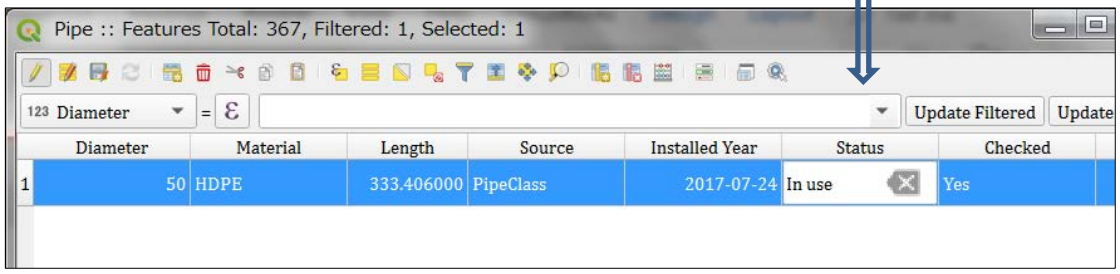
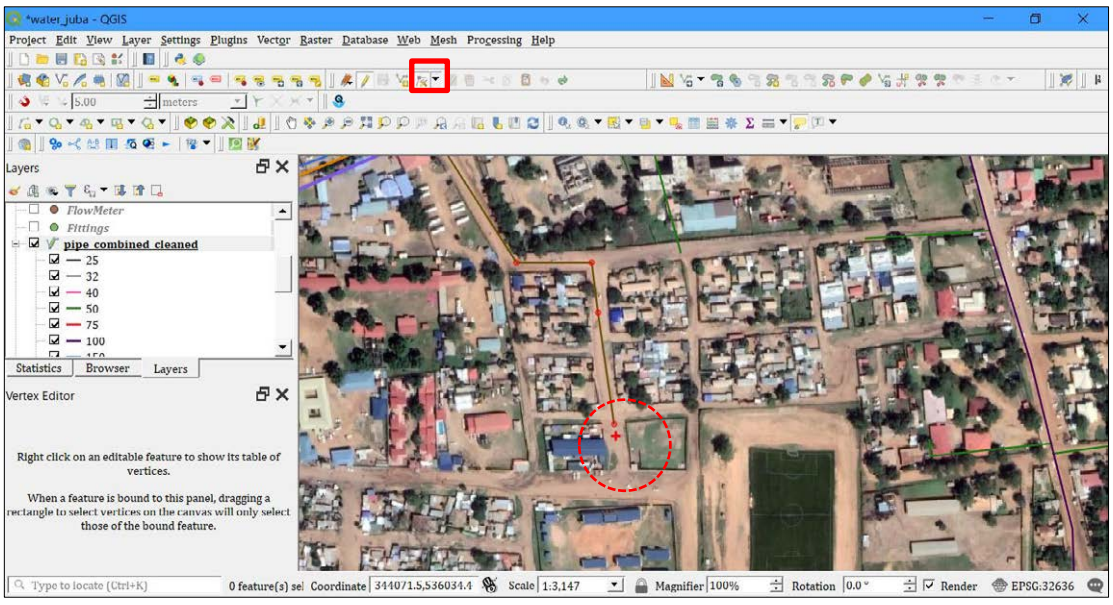
Stepwise Detail

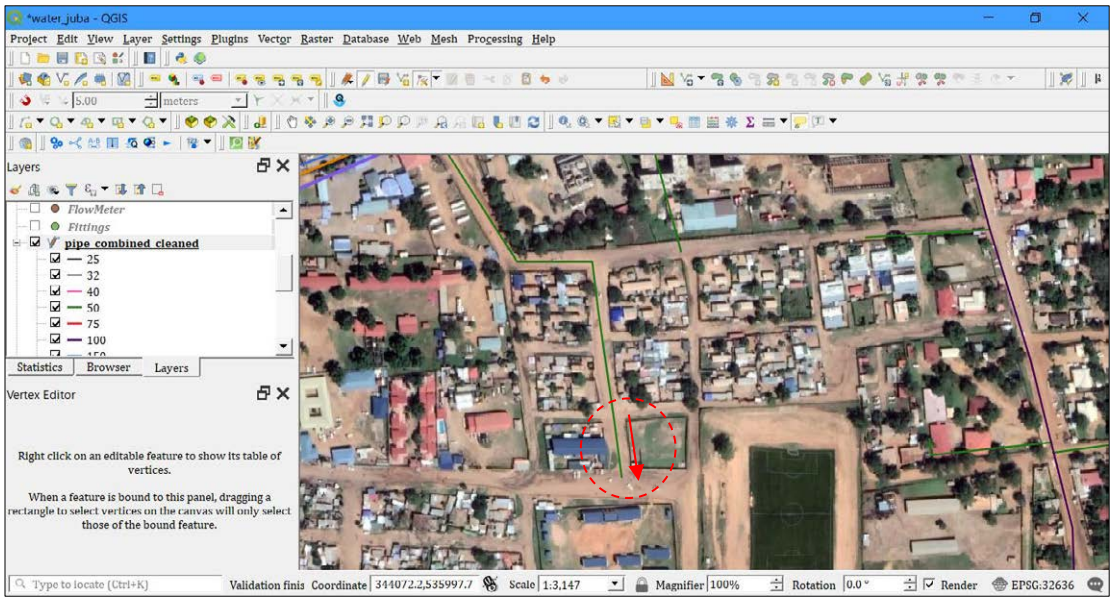
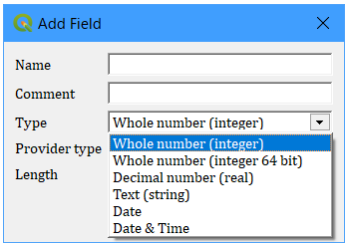
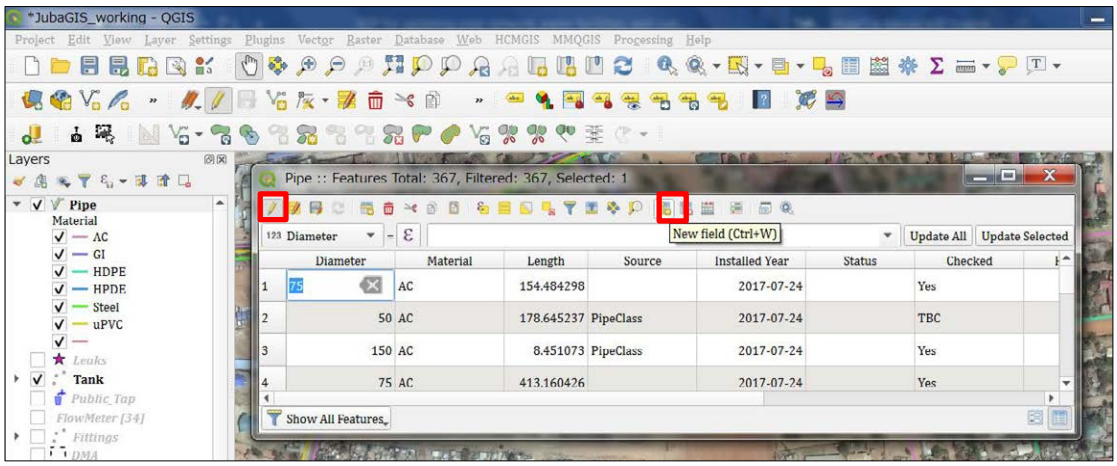
Steps	Description and Images
1)	Open QGIS project of Juba which is prepared and saved earlier, such as 'water_juba' which contains the pipe layer to be edited.

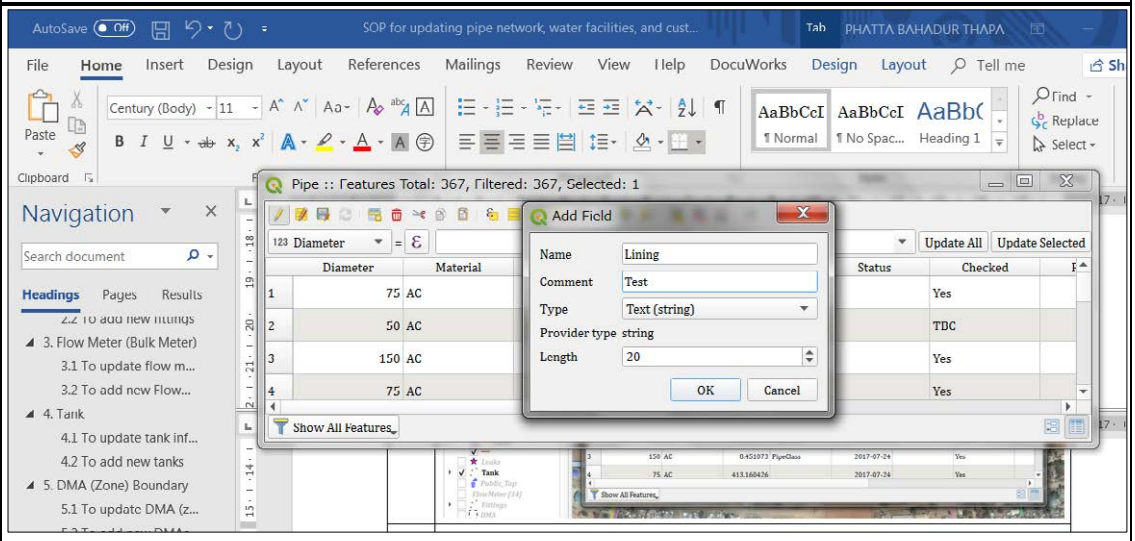
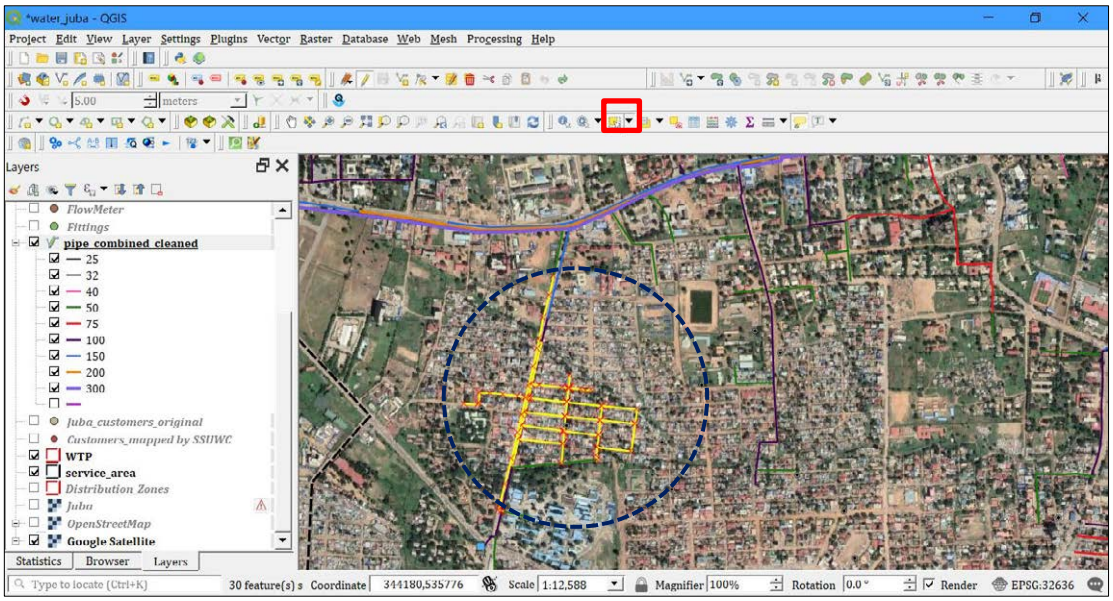
Steps	Description and Images
	
	If no such project exists, create a new QGIS project by opening QGIS program, select Juba's coordinate reference system (CRS) i.e., WGS 84 / UTM zone 36N (EPSG 32636). You can type in the CRS number in Filter field and search.
	
2)	Add Pipe layer shape file.
	

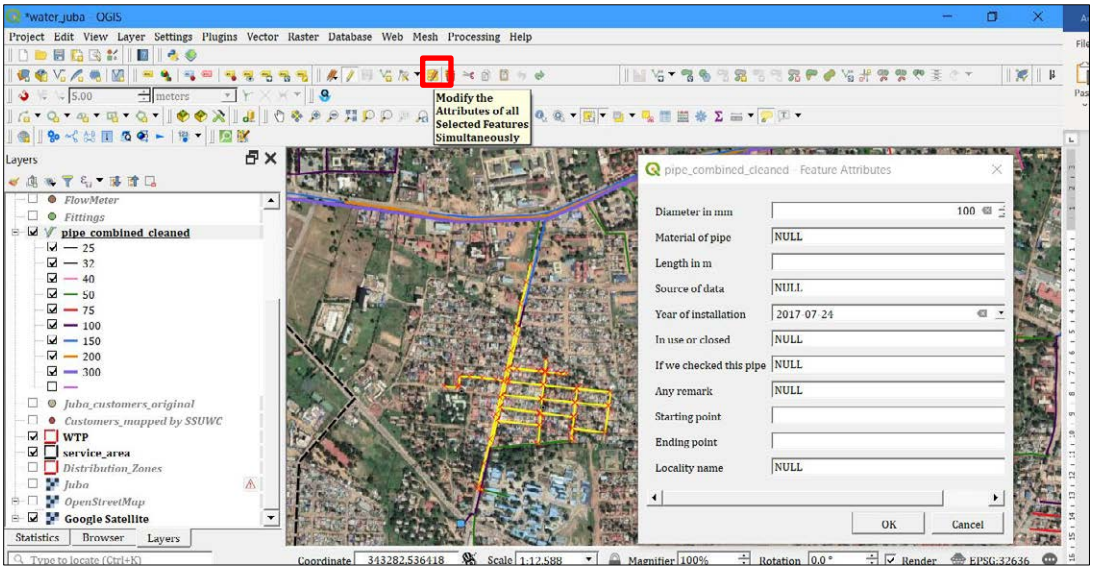
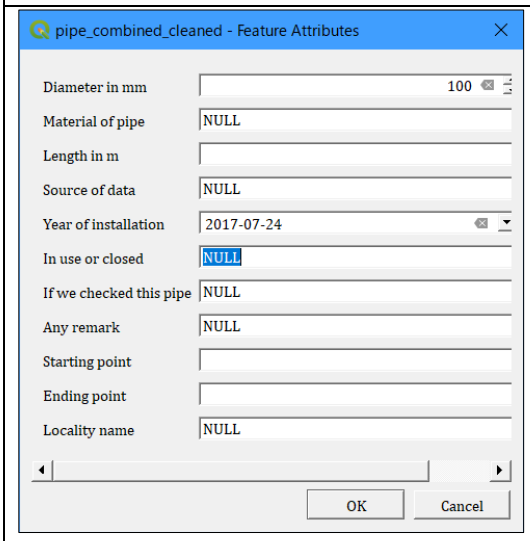
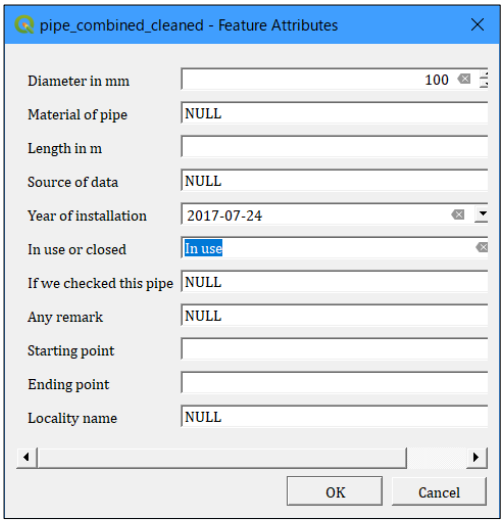
Steps	Description and Images
3)	Select the Pipe layer in the GIS map by clicking on the layer at the right-hand side TOC (Table of Contents) window and start editing by clicking on Toggle Editing tool on tool bar.
	
4)	In the map, find the pipe for which you want to update/change information and click on it with Selection Feature(s) tool.
	
5)	Open attribute table by Right-clicking on the layer and opening attribute table or clicking on Open Attribute Table tool.

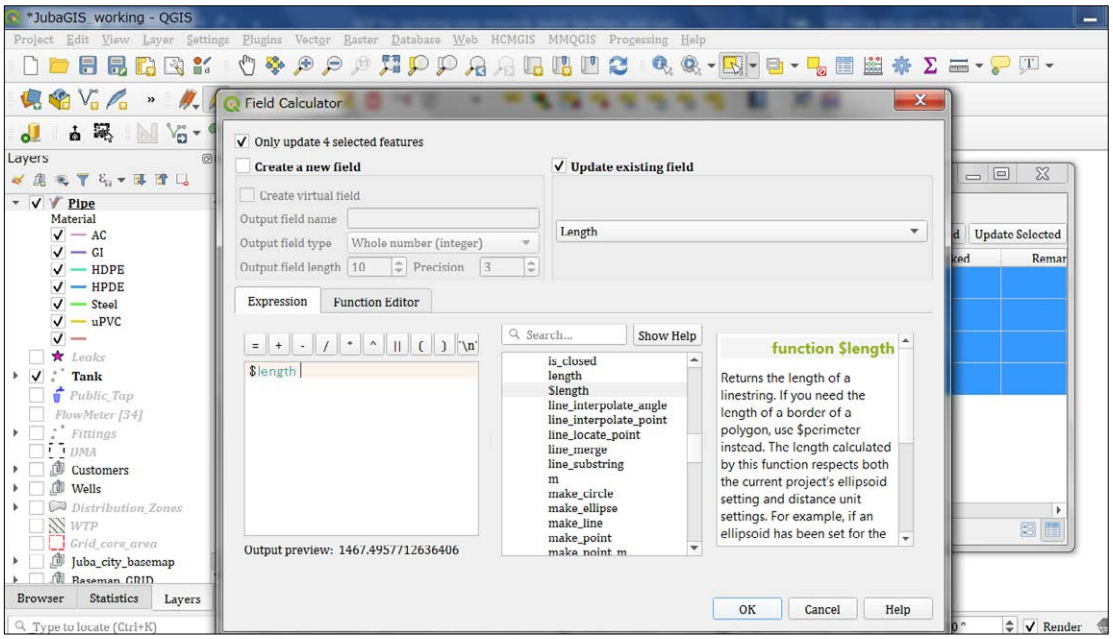
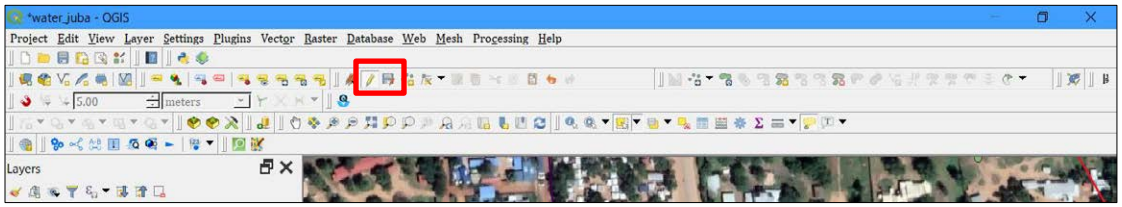
Steps	Description and Images
	
6)	To find the selected pipe easily, you can use filter function at the left-hand-side (LHS) bottom to show selected features only.
	
7)	Change the desired attribute of the selected pipe; type directly in the cell of attribute table. For example, if you want to update the status from blank or Null to 'In use', click in the Status field and type 'In use'. Similarly, you can change any other attribute of pipe like pipe material, diameter or installed year and so on. *Note: Regarding the data type and length of each field, refer to the properties of each field given in the beginning of this section. You can use only the data type of that field. For example, in the numeric field you cannot insert text string. Also, the total length cannot exceed the given length.*

Steps	Description and Images
	
	
8)	For modifying shape of any pipe (e.g., shortening, lengthening, changing route etc) select the pipe and use desired editing tool such as *Vertex Tool*. When you click the pipe with *Vertex Tool* you will see vertices indicated by red circles. You can click and drag any vertex to change the shape of pipeline. To extend pipeline, bring your mouse pointer in front of the last vertex, you will see a plus (+) sign. Click on this sign and click where you want another point of pipe. You can add new vertex or delete existing vertex if you need. Cut feature, Split feature, Merge features, Move feature, and so on can also be used. Since the pipes are line features, only the tools related to line features will be active when you the pipeline layer is active in editing mode.
	

Steps	Description and Images
	
9)	If you want to add any new attribute for the pipe, create a new field as follows and add the attributes. Open attribute table → Start editing (if not already in editing mode) → New Field → Select suitable Name, Type, Length of the field.  Name: It should be 10 characters or less. Comment: If you want to write any explanaroty notes etc you can write here. Type: *Whole number (integer)* for mainly counting whole numbers such as one person, 2 persons etc., *Decimal number (real)* for exact measurements such as length, area, volume etc, *Text (string)* for name of person, pipe material etc, *Date or Date & Time* for recording date or date and time.
	

Steps	Description and Images
	
10)	To change attributes of several pipes together You can also change attribute of several pipes together if they have some common attributes. - Select all the desired pipes using selection tool while pressing Shift key or using Select Features by Polygon tool. Color of selected pipes changes.
	
	- Use group modification tool (click on the tool) and modify the desired attribute. This will modify the attribute of all selected features. So be careful, this tool cannot be used when changing properties which will be different for different pipes, such as the exact length of pipes. The following figures show the example in which the *Status (In use or closed)* property of all selected pipelines is changed from *NULL* to *In use*.

Steps	Description and Images
	
	 
11)	Re-calculate geometry such as length or area QGIS does not automatically calculate length of line. Re-calculate the length of pipe line if you have made any changes that affected its length such as realigning or extending. Start editing (if not already in editing mode) → Open field calculator → Update existing field → Length → Geometry → double-click $length → OK.

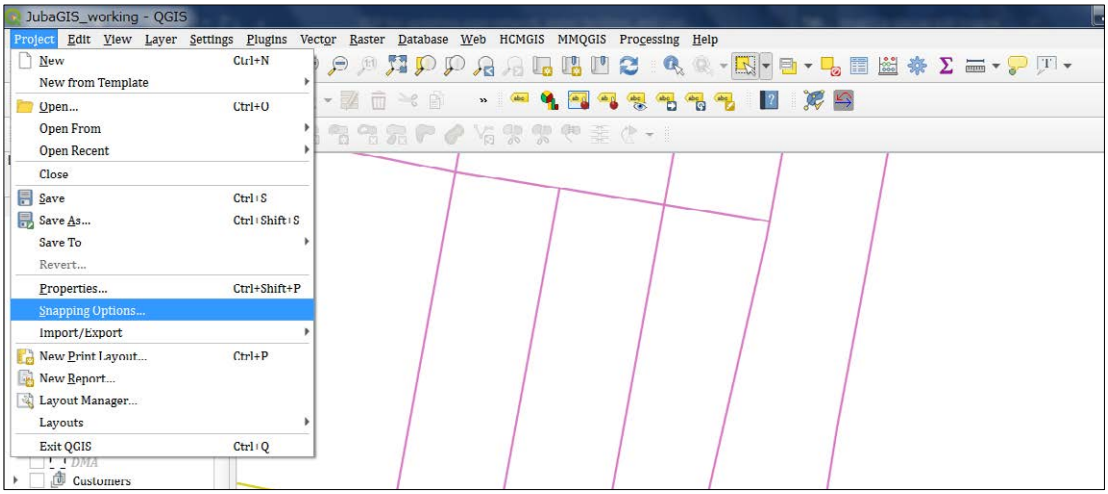
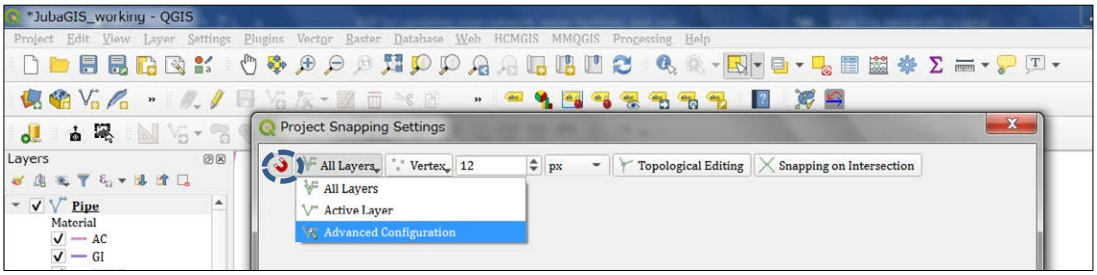
Steps	Description and Images
	
12)	Save your work by clicking on the Toggle editing tool and selecting Save.
	

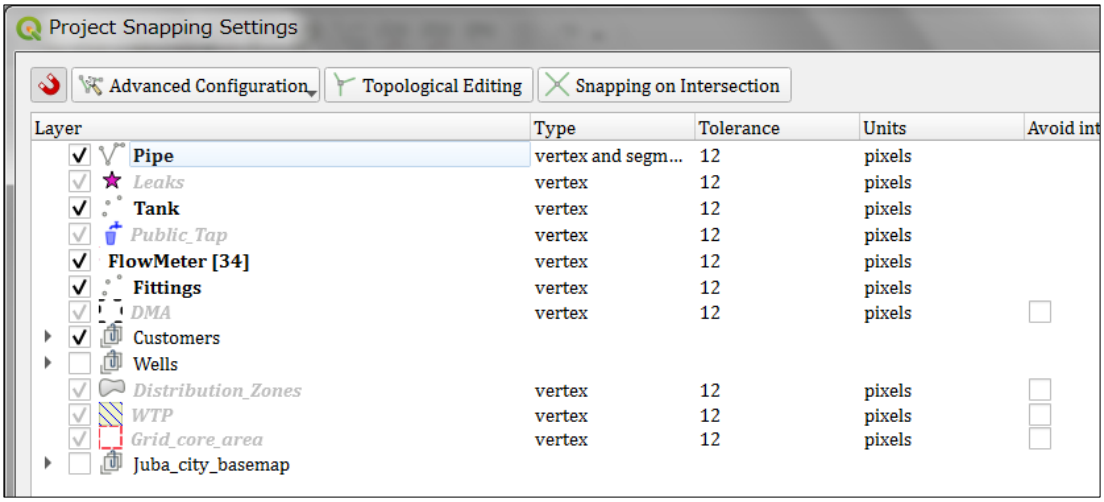
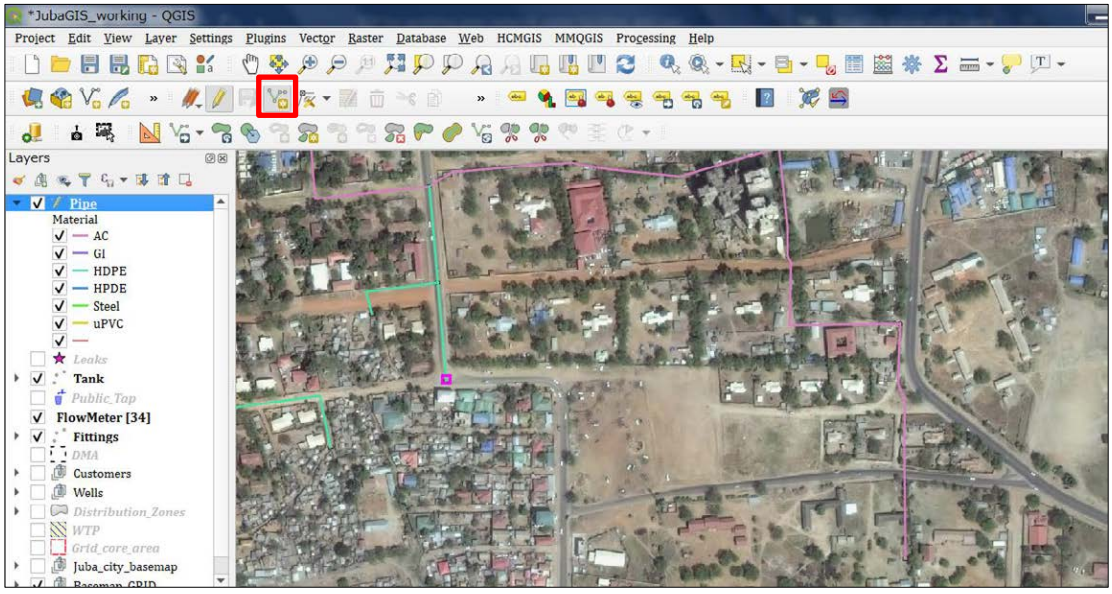
1.3 Steps to Add New Pipelines

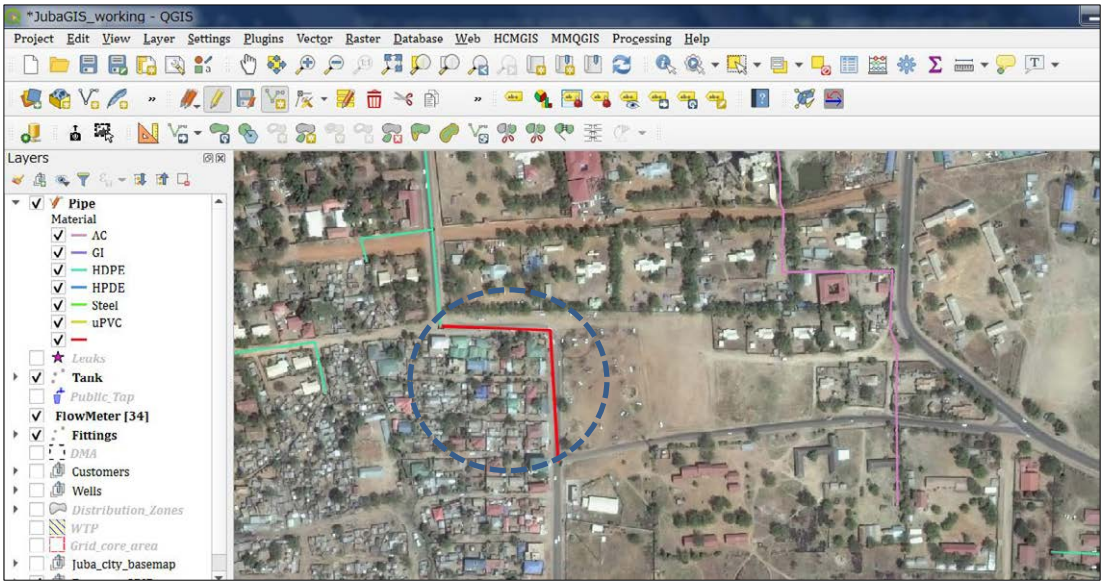
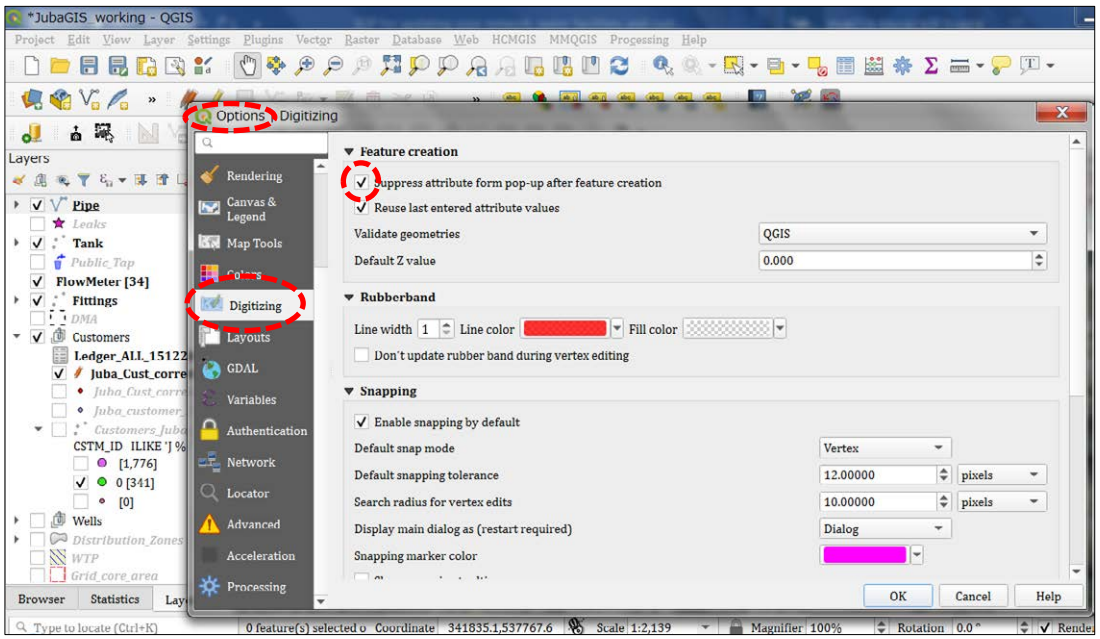
1) *Activate the snapping function.*
2) *Check Pipe layer and other layers where snapping is desired → change Snapping tolerance if you like → close the Snapping option window.*
3) *With 'Add Line Feature' tool, click on the point from where you want to start the line.*
4) *Click on next point along the route of pipe. Continue clicking and when you reach the last point such as a fitting or another pipe, finish the drawing by right-clicking.*
5) *Update attributes if the update attribute prompt opens or close the prompt without updating, you can update later.*
6) *Calculate the length of newly created pipelines as described earlier in section 'To update pipe information'.*

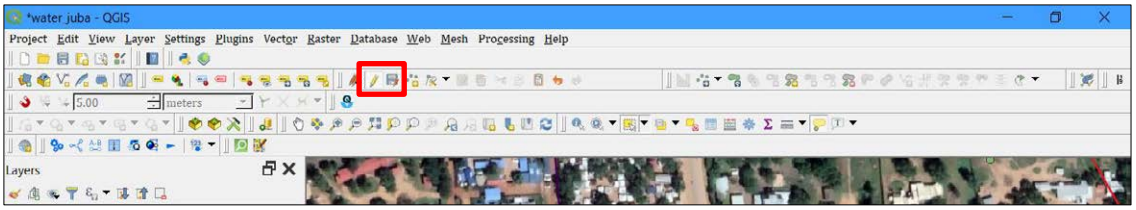
7) Save your work by clicking on the Toggle editing tool and selecting Save.

Detailed Explanation of Each Step

Steps	Description and Images
1)	Activate the snapping function Project menu → Project Snapping Setting → Enable snapping (U magnet like icon) → Advanced Configuration.
	
	
2)	Check Pipe layer and other layers where snapping is desired → change Snapping tolerance if you like → close the Snapping option window.

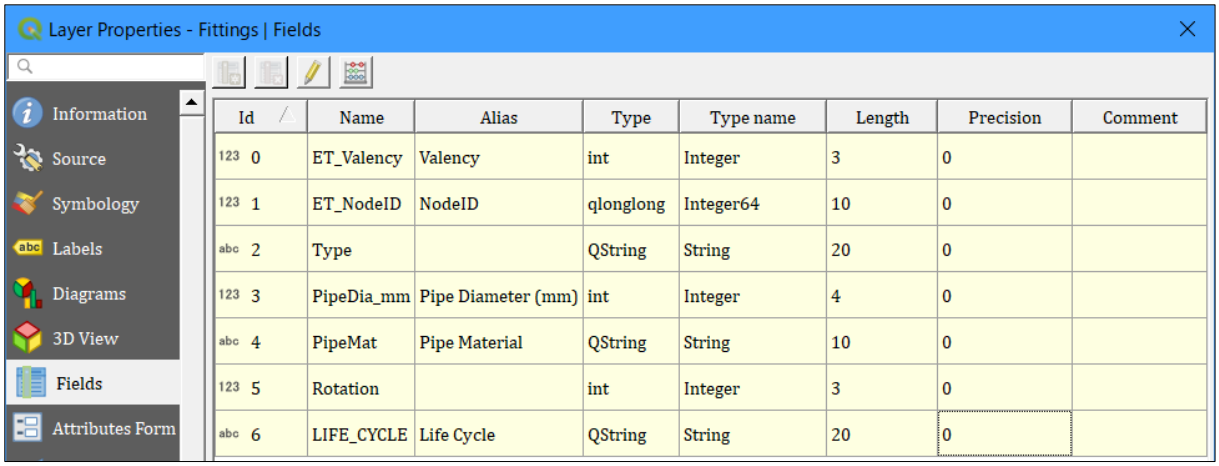
Steps	Description and Images
	
3)	With 'Add Line Feature' tool, click on the point from where you want to start the line.
	
4)	Click on next point along the route of pipe. Continue clicking and when you reach the last point such as a fitting or another pipe, finish the drawing by right-clicking.

Steps	Description and Images
	
5)	Depending on your setting of digitization (Settings menu → Options → Digitizing → Suppress attribute from pop-up after feature creation), 'Update Attribute' window may or may not appear automatically. If a prompt appears immediately after creation of new pipeline, you can provide some attribute or close the prompt without providing any attribute. The attributes may be provided later. If the 'update attribute' prompt doesn't appear then you can proceed to create another pipeline.
	
6)	Calculate the length of newly created pipelines as described in above section 'To update pipe information'.
7)	Save your work by clicking on the Toggle editing tool and selecting Save.

Steps	Description and Images
	

1.4 Fittings

The Fittings layer of Juba has 7 fields as shown below.



Id	Name	Alias	Type	Type name	Length	Precision	Comment
123 0	ET_Valency	Valency	int	Integer	3	0	
123 1	ET_NodeID	NodeID	qlonglong	Integer64	10	0	
abc 2	Type		QString	String	20	0	
123 3	PipeDia_mm	Pipe Diameter (mm)	int	Integer	4	0	
abc 4	PipeMat	Pipe Material	QString	String	10	0	
123 5	Rotation		int	Integer	3	0	
abc 6	LIFE_CYCLE	Life Cycle	QString	String	20	0	

1.5 Properties and Attributes of Each Field in 'Fittings' Layer

Name of Field (Or Alias)	**Explanation**	**Example of data in the field**
Valency	This shows how many pipes are connected with this fitting.	1 for an end cap; 2 for a socket, collar; 3 for a tee, 4 for a cross
NodeID	Unique ID of the node where the fitting exists, essential for hydraulic modeling.	1, 2, 3, 4 etc
Type	Type of fitting	Reducer, end cap/plug, valve, tee, cross,
Pipe Diameter (mm)	Diameter of pipe connected to fitting, in mm	50, 100, 150, 200, 300
Pipe Material	Material of pipe connected to the fitting	AC, uPVC, HDPE, GI, Steel
Rotation	Rotation of fitting to properly align with the direction of pipe	0 to ± 359
Life Cycle	Indicating whether it is proposed, existing and in use, or abandoned	

Example of fitting's attributes

ET_Valency	ET_NodeID	Type	PipeDia_mm	PipeMat	Rotation	LIFE_CYCLE
2	330	Valve	100	uPVC	90	Proposed
3	167	Tee / Tapping	150	uPVC	-78	Existing
1	247	End Cap / Plug	100	AC	2	Existing
2	242	Valve	100	AC	85	Existing
1	326	End Cap / Plug	50	HDPE	268	Existing

1.6 Steps to Update Fitting Information and Change Location

1) *Open QGIS project containing fittings layer.*
2) *If no such project exists, open a new QGIS project, select Juba's coordinate reference system i.e., WGS 84 / UTM zone 36N (EPSG 32636).*
3) *Add Fittings layer shape file.*
4) *Select the Fittings layer in the GIS map by clicking on the layer at the right-hand side Table of Window (TOC) window.*
5) *Start editing by clicking on Toggle Editing tool on tool bar.*
6) *In the map, find the fitting for which you want to update/change information and click on it with Select Feature(s) tool.*
7) *Open attribute table by right-clicking on the layer and opening attribute table or clicking on Open Attribute Table tool.*
8) *If you want to see only the selected features, use filter function at the LHS bottom to show selected feature(s) only.*
9) *Change the desired attribute of the selected fitting by typing directly in the cell of attribute table.*
10) *For moving the fittings to another location select the fitting and use Move feature tool.*

If you want to add any new attribute for the fitting, create a new field as follows and add the attributes.

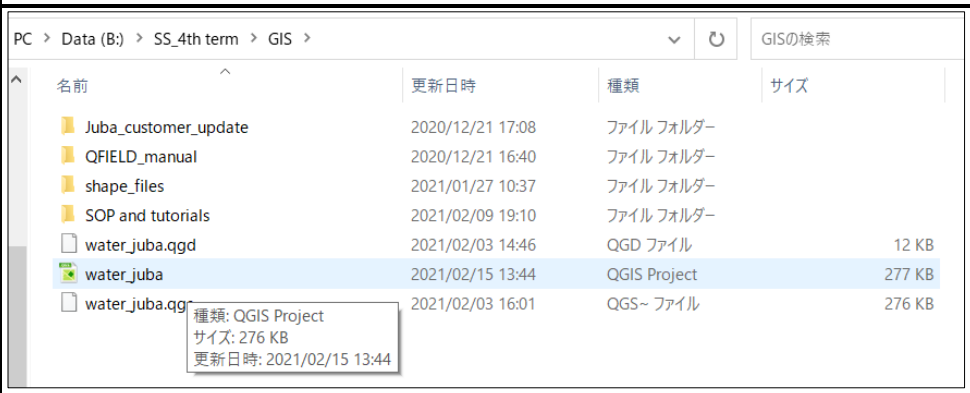
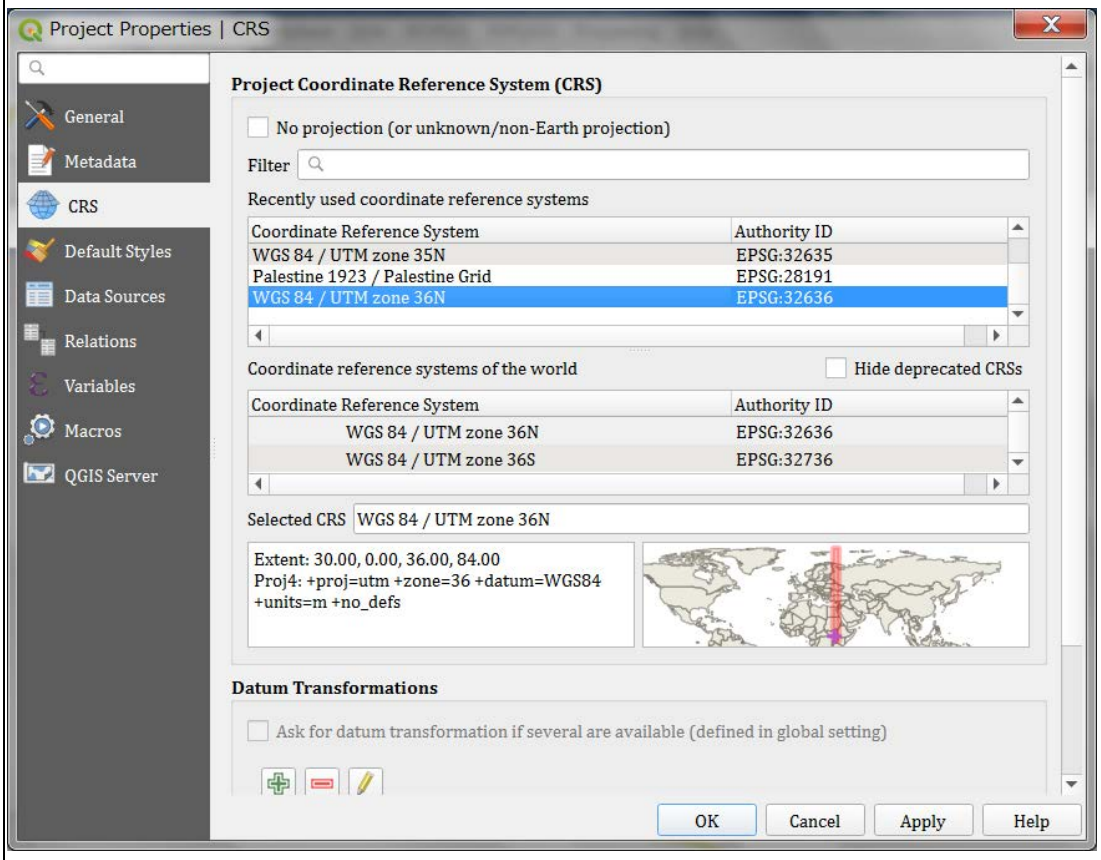
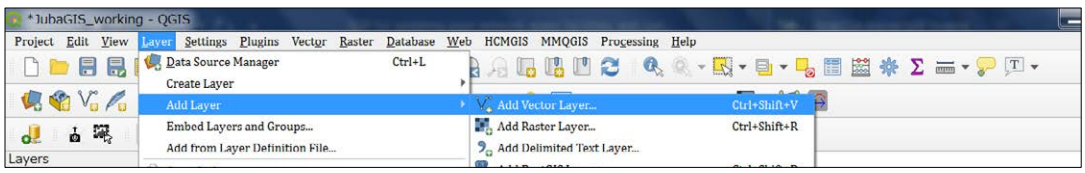
11) *Open attribute table → Start editing (if not already in editing mode) → New Field → Select Name, Type, Length of the field.*

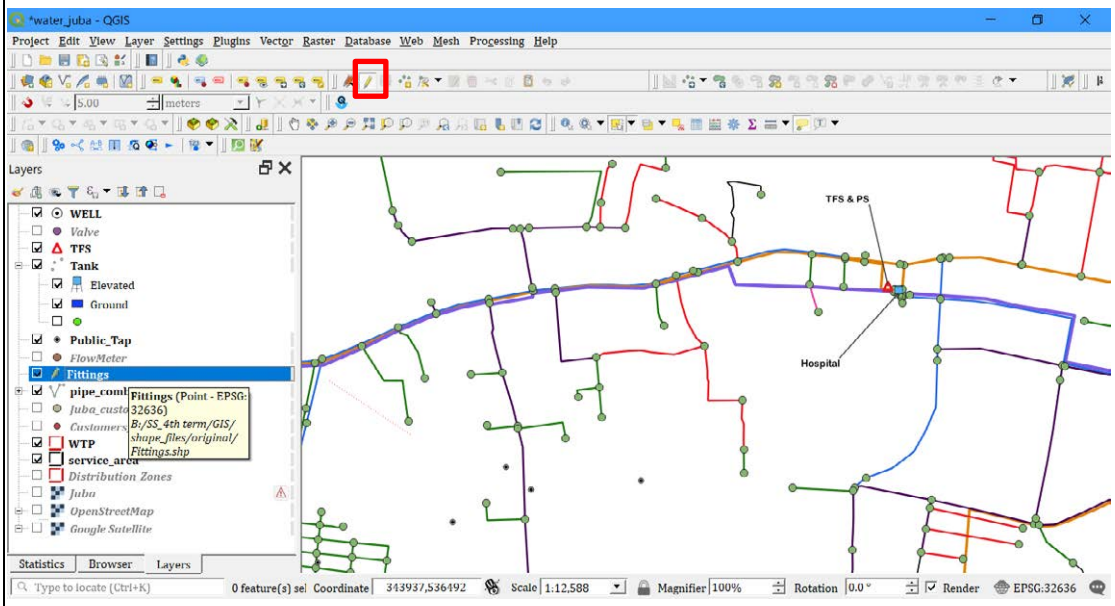
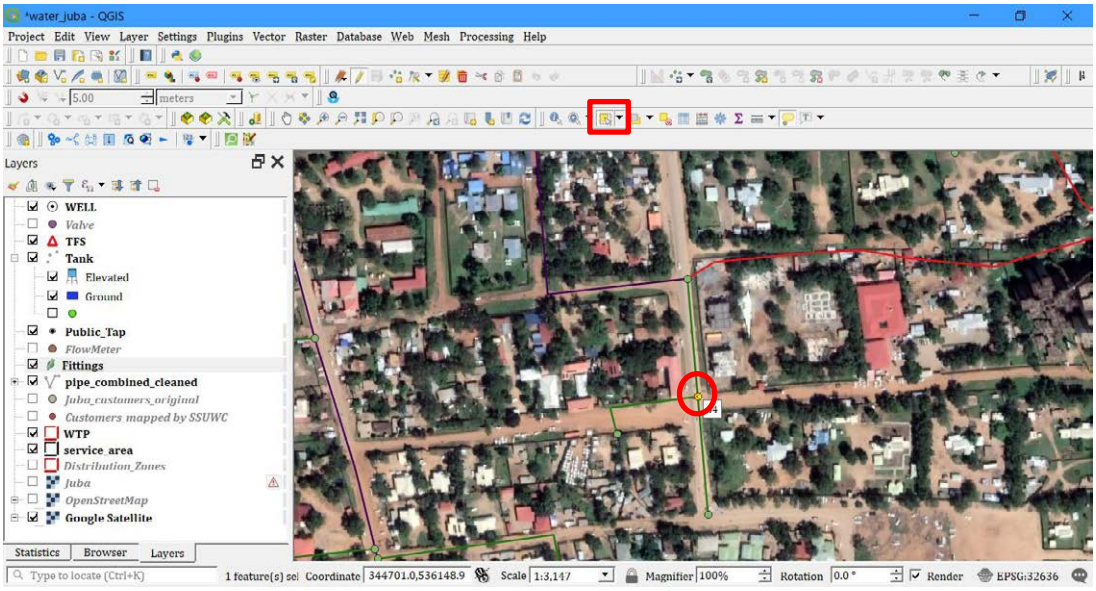
You can also change attribute of several fittings together if they have some attribute similar,

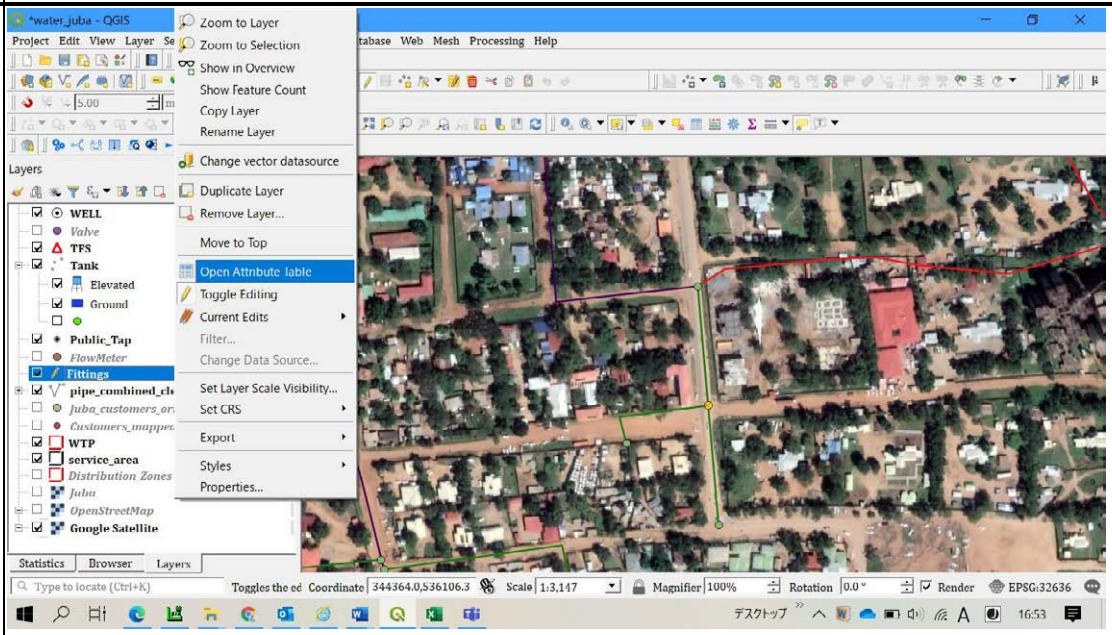
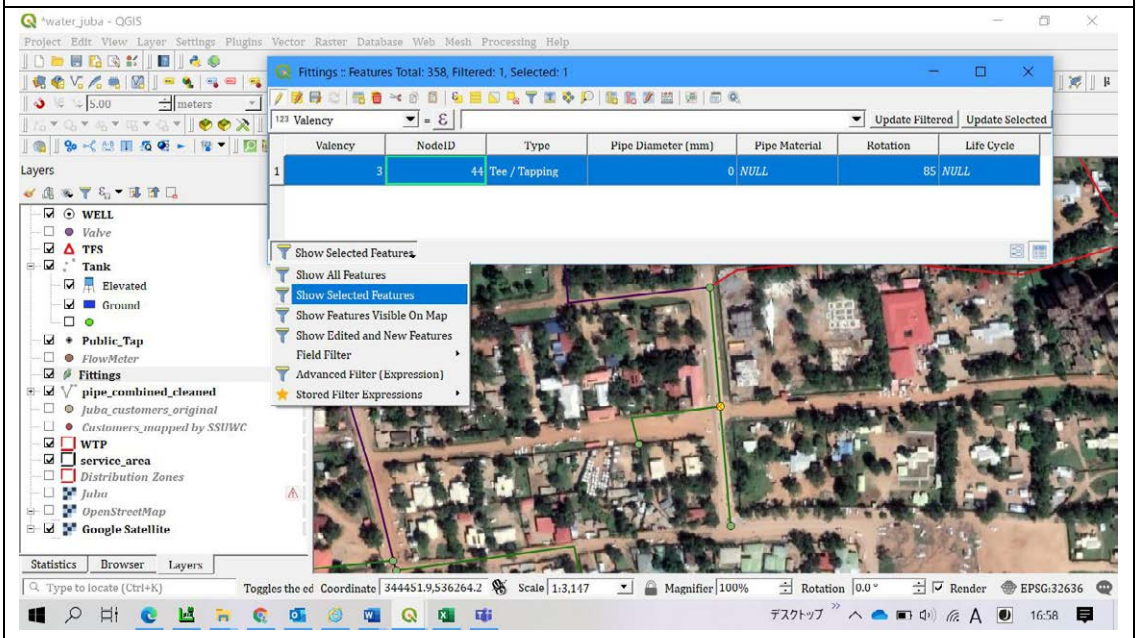
12) *Select all the desired fittings which have some similar attributes with selection tool while pressing Shift key or using Select Features by Polygon tool.*
13) *Use a modification tool (click on the tool) and modify the desired attribute. This will modify the attribute of all selected features.*
14) *Save your work by clicking on the Toggle editing tool and selecting Save.*

Stepwise Details

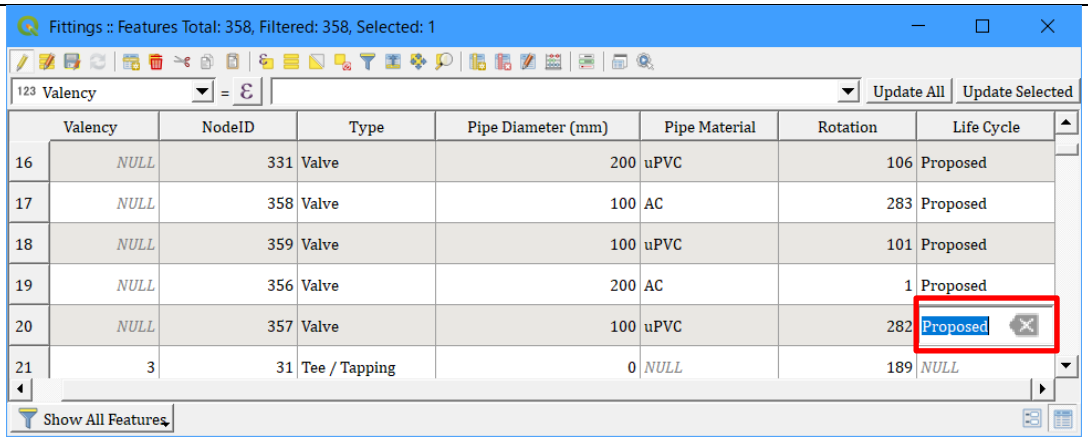
Steps	Description and Images
1)	Open QGIS project of Juba which is prepared and saved earlier, such as 'water_juba' which contains the fittings layer to be edited. Double-click the QGIS Project file or Right-click on it and select Open.

Steps	Description and Images
	
2)	If no such project exists, create a new QGIS project by opening QGIS program, select Juba's coordinate reference system (CRS) i.e., WGS 84 / UTM zone 36N (EPSG 32636). You can type in the CRS number in Filter field and search.
	
3)	Add Fittings layer shape file.
	

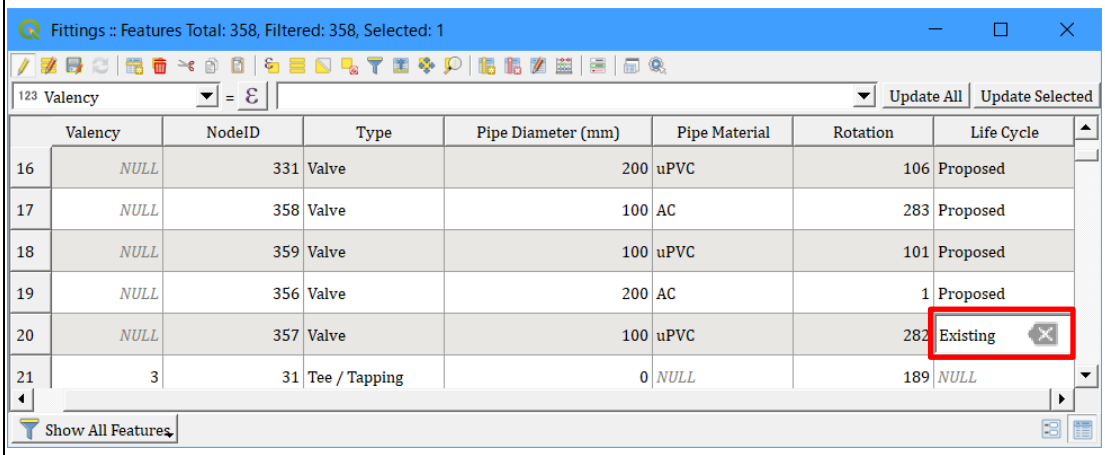
Steps	Description and Images
4)-5)	4) Select the Fittings layer in the GIS map by clicking on the layer at the right-hand side TOC (Table of Contents) window. 5) Start editing by clicking on Toggle Editing tool on tool bar. 
6)	In the map, find the fitting for which you want to update/change information and click on it with Selection Feature(s) tool. 
7)	Open attribute table by Right-clicking on the layer and opening attribute table or clicking on *Open Attribute Table* tool.

Steps	Description and Images
	
8)	To find the selected fitting(s) in attribute table easily, you can use filter function at the left-hand-side (LHS) bottom of the attribute table. Select *Show Selected Features*. 
9)	Change the desired attribute of the selected fitting Click on the cell where you want to change or input new information, the cell color changes to blue highlight, type in the attribute you want. For example, if you want to update the status from *Proposed* to *Existing*, click in the cell in *Life Cycle* field and type 'Existing'. Similarly, you can change any other attribute of fitting. *Note: Regarding the data type and length of each field, refer to the properties of each field given in the beginning of this section. You can use only the data type of that field. For example, in the numeric field you cannot insert text string. Also, the total length cannot exceed the given*

Steps	Description and Images
	length.

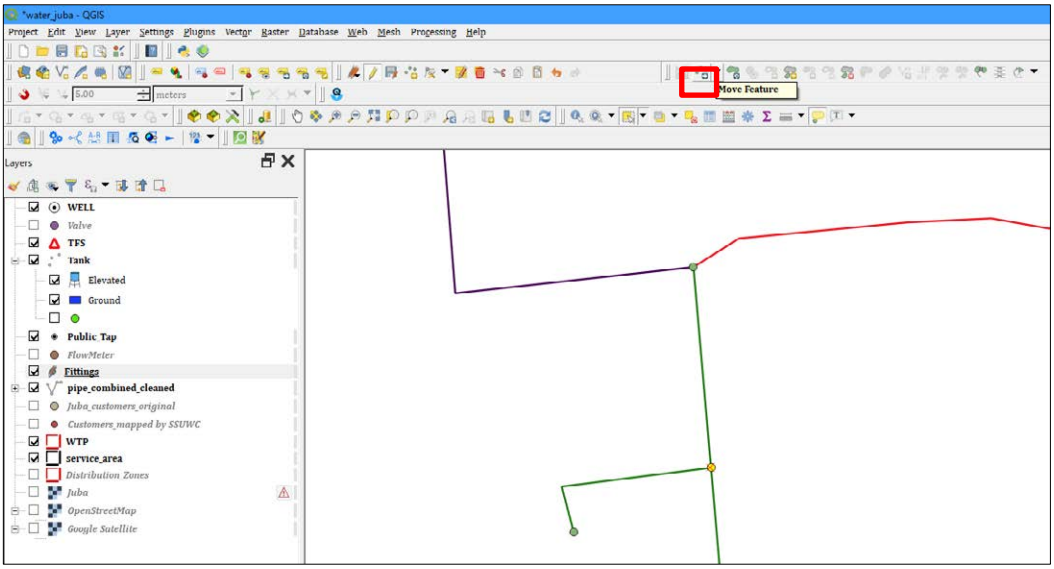


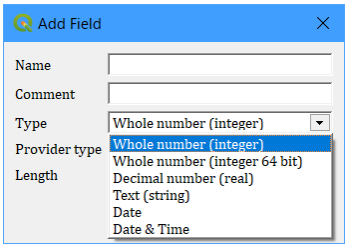
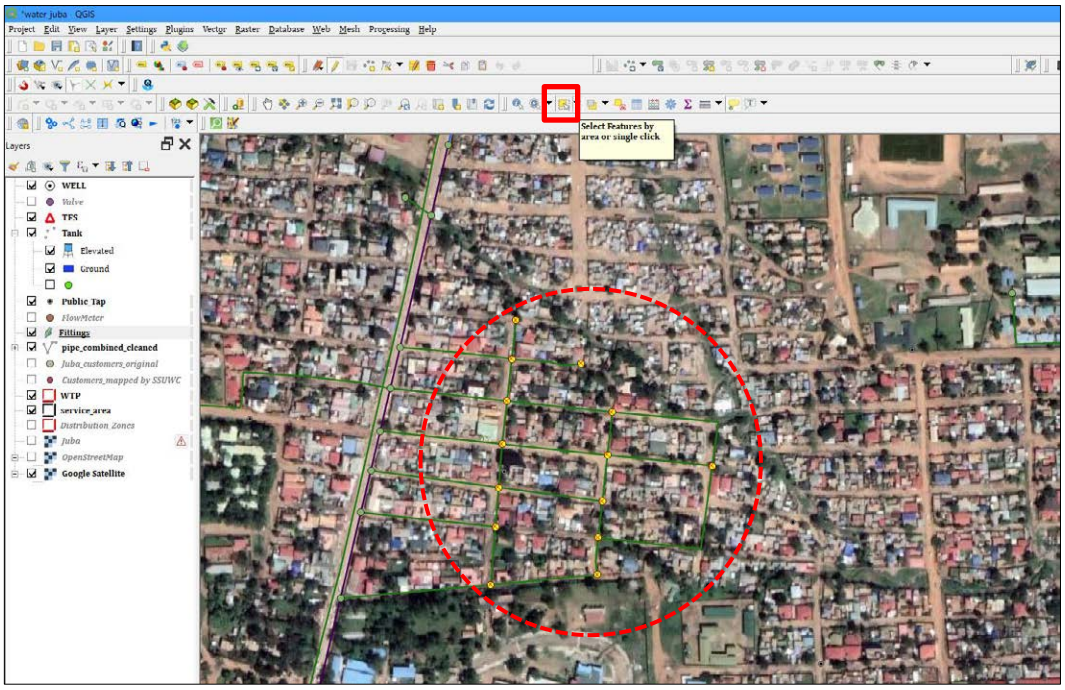
	Valency	NodeID	Type	Pipe Diameter (mm)	Pipe Material	Rotation	Life Cycle
16	NULL	331	Valve	200	uPVC	106	Proposed
17	NULL	358	Valve	100	AC	283	Proposed
18	NULL	359	Valve	100	uPVC	101	Proposed
19	NULL	356	Valve	200	AC	1	Proposed
20	NULL	357	Valve	100	uPVC	282	Proposed
21	3	31	Tee / Tapping	0	NULL	189	NULL

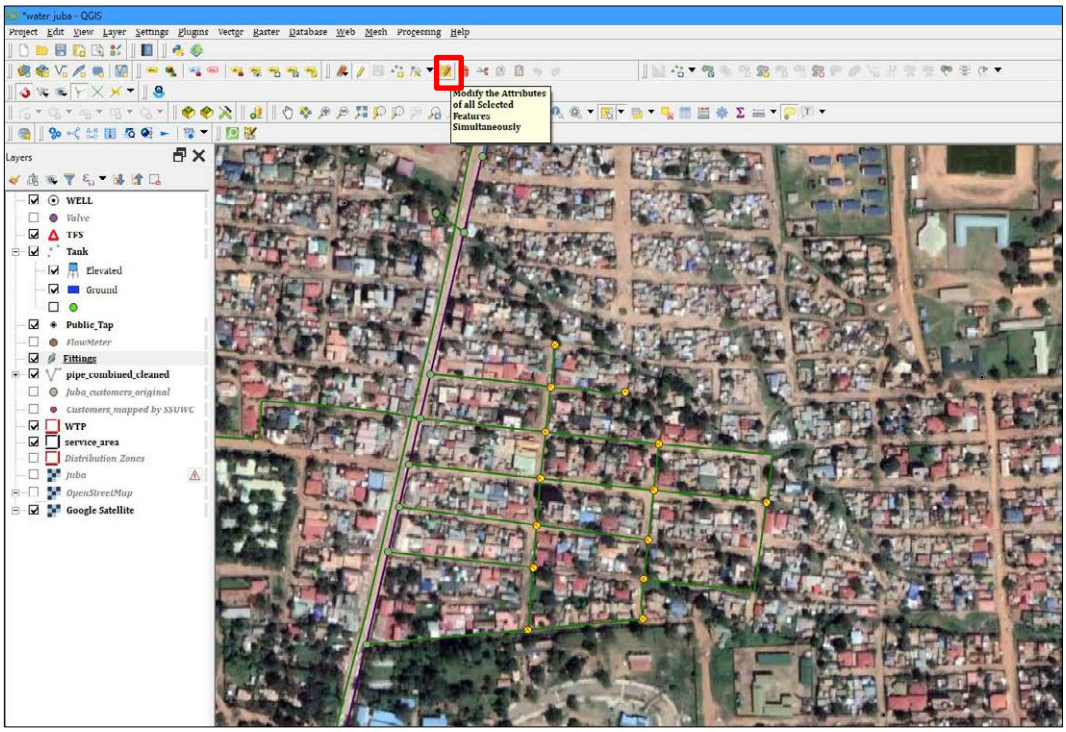
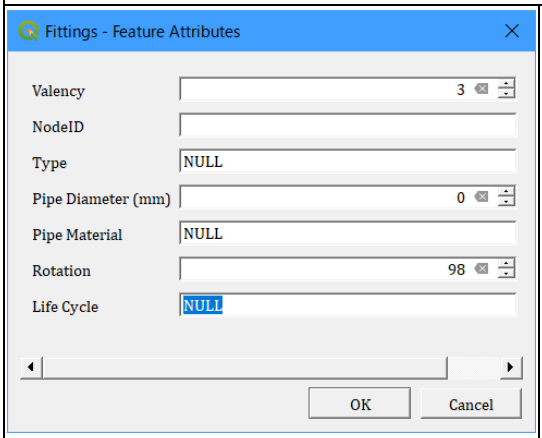
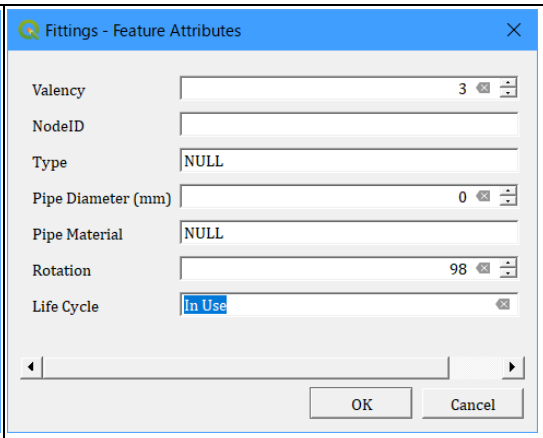


	Valency	NodeID	Type	Pipe Diameter (mm)	Pipe Material	Rotation	Life Cycle
16	NULL	331	Valve	200	uPVC	106	Proposed
17	NULL	358	Valve	100	AC	283	Proposed
18	NULL	359	Valve	100	uPVC	101	Proposed
19	NULL	356	Valve	200	AC	1	Proposed
20	NULL	357	Valve	100	uPVC	282	Existing
21	3	31	Tee / Tapping	0	NULL	189	NULL

10) For moving the fittings to another location select the fitting and use Move feature tool.



Steps	Description and Images
	*You can move the node separately and bring back the connected pipes by editing pipeline described in previous section. Alternatively, you can move the node and all connected pipes together. For this you will need to use '**Topological Editing'. This process is** described in the following section [Section 2.3 Steps to Move Fitting and Pipelines Together].*
12)	If you want to add any new attribute for the fitting, create a new field as follows and add the attributes, the process is same as for Pipeline described above. Open attribute table → Start editing (if not already in editing mode) → New Field → Select suitable Name, Type, Length of the field.  Name: It should be 10 characters or less. Comment: If you want to write any explanatory notes etc you can write here. Type: *Whole number (integer)* for mainly counting whole numbers such as one person, 2 persons etc., *Decimal number (real)* for exact measurements such as length, area, volume etc, *Text (string)* for name of person, pipe material etc, *Date or Date & Time* for recording date or date and time.
13)	Change attributes of several fittings together You can also change attribute of several fittings together if they have some common attributes. - Select all the desired fittings using selection tool while pressing Shift key or using Select Features by Polygon tool. Color of selected fittings changes.
	

Steps	Description and Images
	Use group modification tool (click on the tool) and modify the desired attribute. This will modify the attribute of all selected features. So be careful, this tool cannot be used to change properties which are different for different fittings, such as the sizes. The following figures show the example in which the *Life Cycle* has been changed from *NULL* to *In use*.
	
	 
14)	Save your work by clicking on the Toggle editing tool and selecting Save.

1.7 Steps to Move Fitting and Pipes Together (Topological Editing)

When the alignment of pipeline needs to be changed it is necessary to move the fitting and pipes connected to this fitting.

This can be done by moving the fitting and pipes one-by-one but it takes a lot of time. By using topological editing the fitting and all connected pipes can be moved all together.

1) Activate the snapping function (Project menu → Snapping Options → Enable snapping (click on U magnet like icon) → Advanced Configuration.

2) Check Fittings and Pipe layers to make them participate in snapping (check any other layers where snapping is desired) → change Snapping tolerance if you like → enable the Topological Editing option by clicking on this tab.

3) Make both the fittings and pipe layers editable by clicking on Toggle Edit tool.

4) With the Vertex Tool click and drag to touch the pipe and fittings to select the fitting and pipes together. Color of the fitting changes to blue indicating topological editing option is activated.

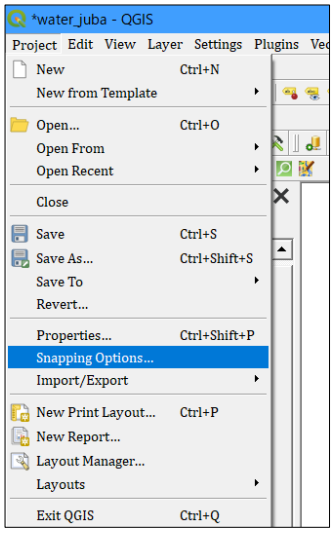
5) Drag the fitting to the desired location. All the pipelines connected with this fitting will be automatically move with the fitting.

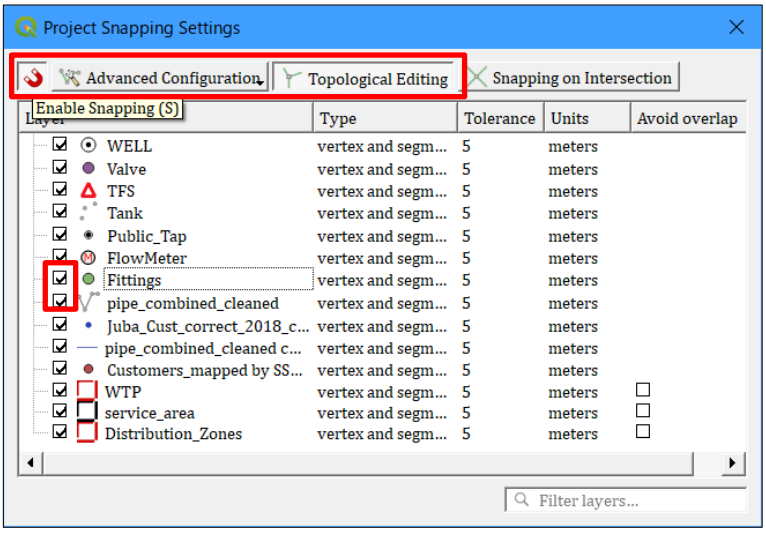
This saves a lot of work compared to one-by-one moving of the fitting and pipes.

6) *Save your work by clicking on the Toggle editing tool and selecting Save.*

Stepwise Explanation

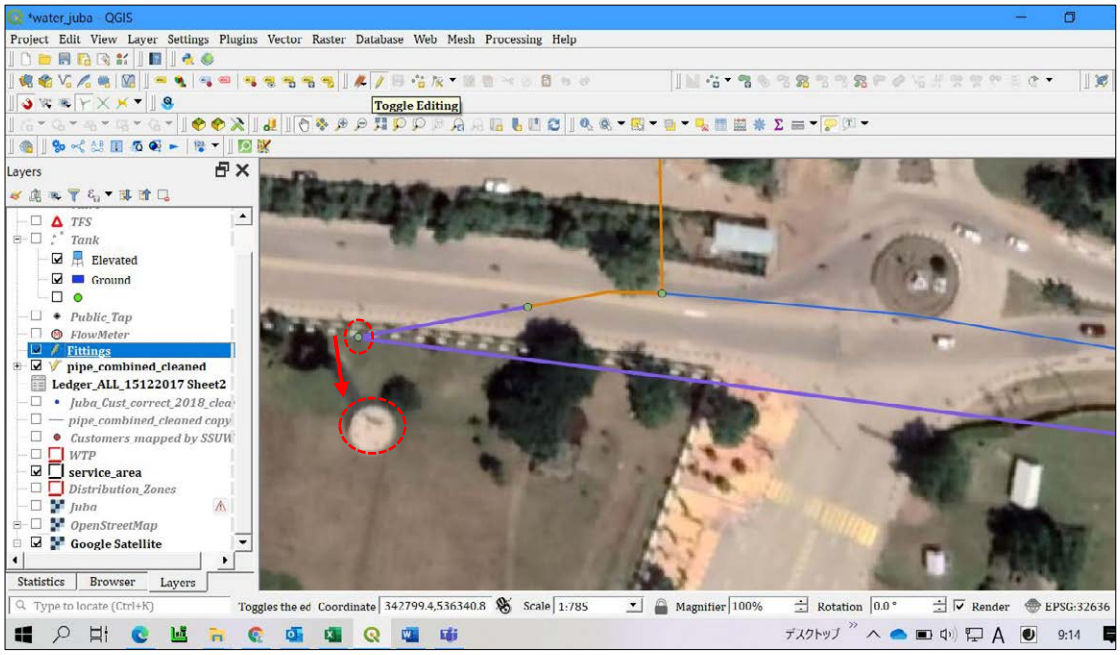
Steps	Explanation with Image
1)-2)	1) Activate the snapping function (Project menu → Snapping Options → Enable snapping (click on U magnet like icon) → Advanced Configuration. 2) Check Fittings and Pipe layers to make them participate in snapping (check any other layers where snapping is desired) → change Snapping tolerance if you like → enable the Topological Editing option by clicking on this tab.



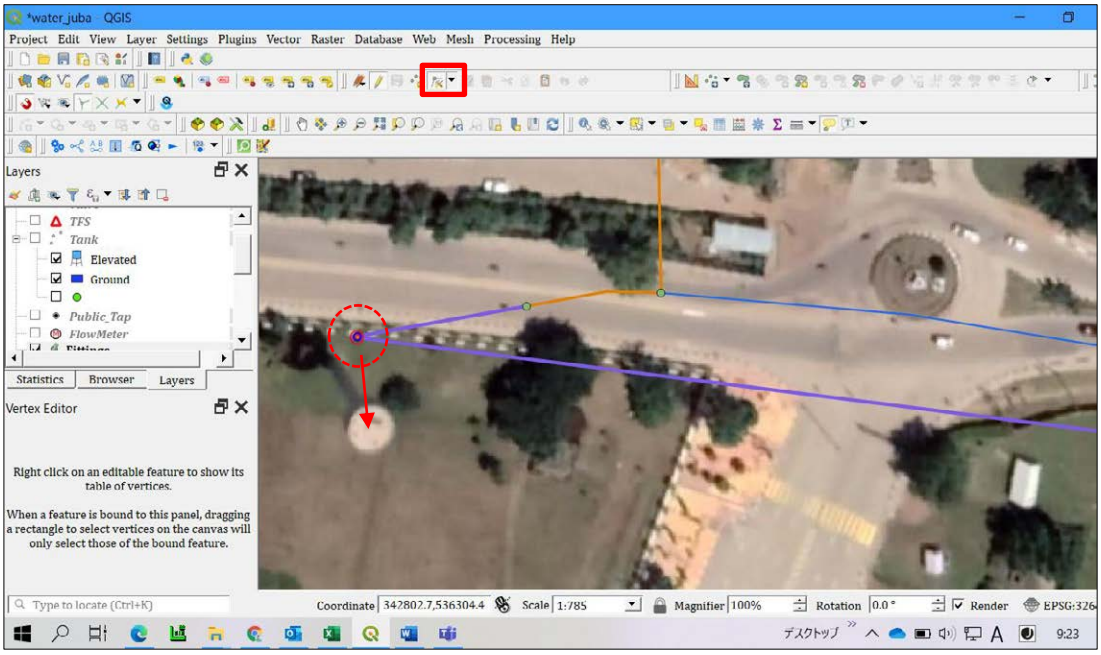


3) Make both the fittings and pipe layers editable by clicking on Toggle Edit tool.

The following example shows how to move the marked node (which is the Parliament Tank) and to its correct location shown on basemap and also move the connected pipelines together with the node.

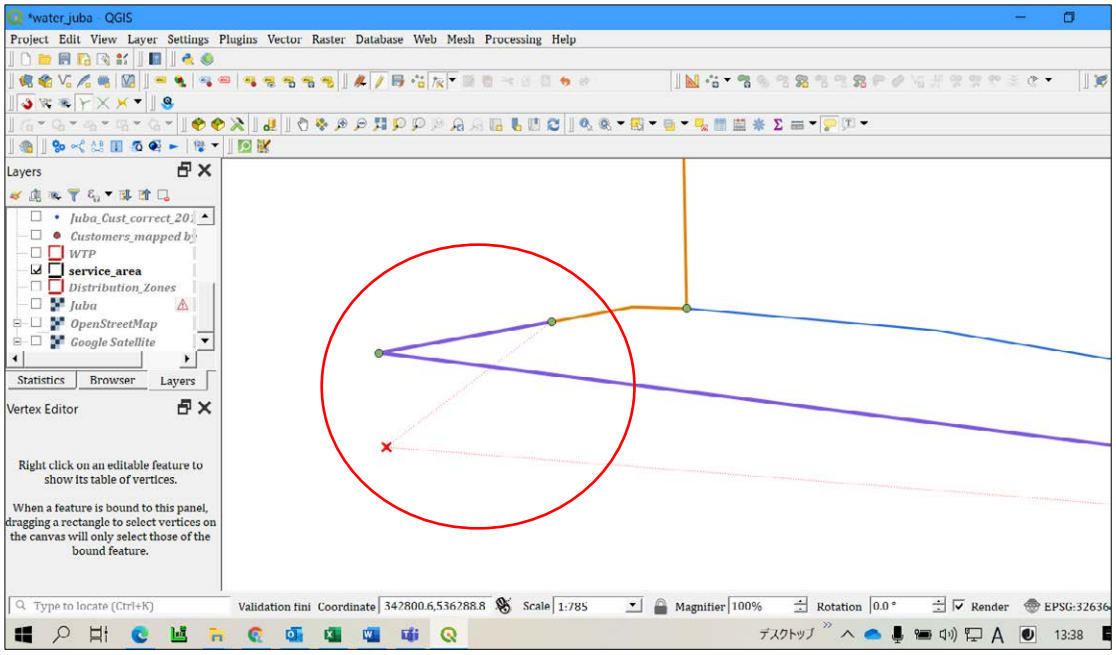


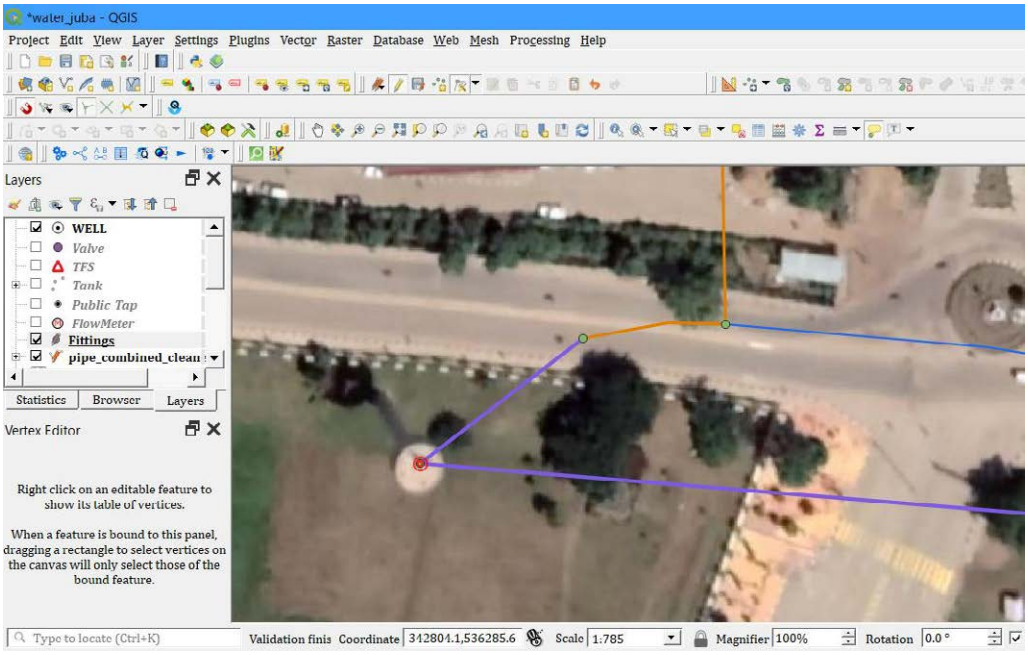
4) With Vertex Tool, click and drag a rectangle around the fitting touching the fitting and the pipelines. Color of the fitting changes to blue indicating topological editing option is activated.



5) Click the fitting and drag it to the desired location→ Click at the desired location.

While dragging the fitting, the pipelines connected with this fitting will be indicated by thin dashed lines. This indicates that the pipelines are also moving with the fitting.





Note:

- *The pipes stretch from their first vertex. The vertex and pipe after the first vertex do not move. You need to reshape/realign the the pipe by using Vertex Tool as described in the above section of pipe.*
- *If you need to undo after the moving, the undo will work only for the selected layer. So, you need to select the fittings layer first on the TOC and use undo function to undo moving of fitting. Similarly, for undoing moving of pipelines you need to first select pipe layer on the TOC and use the undo function.*

6) Save your work by clicking on the Toggle editing tool and selecting Save.

1.8 Steps to Add New Fittings

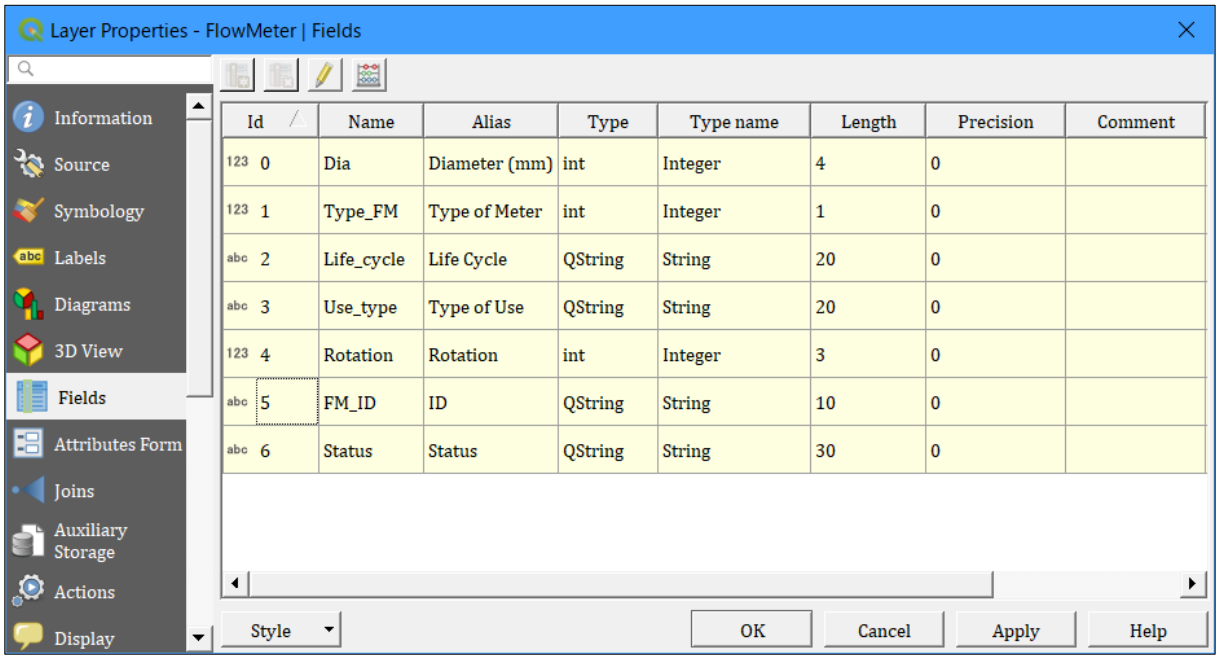
1) *On the snapping function (Project menu → Project Snapping Setting → Enable snapping (U magnet like icon) → Advanced Configuration.*
2) *Check Fittings layer and other layers where snapping is desired → change Snapping tolerance if you like → close the Snapping option window.*
3) *With 'Add Point Feature' tool, click on the point where you want to create the fitting. Fittings are points features in GIS.*
4) *Right-clicking to finish the feature.*
5) *Depending on your setting of QGIS, 'Update Attribute' prompt may or may not open. If it opens, provide some attributes of the new fitting. The attributes may also be provided later, so you can ignore and close the prompt. If the 'Update Attribute' prompt doesn't appear then proceed to create another fitting.*
6) *Update attribute of newly created fittings as described in above section 'To update*

fitting information'.

7) *Save your work by clicking on the Toggle editing tool and selecting Save.*

2. FLOW METER (BULK METER)

The Flow Meter layer of Juba has 7 fields as shown below.



2.1 Properties and Attributes of Each Field in 'FlowMeter' Layer

Name of Field (Or Alias)	Explanation	Example of data in the field
Dia	Diameter in mm	
Type_FM	Type of flowmeter	Turbine, electromagnetic, ultrasonic
Life_Cycle	Whether proposed or existing	
Use_Type	For production, zoning, or distribution	
Rotation	Rotation angle to properly align with the direction of pipe	0 to ± 359
FM_ID	Unique identification number	
Status	Working status	Working, not working, under maintenance

2.2 Steps to Update Flow Meter (Bulk Meter) Information

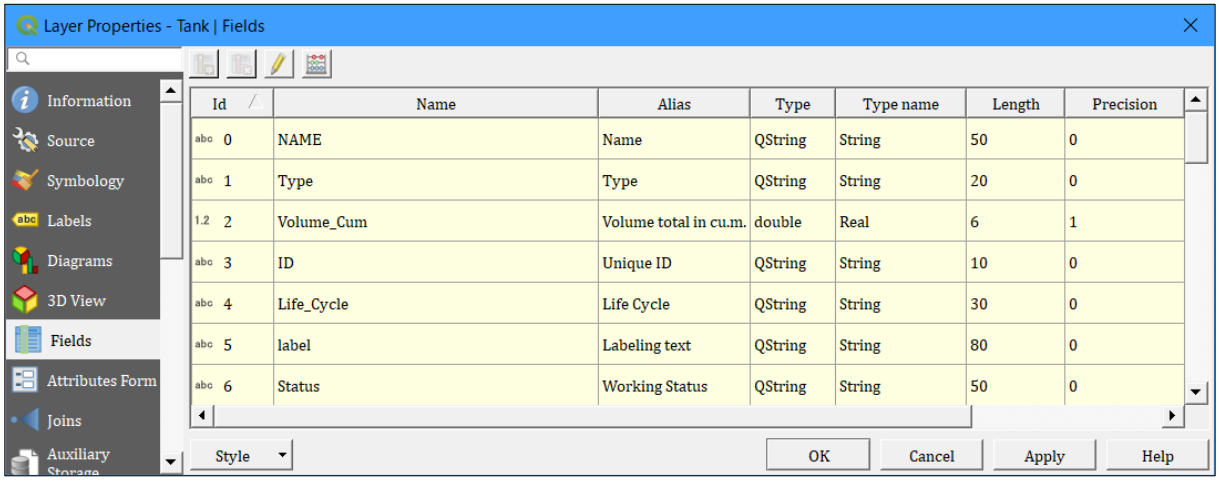
The process is same as for Fittings.

2.3 Steps to Add New Flow Meters

The process is same as for Fittings.

3. TANK

The Tank layer of Juba has 7 fields as shown below.



3.1 Properties and Attributes of Each Field in 'Tank' Layer

Name of Field (Or Alias)	Explanation	Example of data in the field
Name	Name of tank	WTP ground tank 1, Overhead tank, Hospital tank, Parliament tank etc
Type	Type of tank	Ground, elevated
Volume_Cum	Total volume in cubic meter	200 cu.m., 1000 cu.m.,
ID	Unique identification number	
Life_Cycle	Stage of life cycle	Proposed, existing
Label	A string prepared for labelling	Such as 'Juba Univ (old)
Status	Working status	OK, damaged

3.2 Steps to Update Tank Information

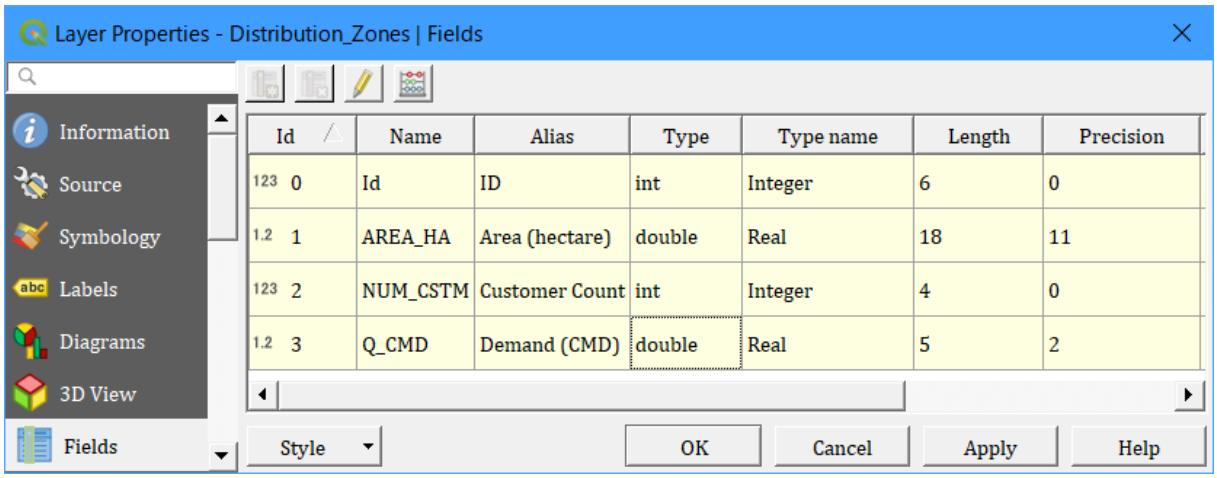
The process is same as for Fittings.

3.3 Steps to Add New Tanks

The process is same as for Fittings.

4. DISTRIBUTION ZONE (OR DMA)

A Distribution Zone may also be considered a District Metered Area (DMA) in case of Juba. So, this section applies both to Distribution Zones and DMAs. But for simplicity, we will just say Distribution Zone hereafter in this SOP. The Distribution_Zones layer of Juba has 4 fields. Name, type, and other properties of these fields are as shown below.



4.1 Properties and Attributes of Each Field in Distribution_Zones Layer

Name of Field (Or Alias)	Explanation	Example of data in the field
Id	Unique identification number	1, 2, ….11
AREA_HA	Area in hectare. It can be calculated by GIS.	157.6 ha for Zone 1
NUM_CSTM	Number of customers in the zone. It can be calculated by customer points in GIS.	180 for Zone 1
Q_CMD	Water demand in the zone in m^3/day. Can be calculated by the number of persons served and per capita demand.	218.7 m^3/day for Zone 1

4.2 Steps to Update Distribution Zone Information and Change Shape

1) *Open QGIS project containing Distribution Zone layer.*
2) *If no such project exists, open a new QGIS project, select Juba's coordinate reference system i.e., WGS 84 / UTM zone 36N (EPSG 32636).*
3) *Add the Distribution Zone layer shape file.*

4) *Select the Distribution Zone layer in the GIS map by clicking on the layer at the right-hand side TOC window.*

5) *Start editing by clicking on Toggle Editing tool on tool bar.*

6) *In the map, find the Zone for which you want to update/change information and click on it with Selection Feature(s) tool.*

7) *Open attribute table by right-clicking on the layer and opening attribute table or clicking on Open Attribute Table tool.*

8) *Use filter function at the LHS bottom to show selected features only, if you want to see the selected zone only.*

9) *Change the desired attribute of the selected Zone; type directly in the cell of attribute table. For example, if you want to change number of customers, delete the existing value in the field NUM_CSTM and type the new value. Similarly, you can change any other attribute of the Zone. Regarding the data type and length of each field, refer to the properties of each field given in the beginning of this section.*

10) *For modifying shape of any Zone (e.g., changing boundary) select the Zone and use desired editing tool such as Cut feature, Split feature, Merge features, Move feature, and so on from the Advanced Digitizing Toolbar. Since the Zones are polygon features, only the tools related to polygon features will be available when the Zone is selected/ clicked.*

11) *If you want to add any new attribute for the Zone, create a new field as follows and add the attributes. Open attribute table → Start editing (if not already in editing mode) → New Field → Select Name, Type, Length of the field.*

12) *Update area of Zone. QGIS does not automatically calculate area of polygon. If shape or size of any Zone has been changed, you need to recalculate the area by using Field calculator. To recalculate the area of a Zone; Start editing (if not already in editing mode) → Open field calculator → Update existing field → AREA_HA → Geometry → $area/10000. The general setting of QGIS gives area in sq.m. To convert to hectare, divide the $area by 10000 by entering the formula as shown above.*

13) *Save your work by clicking on the Toggle editing tool and selecting Save.*

4.3 Steps to add a new Distribution Zone

1) *Activate the snapping function (Project menu → Project Snapping Setting → Enable snapping (U magnet like icon) → Advanced Configuration.*

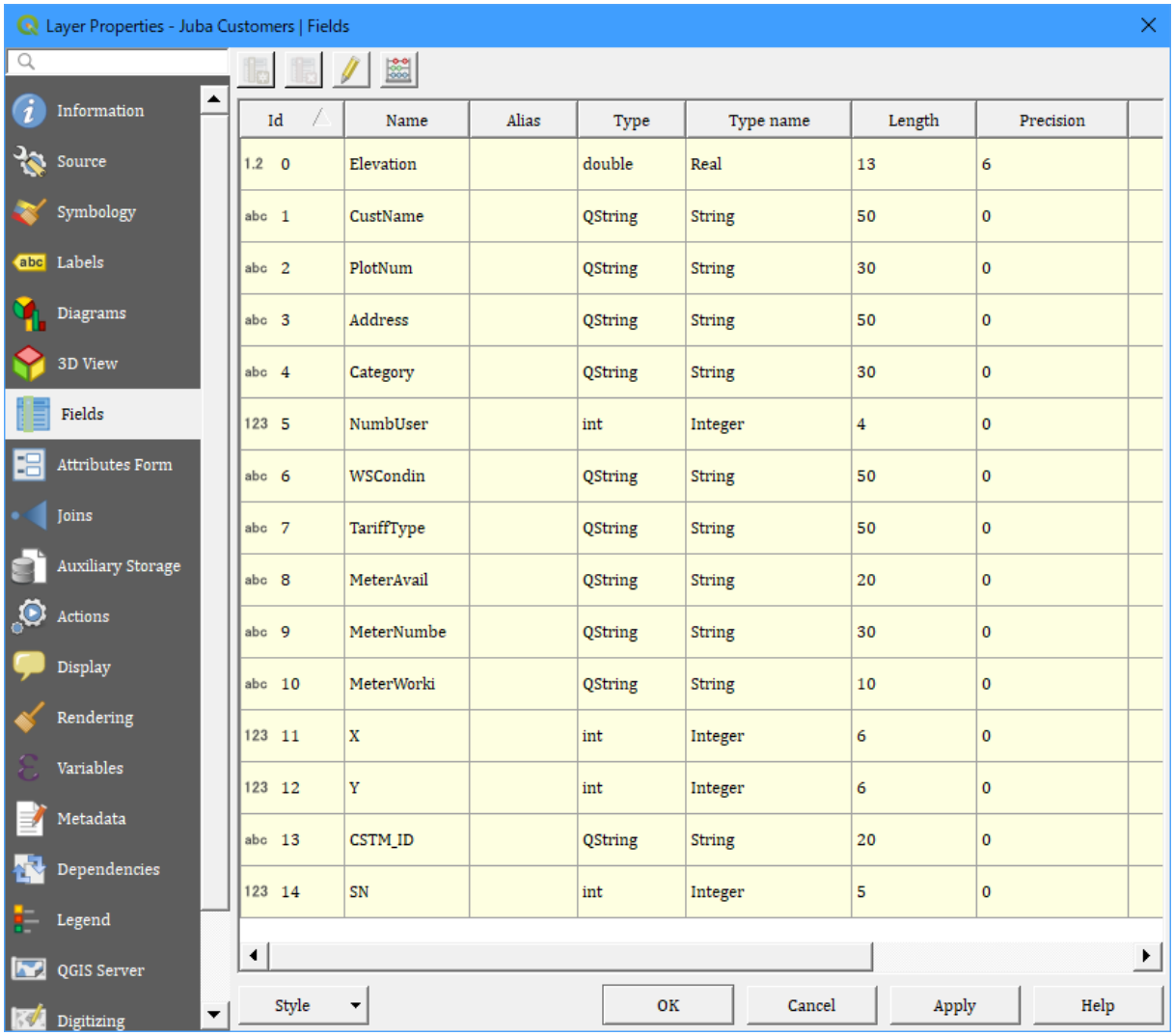
2) *Check the Zone layer and other layers where snapping is desired → change Snapping tolerance if you like → check Avoid intersection → close the Snapping option window.*

3) *With 'Add Polygon Feature' tool, click on the point from where you want to start the Zone boundary.*
4) *Click on next point along the proposed boundary, continue until it touches the boundary of any existing Zone.*
5) *Click on another side of the existing Zone whose boundary you have touched.*
6) *Continue clicking along the proposed boundary of the Zone until about to reach the point from where you had started.*
7) *When you are about to reach the starting point, right-click to finish the new Zone.*
8) *Depending on your setting of QGIS, 'Update Attribute' window may or may not open. If it opens, close the prompt. The attributes can be provided later. If the 'update attribute' prompt doesn't appear then proceed to create another Zone.*
9) *Update attribute of newly created Zone as described in above section 'To update Distribution Zone (DMA) Information'.*
10) *Calculate the area as mentioned in 5.2 (12) above.*
11) *Save the changes by clicking on the Toggle editing tool and selecting Save.*

5. CUSTOMER MAPPING

Location of each customer was collected by GPS and mapped as a point feature in GIS. Unique ID was generated in billing database, and customer points mapped in GIS were matched with the records in the billing system with the help of name and address. As of mid 2018 the billing system had a record of 4527 customers (many of these not existing any more), and the GIS maps had 2149 points. Of these, only 738 could be matched between the billing and GIS.

The following figure shows the fields and their properties of cleaned Customer layer.



Id	Name	Alias	Type	Type name	Length	Precision
1.2 0	Elevation		double	Real	13	6
abc 1	CustName		QString	String	50	0
abc 2	PlotNum		QString	String	30	0
abc 3	Address		QString	String	50	0
abc 4	Category		QString	String	30	0
123 5	NumbUser		int	Integer	4	0
abc 6	WSCondin		QString	String	50	0
abc 7	TariffType		QString	String	50	0
abc 8	MeterAvail		QString	String	20	0
abc 9	MeterNumbe		QString	String	30	0
abc 10	MeterWorki		QString	String	10	0
123 11	X		int	Integer	6	0
123 12	Y		int	Integer	6	0
abc 13	CSTM_ID		QString	String	20	0
123 14	SN		int	Integer	5	0

5.1 Properties and Attributes of Each Field in 'Juba Customers' Layer

Name of Field	Explanation	Example of data in the field
Elevation	Spot elevation of customer point	
CustName	Name of customer as recorded in SSUWC Juba station billing system	
PlotNum	Plot number	
Address	Address	
Category	Category of customer by water use type	School, Domestic Class I, Domestic Class II, NGO, Hotel, Office, Government Unit, Commercial, Church
NumbUser	Number of users	5 (domestic), 200 (College), etc.
WSCondin	Condition of water supply	Good, fair, little, no water, etc.
TariffType	Type of tariff	Flat or meter-based
MeterAvail	Meter available or not	
MeterNumbe	Meter number	
MeterWorki	Meter working or not	
X	X-coordinate of the point	
Y	Y-coordinate of the point	
CSTM_ID	Customer ID prepared by combining customer category and other parameters	J_C3_3_00954 where, The first part (e.g., J) represents Juba The second part (e.g., C3) represents Category III The third part (e.g., 3) represents customer Ledger number, and The last part (e.g., 00954) is the unique five digit number assigned to the each customer
SN	Serial number for reference only	

5.2 Steps to Update Customer Information

To change or update any information of already mapped customer follow the steps outlined below.

1) *Open QGIS project containing the latest cleaned version of Customer layer. Name of the latest cleaned customer layer is 'Juba_Cust_correct_2018_cleaned'.*
2) *If no such project exists, open a new QGIS project, select Juba's coordinate reference system i.e., WGS 84 / UTM zone 36N (EPSG 32636), and add the Customer layer shape file.*
3) *Select the Customer layer in the GIS map by clicking on the layer at the right-hand side TOC window.*

4) *Start editing by clicking on Toggle Editing tool on tool bar.*

5) *In the map, find the customer for which you want to update/change information. To find the desired customer, you can zoom to the location if it is known. Or alternately, you can find it in the attribute table by name or ID of the customer. In this case, open the attribute table → find the customer and select the entire record (row) of this customer → use tools 'Pan map to the selected row' → 'Zoom map to the selected row'.*

   Attribute table can be opened by right clicking on the layer and selecting 'Open attribute table' or by clicking on Open Attribute Table tool.

6) *Use filter function at the LHS bottom to show selected customer only if you prefer to show only the selected one.*

7) *Change the desired attribute of the selected customer; type directly in the cell of attribute table. For example, if you want to update the number of users, delete the existing number after clicking on this cell and then type the new number. Similarly, you can change any other attribute of any customer you want to change.*

   Regarding the data type and length of each field, refer to the properties of each field given in the beginning of this section.

8) *If you want to add any new attribute for the customers, create a new field as follows and add the attributes;*

   Open attribute table → Start editing (if not already in editing mode) → New Field → Select Name, Type, Length of the field.

9) *You can also change attribute of several customers together if they have some similar attributes;*

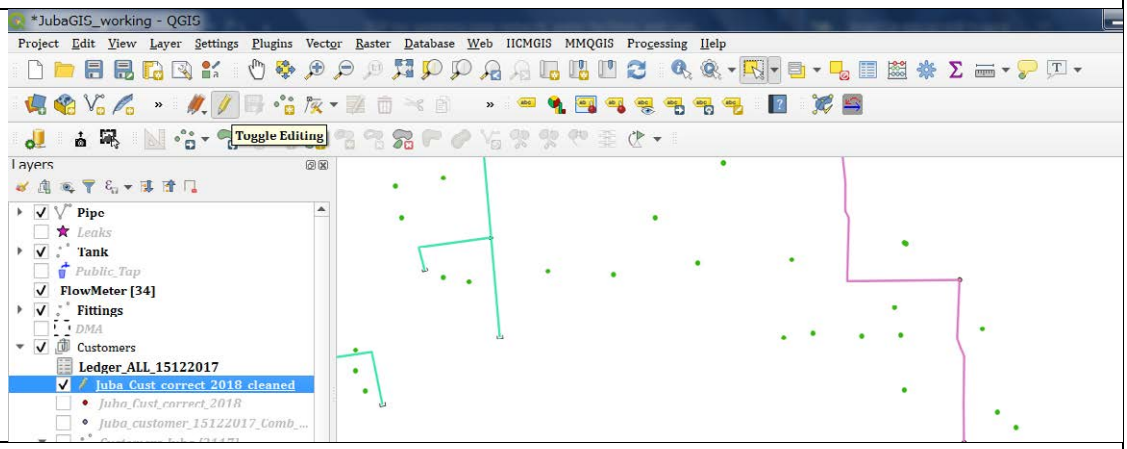
   Select all the desired customers with similar attributes using selection tool while pressing Shift key or using Select Features by Polygon tool.

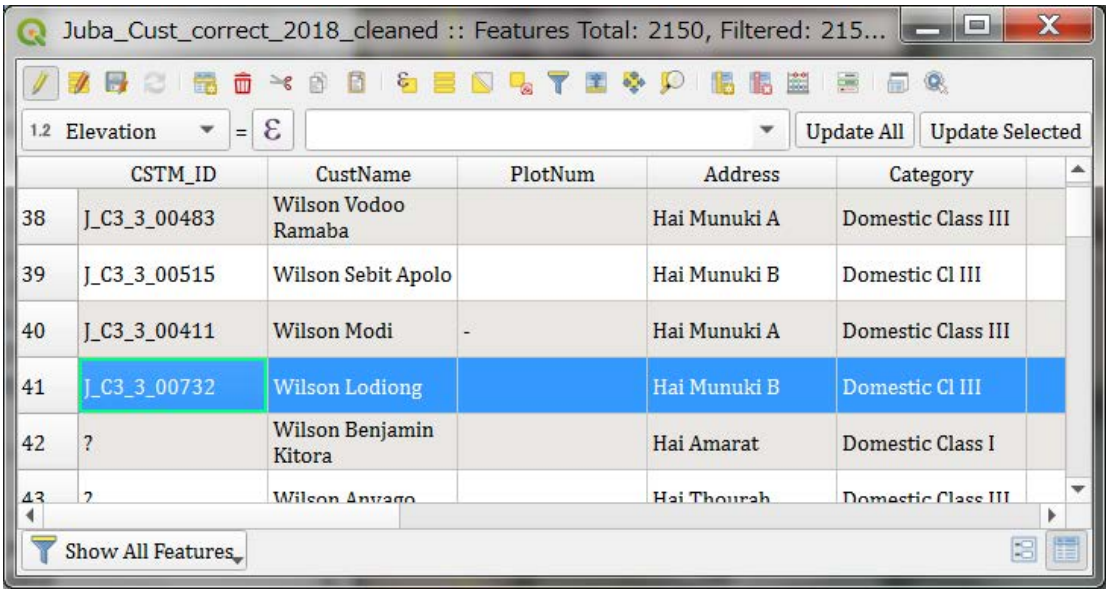
   Use a modification tool (click on the tool) and modify the desired attribute. This will modify the attribute of all selected features.

10) *Save the changes by clicking on the Toggle editing tool and selecting Save.*

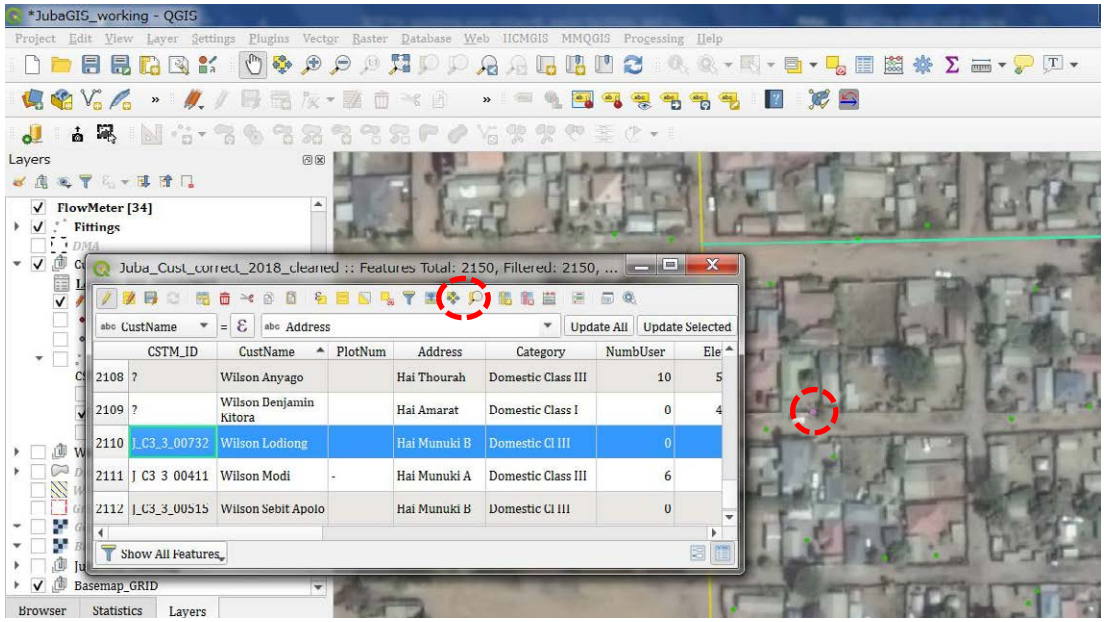
Stepwise Detail

Steps	Description and Images
	1) Open QGIS project containing the latest cleaned version of Customer layer. Name of the latest cleaned customer layer is 'Juba_Cust_correct_2018_cleaned'. 2) If no such project exists, open a new QGIS project, select Juba's coordinate reference system i.e., WGS 84 / UTM zone 36N (EPSG 32636) and add the Customer layer shape file. 3) Select the Customer layer in the GIS map by clicking on the layer at the right-hand side TOC window.

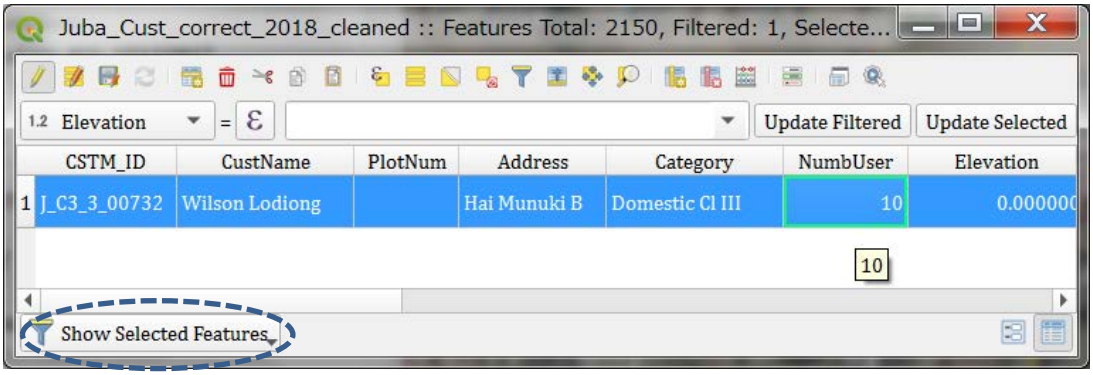
	4) Start editing by clicking on Toggle Editing tool on tool bar.
1) - 4)	
5)	In the map, find the customer for which you want to update/change information. To find the desired customer, you can zoom to the location if it is known. Or alternately, you can find it in the attribute table by name or ID of the customer. In this case, open the attribute table → find the customer and select the entire record (row) of this customer → use tools 'Pan map to the selected row' → 'Zoom map to the selected row'.



	CSTM_ID	CustName	PlotNum	Address	Category
38	J_C3_3_00483	Wilson Vodoo Ramaba		Hai Munuki A	Domestic Class III
39	J_C3_3_00515	Wilson Sebit Apolo		Hai Munuki B	Domestic Cl III
40	J_C3_3_00411	Wilson Modi	-	Hai Munuki A	Domestic Class III
41	J_C3_3_00732	Wilson Lodiong		Hai Munuki B	Domestic Cl III
42	?	Wilson Benjamin Kitora		Hai Amarat	Domestic Class I
43	?	Wilson Anyago		Hai Thourah	Domestic Class III

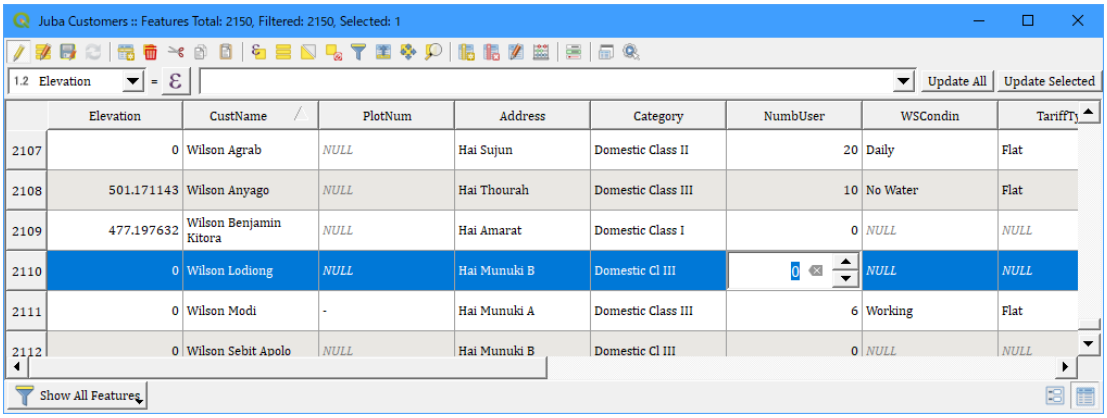


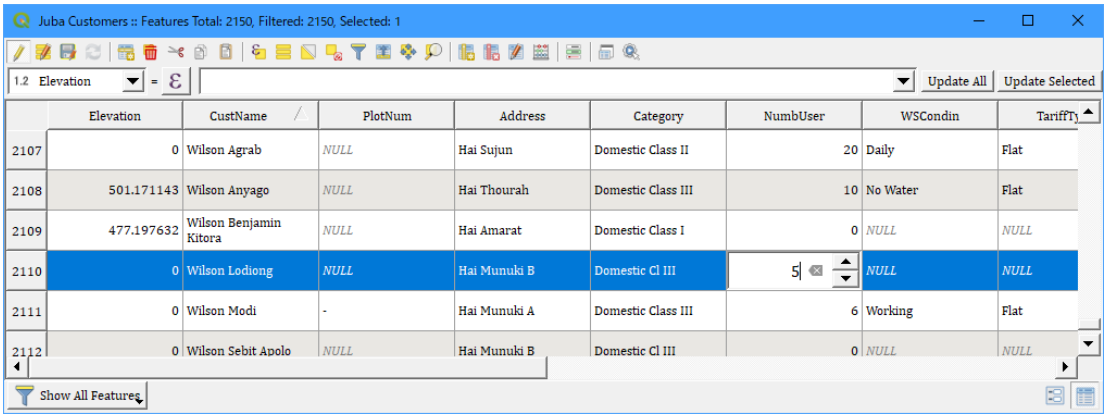
6) Use filter function at the LHS bottom to show selected customer only if you prefer to show only the selected one.



7) Change the desired attribute of the selected customer;
Type directly in the cell of attribute table. For example, if you want to update the number of users, delete the existing number after clicking on this cell and then type the new number. Similarly, you can change any other attribute of any customer you want to change.

The example below shows updating the number of users for Wilson Lodiong.

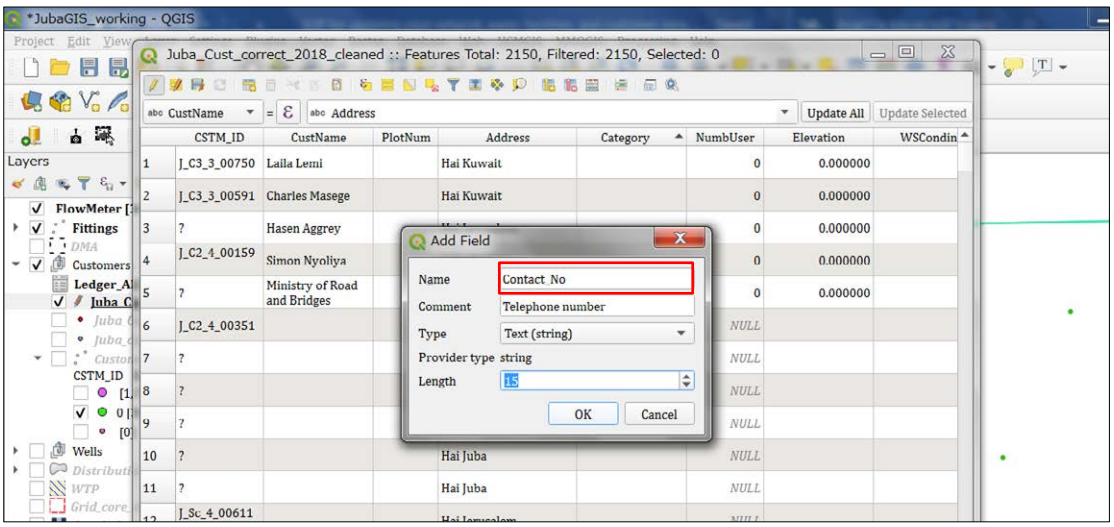


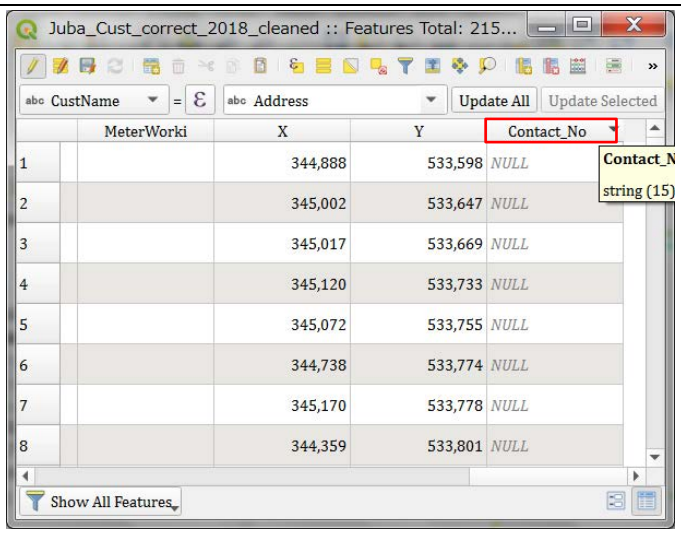


	Elevation	CustName	PlotNum	Address	Category	NumbUser	WSCondin	TariffTy
2107	0	Wilson Agrab	NULL	Hai Sujun	Domestic Class II	20	Daily	Flat
2108	501.171143	Wilson Anyago	NULL	Hai Thourah	Domestic Class III	10	No Water	Flat
2109	477.197632	Wilson Benjamin Kitora	NULL	Hai Amarat	Domestic Class I	0	NULL	NULL
2110	0	Wilson Lodiong	NULL	Hai Munuki B	Domestic Cl III	5	NULL	NULL
2111	0	Wilson Modi	-	Hai Munuki A	Domestic Class III	6	Working	Flat
2112	0	Wilson Sebit Apolo	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL

8) If you want to add any new attribute for the customers, create a new field as follows and add the attributes;

Open attribute table → Start editing (if not already in editing mode) → New Field → Select Name, Type, Length of the field. Contact_No is added in the following example.



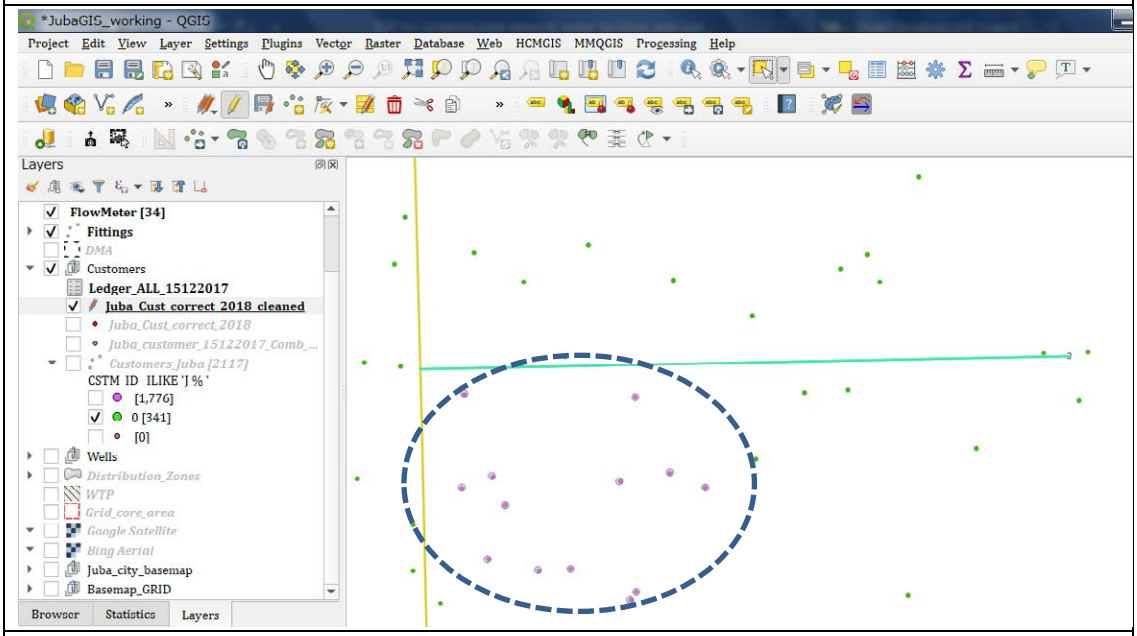


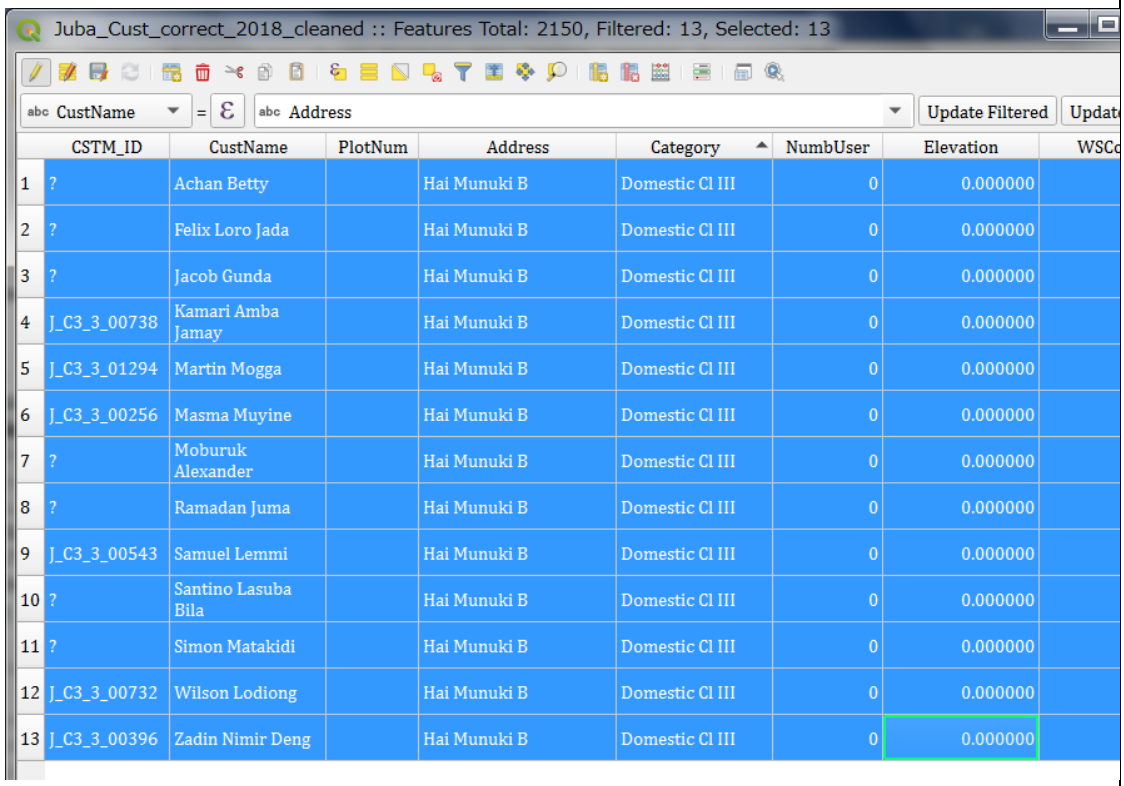
	MeterWorki	X	Y	Contact_No
1		344,888	533,598	NULL
2		345,002	533,647	NULL
3		345,017	533,669	NULL
4		345,120	533,733	NULL
5		345,072	533,755	NULL
6		344,738	533,774	NULL
7		345,170	533,778	NULL
8		344,359	533,801	NULL

9) You can also change attribute of several customers together if they have some similar attributes;

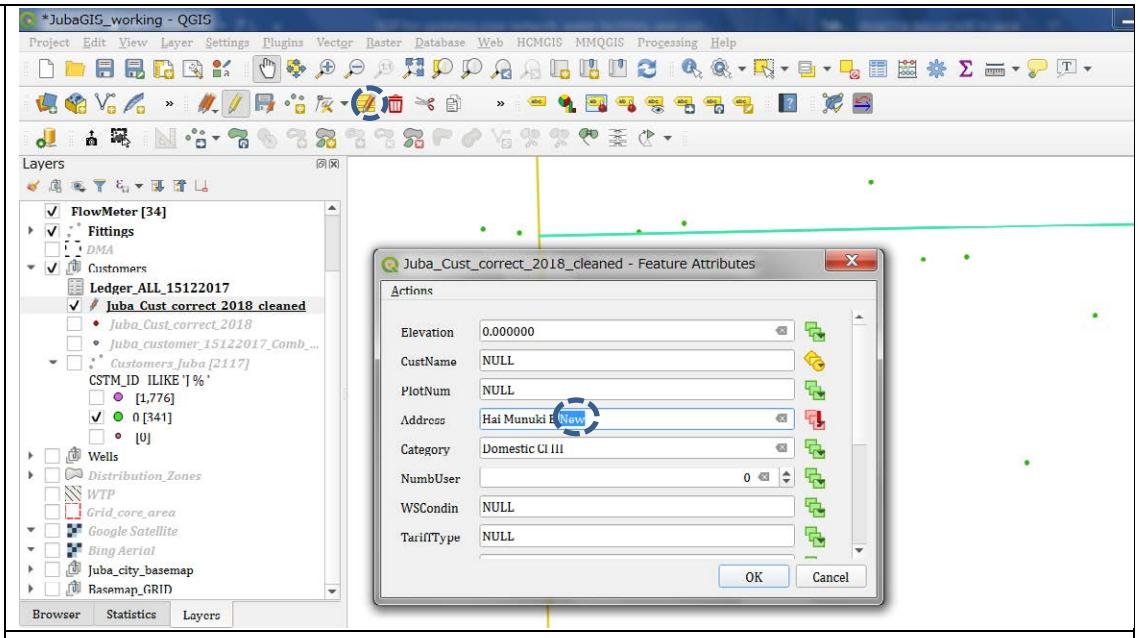
- Select all the desired customers with similar attributes using selection tool while pressing Shift key or using Select Features by Polygon tool.
- Use a modification tool (click on the tool) and modify the desired attribute. This will modify the attribute of all selected features.

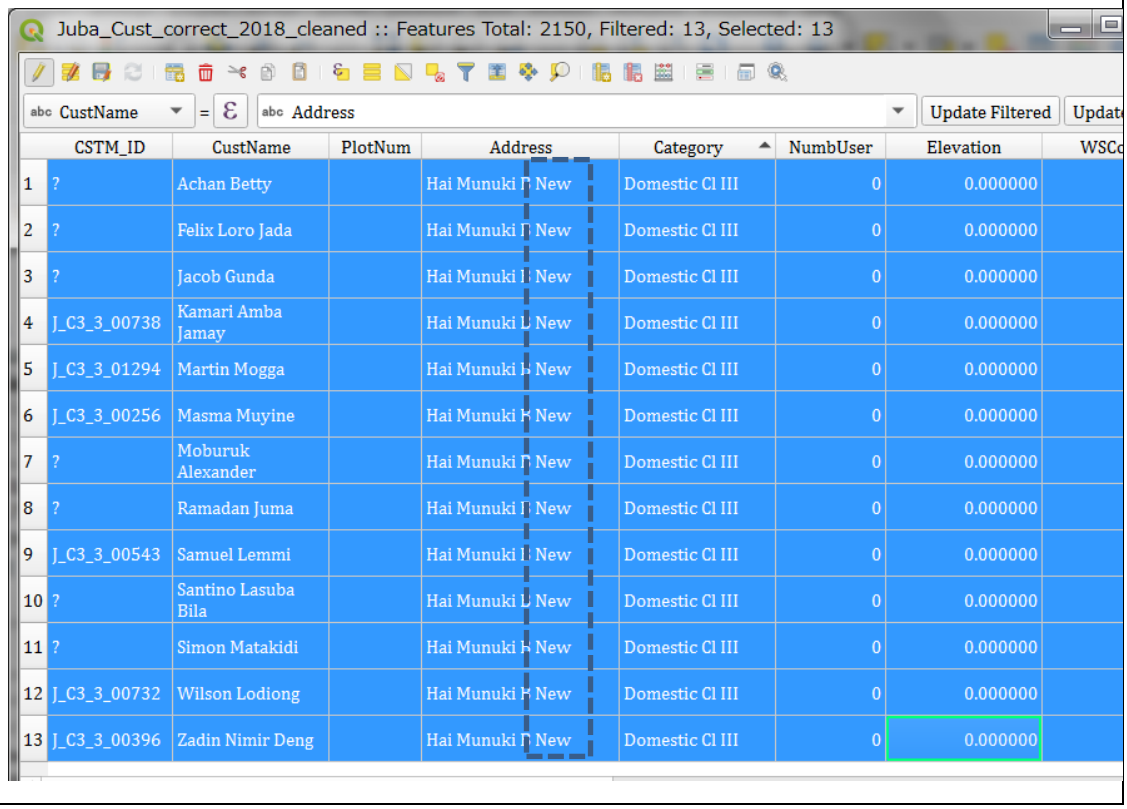
The following exampl shows changing the address of 13 customers from 'Hai Munuki B' to 'Hai Munuki B New'.





	CSTM_ID	CustName	PlotNum	Address	Category	NumbUser	Elevation	WSCo
1	?	Achan Betty		Hai Munuki B	Domestic Cl III	0	0.000000	
2	?	Felix Loro Jada		Hai Munuki B	Domestic Cl III	0	0.000000	
3	?	Jacob Gunda		Hai Munuki B	Domestic Cl III	0	0.000000	
4	J_C3_3_00738	Kamari Amba Jamay		Hai Munuki B	Domestic Cl III	0	0.000000	
5	J_C3_3_01294	Martin Mogga		Hai Munuki B	Domestic Cl III	0	0.000000	
6	J_C3_3_00256	Masma Muyine		Hai Munuki B	Domestic Cl III	0	0.000000	
7	?	Moburuk Alexander		Hai Munuki B	Domestic Cl III	0	0.000000	
8	?	Ramadan Juma		Hai Munuki B	Domestic Cl III	0	0.000000	
9	J_C3_3_00543	Samuel Lemmi		Hai Munuki B	Domestic Cl III	0	0.000000	
10	?	Santino Lasuba Bila		Hai Munuki B	Domestic Cl III	0	0.000000	
11	?	Simon Matakidi		Hai Munuki B	Domestic Cl III	0	0.000000	
12	J_C3_3_00732	Wilson Lodiong		Hai Munuki B	Domestic Cl III	0	0.000000	
13	J_C3_3_00396	Zadin Nimir Deng		Hai Munuki B	Domestic Cl III	0	0.000000	





	CSTM_ID	CustName	PlotNum	Address	Category	NumbUser	Elevation	WSCo
1	?	Achan Betty		Hai Munuki New	Domestic Cl III	0	0.000000	
2	?	Felix Loro Jada		Hai Munuki New	Domestic Cl III	0	0.000000	
3	?	Jacob Gunda		Hai Munuki New	Domestic Cl III	0	0.000000	
4	J_C3_3_00738	Kamari Amba Jamay		Hai Munuki New	Domestic Cl III	0	0.000000	
5	J_C3_3_01294	Martin Mogga		Hai Munuki New	Domestic Cl III	0	0.000000	
6	J_C3_3_00256	Masma Muyine		Hai Munuki New	Domestic Cl III	0	0.000000	
7	?	Moburuk Alexander		Hai Munuki New	Domestic Cl III	0	0.000000	
8	?	Ramadan Juma		Hai Munuki New	Domestic Cl III	0	0.000000	
9	J_C3_3_00543	Samuel Lemmi		Hai Munuki New	Domestic Cl III	0	0.000000	
10	?	Santino Lasuba Bila		Hai Munuki New	Domestic Cl III	0	0.000000	
11	?	Simon Matakidi		Hai Munuki New	Domestic Cl III	0	0.000000	
12	J_C3_3_00732	Wilson Lodiong		Hai Munuki New	Domestic Cl III	0	0.000000	
13	J_C3_3_00396	Zadin Nimir Deng		Hai Munuki New	Domestic Cl III	0	0.000000	

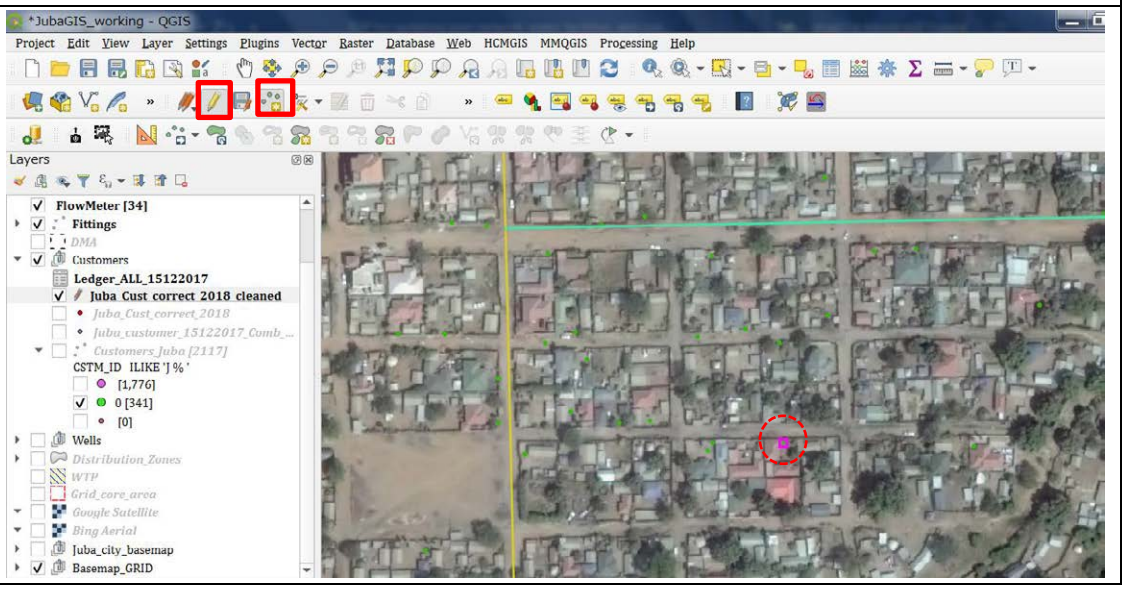
5.3 Steps to Add New Customer Points

New customer points can be added by two methods; (i) manually one by one looking at the basemap or (ii) from GPS survey.

(i) Manual one by one method

1) *Start editing of the Customer layer if it is not already in editing mode.*
2) *Zoom to the location of customer's house and then to the location of water meter. If there is no meter, zoom to the intersection of house connection and customer property boundary. Suitable scale is about 1:500 to 1:1000.*
3) *With 'Add Point Feature' tool, click on the above-mentioned location.*
4) *Depending on your setting of QGIS, 'Update Attribute' window may or may not open. If it opens, close the prompt. The attributes can be provided later. If the 'update attribute' prompt doesn't appear then proceed to create another customer point.*
5) *Update attribute of newly added customers as described in above section 'Steps to update customer information'.*

Explanation

Steps	Description and Image
1) – 5)	

(ii) From GPS survey

1) *Switch on and connect the GPS machine to the computer.*
2) *Wait until the connection between the computer and GPS machine is established. The GPS will be shown as an external memory in the computer.*
3) *In QGIS project, Add layer → Add vector layer → Select file type 'GPX' → Navigate to the GPX file in GPS folder → Open → Add → Select 'waypoints' → OK → Close.*

4) *Export this file as a GIS shape file; Right-click the GPX layer → Export → Save features as → in the Format field select 'ESRI shape file' → in the File name field click to (...) at the right → navigate to the folder where you want to save the shape file and give suitable file name → CRS select 'Project CRS: EPSG:32636 – WGS 84 / UTM zone 36N → OK.*

5) *Once this file is created, add to the project if it is not automatically added.*

6) *Merge the newly created shape file of customer points with existing customer shape file; Vector menu → Data management tools → Merge vector layers.*

7) *In the Input layer field click to (...) at the right → select the existing and newly created customer layers → OK → Run. Two layers will be merged and a new temporary layer will be created. Check the newly created shape file layer by opening its attribute table.*

8) *Save this file; Right-click on the newly merged layer → Export → Save features as → in the Format field select 'ESRI shape file' → in the File name field click to (...) at the right → navigate to the folder where you want to save the shape file and give suitable file name → Save.*

   This completes the addition of newly surveyed customer points in GIS shape file.

9) *Check if any customer point is duplicated and delete the duplicate points*

   <u>Method a) Using Processing Tool</u>

   Processing Menu → search 'duplicate' → in Vector general you will find 'Delete duplicate geometries → Select Customer layer → Run → check and Save the cleaned layer as a new Customer layer

   <u>Method b) Using X and Y coordinates</u>

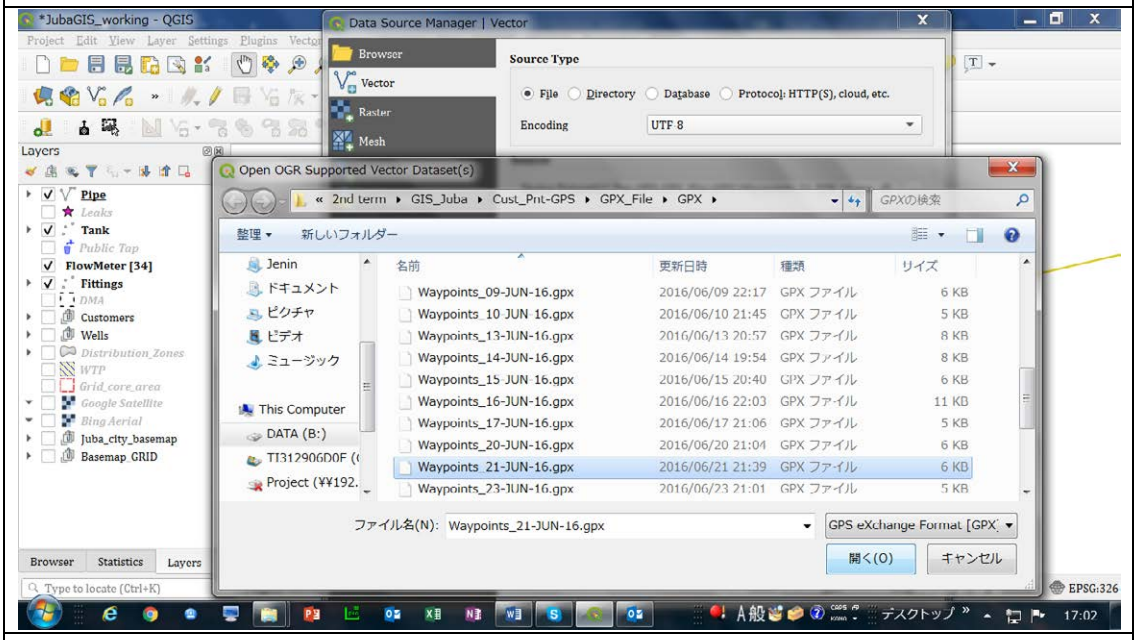
   For X-coordinate; Start editing → Open field calculator → Update existing field → X → Geometry → $x → OK. For Y-coordinate; Open field calculator → Update existing field → Y → Geometry → $y → OK.

   Sort the features by X-coordinate. If more than one point are found to have exactly the same X and Y-coordinates, then these are duplicates. Check and delete the duplicate points one-by-one. This method is not suitable if the numbers are many.

Stepwise Detailed Explanation

Steps	Explanation and Images
1-3)	1) Switch on and connect the GPS machine to the computer. 2) Wait until the connection between the computer and GPS machine is established. The GPS will be shown as an external memory in the computer. 3) In QGIS project, Add layer → Add vector layer → Select file type 'GPX' → Navigate to the GPX file in GPS folder → Open → Add → Select 'waypoints' → OK

→ Close.


*JubaGIS_working - QGIS
Data Source Manager | Vector
Browser
Vector
Raster
Mesh
Source Type
File
Directory
Database
Protocol: HTTP(S), cloud, etc.
Encoding
UTF-8
Open OGR Supported Vector Dataset(s)
2nd term ▸ GIS_Juba ▸ Cust_Pnt-GPS ▸ GPX_File ▸ GPX ▸
GPXの検索
整理
新しいフォルダー
Jenin
ドキュメント
ピクチャ
ビデオ
ミュージック
This Computer
DATA (B:)
名前
更新日時
種類
サイズ
Waypoints_09-JUN-16.gpx 2016/06/09 22:17 GPX ファイル 6 KB
Waypoints_10-JUN-16.gpx 2016/06/10 21:45 GPX ファイル 5 KB
Waypoints_13-JUN-16.gpx 2016/06/13 20:57 GPX ファイル 8 KB
Waypoints_14-JUN-16.gpx 2016/06/14 19:54 GPX ファイル 8 KB
Waypoints_15-JUN-16.gpx 2016/06/15 20:40 GPX ファイル 6 KB
Waypoints_16-JUN-16.gpx 2016/06/16 22:03 GPX ファイル 11 KB
Waypoints_17-JUN-16.gpx 2016/06/17 21:06 GPX ファイル 5 KB
Waypoints_20-JUN-16.gpx 2016/06/20 21:04 GPX ファイル 6 KB
Waypoints_21-JUN-16.gpx 2016/06/21 21:39 GPX ファイル 6 KB
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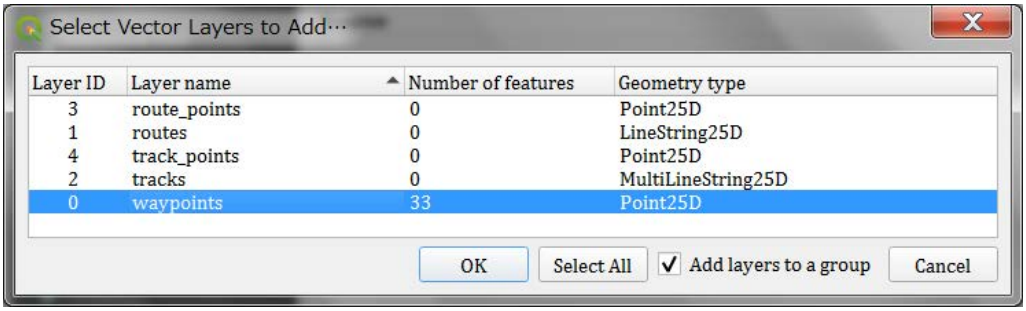
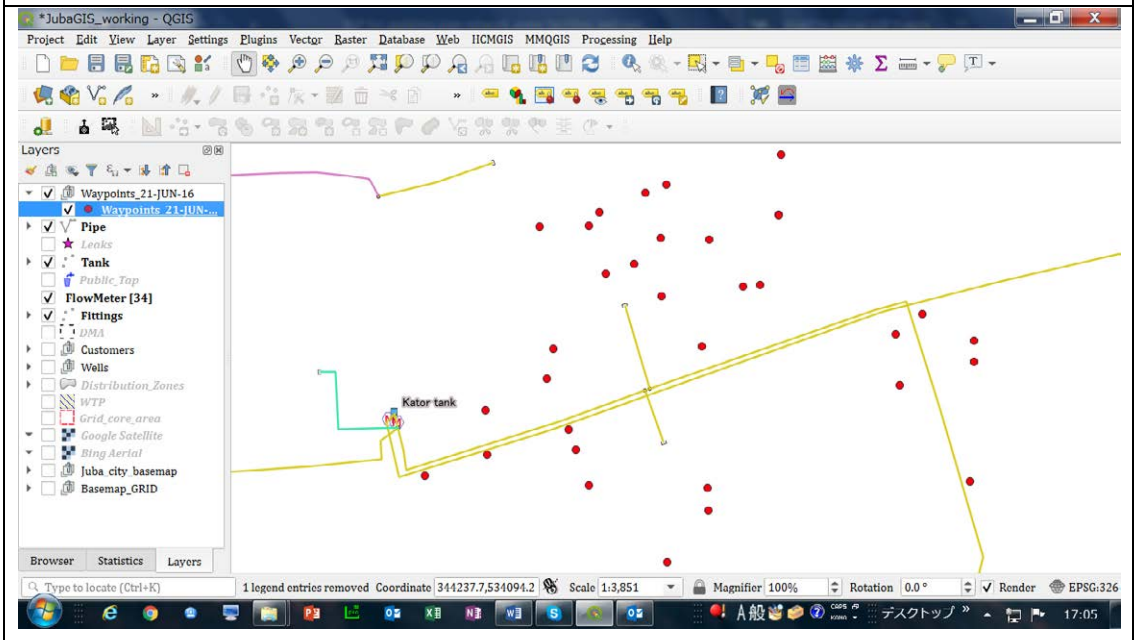
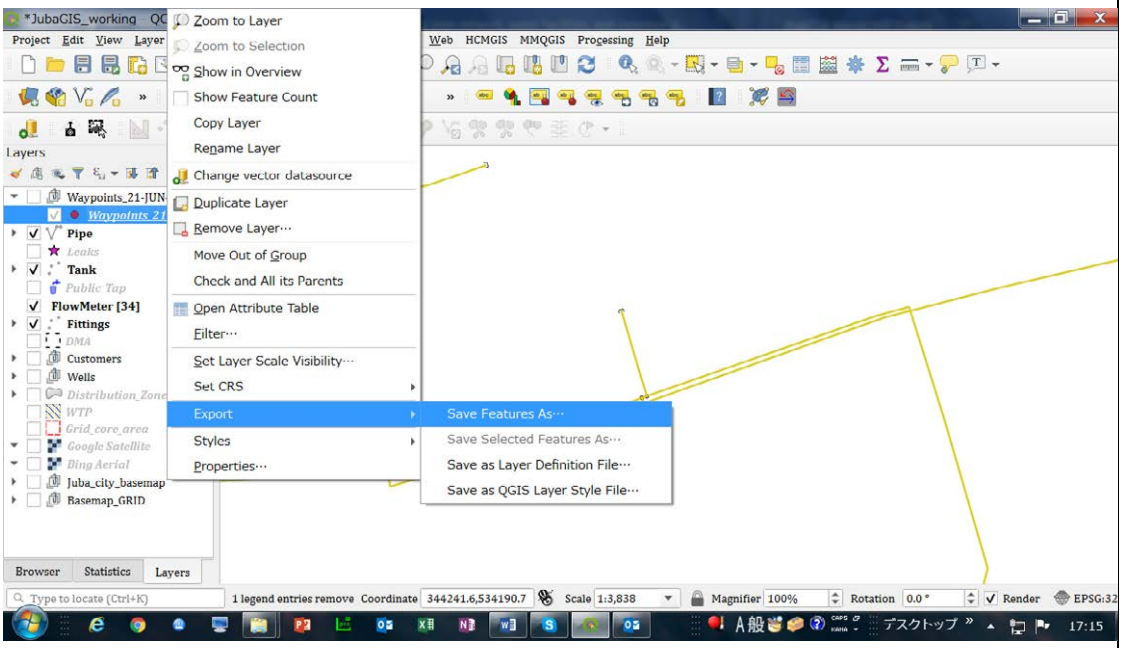
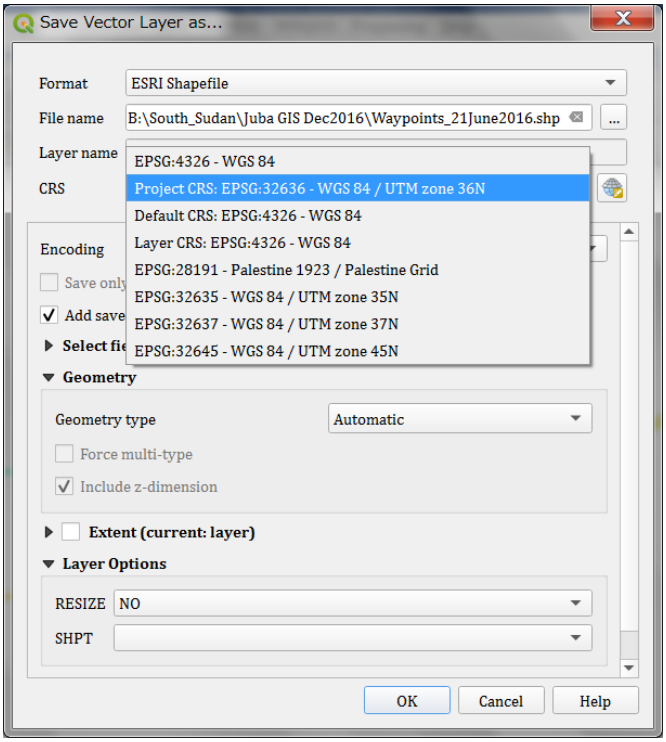
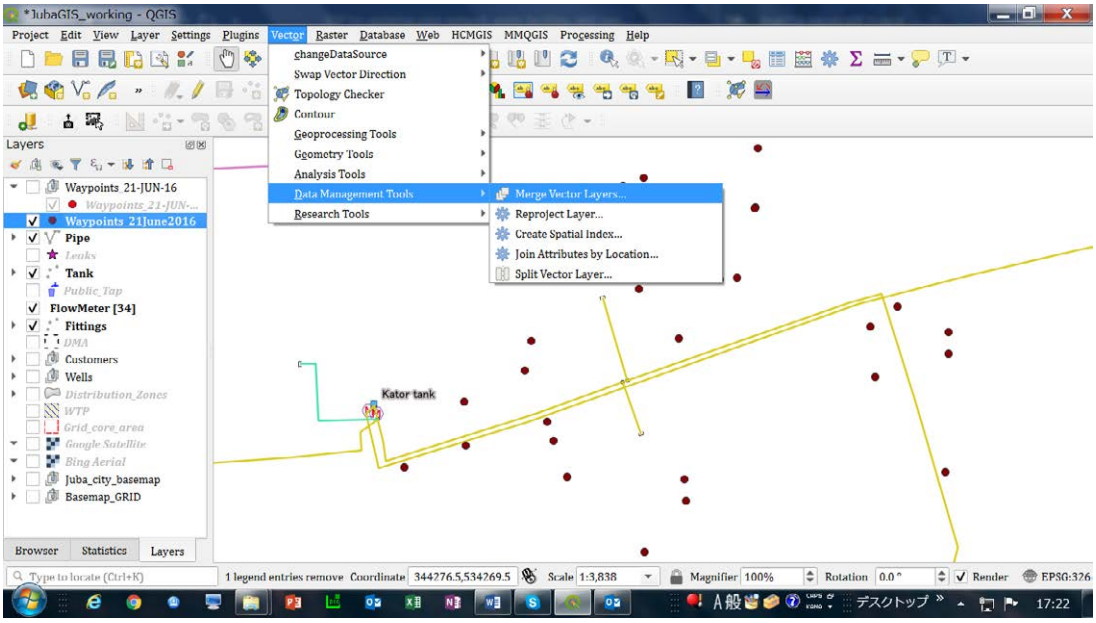
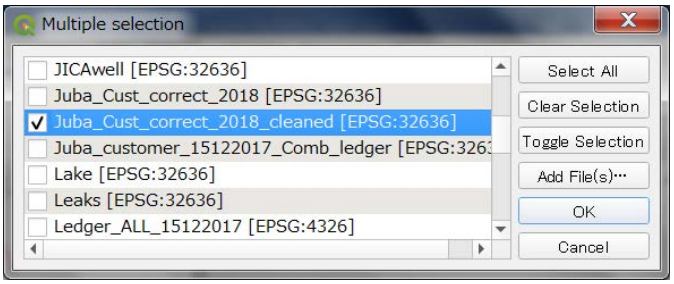
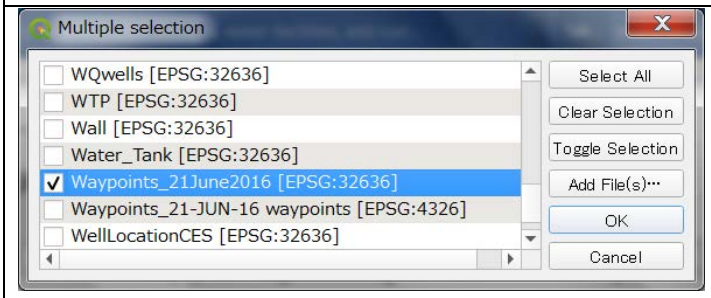
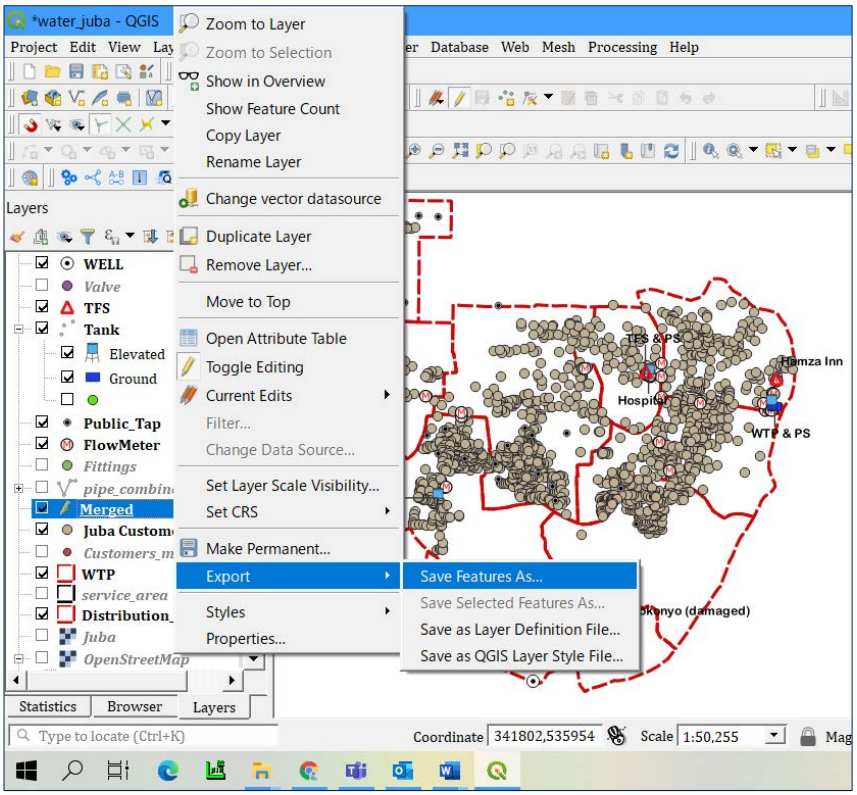
GPS eXchange Format [GPX]
開く(O)
キャンセル
Layers
Pipe
Leaks
Tank
Public Tap
FlowMeter [34]
Fittings
DMA
Customers
Wells
Distribution_Zones
WTP
Grid_core_area
Google Satellite
Bing Aerial
Juba_city_basemap
Basemap_GRID
Browser
Statistics
Layers
EPSG:326
17:02

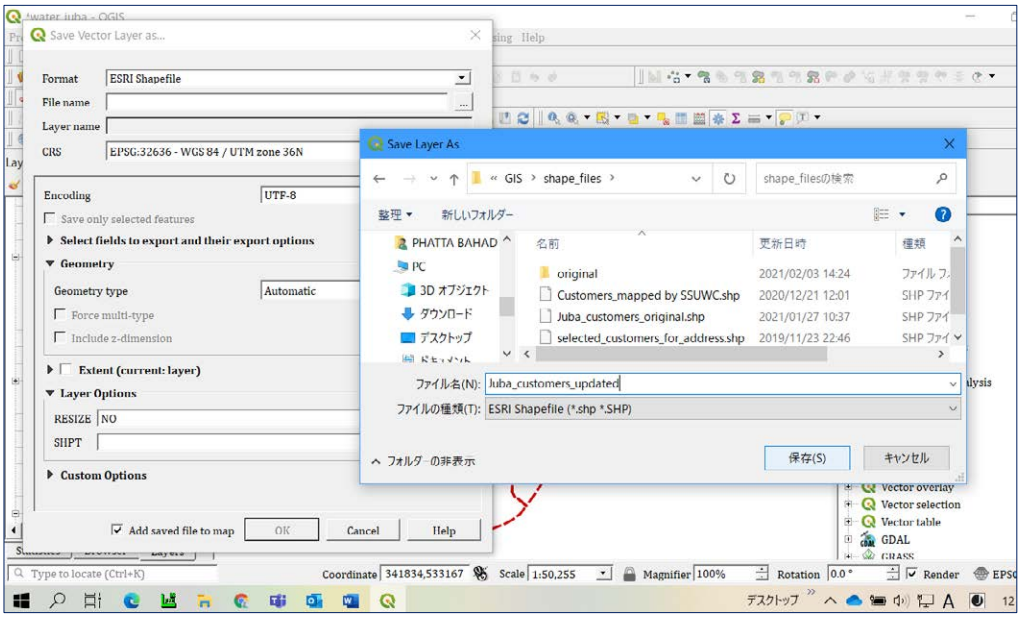

Select Vector Layers to Add…
Layer ID
Layer name
Number of features
Geometry type
3 route_points 0 Point25D
1 routes 0 LineString25D
4 track_points 0 Point25D
2 tracks 0 MultiLineString25D
0 waypoints 33 Point25D
OK
Select All
Add layers to a group
Cancel


*JubaGIS_working - QGIS
Project Edit View Layer Settings Plugins Vector Raster Database Web HCMGIS MMQGIS Processing Help
Layers
Waypoints_21-JUN-16
Waypoints_21-JUN-...
Pipe
Leaks
Tank
Public_Tap
FlowMeter [34]
Fittings
DMA
Customers
Wells
Distribution_Zones
WTP
Grid_core_area
Google Satellite
Bing Aerial
Juba_city_basemap
Basemap_GRID
Kator tank
Browser
Statistics
Layers
1 legend entries removed
Coordinate 344237.7,534094.2
Scale 1:3,851
Magnifier 100%
Rotation 0.0 °
Render
EPSG:326
17:05

4)	Export this file as a GIS shape file; Right-click the GPX layer → Export → Save features as → in the Format field select 'ESRI shape file' → in the File name field click to (...) at the right → navigate to the folder where you want to save the shape file and give suitable file name → CRS select 'Project CRS: EPSG:32636 – WGS 84 / UTM zone 36N → OK.
	
	
5) - 6)	5) Once this file is created, add to the project if it is not automatically added. 6) Merge the newly created shape file of customer points with existing customer shape file;

	Vector menu → Data management tools → Merge vector layers.
	
7)	In the Input layer field click to (...) at the right → select the existing and newly created customer layers → OK → Run.
	
	
8)	Save this file; Right-click on the newly merged layer → Export → Save features as → in the Format field select 'ESRI shape file' → in the File name field click to (...) at the right → navigate to the folder where you want to save the shape file and give suitable file name → Save.

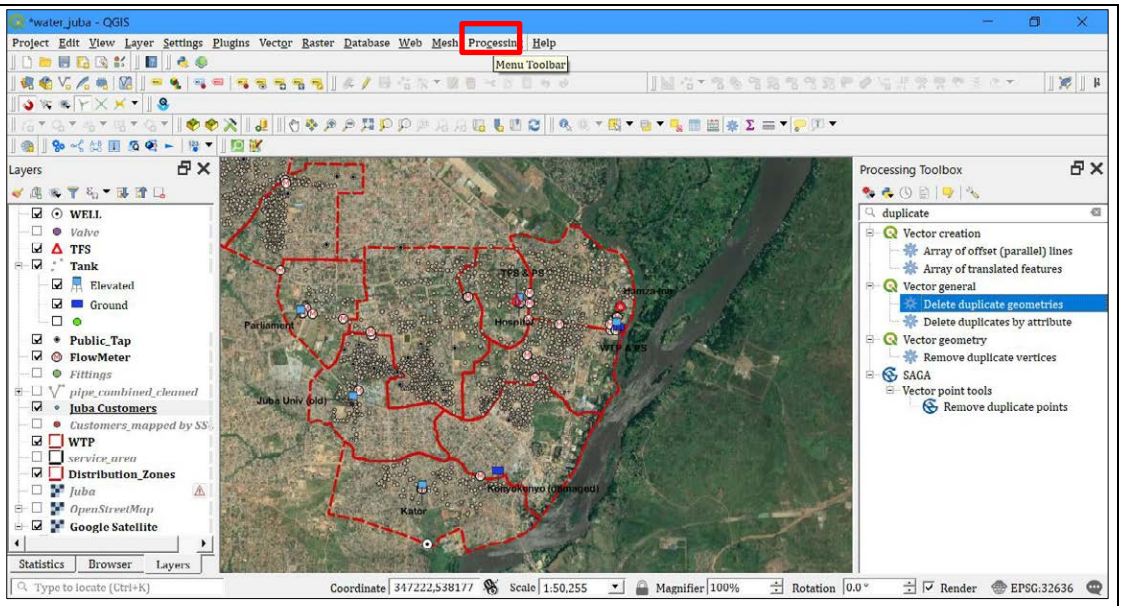


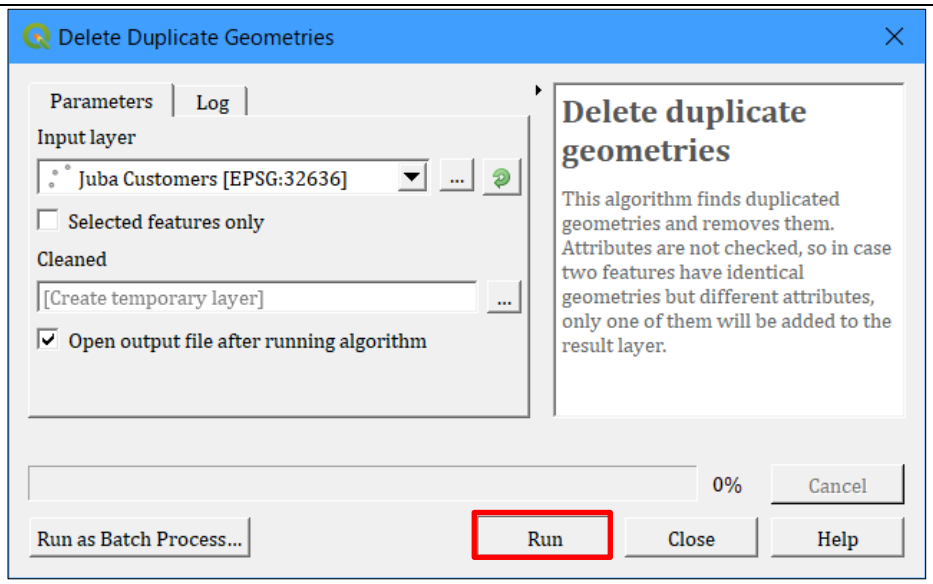


9) Check if any customer point is duplicated and delete the duplicate points

<u>Method a) Using Processing Tool</u>

Processing Menu → search 'duplicate' → in Vector general you will find 'Delete duplicate geometries → Select the newly created Customer layer → Run → check and Save the cleaned layer as a new Customer layer.





Method b) By calculating X and Y coordinates and manually checking for duplicate

This method is useful if you suspect a few duplicated points. If there are many, use the previous method.

Check if any customer point is repeated, calculate X and Y coordinates. For X-coordinate; Start editing → Open field calculator → Update existing field → X → Geometry → $x → OK. For Y-coordinate; Open field calculator → Update existing field → Y → Geometry → $y → OK.

Sort the features by X-coordinate. If more than one point are found to have exactly the same X and Y-coordinates, then these are duplicates. Check and delete the duplicate one.

6. LINKING CUSTOMER POINTS TO BILLING DATA

Preliminary maps of water supply network and facilities, and customer points were prepared during earlier stages of the Project. The accuracy of water network was improved by checking of network map by joint team of distribution and GIS during earlier training sessions in Uganda. The customer points were taken with hand-held GPS system. During the mapping exercise, customer names and basic information recorded separately.

Out of 2,108 customer points mapped, 1,460 points had the customer name and other survey information linked with them as attributes. The rest of the points (648 numbers) did not have customer name or address information. The trainees of GIS training in June 2017 training session were given homework to complete putting the name and address information to those customer points. They could do this by tallying with the old survey report or redoing the survey. Customer names and address are required to link customers points in GIS with customer billing system.

When customer points in GIS are linked with customer billing system the map becomes a very useful tool for management. For example, we can easily identify which customer has paid water tariff upto when, which customer has the highest and which has the lowest consumption, which area has the more number of non-paying customers, and so on.

This section of the SOP outlines the methods for preparing customer data for linking and establishing links with GIS points.

6.1 Preparing Customer Data for Linking

To link the customer points in GIS with the customers in billing system, a unique field (unique identifier such as customer number) needs to be created both in the GIS map and billing system.

If already existing, Customer ID will be suitable for this purpose. But Juba does not have unique Customer ID. So a new system has been developed.

The format of the Customer ID is as follows:

J_A_1_00001

Where,

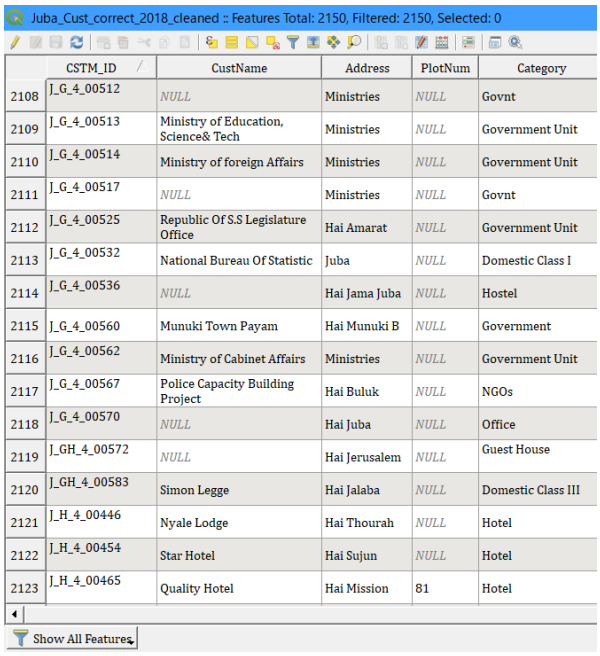
J represents Juba

A represents Customer Type

1 represents customer Ledger Number, and

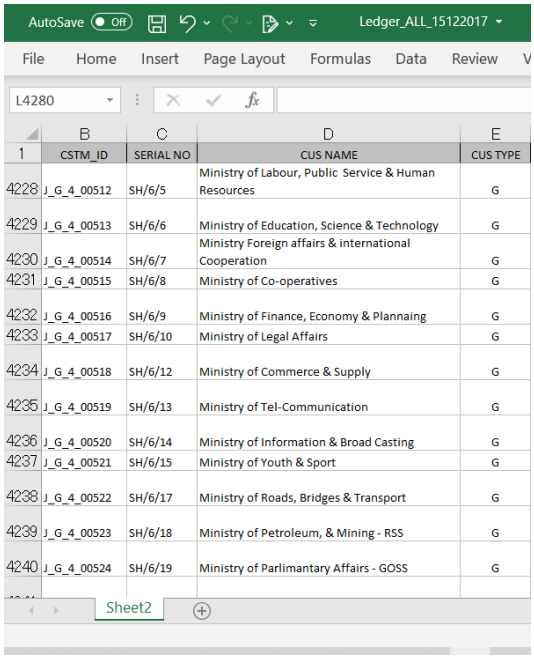
00001 represents Customer Number

The right-hand side figure shows billing system database which is in MS Access and can be easily exported to MS Excel. The left-hand side figure is the attribute table of customer points in GIS. The CSTM_ID column contains customer IDs, exactly same in both figures.



	CSTM_ID	CustName	Address	PlotNum	Category
2108	J_G_4_00512	NULL	Ministries	NULL	Govnt
2109	J_G_4_00513	Ministry of Education, Science& Tech	Ministries	NULL	Government Unit
2110	J_G_4_00514	Ministry of foreign Affairs	Ministries	NULL	Government Unit
2111	J_G_4_00517	NULL	Ministries	NULL	Govnt
2112	J_G_4_00525	Republic Of S.S Legislature Office	Hai Amarat	NULL	Government Unit
2113	J_G_4_00532	National Bureau Of Statistic	Juba	NULL	Domestic Class I
2114	J_G_4_00536	NULL	Hai Jama Juba	NULL	Hostel
2115	J_G_4_00560	Munuki Town Payam	Hai Munuki B	NULL	Government
2116	J_G_4_00562	Ministry of Cabinet Affairs	Ministries	NULL	Government Unit
2117	J_G_4_00567	Police Capacity Building Project	Hai Buluk	NULL	NGOs
2118	J_G_4_00570	NULL	Hai Juba	NULL	Office
2119	J_GH_4_00572	NULL	Hai Jerusalem	NULL	Guest House
2120	J_GH_4_00583	Simon Legge	Hai Jalaba	NULL	Domestic Class III
2121	J_H_4_00446	Nyale Lodge	Hai Thourah	NULL	Hotel
2122	J_H_4_00454	Star Hotel	Hai Sujun	NULL	Hotel
2123	J_H_4_00465	Quality Hotel	Hai Mission	81	Hotel

Customer points in GIS



	B	C	D	E
1	CSTM_ID	SERIAL NO	CUS NAME	CUS TYPE
4228	J_G_4_00512	SH/6/5	Ministry of Labour, Public Service & Human Resources	G
4229	J_G_4_00513	SH/6/6	Ministry of Education, Science & Technology	G
4230	J_G_4_00514	SH/6/7	Ministry Foreign affairs & international Cooperation	G
4231	J_G_4_00515	SH/6/8	Ministry of Co-operatives	G
4232	J_G_4_00516	SH/6/9	Ministry of Finance, Economy & Plannaing	G
4233	J_G_4_00517	SH/6/10	Ministry of Legal Affairs	G
4234	J_G_4_00518	SH/6/12	Ministry of Commerce & Supply	G
4235	J_G_4_00519	SH/6/13	Ministry of Tel-Communication	G
4236	J_G_4_00520	SH/6/14	Ministry of Information & Broad Casting	G
4237	J_G_4_00521	SH/6/15	Ministry of Youth & Sport	G
4238	J_G_4_00522	SH/6/17	Ministry of Roads, Bridges & Transport	G
4239	J_G_4_00523	SH/6/18	Ministry of Petroleum, & Mining - RSS	G
4240	J_G_4_00524	SH/6/19	Ministry of Parlimantary Affairs - GOSS	G

Customers in billing database (converted to Excel from MS Access)

6.2 Steps for Establishing Links

1) Export the billing database (MS Access file) to MS Excel file.

2) Add the Excel file in QGIS by Layer → Add Layer → Add Vector Layer → file type MS Excel → navigate to the above Excel file → Open

Perform the 'Joining' of Excel file to GIS points of customers.

3) Open the Customer layer's properties by double clicking or right clicking and selecting 'Properties' in GIS.

4) On LHS list select 'Joins'.

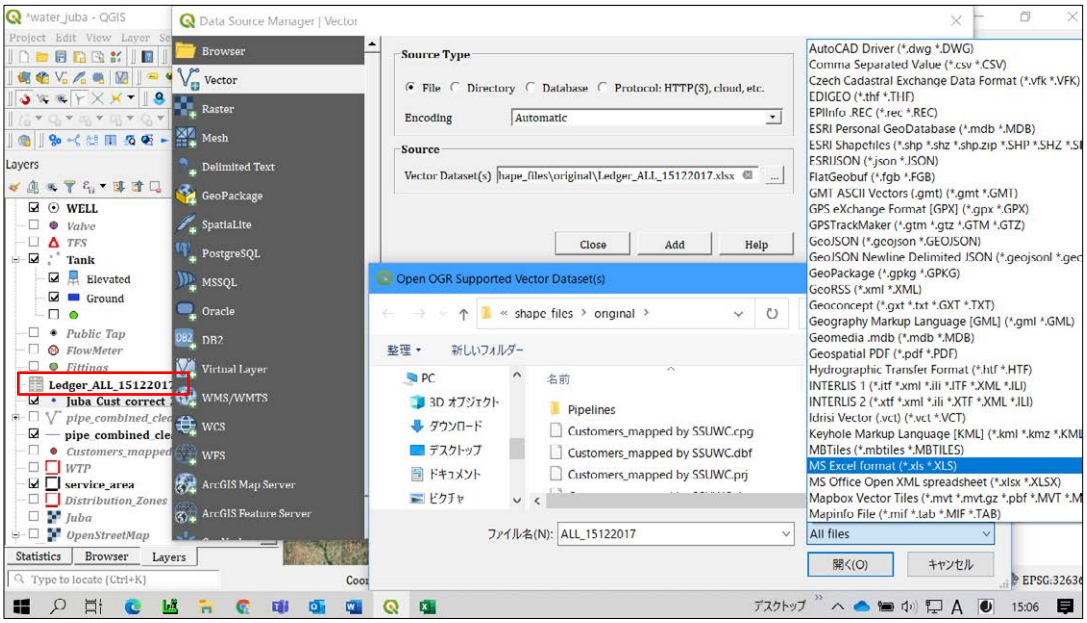
5) Click on plus sign.

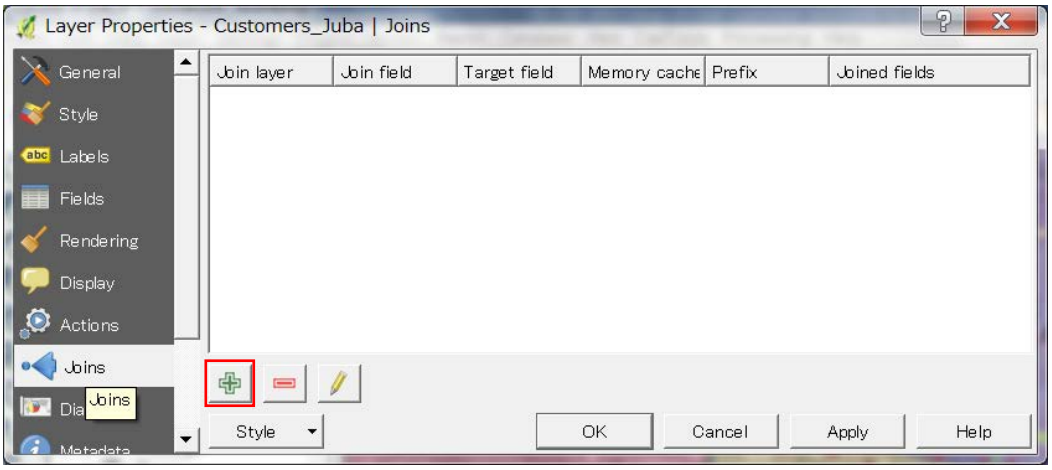
6) Set join properties.

7) Click OK. Click Apply and then OK to close the window.

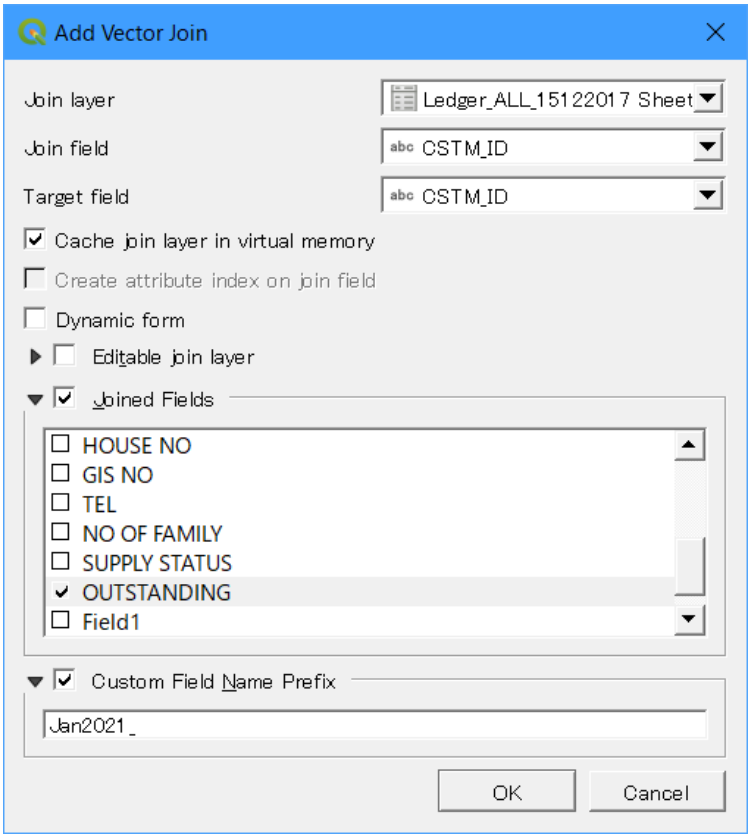
8) Save the file with a new name.

Stepwise Explanation

Steps	Explanation and Images
1)	Export the billing database (MS Access file) to MS Excel file and save in a known folder.
2)	Add the Excel file in QGIS by Layer → Add Layer → Add Vector Layer → file type MS Excel → navigate to the above Excel file → Open. The Excel file will be added as a Table and appear on the TOC. 
3)-5)	Perform the 'Joining' of Excel file to GIS points of customers. 3) Open the Customer layer's properties by double clicking or right clicking and selecting 'Properties' in GIS 4) On LHS list select 'Joins'. 5) Click on the plus sign.



6) Once you click on the plus sign, a window similar to the following will appear. Set the join properties



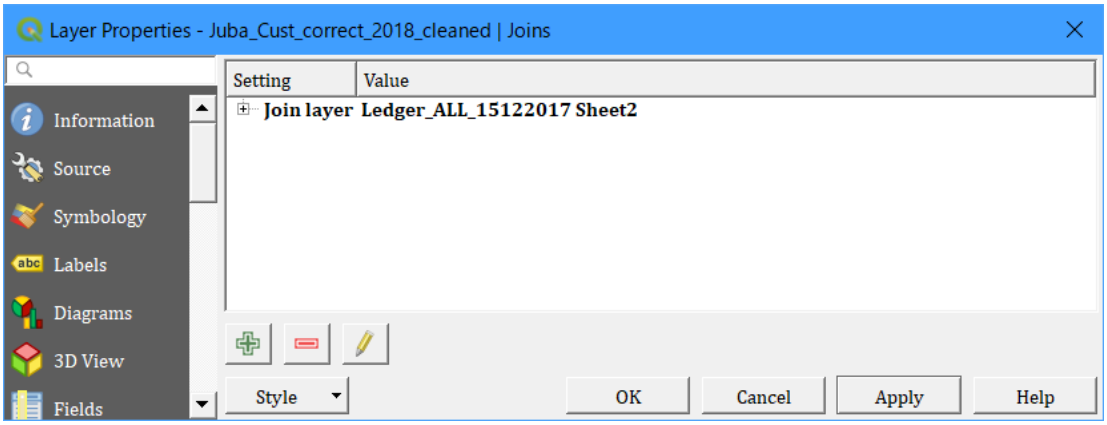
- In the 'Join layer' section, select the layer (the Excel file table) you have just prepared and added.
- Select CSTM_ID in the 'Join field'
- Select CSTM_ID in the 'Target field'

  In doing above, the data from customer ledger will be joined with the customer points in GIS.
- Check the 'Join fields' and select whatever fields you want to join.

  It is not necessary to join all information of customer to GIS. You can select whatever columns you like to join. In the example below, only two fields 'Deposit' and 'Outstanding' are selected to join.

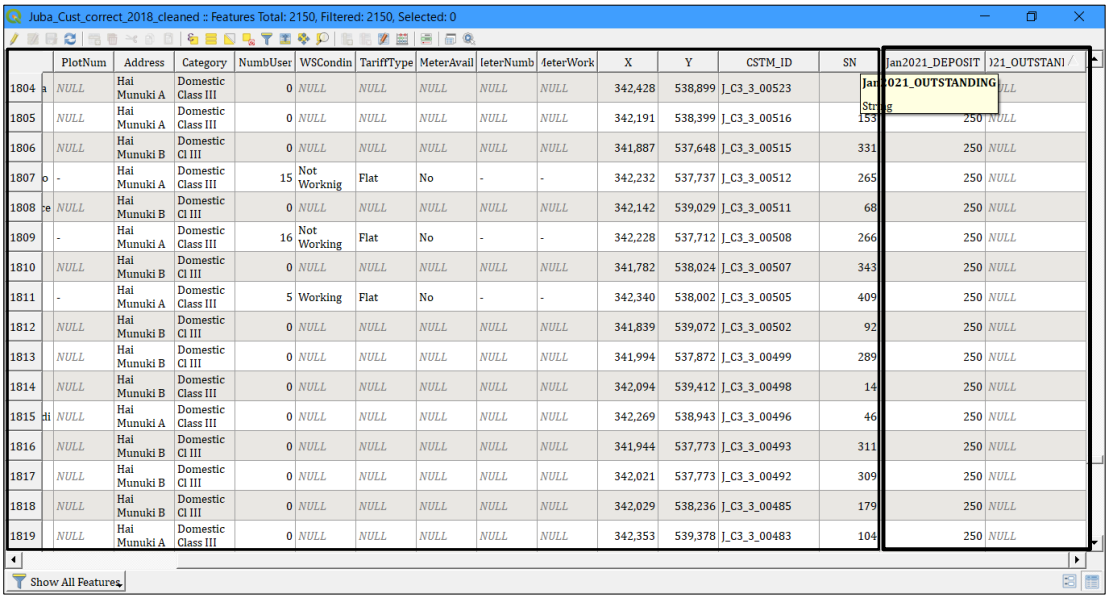
- The 'Custom Field Name Prefix' is the indicator that the fields are joined from customer database to GIS. You can insert short and logical prefix. The following example shows 'Jan 2021' as the prefix. It indicates that the data is for Jan 2021. Adding prefixes such as 2021BR2 (data from 2nd billing round of year 2021) is helpful to distinguish data of different bill rounds in future.

7) Click OK. Click Apply and then OK to close the window.



- For each customer who has the same CSTM_ID in both GIS and Excel, the data from Excel is joined with the data from GIS.

In the following figure, the portion within red frame are original from GIS shape file and within green frame are joined from customer billing database.



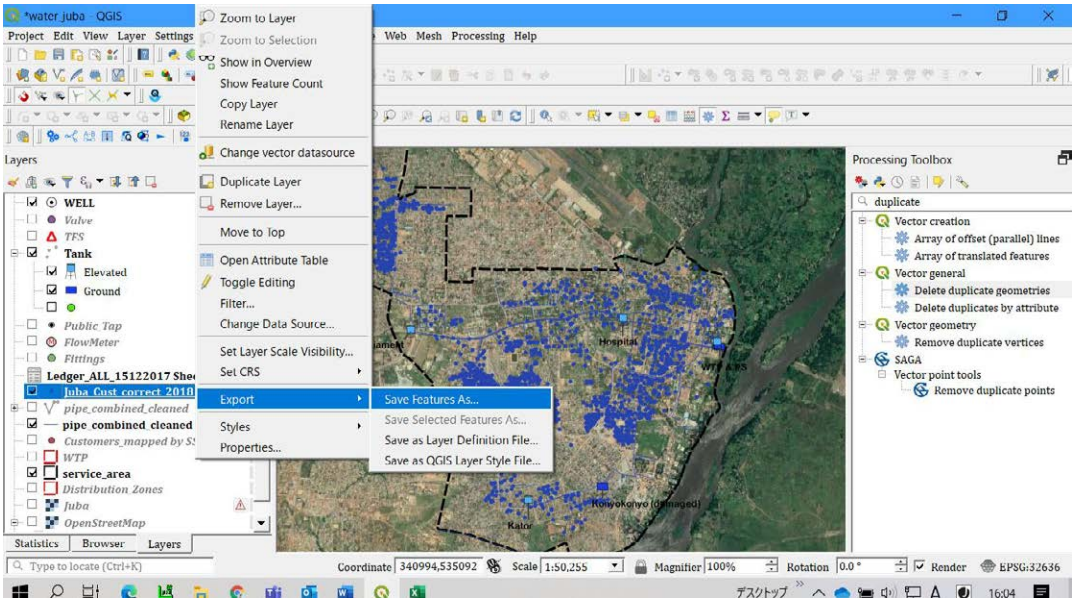
	PlotNum	Address	Category	NumbUser	WSCondin	TariffType	MeterAvail	leterNumb	leterWork	X	Y	CSTM_ID	SN	Jan2021_DEPOSIT	)21_OUTSTANI
1804	NULL	Hai Munuki A	Domestic Class III	0	NULL	NULL	NULL	NULL	NULL	342,428	538,899	)_C3_3_00523			NULL
1805	NULL	Hai Munuki A	Domestic Class III	0	NULL	NULL	NULL	NULL	NULL	342,191	538,399	)_C3_3_00516	153	250	NULL
1806	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	341,887	537,648	)_C3_3_00515	331	250	NULL
1807	-	Hai Munuki A	Domestic Class III	15	Not Worknig	Flat	No	-	-	342,232	537,737	)_C3_3_00512	265	250	NULL
1808	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	342,142	539,029	)_C3_3_00511	68	250	NULL
1809	-	Hai Munuki A	Domestic Class III	16	Not Working	Flat	No	-	-	342,228	537,712	)_C3_3_00508	266	250	NULL
1810	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	341,782	538,024	)_C3_3_00507	343	250	NULL
1811	-	Hai Munuki A	Domestic Class III	5	Working	Flat	No	-	-	342,340	538,002	)_C3_3_00505	409	250	NULL
1812	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	341,839	539,072	)_C3_3_00502	92	250	NULL
1813	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	341,994	537,872	)_C3_3_00499	289	250	NULL
1814	NULL	Hai Munuki B	Domestic Class III	0	NULL	NULL	NULL	NULL	NULL	342,094	539,412	)_C3_3_00498	14	250	NULL
1815	NULL	Hai Munuki A	Domestic Class III	0	NULL	NULL	NULL	NULL	NULL	342,269	538,943	)_C3_3_00496	46	250	NULL
1816	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	341,944	537,773	)_C3_3_00493	311	250	NULL
1817	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	342,021	537,773	)_C3_3_00492	309	250	NULL
1818	NULL	Hai Munuki B	Domestic Cl III	0	NULL	NULL	NULL	NULL	NULL	342,029	538,236	)_C3_3_00485	179	250	NULL
1819	NULL	Hai Munuki A	Domestic Class III	0	NULL	NULL	NULL	NULL	NULL	342,353	539,378	)_C3_3_00483	104	250	NULL

8) Save the file with a new name

The joining method mentioned above is temporary. The joined fields will disappear if the added customer database file is removed from GIS. To make the joined fields permanent, it needs to be saved as a new file. Do as follows:

- Right click on the newly joined layer → Export →Save Features As
- Save the file to a known location and folder.

Give a clear new name such as 'Customer_Juba_2021BR2' for the new shape file. Now the

	older customer shape file can be removed from GIS and the new file can be used in its place.
	

The End!

Annex-4.1: Manual for Non-revenue Water Management

The Government of the South Sudan (GOSS)
Ministry of Water Resources and Irrigation (MWRI)
South Sudan Urban Water Corporation (SSUWC)

The Project for Management Capacity Enhancement of South Sudan Urban Water Corporation - Phase 2

SOP FOR

LEAKAGE MANAGEMENT

OCT 2021

JAPAN INTERNATIONAL COOPERATION AGENCY
TEC INTERNATIONAL CO. LTD

SOP FOR LEAKAGE MANAGEMENT

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Annexes

Chapter 1. What is NRW?

Water is produced from treatment plant and supplied to customers. But not all water reaches to the customers. On the way from WTP to the customer taps some water is lost in various ways. Finding out how much water is going where is called Water Balance.

The following figure shows the components of water balance.

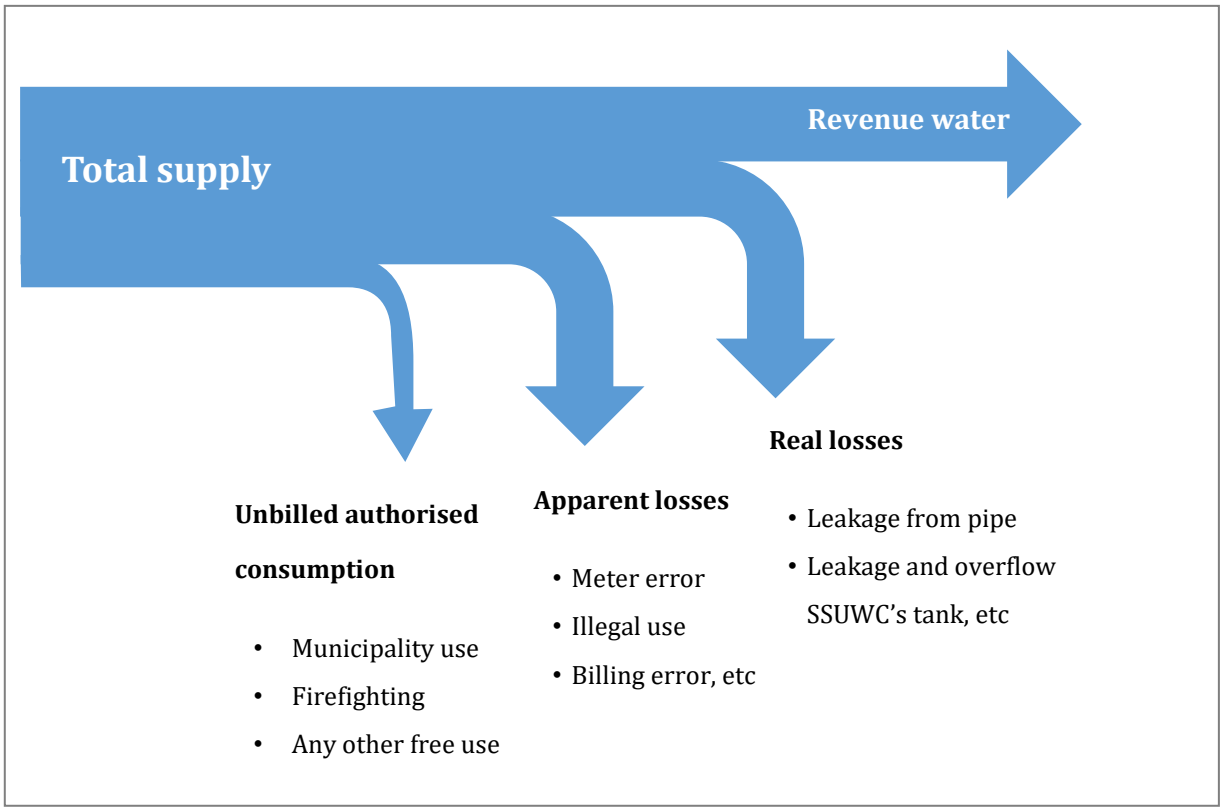


Figure 1: Components of Water Balance

The portion of water which reaches to customers and billed is called Revenue Water. Produced minus Revenue Water is called Non-revenue Water or NRW in short.

The following figures show the formula for NRW and what contribute to NRW.

WATER SUPPLIED	-	WATER BILLED *(Billed Authorized Consumption)*	=	NON-REVENUE WATER *(NRW)*

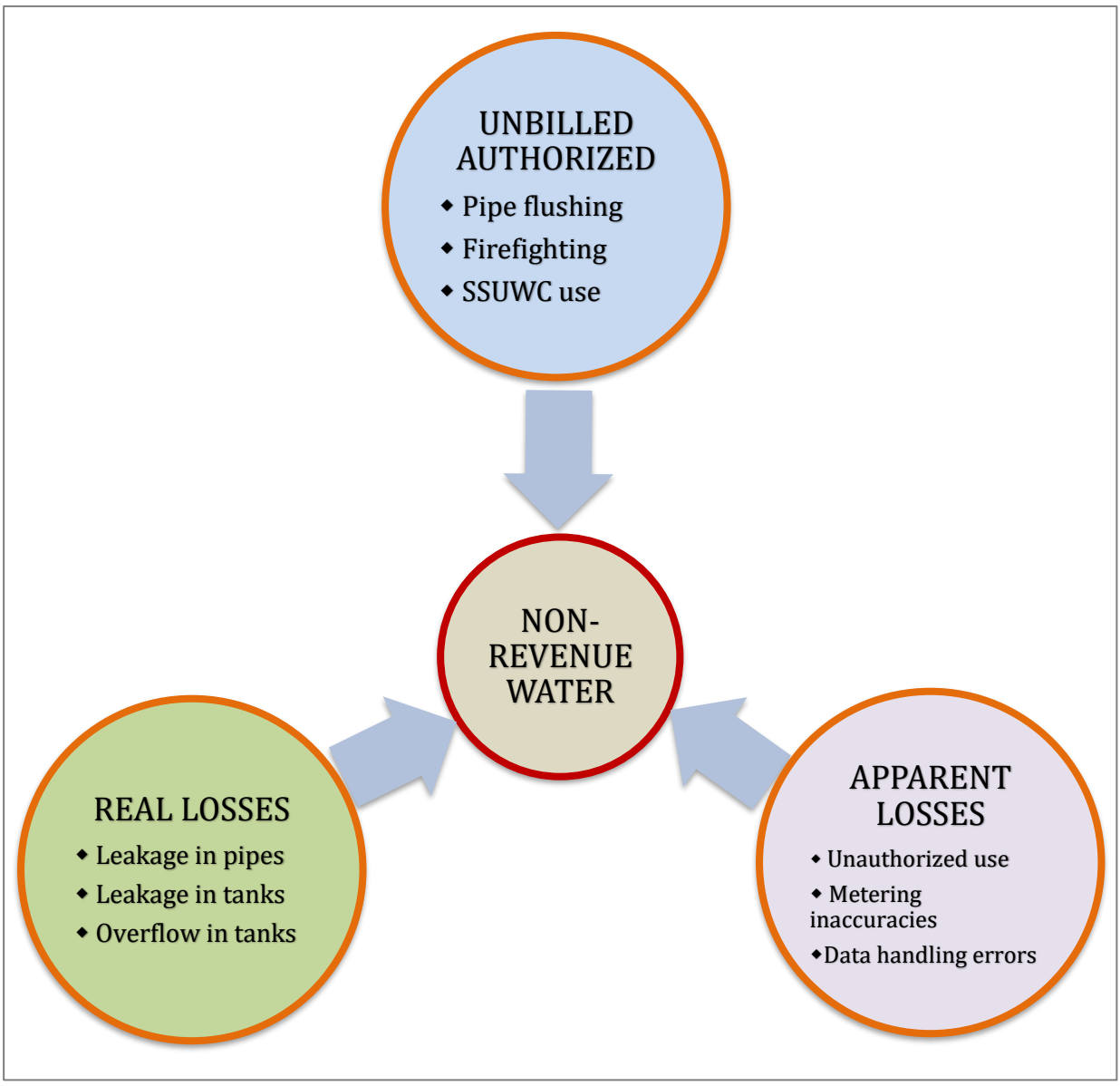


Figure 2: Components of NRW

Chapter 2. What Causes Leakage in Pipe Network?

Various factors cause leakage as shown in the following figure.

Figure 3: Causes of Leakage in Pipe Network

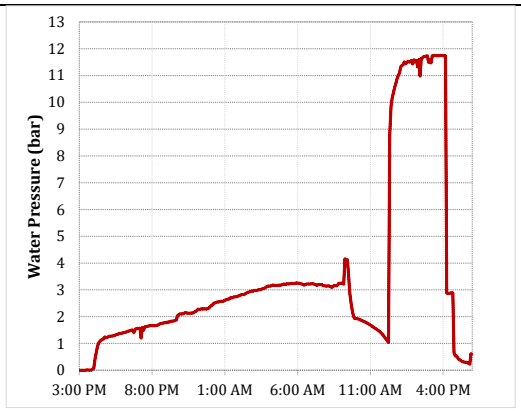
Examples of Causes of Leakage:

Corrosion of pipe

Corrosion of fitting

Corrosion of pipe

High Pressure



High pressure (pressure graph)

Very high pressure

Poor workmanship (not properly connected)

Poor workmanship (not properly welded)

		
Lack of regular maintenance	Overflow from reservoir	Bad quality material (leakage from valve)

Chapter 3. Types of Leakage and Methods of Reduction

Based on whether the leakage has appeared on the ground or not, it can be divided into two types: **surface (reported)** and **underground**.

The underground leakage is further divided into **unreported** and **background** leakage based on its size. Background leaks are small individual leaks such as weeps and drips with flow rates smaller than 0.25 m^3/hr at 50 m pressure. They are difficult to detect with traditional sounding equipment.

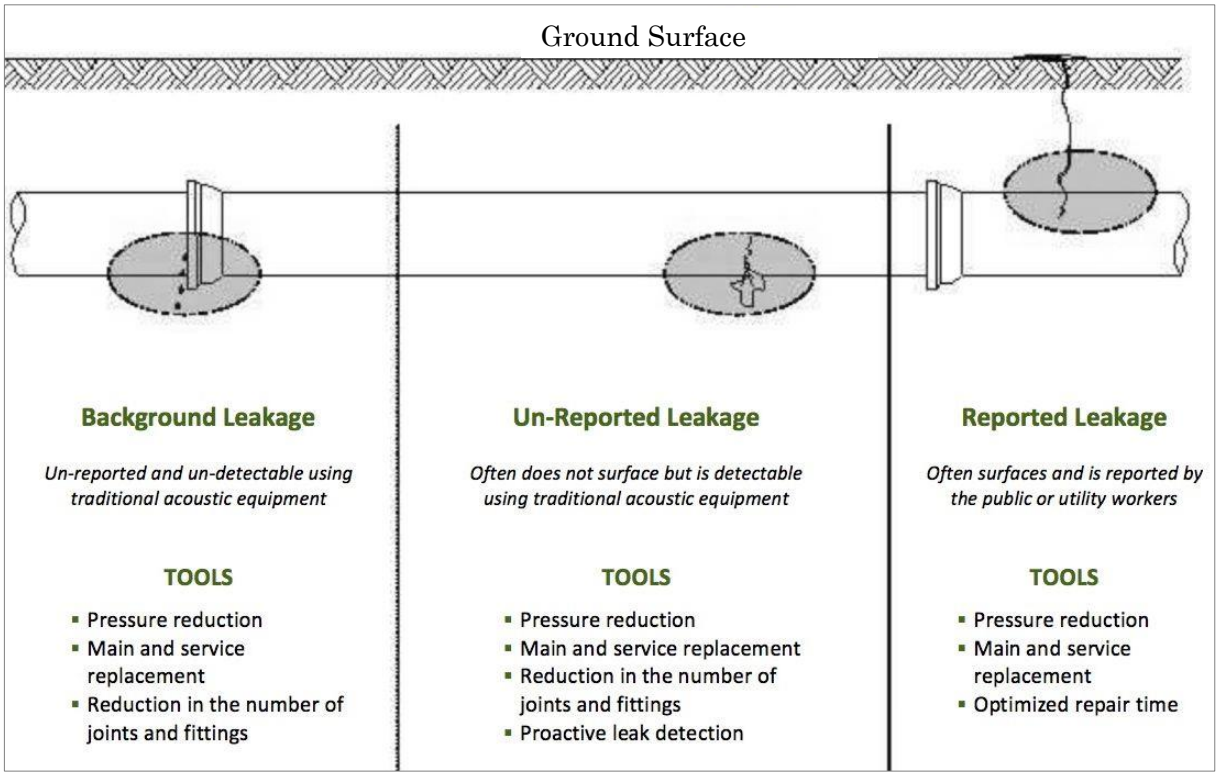


Figure 4: Type of leakage

Prevention methods of leakage depends on the cause of leak.

Prevention methods according to cause of leakage are summarized in Table 1.

Table 1: Types of Leakage and Tools for Reduction

S.N.	Cause of Leakage	Main tools/methods for leakage prevention
1	Poor design (material selection, sizing, and layout)	✓ Take care during design stage
2	Poor quality materials	✓ Use only good quality materials
3	Mishandling of materials prior to installation	✓ Raising awareness of utility staff and contractors' personnel
4	Poor installation and workmanship	✓ Standardization ✓ Enforcement of quality control methods ✓ Proper supervision
5	Incorrect backfill	✓ Enforcement of quality standard ✓ Proper supervision
6	Vibration and traffic loading	✓ Adequate depth of pipe laying ✓ Thrust blocks
7	Corrosion of external and internal surface of pipe	✓ Lining (internal/external) of pipe ✓ Use of corrosion resistant pipe and pipe fittings ✓ Corrosion protection (such as cathodic protection)
8	Damage by third parties	✓ Provide information of pipe location during pipe laying (marker posts, warning tapes) ✓ Repair quickly
9	Excessive pressure	✓ Pressure reduction
10	Pressure fluctuations including water hammer	✓ Proper operation of pumps and valves ✓ Surge protection methods ✓ Shift to continuous supply system ✓ Better organization of distribution network
11	Lack of proper scheduled maintenance	✓ Introduction of scheduled maintenance system ✓ Operation and maintenance manuals

Simple actions to reduce leakage are shown below in Figure 5:

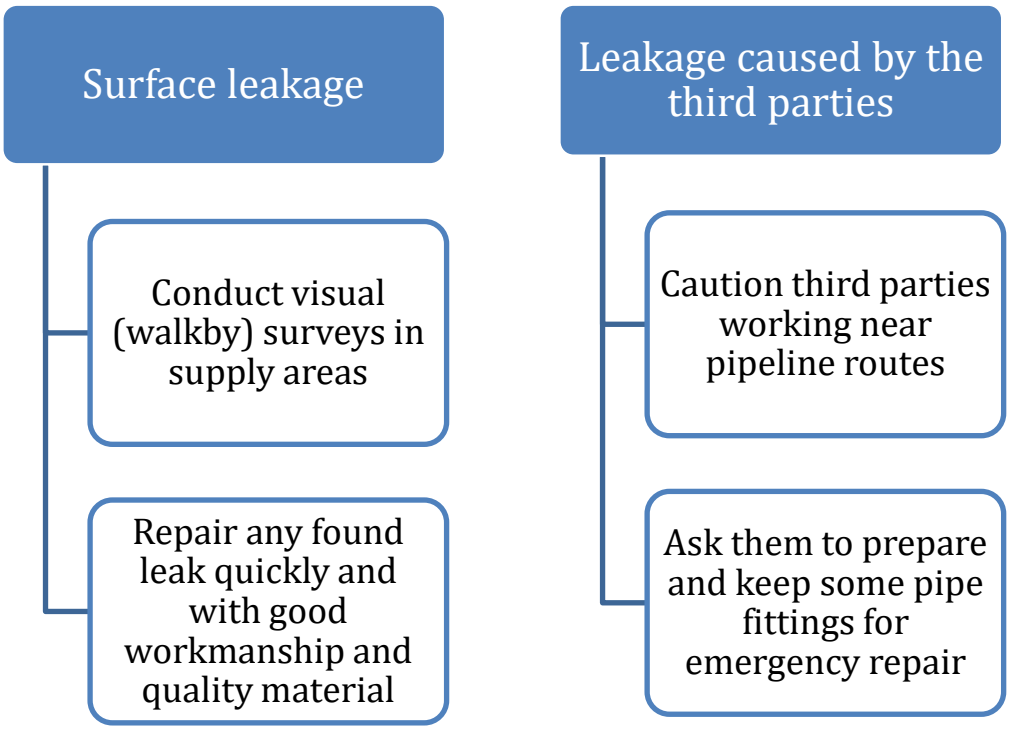


Figure 5: Simple actions to reduce leakage

For underground leakage detection the conditions in Juba are not favorable yet because it requires:

① Stable supply (to eliminate the noise of water use),

② Nighttime work (to get higher pressure and have less external noises), and

③ Leak detection equipment.

So, emphasis should be given to visual leak survey.

Chapter 4. Procedure of Visual Leak Survey

Give one day in a week for this work. It can be every Wednesday (or any other convenient day in a week)

1. Fix team members who will be involved in the survey,
2. Including team members decide the day and time of survey each week,
3. Identify which area has the water supply on that day (*this is possible after water supply becomes regular*),
4. Prepare a map before the day of survey. There are two options for this step. The first option (QField in QGIS) is preferrable as far as possible,

4.1 Use QField on mobile device and take it to site

Prepare a QField package with at least Pipe, Fittings, Leak Point, and Customer layers [Get help from GIS team]. Use Google satellite image as a base in the package. Go to site with the mobile device. [Details about how to prepare mobile device for QField and how to record field data and update on GIS have been provided under GIS training]

3.2 Use printed map and take it to site

If due to any problem you cannot use QField, try to get a printed map of the area you are going to visit from GIS section, the map should show at least the layers of Pipe, Fittings, Leak Point, and Customer as above. Map scale should preferably be 1:1000.

5. Arrange the car to go to the site or get into the car which is going to the site,
6. When you reach the site, open the QField on the mobile device. If you are using map, open the map. Start walking from one end of a road watching carefully for any sign of water leakage,
7. If any leakage on the road surface is found, mark its location on the mobile device with QField or on the paper map. If you could not arrange any of

the mobile device or printed map, make a sketch indicating clearly the location of leak. This should help you find its location on GIS map when you go back to office,

8. If there is no direct visible leakage but there are signs of leakage such as green patch of vegetation or water ditch near the road, mark its location as above, and plan another survey to investigate further about these.

Chapter 5. Procedure of Leak Repair

Every day

1. Confirm if there is any complaint / information of leak or pipe burst,
2. Check from GIS if there is any leak found by visible leak survey but not repaired yet.

If there is a complaint / information of leak or pipe burst, proceed as follows:

1. Prepare the mobile device and QField package,
2. Go to the site mentioned on the complaint to check the cause of the leak and find the material and size of pipe if the pipe is visible. If the leaking pipe is not visible, check the existing GIS map of pipe network,
3. Record the location of leak on mobile device using QField,
4. Control the burst by closing nearby valve if available,
5. Come back to office and fill in the **Leak Record Form** *[this form was prepared, and NRW/distribution team was trained on how to fill this form during remote training in Uganda]*,
6. Estimate what materials will be required,
7. Fill in the **Material Request Form** *[this form was prepared and explained to NRW/distribution team by remote workshop]* and get the required material from store,
8. Arrange the team,
9. Arrange the backhoe,
10. Arrange the car or get in the car which is going to the site,
11. Repair the burst / leak,
12. Start the supply by opening the closed valve (*if any valve was closed before repairing as mentioned in No. 4 above*),

13. Try to clean the pipe after repairing the leak by opening any washout (if available nearby) or opening nearby customer tap for some time,
14. Come back to office and fill in the **Leak Repair Report Form** *[this form was prepared, and NRW/distribution team was trained on how to fill this form during remote training in Uganda]***,**
15. Return unused materials to the store, update the **Material Request Form** and submit to the authorised person (Area Manager or any person authorised by him/her),
16. Report to the head of the Distribution Department (Submit the filled **Leak Report** and **Leak Repair Report** forms),
17. The head of the Distribution Department should record the data of the above two forms in MS Excel, and update GIS with the help of GIS section as required,
18. Put the filled paper forms in a binder file safely for future reference.

Chapter 6. Methods and Tools for Leak Repair

6.1 General

Speed and quality of leak repairs are crucial for reducing leakage. Method of leak repair and tools differ depending on the material of pipe, nature of leak, and whether the pipe is main or service pipe.

It is necessary to first visit the site, understand the situation of pipe, and find out the necessary valves that need to be shut off. For mains leak, depending on the type and seriousness of the leak, the damaged section of the pipe may be cut out and replaced with a new pipe or the leaking point can be closed with a repair clamp. In case of Juba most of the pipes are AC pipe. So if the leakage has occurred in AC pipe, cutting a section of the pipe in not recommended to reduce health risk. Instead, the whole length of pipe should be taken out and a new pipe (other than AC) should be inserted in place.

With service pipe leaks, there are various methods of repair depending on the pipe material and connection method. Repair during supply time requires closing the supply to the service pipe. One method of closing is to dig up where the service meets the main (tapping saddle connection or ferrule) and turn off the water supply to the property by the main tap. Another way is to gain access to the service pipe and temporarily clamp the pipe or freeze it. Repairs are then carried out; or using their discretion the team or water utility may decide if it would be more economical in the long term to replace the whole service pipe.

It is very important after a leakage repair to re-scan the areas for other leaks, which may have been masked by the now repaired leak.

This section describes various methods of leak repair and tools required for carrying out repairs.

6.2 Leak repair method for service connection

a) Repairing leak in PVC (also called uPVC) service connection by replacing a pipe section

Materials required:

- Clean rags
- Replacement pipes and/or fittings
- PVC cutters
- PVC solvent
- PVC glue

Process:

1. Find out the point of leak. Wipe the area around the suspected leak dry with a clean cloth and look carefully for the source of the leak. It can be considerably far away from the place where water is seen coming out.
2. There is no practical method for removing PVC pipe from glued fittings. When the leak is located at or within 2 inches of a joint, the simplest repair method is to remove a section of pipe along with the adjoining fitting(s).
3. Turn the water supply off to the affected pipes. If the house has an internal or local shut-off valve, use that. If not, you may need to turn off the main water supply valve.
4. Remove the defective section of pipe or pipe and fitting. Use PVC cutters to remove at least 1 inch of piping on either side of the leak. The defect causing the leak may not be readily apparent with visual inspection. Removing a small amount of apparently sound material decreases the likelihood of the leak reappearing. Place the PVC cutters at the desired location, hold the cutter's jaws at a 90-degree angle to the pipe and make a straight cut through the pipe on either side of the leak.
5. Allow the water inside the pipes on both sides of the removed section to drain completely. Dry the ends of both pipes with a clean cloth.
6. Loosely assemble the replacement parts and dry-fit them in position. Make any necessary adjustments to the parts before glue-up. Once all the

parts are properly sized, disassemble them in preparation for primer and glue application.

7. Apply PVC primer solvent to the inside of each fitting and the outside of each pipe. Using applicator brush apply a thin coat of solvent to all surfaces to be joined.
8. Start at one side of the exposed pipe. Apply a coat of PVC glue to the outside of the pipe and the inside of the replacement fitting with the applicator brush. Insert the pipe into the fitting with a twisting motion. This helps spread the glue inside the joint and helps the pipe slide completely into the neck of the fitting. Hold the newly formed joint together firmly for 10 seconds to prevent slippage.
9. Repeat this procedure until all missing pieces are replaced.
10. Allow the glue on the repaired pipeline to cure for at least 15 minutes. In warmer, drier conditions, the glue may not take this long to cure. However, applying pressure too soon can cause the new joints to fail.
11. Restore water pressure and check for leaks.

b) Repairing pin hole leak in PVC pipe by repair clamp

With PVC replacing a section of the pipe (above method) is suggested, but if you can't do it by any reason, the following method can be adopted:

- Make sure to prepare the surface. Turn the water supply off, sand the area (get rid of epoxies and rough up the surface).
- For a good seal, add some 100% silicon "caulking".
- Then put the clamp on. The clamps come with a rubber gasket and if you are using a universal size one then be extra careful not to crack the pipe.
- Allow a couple of hours for the silicone to dry. Allowing for overnight to dry will give better result.

Recommended repair methods of leaks on house service connection are schematically shown in the following Figure.

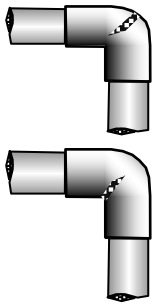
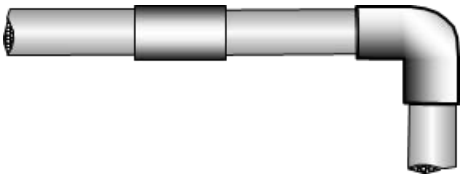
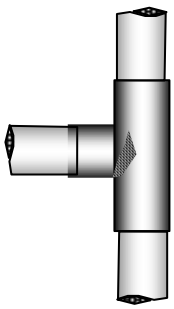
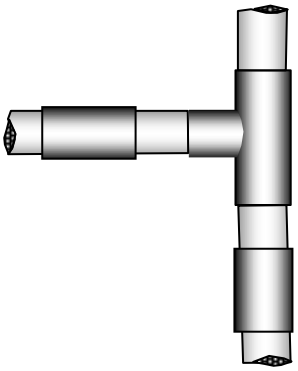
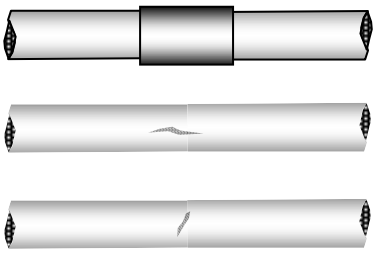
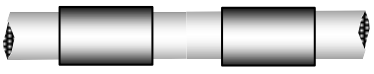
Leak location and type	Recommended repair method
i) Crack, corrosion, or loosening of Elbow joint 	Replace the leaking Elbow as shown in the following sketch. 
ii) Crack, corrosion, or loosening of Tee joint 	Replace the leaking Tee as shown in the following sketch. 
iii) Crack, corrosion, or loosening of straight pipe 	Replace the cracked portion with a short PVC pipe and connect by flexible couplings as shown below. 

Figure 6: Schematics of recommended leak repair methods on house service connection

6.3 Leak repair methods for distribution mains

Leaks on distribution mains are generally repaired by one of the following methods:

1. By repair clamps

   If the leak is from a small crack or pin hole it is possible to close the leak by a repair clamp. This method is most economical and can be done at shortest time. This can be done without stopping water on the line.

2. By cutting the damaged section and inserting a new pipe

   If the leak is from a crack spread over a wide area or from joints, then this method needs to be applied. This method is more expensive as it needs two couplers and some length of new pipe. Also water supply through the pipe should be stopped.

Schematics of leak repair on distribution main under various conditions of leak are shown in the following Figure.

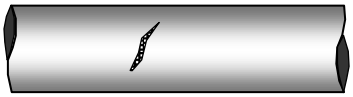
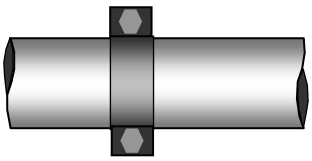
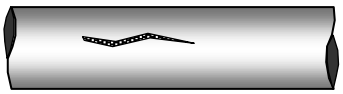
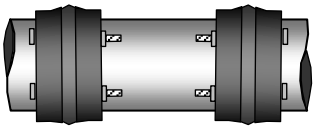
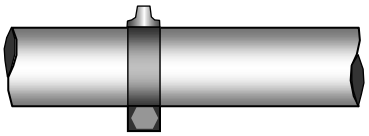
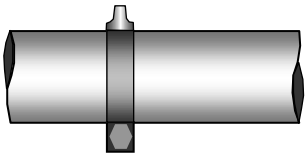
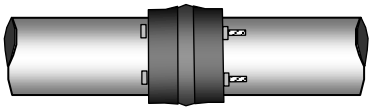
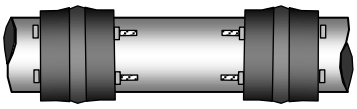
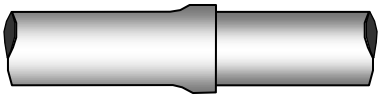
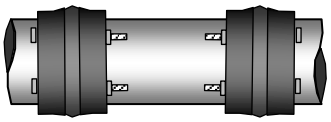
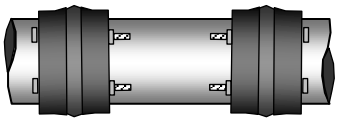
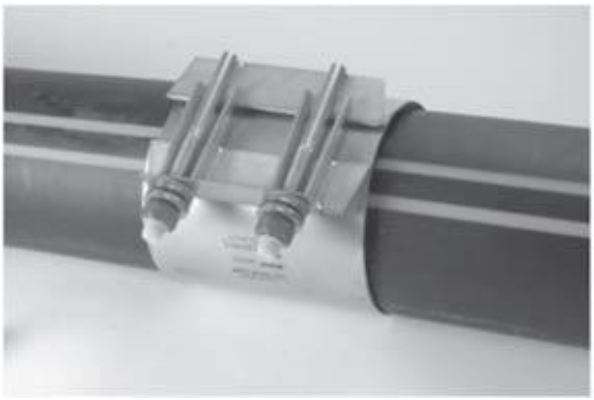
Leak location and type	Recommended repair method
i) Vertical crack (small) 	 Repair by repair clamp
ii) Horizontal crack 	 Replace by a short pipe section (same material or PVC for prevention of electric corrosion) and connect by couplers
iii) Tapping saddle 	 Replace the tapping saddle.
iv) G-bolt type joint 	 Replace by a short pipe section (same material or PVC for prevention of electric corrosion) and connect by couplers
v) Socket joint 	 Replace by a short pipe section (same material or PVC for prevention of electric corrosion) and connect by couplers
vi) Screw type socket joint 	 Replace by a short pipe section (same material or PVC for prevention of electric corrosion) and connect by couplers

Figure 7: Recommended leak repair methods on AC/PVC distribution mains

6.4 Sample pictures of leak repair by different methods

	
Leak repair by cutting leaking portion and inserting a short length of pipe joined by mechanical joints	Inserting non-metallic pipe to repair leaks on metallic pipe, fixing by plastic connectors and tightening rings
	
Repairing metallic pipe by flanged connector in one side and dismantling joint in another	Replacing a section of PE pipe and joining by quick fit sockets on both sides
	
Repairing PE pipe by quick fit sockets	Repairing PE pipe by repair clamp

	
Repairing metallic pipe by repair clamp	Repairing bigger diameter non-metallic pipe by repair clamp
	
Cutting out leaking joint on PVC pipe for replacing leaking joint (Tee)	Joining with new fitting and solvent cement

Figure 8: Photos showing leak repair work on various type of pipe and leak condition

6.5 Leak repair tools and materials

Leak repair work involves several processes such as excavation of road, cutting of pipe, cleaning of pipe, welding or gluing of new fittings, reinstating pavement, disinfecting repaired line and so on. The main equipment and tools required for the leak repair are as follows:

- Excavating Equipment
- Crane
- Vehicle
- Pavement Breakers / Cutters
- Pipe Cutters
- Wrenches
- Ditch Pumps

- Chlorinating Equipment
- Welding Equipment
- Generators
- Other tools

Some of the tools are shown in the following Figure.

	
Plastic pipe cutter	Solvent cement
	
Pipe wrench	Adjustable wrench
	
Sliding wrench	Various tools set
	
Chain wrench	Using method of Chain wrench

Figure 9: Main tools required for leak repair

Some sample of repair clamps are shown below. The followings are the typical materials for leak repair on different pipe materials:

- DI: Pipe piece, Collar, Repair Clamp, Jointing Accessories
- PVC: Repair Clamp, Solvent Cement, Jointing Accessories
- Steel, GI: Pipe pieces, Repair Clamp, Coupling, Patch Plate, Welding, Socket
- PE: Pipe pieces, Plastic Adaptor, Repair Clamp.

<table>
<tr><td> 
Leak repair clamp</td><td> 
Leak repair clamp (opened)</td></tr>
<tr><td> 
Steel leak repair clamp</td><td> 
CI leak repair clamps</td></tr>
<tr><td> 
Flanged branch repair clamp</td><td> 
Plastic leak repair clamp</td></tr>
</table>

Figure 10: Different types of repair clamp

LEAK / BURST LOCATION AND REPAIR RECORDING FORMAT

- The following forms should be filled when a leak or burst is reported and repaired.
- A copy of the filled form should be submitted to Mapping / GIS section and one should be put on permanent record file.
- Put check mark (✓) or write in the space provided to complete the forms.

FORM 1: LOCATION DETAILS			**Burst No.**	
			Leak No.	
DATE: *(reported)*	*(dd/mm/yyyy)*		**ZONE:**	
DATE: *(confirmed)*	*(dd/mm/yyyy)*		**Account No:** *(for leak on HSC)*	
NAME:	*(name of person confirming the leak)*		**Property No:** *(for leak on HSC)*	

LOCATION *(describe land mark, direction etc):*

GPS Coordinate (if possible):

X:_____

Y:_____

SKETCH *(show as much detail as possible which helps to find its exact location in future)***:**

METHOD OF LEAK LOCATION:	Reported by Other		**PRIORITY:**	High	
	Found by Visible Leak Search			Moderate	
	Found by Using Equipment			Low	
TRAFFIC CONDITION:	1. Light	2. Medium	3. Heavy		

FORM 2: REPAIR DETAILS	(To be filled after completing the repair work)				
REPAIR DATE & TIME:	Date	Start Time	Finish Time	PIPE DIAMETER:	
NAME OF PERSONS INVOLVED IN REPAIR:	1.			PIPE MATERIAL:	
	2.				
	3.				
EARTH COVER: (Above top of pipe)	cm				

LOCATION OF THE LEAK

Main	Service Pipe	Main-Service Pipe Junction	Sluice valve	Air valve	Fire Hydrant	Meter	Stop Tap	Not Found	**Private Part (after meter)**	Service Pipe	Stop Valve

OTHER *(Specify)*

CAUSE OF THE LEAK

1 = Broken
- 1-1 = Due to overload
- 1-2 = Shaking (ground movement, vibration)
- 1-3 = Improper burying

2 = Hole
- 2-1 = Due to normal corrosion
- 2-2 = Electric corrosion

3 = Horizontal Crack
- 3-1 = Due to Water Hammer
- 3-2 = Defect in material

4 = Circumferential Crack
- 4-1 = Due to Water Hammer
- 4-2 = Defect in material

5 = Disconnection
- 5-1 = Due to faulty connection
- 5-2 = Overload
- 5-3 = Shaking

6 = Others
- 6-1 = Faulty installation
- 6-2 = Due to other problems (Describe)
- 6-3 = Any other (Specify)_____

Fittings or spare parts used:

Cost of leak repair *(including fittings, other materials, and manpower):*

Leakage size:

(1) Small (2) Medium (3) Big (4) Very big

Chapter 7. Procedure of Recording Leak Location

7.1 Recording using mobile device with QField application

This method is preferred over other methods because it is most convenient and not so difficult. This method can be used with mobile phone or other devices such as tablet. For detailed procedure refer to **Annex 1: Using QFIELD for recording leak location.** The main steps are as follows:

1. Using QField Synac application in QGIS, prepare a package of 'Leak record' layer and basemap,
2. Transfer the package to the mobile device (tablet or mobile phone),
3. Go to the site with the device. At the site of leak, open the QField application on the mobile device,
4. Record the location of Leak repair by adding a point in the 'Leak record' layer and save it,
5. After coming back to office, transfer the updated file to computer folder
6. Update the 'Leak record' layer by using the Synac option of the QField plugin.

7.2 Recording using paper map

This method is simple, but needs working printer to print.

1. With assistance of GIS section prepare A4 size map of area near leak point,
2. After repairing the leak, mark the location of leak on the map,
3. Give the paper to GIS section for updating in GIS,
4. In GIS section, add the leak point manually as a new point in the existing 'Leak point' layer and save the paper in folder.

7.3 Recording using GPS machine

This is an older method in which GPS machines are used to record location of each repair point. This method is not recommended now as easier methods using mobile phones (mentioned above) are available. For reference, the method is as follows:

1. Take the GPS machine at site during leak repair,
2. Record the location of leak as a Way point,
3. After leak repair and coming back to office, transfer the leak location (Way point) to the computer through QGIS
   (a) Start GIS program (Juba GIS project file),
   (b) Connect the GPS machine (the one used to take record GPS coordinate of the leak / pipe burst) to GIS computer through the connection cable,
   (c) Load the GPX file from GPS machine to GIS program in computer (Refer to **Annex 2: GPS Operation Manual** for detail),
   (d) Save the GPS point (way point) as a shape file,
4. Disconnect the GPS machine, and
5. Recharge the GPS machine for next use.

Chapter 8. Procedure of New House Connection

Every day

1. Confirm if there is a house connection work (already approved by Area Manager)

If there is a house connection work, proceed as follows:

1. Survey the area, take the measurement for pipe,
2. Report to Area Manager for estimate,
3. Confirm that the customer has paid the charges,
4. Confirm that the customer has filled and submitted the **Contract Form** and received the meter from SSUWC,
5. Arrange the team for the connection work,
6. Arrange the car or get in the car which is going to the site,
7. Check if the customer has bought the correct materials,
8. Make the connection,
9. Install the meter,
10. Connect water,
11. Report to the Head of the Department.

Chapter 9. Recording of Flowmeter

Some meters are recommended to be read every day, some every week, and some every month. In principle, the meters in and around WTP and tanker filling stations should be read daily, the meters in Hospital pumping station should be read on weekly, and other meters should be read on monthly basis.

The schematic of Juba station transmission distribution diagram (Figure 11) shows the location of all flowmeters.

The steps of reading and recording bulk flowmeters are as below:

1. Print and keep the reading form with you (the form should have last reading in it),
2. Go to the flowmeter chamber of your responsibility (the meters are divided under the responsibility of Purification Department, or Distribution Department, or Tanker Filling Station attendant, based on location),
3. Check if water meter is working well (if the meter is running when there is water supply),
4. Read the water meter and note the reading in the format,
5. Compare with the previous reading value and confirm the current reading is correct, if necessary double check the digits,
6. If one person is reading and another is taking note, the reading person should say aloud the number one by one and the person taking note should repeat the number aloud after the reading person one by one. This method helps to avoid the error,
7. If the meter seems stopped or not working well, note the condition,
8. Come back to station and input data into Excel file or give the reading to the person who can input data into Excel file,
9. Report to the Head of Distribution Department if any meter is not

working well,

10. At the end of every month prepare monthly report of flowmeter readings.

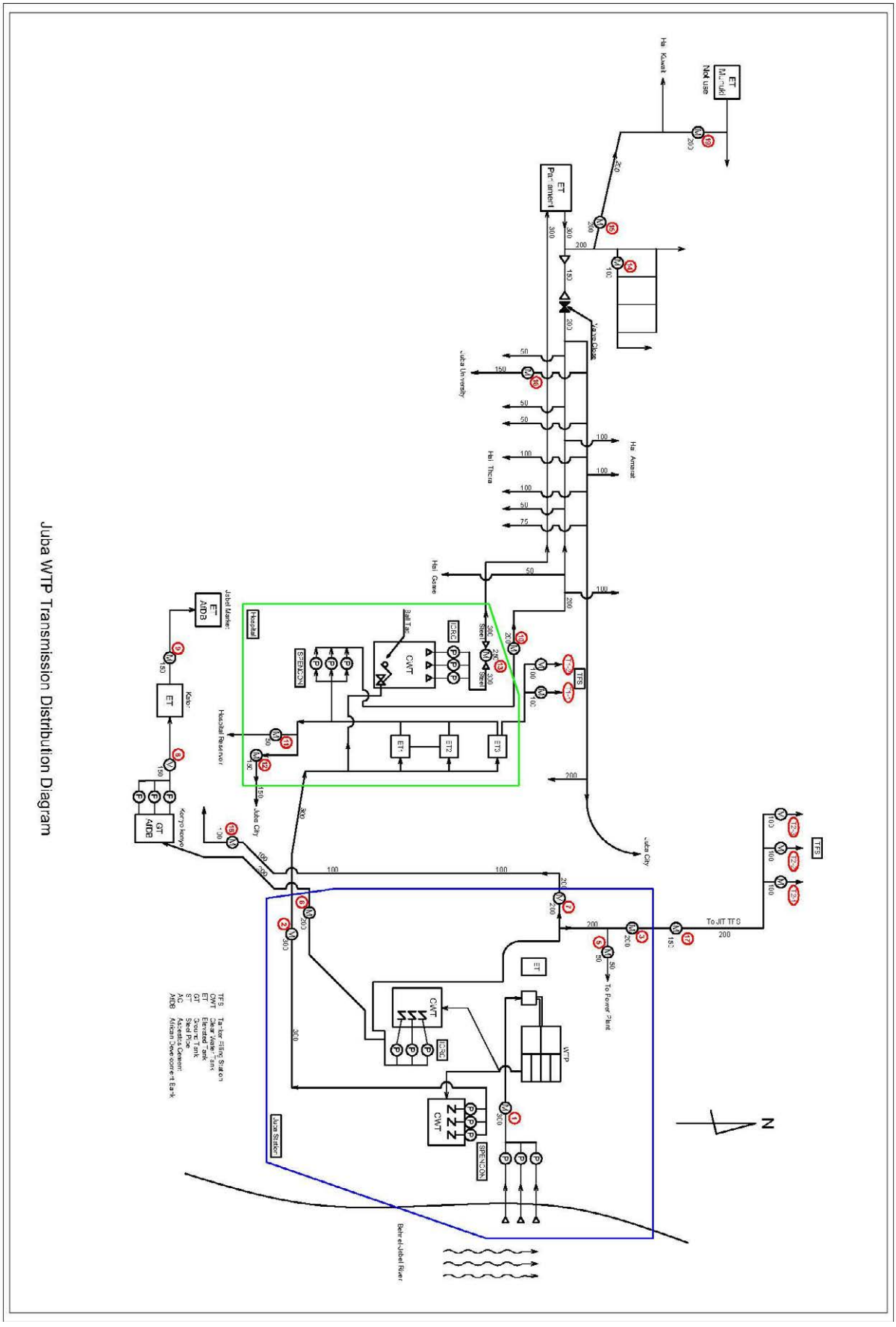


Figure 11: Juba station transmission distribution diagram showing flowmeters

Chapter 10. O&M of Flowmeter

In the time of flowmeter failure

1. Stop the pump operation if the pump is operating,
2. Close valve upstream / downstream of flowmeter to prevent water flowing out from pipeline,
3. Open the top cover of the flowmeter,
4. Remove garbage and any stone piece that may have been stuck in the turbine of flowmeter,
5. Check with your hand if the turbine is moving well,
6. If the turbine is moving well, the flowmeter may be fine. Close the top cover,
7. Open the valve(s),
8. Start pump operation,
9. Check if the flowmeter is running well or not,
10. If the flowmeter is not running well, it should be replaced. Report the problem to the Head of the Distribution Department for forwarding it to the Area Manager. (For more explanation with the help of pictures refer to **Annex 2**)

Chapter 11. Checking Procedure of all Recording Work

Everyday

1. Receive report about:
   (1) Daily water flow (from flowmeters that are read on daily basis)
   (2) Water leakage repair work and/or installation work
   (3) GIS recording
2. Check each recording work mentioned above

If any report is not received, proceed as follows:

1. Find responsible person in charge of recording work
2. Call attention and solve the problem regarding record work

Chapter 12. Calculation of Non-revenue Water

Every month

1. Get flowmeter data for last one month of the flowmeters which record water sent outside from WTP, namely

   (1) Flowmeter to Jit TFS side

   (2) Flowmeter to Power Plant

   (3) Flowmeter to Hospital Tank (300 mm line)

   (4) Flowmeter at main gate (200 mm AC line)

   (5) Flowmeter at HQ gate (200 mm AC line)

2. Sum the flow quantity from the above five flowmeters for a month. If any flowmeter is not working for some days, estimate the flow from average of working days. The sum is the volume of water supplied in the month. This is also called System Input Volume (SIV),

3. Get billed quantity of water (m^3) for the month from the head of the commercial section,

4. Check the ledger if any big customer (such as Tanker Filling Stations, hospital, university, parliament, and so on) is missing,

5. If they are missing, calculate how much volume of water is consumed by such big customers in one month. This is for only those who pay for water (who are billed),

6. If water meter is not working but water is used by any of the above customers, make an estimate of water use based on the consumption of previous month(s),

7. Sum the volume of Steps 3, 5, and 6. This will give the Billed Authorized Consumption (Ref. Standard IWA Water Balance),

8. Subtract the Billed Authorized Consumption from the Water Volume Supplied to get the NRW.

WATER SUPPLIED (OR SIV)	**-**	**WATER BILLED** ***(Billed Authorized Consumption)***	**=**	**NON-REVENUE WATER** ***(NRW)***

The End!

SOP for Leakage Management

Annex 1

Using QFIELD for Recording Leak Location

QFIELD is an application of QGIS which makes it easy to capture data from field using mobile devices (such as smart phone or tablet) and update the captured data in QGIS.

MAIN STEPS

1. Install QField app on your Android device (mobile phone or tablet) from Google Play
2. Install QFieldSync plugin in your computer which has QGIS program
3. Configure QField Sync
4. Create a QField package to take to site
5. Copy the QField package to the target device (mobile phone or tablet)
6. Go to field and collect / update data
7. Copy the modified data back to your computer
8. Synchronize the modified data with QGIS in your computer

1. INSTAL QFIELD APP IN YOUR ANDROID DEVICE (MOBILE PHONE OR TABLET)

✧ Search 'QField' in Google Play Store and install it on your mobile device like any other app (QField can be used with any version newer than Android 5)

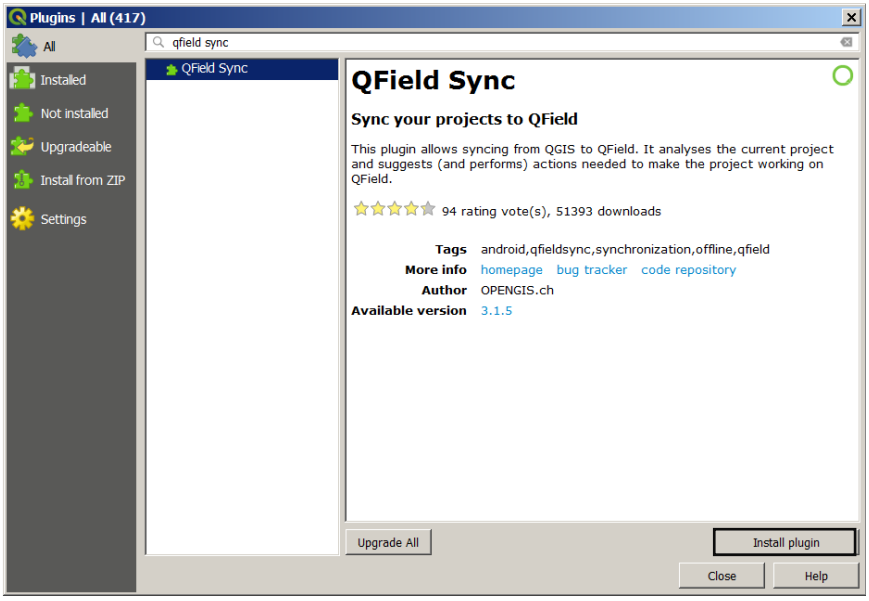
2. INSTAL QFIELDSYNC PLUGIN IN YOUR COMPUTER

The QFieldSync plugin helps preparing and packaging QGIS projects for QField.
QFieldSync supports your project preparation with automating the following:

- Required steps for project setup (e.g. Movable project).
- Creating basemaps from a single raster layer or from a style defined in a map theme.
- Configuring the offline editing functionality and synchronizing changes back.

INSTALLATION PROCESS

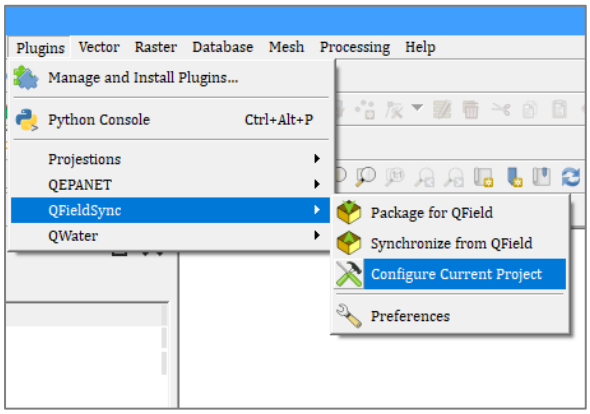
In QGIS, open the plugin library and search for **qfield sync**. Select the plugin in the list and click on **Install plugin**.



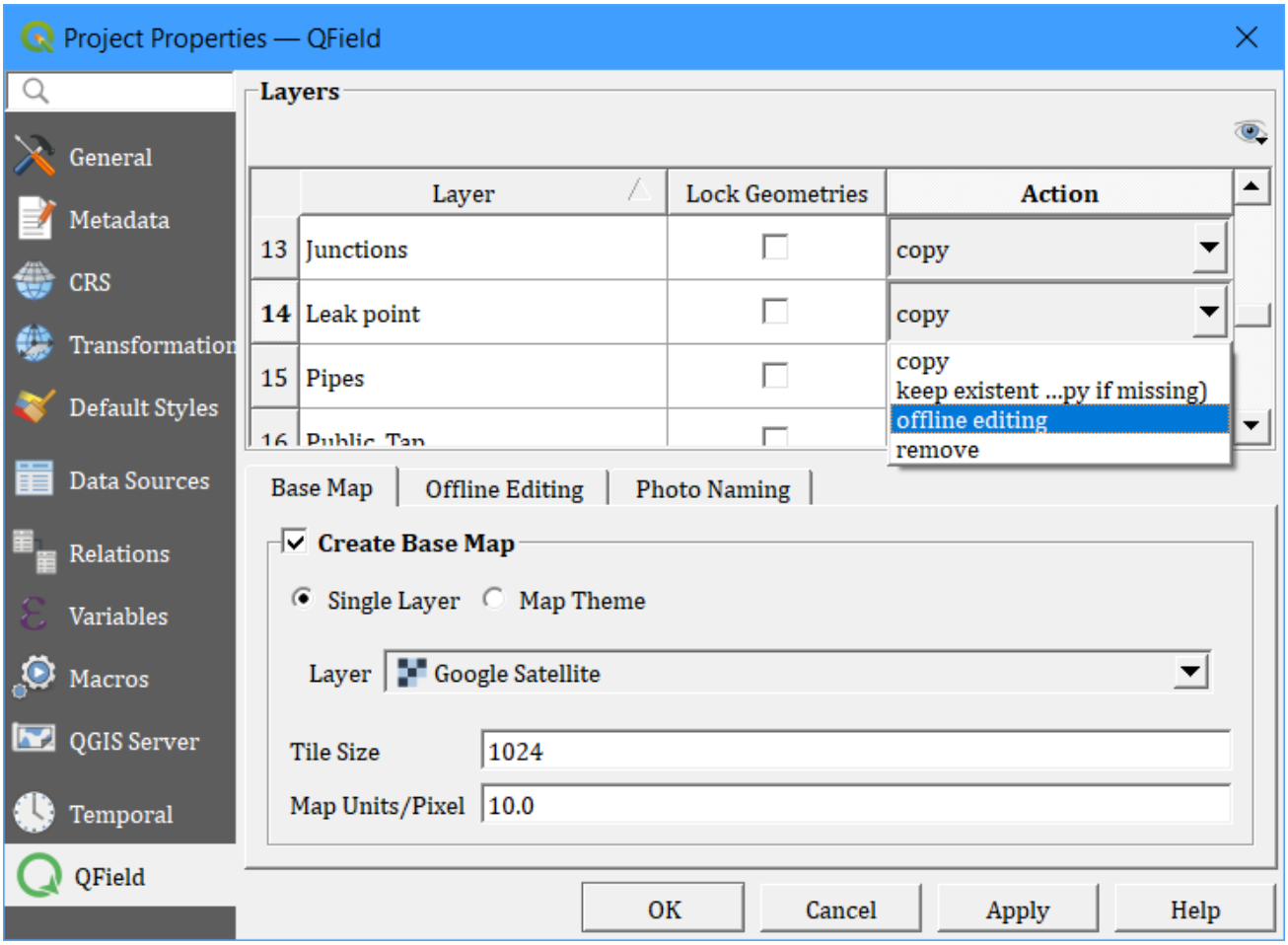
3. CONFIGURE QFIELD SYNC

The project configuration is saved in the master.qgs project file. This way it is possible to pre-configure a project once and use it repeatedly.

Open **Plugins → QFieldSync → Configure Current Project → Layers**



Our main purpose is to take the layer to site for 'offline editing' (*i.e.*, the layer on which we want to add data or edit data at site).



In the project configuration dialog, an *action* can be defined for each layer individually. Depending on the layer type, different types of actions are available.

Meaning of actions:

Lock Geometries
If you check the Lock Geometries option, the layer cannot be changed, it will be locked.

Copy
The layer will be copied to the package folder.

Keep existing (copy if missing)
The existing layer will be left untouched but will be copied if missing in the database.

Offline editing
A working copy of the layer is copied into the package folder. Every change which is done in the packaged project during work is recorded in a changelog. When synchronizing the changes back later on, this log will be replayed and all changes also be applied to the main data base. There is no conflict handling in place.

Remove
The layer will be removed from the working copy. This is useful if a layer is used in the basemap and will not be needed in the packaged project.

Base map configuration
A base map is a raster layer which is added as the bottommost layer to the packaged project file. If the base map option is enabled, a base map will be rendered, whenever the project is packaged. The area of interest - the extent which will be rendered - will be chosen at packaging time.
There are two possible sources for a base map:

Layer
A raster layer. This can be a satellite image or online maps. But this will be available to work offline once you saved it.

Map Theme
A map theme. This is useful to create a base map based on a combination of several layers with styling. These layers can then be removed from the working package and do not need to be rendered on the device. This can save some disk space and battery on the device.

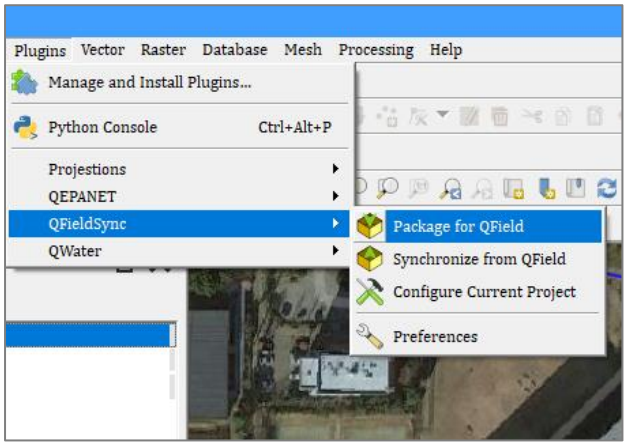
The tile size defines the spatial resolution. It determines the number of map units per pixel. If the map canvas CRS has meters as units and tile size is set to 1, each raster pixel will have a spatial extent of 1x1 m, if it is set to 1000, each raster pixel will have a spatial extent of 1 square kilometer.

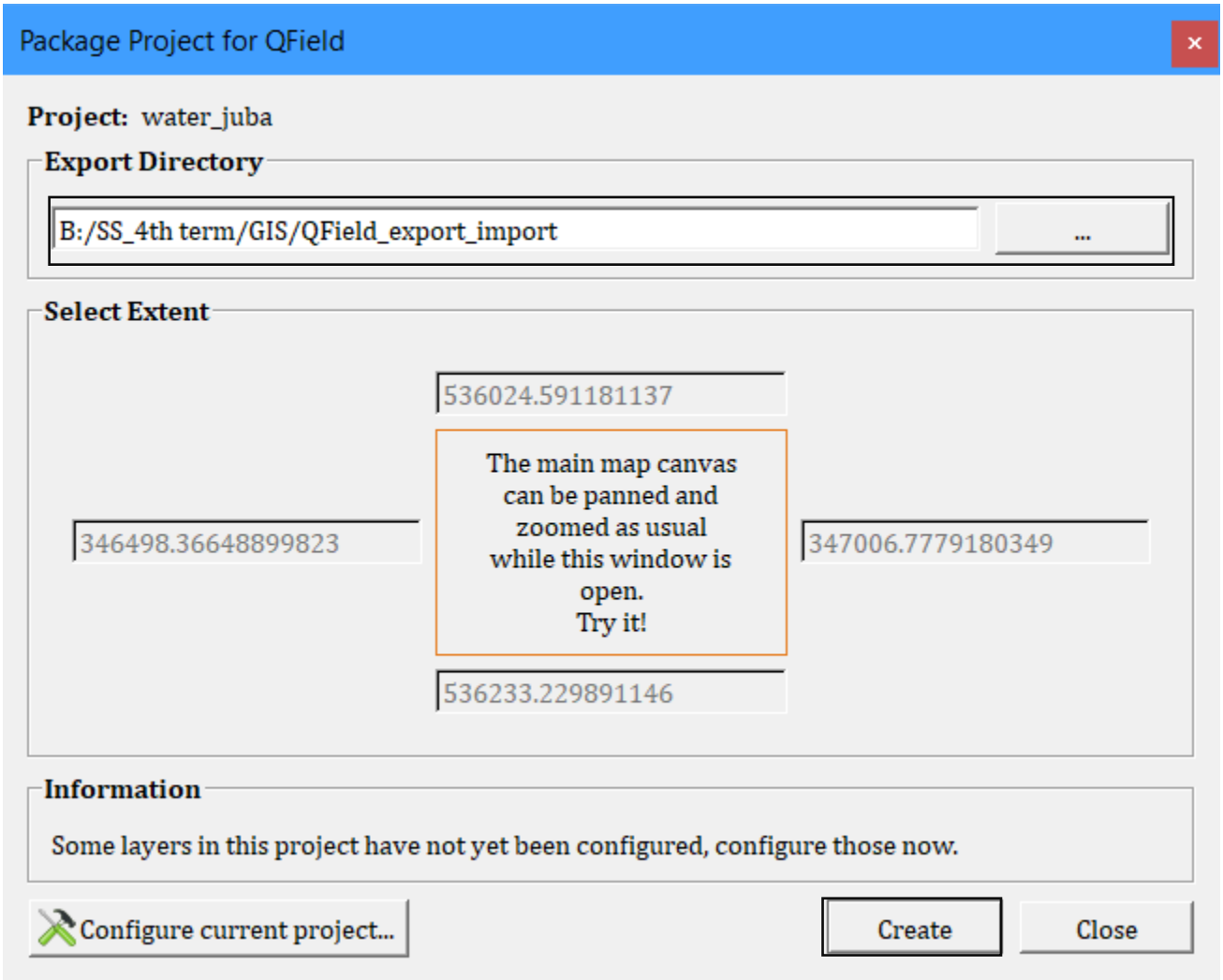
Offline editing configuration
If *only synchronize features in area of interest* is checked, only features which are within the extent of the map canvas at packaging time will be copied to the offline editing working copy.

- ✓ Select **offline editing** for layers you want to edit or add new.
- ✓ You can use existing 'Leak point' layer. The above example shows various other layers.
- ✓ You can use any basemap loaded in QGIS project but if you use online basemap such as Google Satellite or Open Street you will need internet in your mobile device. Juba has satellite image basemap which can be used even if there is no internet in your mobile but it is heavy.

4. CREATING QFIELD PACKAGE TO TAKE TO SITE

Once the project is configured, package it in a folder in your computer. Give easy to recognize name to the folder. This folder will contain the .qgs and the data used in it.





✓ Click **...** and navigate to the folder where you want to create the package

✓ Click **Create**

5. COPY THE QFIELD PACKAGE TO THE TARGET DEVICE

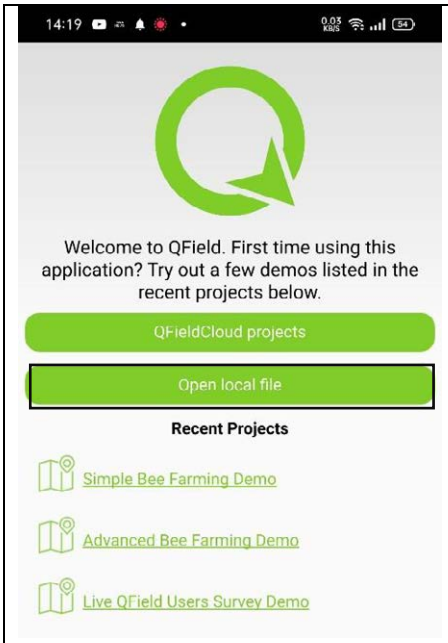
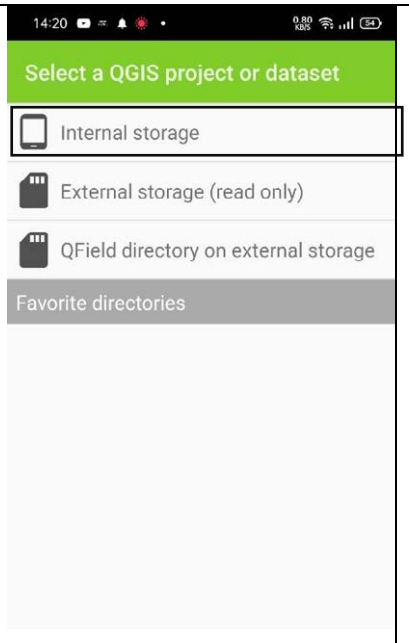
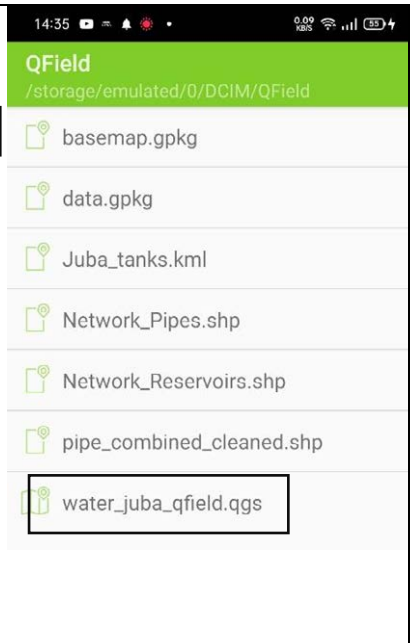
Connect your mobile device with your computer through USB cable. Copy the whole folder Packaged in the previous step from your computer to internal memory of your mobile device.

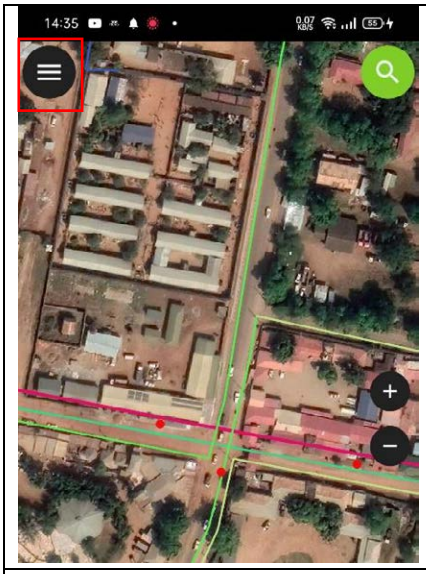
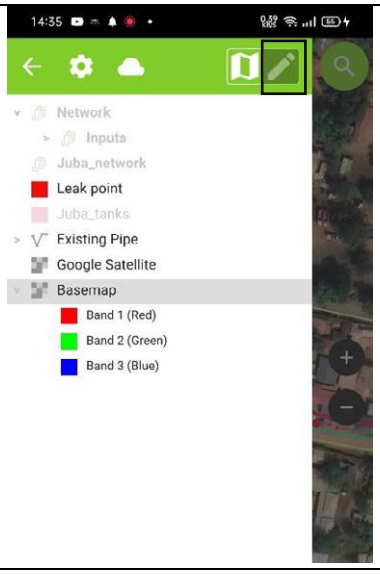
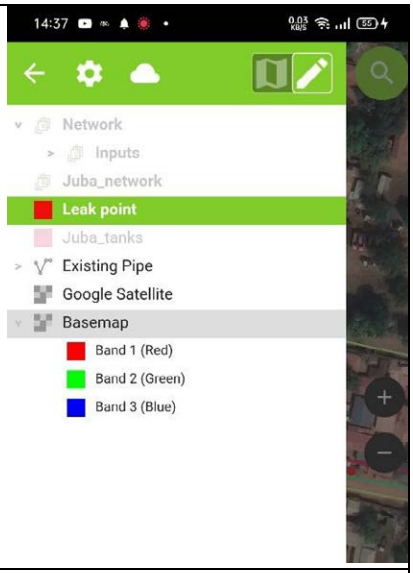
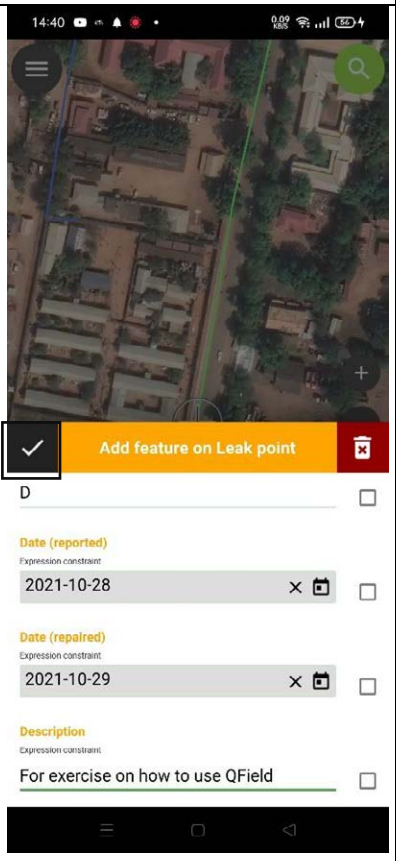
6. GO TO SITE AND COLLECT / UPDATE DATA

When you reach the site,

- ✓ Open QField application on your device,
- ✓ Open the project by selecting **Open new project** and navigating to the folder you just saved in the previous step. Next time if you want to work on the same file, you can use **Open recent project**, it will be listed in the QField,
- ✓ Add new features or edit properties of existing features (see steps below).
- ✓ Save the work and close QField application.

Steps for creating (adding) new point:

		
✓ Open QField application on your mobile device and Open the Packaged file ✓ Tap Open local file	✓ Select Internal storage	✓ Go to the folder you created in your mobile ✓ Open the folder ✓ Tap the .qgs file

<table>
<tr>
<td> 
</td>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>✓ This opens the qgis map with packaged basemap something like shown above. Here the red dots are leak points recorded previously.
✓ Tap on the three lines at the top left to open layers</td>
<td>✓ When the book like mark is selected you can only see the map
✓ Tap the pencil mark to start editing mode, just like in QGIS</td>
<td>✓ Tap Leak point layer is active and in digitizing mode now</td>
</tr>
<tr>
<td> 
</td>
<td> 
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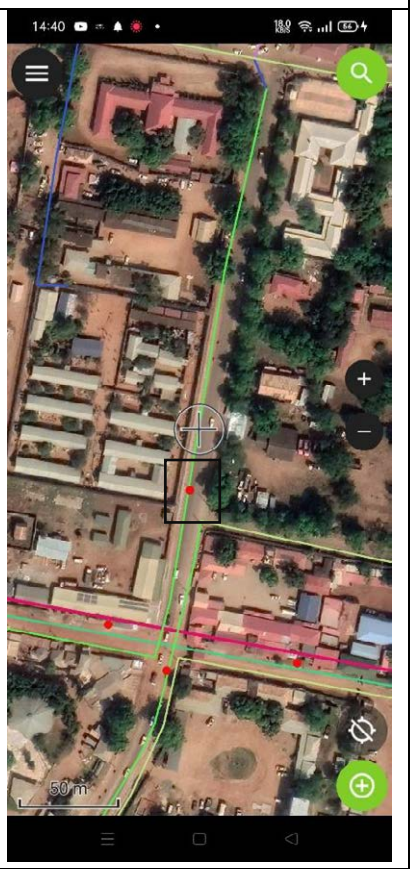
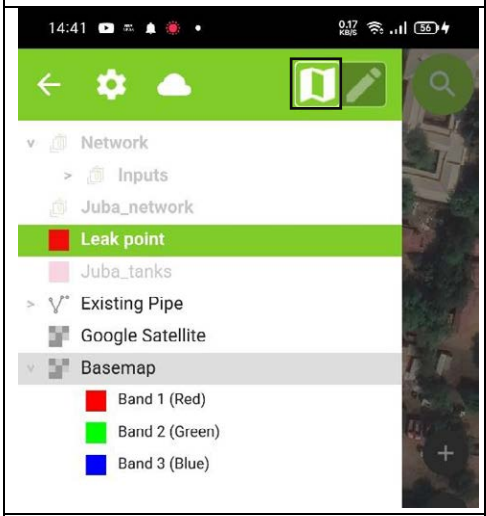
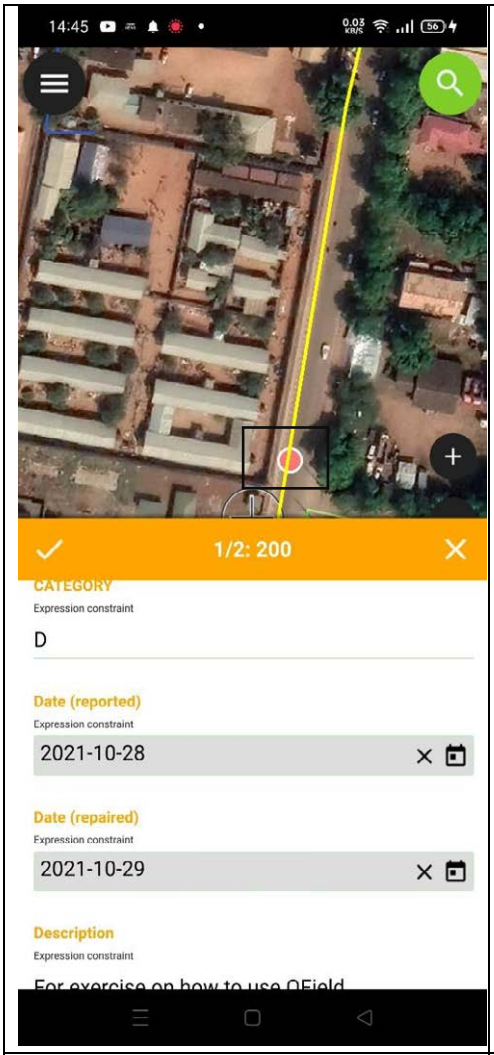
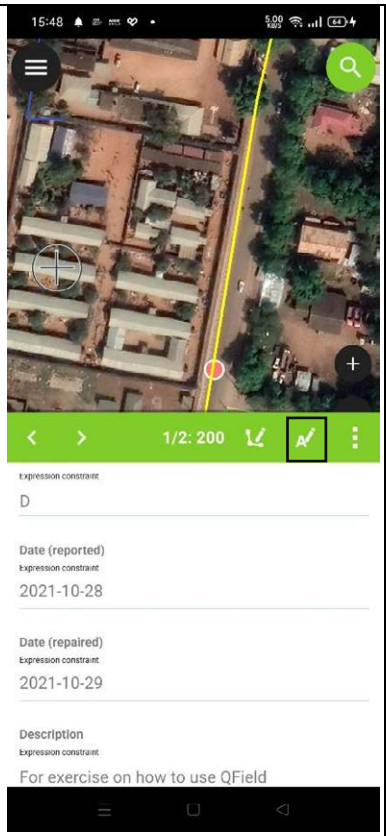
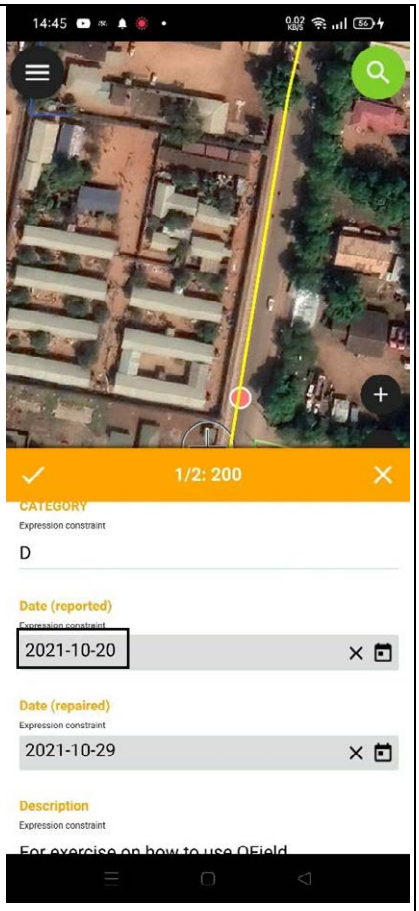
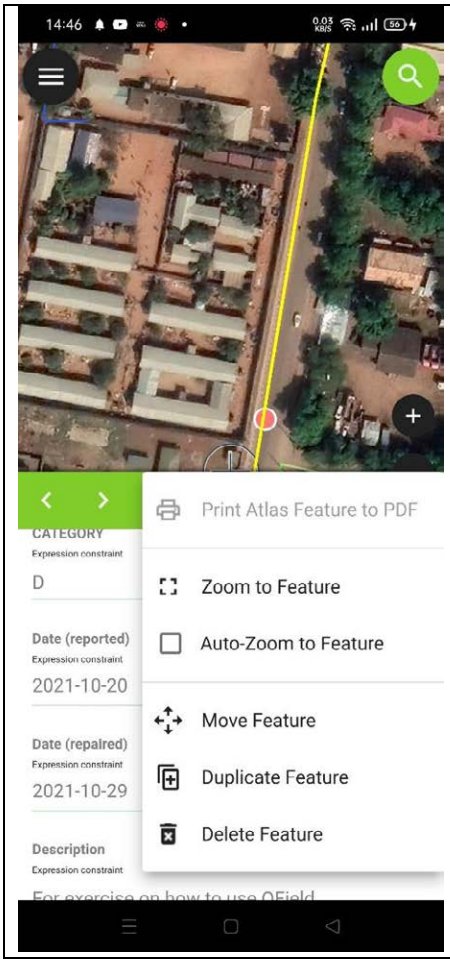
<td> 
</td>
</tr>
</table>

✓ Move (scroll) your screen until cross and circle come to the location of leak point you ✓ want to record ✓ Tap the green plus sign at the bottom left to add a new point	✓ Input the information in the fields if you like, ✓ You can skip this now and input when you go back to office also ✓ When you are done, tap the right mark. If you made some mistake and want to delete this you can delete by tapping on the delete mark.	✓ A new point now appears ✓ Repeat the same process to record other locations
		
✓ To stop editing, tap the Book icon left of pencil icon ✓ Use Back button of your mobile to close the QField app		

Steps for editing / changing the attributes of existing features

		
✓ Open the qgs file as described in previous steps ✓ Make the layer in digitizing mode by tapping on Pencil mark ✓ Tap the feature you want to edit/change ✓ It opens the screen shown next (right side)	✓ If you want to change attributes only, then first tap the tool with A letter and pencil mark ✓ Change the information you want to change by tapping on and overwriting on the attributes	✓ For example, the reported date has been changed from 28 to 20 October in this ✓ After you change any value, tap the correct mark to save the change ✓ Use back buttons to go back to the main screen

	There are more functions as shown on the left. You can explore these when you have time.	

7. COPY THE MODIFIED DATA BACK TO YOUR COMPUTER

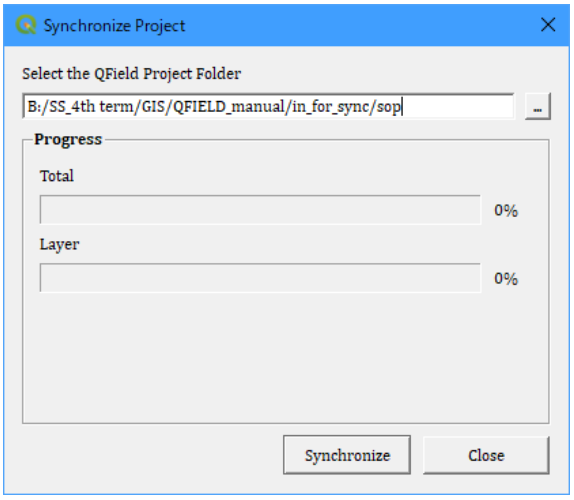
Once your field work is finished, close the QField application. Connect your mobile device to computer using USB cable, copy the whole folder from your device to a new folder in your computer.

8. SYNCHRONIZE THE COLLECTED/UPDATED DATA WITH THE DATA IN YOUR COMPUTER

✓ Select **Synchronize from Qfield** in **QGIS**

✓ Click to **…** and navigate to the folder which was saved from your mobile device in above step

✓ Click **Synchronize**



This will update your GIS data in your main project (in your computer) with the data you updated/collected using your mobile at site.

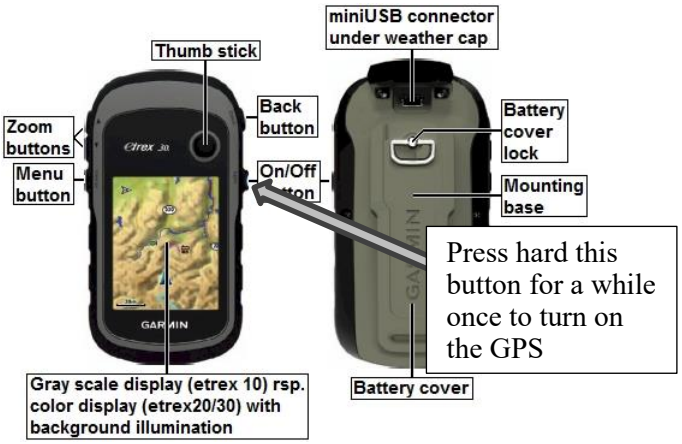
For online tutorial and more information, you can check the following link:

https://qfield.org/docs/

Annex 2: GPS Operation Manual

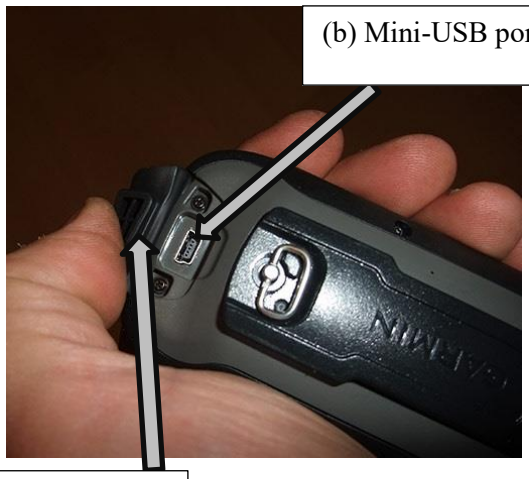
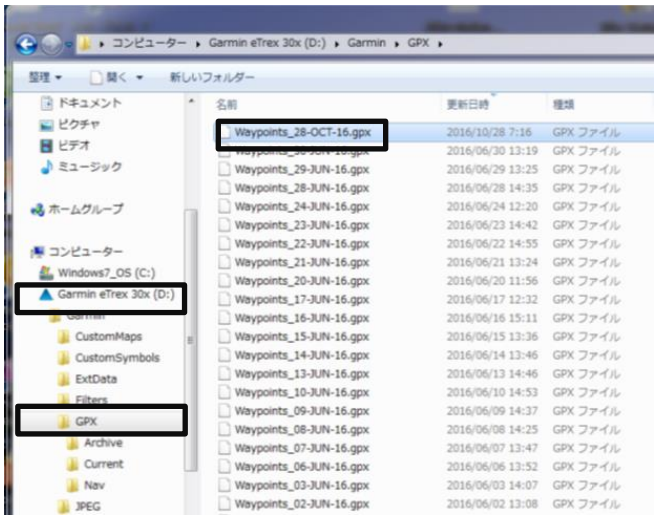
Recording of Location Data in GPS and Importing Data from GPS to QGIS map (GPS Garmin eTrex 30)

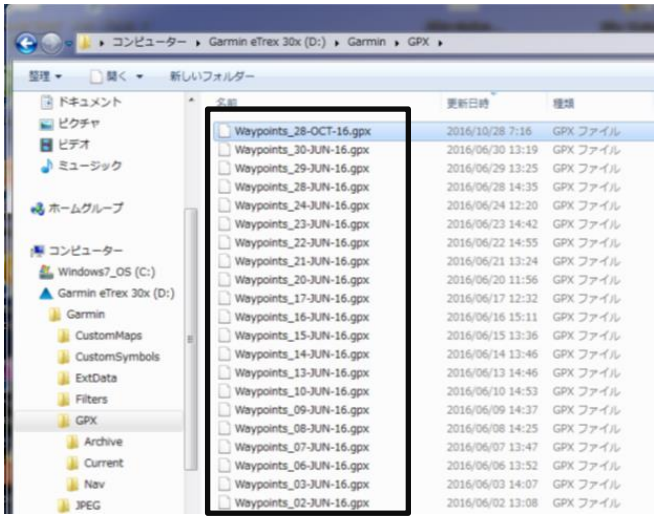
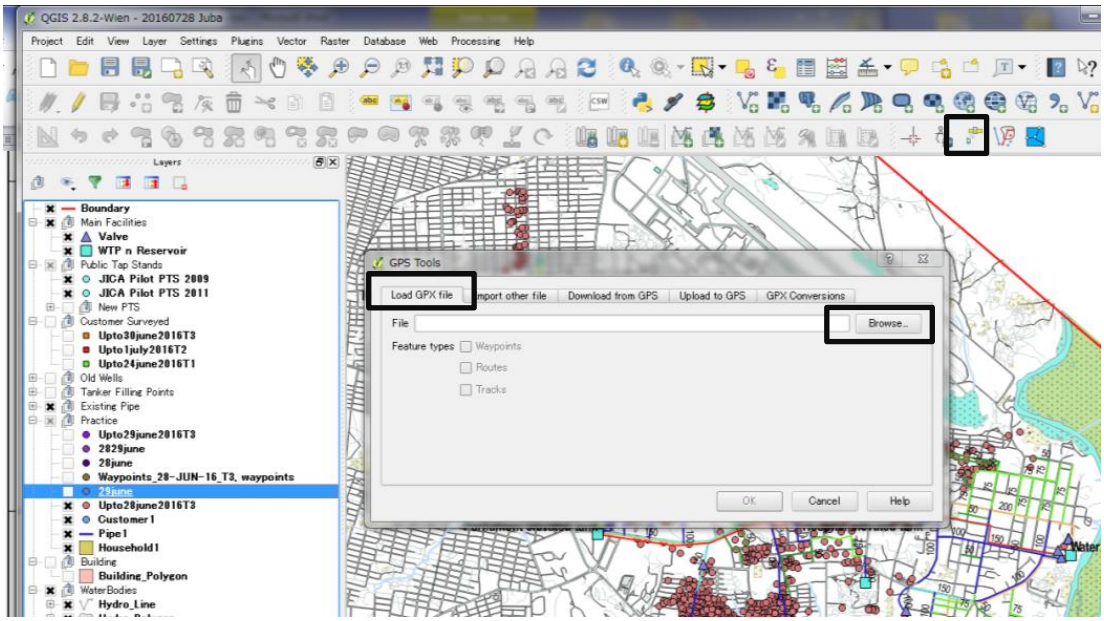
(Taken from Handout of GIS training)

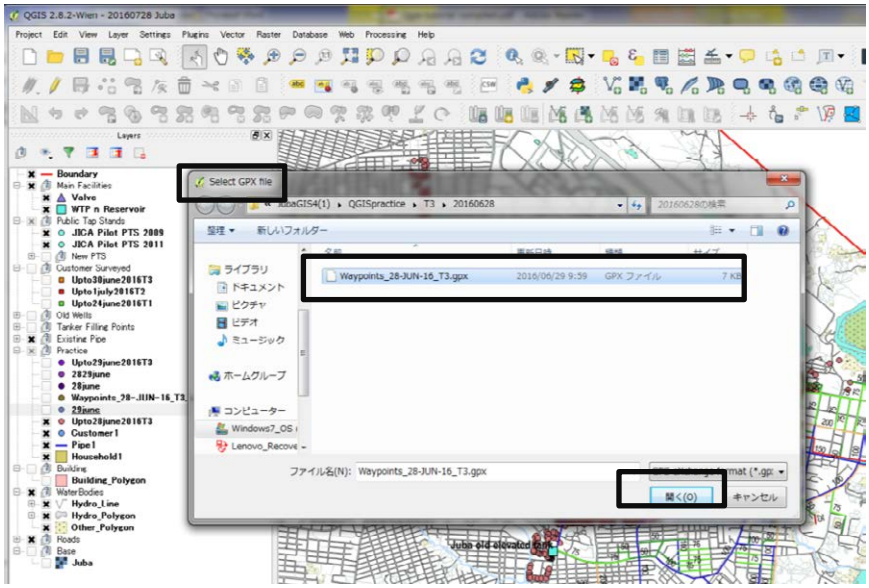
No.	Image	Procedure
1		1. To turn on GPS, please press **On/Off button** for a while
2		After the device is turned on, it begins acquiring satellite signals. The device needs a clear view of sky to acquire satellite signals. When the GPS bars on the backlight page are solid green, device has acquired satellite signals.

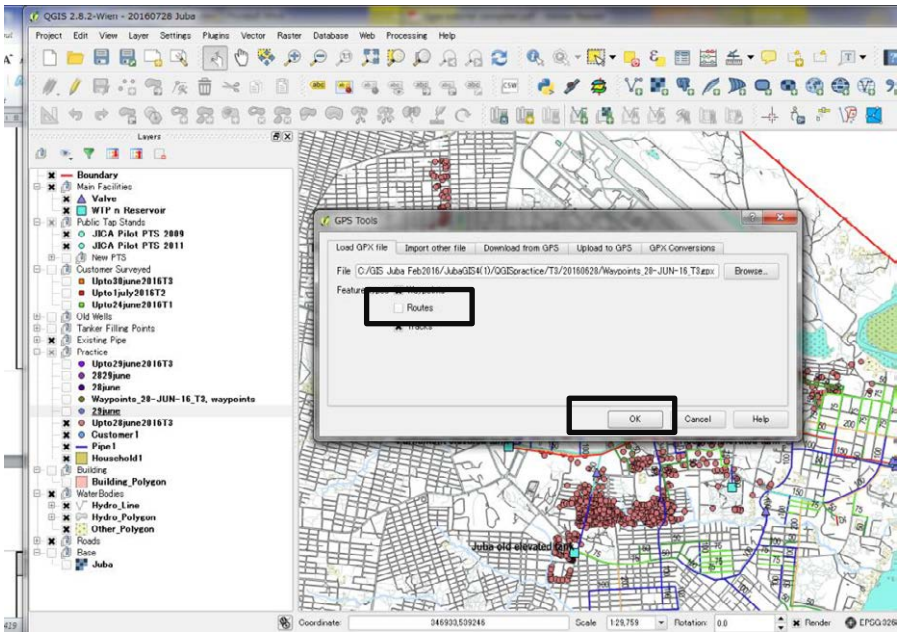
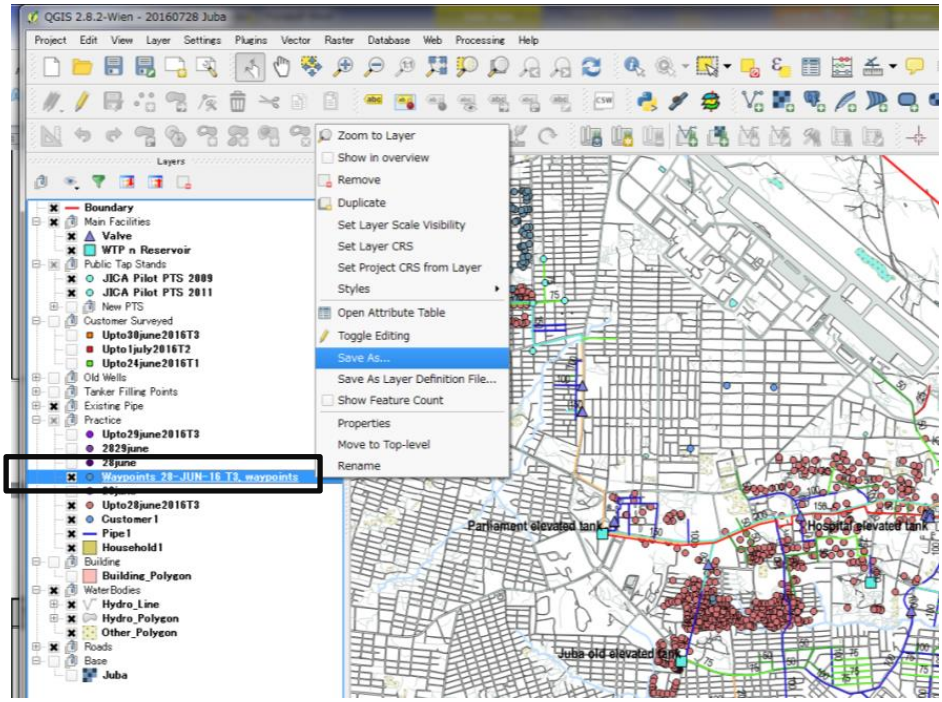
No.	Image	Procedure
3		To mark the location of customer, go to the location and Select **"Mark Waypoint"** by moving the pointer using Thumb Stick (left, right, up or down) to the Mark Waypoint Icon and pressing the Thumb Stick once when the point is on the Mark Waypoint Icon.
4		To save the Waypoint without changes, click on **"Done"** by selecting Done and pressing the Thumb Stick once. To make changes to the Waypoint, select an item to edit, and click on **"Done"**.
5		To ignore saving of Waypoint, Press **Back Button** once.

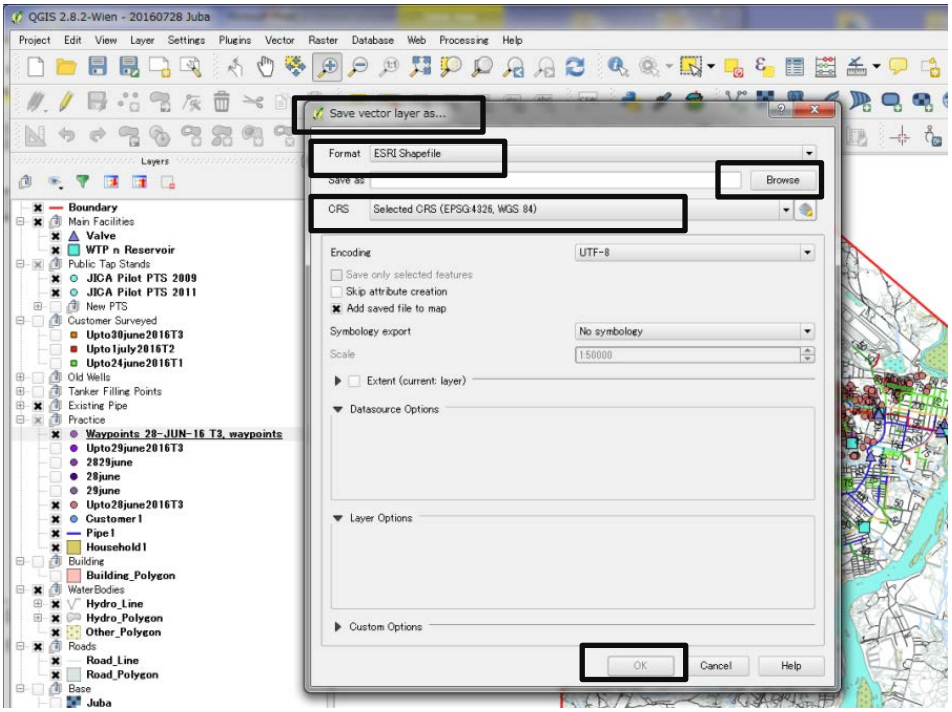
No.	Image	Procedure
6		The identification number (Name) of Waypoints changes by itself to the next number, unless it is modified manually.
7		Upon completion of marking Waypoint, please turn off the GPS device by pressing **On/Off button** for a while. To copy the GPX file from GPS to computer, connection of GPS to computer will be required.

No.	Image	Procedure
8	 	To connect the GPS to a computer, connect the USB cable to a USB port on your computer. 1. Pull up the weather cap (a) from the mini-USB port (b). 2. Plug the small end of the USB cable into the mini-USB port (b). 3. Connect the other end to the USB port of the computer.
9		After connecting the GPS to the computer, Go to Mass Storage Drive; Go to **"Garmin"** Folder; Go to **"gpx"** folder. Copy the gpx file (e.g. "Waypoints_28-OCT-16") from Garmin folder to the folder in the computer by just clicking and dragging.

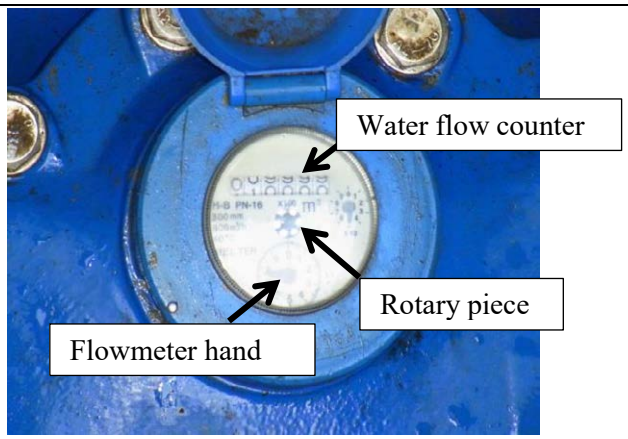
No.	Image	Procedure
10		Garmin saves the Waypoints for different days with that day file name (e.g. for points marked on 29th June 2016, the file name is: "Waypoints_29-JUN-16")
11		

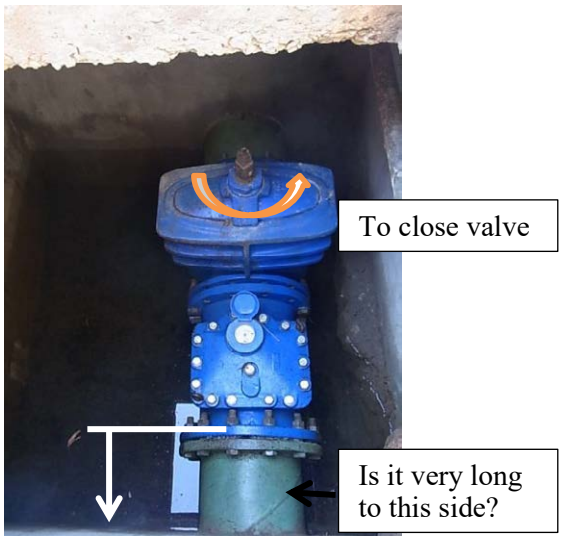
No.	Image	Procedure
		After copying of gpx file, the file will need to be converted to shape file (*.shp) in QGIS. For this purpose, follow steps given below: a. Click **GPS tools icon** ( ) on the toolbar. This will open **GPS Tools window** or this can be done by Clicking **Vector > GPS > GPS Tools**. b. In the **GPS Tools window**, on **Tab Load GPX file**, click **Browse**. Select the GPX file in the **Select GPX file window**, click **Open**. c. In the **GPS Tools window**, **Deselect** Routes and Click **OK**. d. The layer (e.g. Waypoints_28-JUN-16_T3, waypoints) is added.
11		

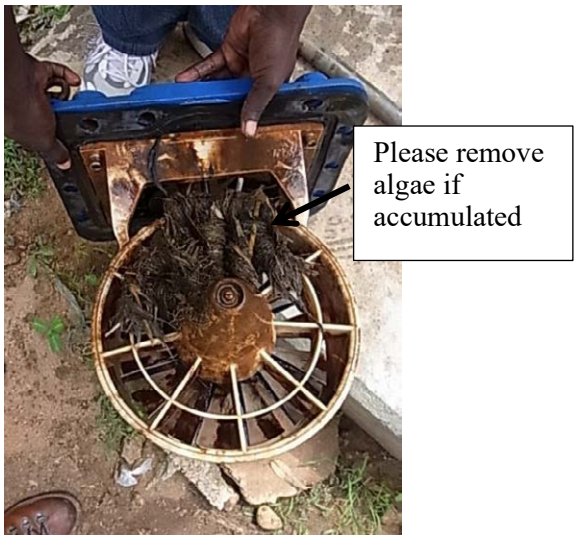
No.	Image	Procedure
	 	

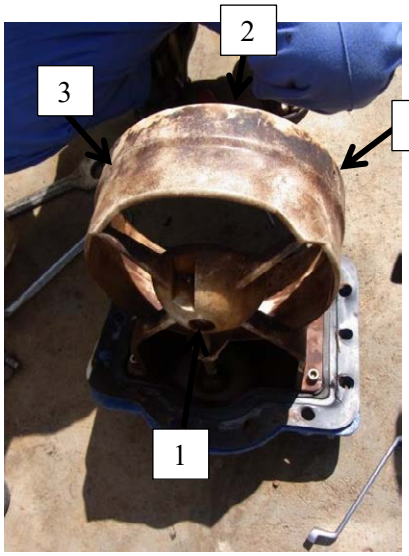
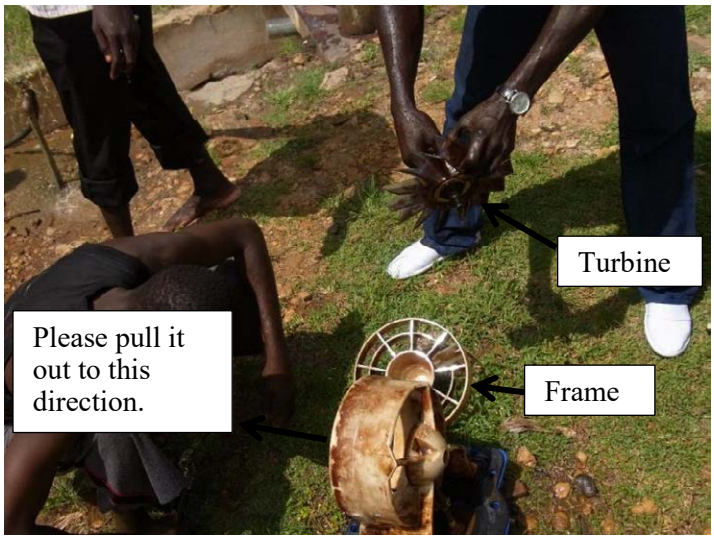
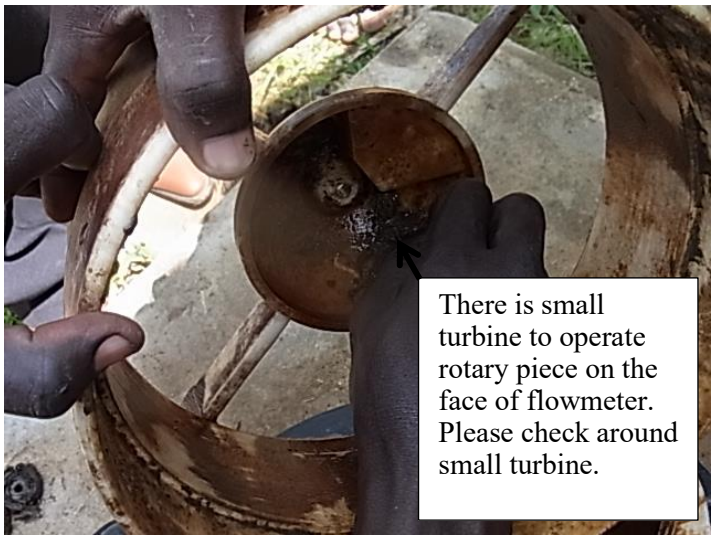
No.	Image	Procedure
		
11	e. Right click the layer “Waypoints_28-JUN-16_T3, waypoints” and on the menu select **Save as**. This will open **Save vector layer as** window. f. In the **Save vector layer as** window; **Select Format**: ESRI Shapefile, **CRS**: EPSG:32636, **Save as**: Click Browse and Type desired file name in desired folder (e.g. Waypoint 28june example.shp in the folder “C:¥GIS Juba Feb2016¥JubaGIS4(1)¥QGISpractice¥T3”); Click **OK**. A new layer “Waypoint 28june example” will be added.	

Annex. 3 Flowmeter Operation and Maintenance Manual

No.	Image	Procedure
1		Before we maintain the existing flowmeter, we need to confirm few things. 1. Is rotary piece moving? 2. Is water flow counter moving? 3. Is flowmeter hand moving? If no, we have to repair the flowmeter.
2		Items to be checked are shown in the picture. Monitoring staff shall wipe flowmeter window by cloth to keep clear.

No.	Image	Procedure
3		If we need to open flowmeter to repair, please confirm few things. 1. Is the pump operating? If it is operating, stop the pump operation. 2. Is the valve opened? If so, please close valve. 3. Is the length of pipe of opposite side of valve very long? If you think that it is very long, please bring discharge pump.
4		To open valve 1. Loosen the screw. When you loosen a screw, loosen next screw at opposite angle. 2. During loosening of a screw, if the pressured water occurs, confirm if the valve is closed properly and pump is stopped.

No.	Image	Procedure
5		After removing the parts of turbine, check inside if algae is accumulated.
6		Please see the removed turbine, the turbine is clogged up by the algae. Please remove it.

No.	Image	Procedure
7		To remove turbine and frame of turbine, loosen 4 screws, which are shown in the picture. No. 1 & 2 screws are holding turbine. No. 3 & 4 screws are holding frame of turbine.
8		After removing 4 pieces of screw, pull the frame out and take turbine off.
9		Check inside and remove algae from the frame which is pegged at main body

No.	Image	Procedure
9	 This is normal condition of screw.  This is the attrite screw.	Before driving screw home, check the condition of screw.
10		After removing algae and checking screw, load main body with the frame and turbine.
11		1. Then, put back to the pipe. 2. Open gate valve and turn on pump 3. Please check flowmeter weather it works or not.

Annex-4.2: O&M of Distribution Facilities

OPERATION AND MAINTENANCE
OF
DISTRIBUTION FACILITIES

2021 December

THE PROJECT FOR
MANAGEMENT CAPACITY ENHANCEMENT
OF SOUTH SUDAN URBAN WATER CORPORATION
IN
SOUTH SUDAN

Table of Contents

1. OPERATION AND MAINTENANCE OF DISTRIBUTION RESERVOIR AND ELEVATED TANK

1.1. TYPE OF WATER STORAGE

The type and capacity of water storage required depend on the scale of the water supply system, topographic condition, land availability and various other considerations. The primary types of water storage in Juba city are

- ✓ Ground-level reservoirs,
- ✓ Buried reservoirs, and
- ✓ Elevated tanks

1.2. PURPOSE OF WATER STORAGE

Water storage in the water supply system has following purposes.

- ✓ Equalizing supply and demand
- ✓ Increasing operation convenience: Number of operators will be reduced.
- ✓ Leveling out pumping requirements: Transmission pump utility must not continually match the changing demand with reservoir.
- ✓ Decreasing power costs: at the night
- ✓ Providing water during power source or pump failure
- ✓ Providing large quantities of water to meet fire demands
- ✓ Providing surge relief
- ✓ Increasing detention times
- ✓ Blending water source

The detailed explanation is mentioned in the book of reference for “Water Transmission and Distribution, Fourth Edition, AWWA”.

1.3. OPERATION AND MAINTENANCE (O&M) FOR WATER STORAGE FACILITIES

- Basic maintenance

Every 2~3 years, storage shall be completely inspected and cleaned. As for an elevated tank, it shall be drained, cleaned, inspected, repaired and painted by a competent contractor. As for ground-level reservoir, it shall be drained, cleaned, inspected, repaired and painted by a competent contractor. The surface of the wall and floor should be cleaned thoroughly with a high-pressure water jet or by sweeping or scrubbing.

- Disinfection

After cleaning and/or painting complete, water storage tanks must be disinfected before being placed in service. In the first method, the volume of the entire tank is chlorine, so that the water will have a free chlorine residual of at least 10mg/L after the proper detention time. The detention time is 6 hours if the disinfecting water is chlorinated before entering the tank, and 24 hours if the water is mixed with hypochlorite in the tank. The chlorinated level must be reduced to acceptable levels before the water is used or discharged.

- Inspection

Tank should be inspected for corrosion and cracks on both the inside and outside. This requires draining the tank to check the surfaces and the operation of the cathodic protection equipment. Overflows and vents should be examined to make sure that they are not blocked and that screens are clean and in place.

- Safety
  - The security of ladders must be checked frequently. Required safety cages or safety cable equipment must be provided.
  - Workers must be provided with boots and clothing for working in wet and slippery conditions.
  - Workers performing disinfection must be provided with special protective goggles and gloves.
  - Special fans or other ventilation equipment must be provided inside tanks while work is being done there.
  - Adequate light must be provided inside tanks for workers to perform their work properly and safety. Special care must be taken to use waterproof wiring and light units to prevent shocks in a wet environment.

1.4. EXISTING WATER STORAGE AND CURRENT CONDITION

The list of existing water storage facilities is shown in the table-1.

Table -1. Length of Existing Transmission and Distribution Pipelines

Location	Capacity (m^3)	Material	Type	Year
Water treatment plant	100, 330	Concrete	Ground	1970's
Hospital	210, 125, 85, 360(ICRC)	Metallic Concrete	Elevated tank Ground	1983 2019
Parliament	210	Concrete	Elevated tank	
Kator	(250)	Metallic	Elevated tank	2007
Konyo Konyo	100	Metallic	Elevated tank	2021
Munuki	25	FRP	Elevated tank	2006
Total capacity	1,540			

The method of O&M varies in the conditions, such as type of storage, storage material and construction age. The O&M method for each storage is described below.

- Storages in water treatment plant

  The construction year is 1970's and it is aged facilities. As for the cleaning, No 1. tank was cleaned up in June 2011, and crack and corrosion was not indicated in this tank. Remaining three tanks are required to clean up and inspect.

- Elevated tanks in hospital

  Those tanks' material is metallic and the age is about 30 years. Currently, the water leakage has been indicated in several part of the tank due to corrosion of bolt and nuts. This elevated tank needs to be cleaned up, inspect and repair immediately.
  ICRC constructed the new concrete reservoir on ground in 2019. The volume is 360 m^3.

- Parliament elevated tank

  It was built in recent year and crack and corrosion has not been indicated now. However, the periodical inspection shall be done in the future.

- Kator elevated tank

  It was built in recent year and water leakage from the tank has not been reported, however, the periodical inspection shall be done in the future. Especially, bolt tightening and corrosion of bolt shall be inspected. It is not working now.

- Konyokonyo pump tank

  ICRC constructed new metallic elevated tank in 2021 which has 100 m^3 volume and 10 m height above ground. However, this isn't operated yet December 2021.

- Munuki elevated tank

  This tank was constructed by the JICA's development study. Water leakage from the tank has been reported until now, however, the periodical inspection shall be done in the future. Especially, bolt tightening and corrosion of bolt shall be inspected.

2. OPERATION AND MAINTENANCE OF TRANSMISSION AND DISTRIBUTION PIPELINE

2.1. CURRENT CONDITION OF THE EXISTING PIPELINE IN JUBA CITY

Currently, UWC has approximately 71.9 km length of pipelines in Juba city existing water supply system. The pipe material is mainly aged asbestos pipe (AC). Recently, PVC has been used for new installation and replacement work instead of AC, because the plenty of PVC pipes have been laid in the UWC stockyard and PVC has advantage of its character, such as lightweight and easy method of installation, etc. GI or Steel pipe have been used for the outlet pipe of main water supply facilities, such as distribution reservoir, elevated tank and pumping station. PE pipe has been used for the 2-inch pipe as branch pipe or house connection. The detail length of each pipe material is shown in the table 2. Additionally, the existing transmission and distribution network in Juba city is shown in the figure-1.

Table -2. Length of Existing Transmission and Distribution Pipelines (Jan 2011)

Dia. (mm)	AC	PVC	GI&STEEL	PE	Total Length (m)
300	-	-	4,575	-	4,575
200	9,083	6,006	-	-	15,089
150	4,155	6,743	-	-	10,898
100	14,488	1,866	772	-	17,126
75	10,937	2,376	-	-	13,313
50	10,169	-	-	202	10,371
25	-	-	523	-	523
Total	48,832	16,991	5,869	202	71,894

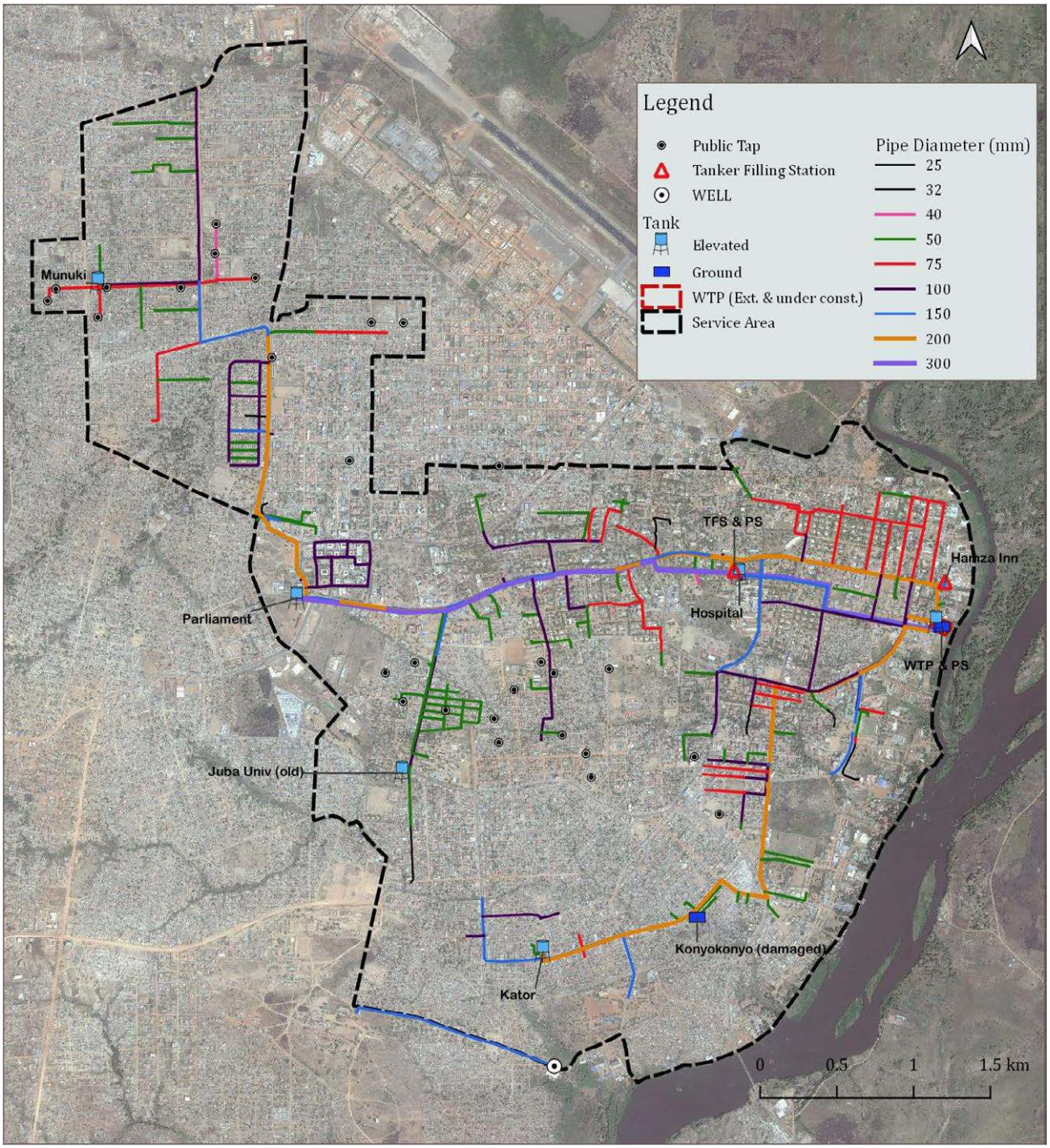


Figure-1 Existing Transmission and Distribution Pipelines (2021)

2.2. WATER QUALITY TEST IN DISTRIBUTION PIPELINE

In order to secure safe water quality in the transmission and distribution pipeline, it is necessary to carry out water quality monitoring. This safety of water quality will result in increased customer satisfaction and compliance with all regulatory requirements. Currently, water quality monitoring plan including routine monitoring, sampling plan and nonroutine monitoring has been formulated by the purification department in UWC.

The situations which need to carry out water quality test in the distribution pipeline are:

- ✓ Customer complaint investigations
- ✓ Construction activities
- ✓ Emergency monitoring

When UWC receives complaint about water quality, water quality test shall be carried out and done by an onsite investigation. As for construction activities, after installation or rehabilitation of the pipe main, the pipe must be tested and found acceptable prior to a return to service. Main breaks, treatment upsets, and backflow events are only a few possible emergency situations that may occur in distribution system. Generally, quick field tests are needed to provide information in a timely manner. However, the present capacity for the unscheduled water quality tests in UWC is not enough due to lack of reagents, equipment and staff.

2.3. OPERATION AND MAINTENANCE PRACTICES TO MAINTAIN WATER QUALITY IN DISTRIBUTION PIPELINE

Most water quality problems in the distribution system are color, taste, odor and residual chlorine, and they can be controlled by some items mentioned below

- Reducing of hydraulic detention time

  The distributed water is in contact with a pipe wall and stored in the distribution reservoir. It is great opportunity for water quality changes. Especially, the longer detention time influences reduction of residual chlorine. Therefore, the normal operation procedure should be developed to minimize the detention time in the system. Distribution network analysis can be used to help define water age throughout the system to help evaluate ways to reduce this value. However, the formulation of the distribution network model in Juba city has not been started yet and distribution department in UWC needs field survey to understand the existing network.

- Flushing of pipeline

  In dead-end mains or in areas of low water consumption, corrosion products and other solids trend to settle on the pipe bottom. These sediments can reduce the capacity of water flow and they can be

source of color, odor and taste in the water when sediments are stirred up by changing of water flow direction or flow velocity in the distribution pipe. Furthermore, they can result in high disinfectant demand. The water supply amount in Juba city is limited and enough amounts of water for flushing is not expected and it is not realistic in current condition. However, routine flushing would be regular maintenance for dead-end mains or other trouble spots. A scheduled, systematic, systemwide flushing program can result in long-term water quality improvements.

- Positive pressure

  Backflow may occur when there is negative or zero pressure in pipelines. Contaminants may invade into the system through leaking pipes and air valves, etc. Standards for minimum pressure in the distribution system vary, however, according to US state standards and water system guidelines, 138kPa is the lowest minimum pressure.

- Direction and velocity control by pump startup, shutdown, and valve operation

  Water quality can be affected by changes in velocity or direction of water flow in pipe network. As for the operation of valves, they should be opened or closed slowly. Pump should be started with the outlet valve closed. As the motor reaches full speed, open the valve slowly. The reverse procedure will help avoid problems upon pump shutdown.

2.4. INSPECTION OF TRANSMISSION AND DISTRIBUTION PIPELINE

In order to understand water supply condition, the measurement tests of water flow and water pressure are an important part of system maintenance. They should be scheduled as part of the regular operation of the system.

When the distribution system has changes, pressure and flow will reduce (or occasionally) to unacceptable levels. The changes include

- ✓ expansion of distribution network without new water treatment plant;
- ✓ additional house connection added to existing mains;
- ✓ unintentionally closed or partially closed valves;
- ✓ undetected leaks in mains or services;
- ✓ change to water storage tanks; and
- ✓ reductions in pipe capacity due to corrosion, pitting, tuberculation, sediments or deposit, or slime growth

- Pressure to be secured in the dead-end of distribution pipeline

According to AWWA, some regulatory agencies require to maintain normal pressure in the distribution system between 240 kPa (35 psi) and 590 kPa (100 psi), with minimum of 140 kPa (20 psi) under fire conditions

On the other hand, according to JWWA, the minimum dynamic water pressure is 150 kPa and maximum static pressure is 740 kPa. Under fire condition, minimum dynamic water pressure should be secure positive pressure.

- Checking pressure

Minimum pressure must be maintained to ensure adequate customer service during peak flow periods or while water is being used to fight fire, however, the water to fight fire has not been used in Juba city now. Pressure of distribution pipeline is tested by pressure gauge and pressure gauge is connected to either a fire hydrant or a faucet. Staff of distribution department should confirm that a minimum positive pressure must be maintained in mains to protect backflow.

- Checking loss of head

Pressure drop must be measured in a certain length pipeline. If big pressure drop is observed, the change of pipe diameter or flushing of pipe should be considered due to ensure the appropriate pressure at house connection.

- Checking flow

In Juba city water supply system, flow test should not be conducted due to the limitation of water volume. When the water supply volume is increased, flow test should be conducted at a hydrant. If the water capacity is reduced, the cause may be an increase in pipe interior roughness. This problem is often found in aged pipe, unlined cast-iron pipe.

- Routine inspection

Firstly, in order to operate valves properly, valves should be regularly inspected and operated to determine whether repair is required.

All staff in distribution department should report potential water system problems and notify management of anything suspicious. The examples of suspicious problems are:

- ✓ Suspected leaks
- ✓ Vandalism
- ✓ Damaged equipment
- ✓ Illegal connection or unauthorized use

2.5. REHABILITATION OF TRANSMISSION AND DISTRIBUTION PIPELINE

In the existing transmission and distribution network, most of pipe is mainly asbestos pipe with approximately 49km. These asbestos pipes were installed in 1970's to 1980's and became aged pipes. They cause huge number of water leakages in the served area, because asbestos pipe has weakness against impact and weight. Especially, the earth cover of pipes is very shallow and the contractors break asbestos pipe and large water leakage occurs.

Therefore, the replacement of asbestos pipe is currently primary issue in UWC. The procedure of rehabilitation is:

A) Pipe material should be determined with consideration of advantage and disadvantage. The comparison of transmission and distribution pipeline materials and pipe joints and their applications are shown below.

Table -3 Comparison of transmission and distribution pipeline materials

Material	Common Size-Diameter		Normal Maximum Working Pressure	Advantage	Disadvantage
	In.	(mm)	(Mpa)		
Ductile iron	3-64	(76-1,625)	2.413	Durable, strong, high flexural strength, good corrosion resistance, lighter weight than cast iron, greater carrying capacity for same external diameter, easily tapped	Subject to general corrosion if installed unprotected in a corrosive environment
Concrete (reinforced)	12-168	(305-4,267)	1.724	Durable with low maintenance, good corrosion resistance, good flow characteristics, O-ring joints are easy to install, high external load capacity, minimal bedding and backfill requirements	Requires heavy lifting equipment for installation, may require special external protection in high-chloride soils
Concrete (prestressed)	16-144	(406-3,658)	2.413	Same as reinforced concrete	Same as reinforced concrete
Steel	4-120	(100-3,048)		Lightweight, easy to install, high tensile strength, low cost, good hydraulically when lined, adapted to locations where some movement may occur	Subject to general corrosion if installed unprotected in a corrosive environment; poor corrosion resistance unless properly lined, coated, and wrapped
Polyvinyl chloride	4-36	(100-914)	1.379	Lightweight, easy to install, excellent resistance to corrosion, good flow characteristics, high tensile strength and impact strength	Difficult to locate underground so tracer tape can be used, requires special care during tapping, susceptible to damage during handling, requires special care in bedding
High-density Polyethylene	4-63	(100-6,000)	1.750	Lightweight, very durable, very smooth, liners and wrapping not required, can use ductile-iron fittings	Relatively new product, thermal butt-fusion joints, requires higher laborer skills

Table -4 Pipe joints and their applications

Type of material	Type of Joint	Application
Ductile iron	Push-on or mechanical	General use where flexibility is required
	Flanged	Where valves or fitting are to be attached in vaults or above grade
	Flexible ball	River crossings or in very rugged terrain
	Restrained	To resist thrust forces and in unstable soils
Concrete	Galvanized steel ring, bell-and-spigot types, or their variations with elastomeric	All locations
Plastic (PVC)	Bell and spigot type	Most commonly used for typical municipal uses
	Solvent weld	Only for small lines
(HDPE)	Thermal butt-fusion, flange assemblies, or	
	Mechanical methods recommended by manufacturer	Joining HDPE pipe to valves and ductile-iron fittings
Steel	Mechanical sleeve coupling	All diameters, but especially on pipe too small for a person to enter
	Rubber gasket joints	Low-pressure applications
	Welded joints	High-pressure applications, 24-in. and larger pipes
	Flanged joints	Where valves or fittings are to be attached
	Expansion joints	Allows movement so that expansion or contraction is not cumulative over several lengths

B) Pipe carrying capacity depends on a combination of factors, including pipe size/diameter, pressure, flow velocity, and head loss resulting from friction. The amount of friction loss depends on the pipe roughness, flow velocity, and pipe diameter. These conditions should be checked by network analysis in each section. The applicable conditions are:

- ✓ Velocity: About 1m to 1.5m/sec in order to minimize friction loss as water flows through the pipe. If velocity is increased, friction loss will be increased.
- ✓ Pressure: Minimum dynamic water pressure: 0.15Mpa (150kPa), Maximum static water pressure: 0.74Mpa (740kPa)
- ✓ Friction loss: Experience shows that it should be less than 5 permillage.

C) A distribution system layout is usually categorized in three types:

- ✓ Arterial-loop system
- ✓ Grid system
- ✓ Tree system

A distribution system layout in Juba city is currently “Grid system”. In order to optimize the operation and maintenance, UWC shall improve to “Arterial-loop system”. The layout of image of three distribution is shown below.

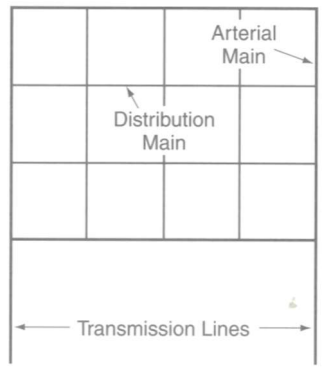
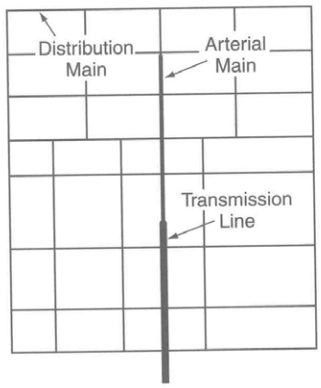
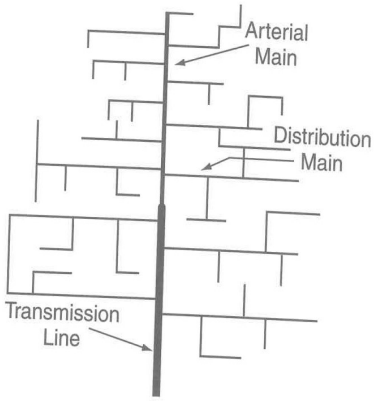
Arterial-loop system	Grid system	Tree system
		

Figure-2 Layout of image of three distribution

3. PREVENTION OF WATER LEAKAGE AND ITS REHABILITATION

3.1. LARGE LEAKAGE AND SMALL LEAKAGE

The difference between the authorized consumption and system input water volume (transmission water volume from water treatment plant) is water loss which is main content of Non-Revenue Water (NRW). Non-revenue water causes reduction of tariff income and it will be an aggravating factor of management of UWC. Generally, water loss can be generated by physical water loss of water leakage. In this chapter, the method of prevention of water leakage and its rehabilitation are described. For the reference, the best practice of water balance published by IWA (International Water Association) is shown in the table.

Biggest leakage since recording work of water leakage started.

Table -5 Best Practice of Water Balance in IWA

System input volume (Corrected for known errors)	Authorized consumption	Billed Authorized Consumption	Billed Metered Consumption (including water exported)	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-revenue Water
			Unbilled Unmetered Consumption	
	Water losses	Apparent Losses	Unauthorized Consumption	
			Customer Metering Inaccuracies	
		Real Losses	Leakage on Transmission and/or Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
			Leakage on Service Connections up to point of Customer metering	

Table -6 Explanation of Each Water Volume

Billed authorized consumption (metered & unmetered)	Sum of Volume delivered to residential customers. It represents the sum of all billed consumption from both metered and unmetered sources. The billed metered consumption includes all groups of customers such as domestic, commercial, industrial or institutional. The billed unmetered consumption includes all billed consumption which is calculated based on estimates or norms but is not metered.
Total non-revenue water (NRW)	Quantity of water that does not provide any revenue to the utility. NRW= Total volume delivered from the treatment plants – Billed authorized consumption.
Unbilled metered volume	Metered Consumption which is for any reason unbilled. This might for example include metered consumption of the utility itself or water provided to institutions free of charge.
Unbilled unmetered volume	Any kind of Authorized Consumption which is neither billed nor metered. This component typically includes items such as fire fighting, flushing of mains and sewers, street cleaning, frost protection, etc.
Apparent losses volume	= unauthorized consumption + meter under-registration + data handling errors Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use).
Real losses volume	Physical water losses from the pressurized system and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows. May also be called leakage.

- Large leakages

  Large leakages are usually easy to find on the road. In Juba city, plenty of leakages are found on the road and they form unusual puddle and/or running flow.

- Small leakages

  Small leakages do not always come to the surface. Their flow is too small to be noticed. However, it can be seen from the table that a relatively small leakages can generate large amount of water over a period of time.

Table -7 and -8 shows the estimate amount of leakage by broken shape and visible leakage amount by cartoon.

Table -7 Estimate Amount of Leakage by Broken Shape

Unit: Upper is maximum m^3/d and below is minimum m^3/d

Size of Whole (cm^2)	Water Pressure (kgf/cm2)					Shape of Broken Part		
	3.0	4.0	5.0	6.0	7.0	Circle	Square	Irregular Shape
1.00	76.00	88.00	98.00	107.00	116.00			
	3.16	3.66	4.08	4.45	4.83			
0.60	54.00	63.00	70.00	76.00	83.00			
	2.25	2.62	2.91	3.16	3.45			
0.50	52.00	60.00	67.00	73.00	79.00			
	2.15	2.50	2.79	3.04	3.29			
0.40	50.00	57.00	64.00	70.00	75.00			
	2.80	2.38	2.66	2.91	3.12			
0.30	33.00	38.00	43.00	47.00	51.00			
	1.37	1.58	1.79	1.95	2.12			
0.20	27.00	31.00	35.00	38.00	41.00			
	1.12	1.29	1.45	1.58	1.70			
0.10	17.00	30.00	22.00	24.00	26.00			
	0.70	0.83	0.91	1.00	1.08			
0.08	15.50	18.00	20.00	22.00	24.00			
	0.64	0.75	0.83	0.91	1.00			
0.06	11.60	13.40	15.00	16.40	17.70			
	48.00	0.55	0.62	0.68	0.73			
0.04	7.70	8.90	10.00	11.00	11.80			
	0.32	0.37	0.42	0.45	0.49			
0.02	3.90	4.50	5.00	5.50	5.90			
	0.16	0.18	0.20	0.22	0.24			
0.01	1.30	1.60	1.80	2.00	2.10			
	0.05	0.06	0.08	0.08	0.08			

Table -8 (1) Visible Leakage Amount (by cartoon)

Water Tap

A	B	C	D	E	F
Drop 30/min	Drop 95/min	Line of thread	Opening of tap 90 deg.	Opening of tap 180 deg.	Full open

Stop Valve

A	B	C	D
Dropping like line of thread	Spreading partly	Spreading half part	Spreading whole part

Polyethylene Pipe

A	B	C	D, E, F
Pinhole	Crack 1cm	Crack 2cm	3cm, 4cm, 5cm

Table -8 (2) Visible Leakage Amount (by cartoon)

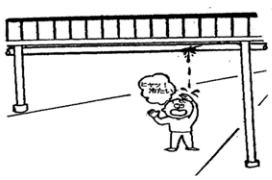
Unit: Upper is maximum m^3/d and below is minimum m^3/d

Condition / Item	A	B	C	D	E	F
Water Tap	0.011	0.036	0.09	30.9	39.6	56.8
		0.0015	0.004	1.29	1.65	3.36
Stop valve	0.045	2.3	3	7.1		
	0.002	0.096	0.125	0.296		
Polyethylene Pipe	0.03-0.05	2.7	15.4	28.4	43.8	68.8
	0.001-0.002	0.113	0.41	1.18	1.83	2.86

Note: Measured by dynamic water pressure 3.5 kgf/cm^2 and converted to $5kgf/cm^2$

3.2. LEAKAGE DETECTION METHODS

As for detection methods of small leaks, there are two basic methods. They are listening surveys and a combination of listening surveys and flow rate measurements. However, large leaks indicated on the surface occur mainly in Juba city and UWC should tackle prevention of water leakage with positive approach. Therefore, the explanation of detection method for large leaks is described in this section. The methods are shown below.

	Report by pedestrians or citizen informing that the road is wet		Report by pedestrians or citizen informing that the road becomes hollow
	Report by pedestrians or citizen informing that water flows out from river bank		Report by pedestrians or citizen informing that road water is dropped from bridge
	Report by pedestrians or citizen informing that water comes out from manhole		

3.3. PREVENTION OF WATE LEAKAGE AND ITS REHABILITATION

UWC has been struggling against large water leakage in the existing water supply system in Juba city. Although the distribution department has small number of pipe materials, workers have exercised ingenuity and prepared substitute materials, such as waterproof rubber pad and saddle for house connection. However, their quality of these products is not high and they are inadequate materials from the viewpoint of water leakage prevention. The following improvement points affect how well prevention of water leakage performs.

- Rehabilitation of asbestos pipe

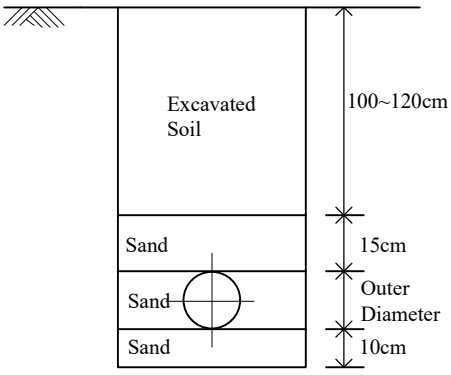
As it is mentioned in section 3.2.1, the most existing pipe is asbestos pipe with approximately 49km. They cause huge number of water leakages in the served area. The replacement of asbestos pipe is currently primary issue in UWC. The new pipe should avoid a connection to the old asbestos pipe. Instead of connection with an old asbestos pipe, renewal of existing network in the target area should be implemented at the same time.

- Installation of valves

Shutoff valves should be provided so that areas within the system can be isolated for repair or maintenance. In order to minimize service interruptions, valves should be located at regular intervals and at all branches from the arterial mains. Where mains intersect in a grid, at least two (preferably three) of the branch lines should be provided with valves, The distribution system should be planned so that most of the flow is maintained even if any section of the system is taken out of service.

- Earth cover and backfill soil

Shallow earth cover may cause pipe break, because load of heavy duty car affects high soil pressure and it exceeds pressure capacity of the installed pipe. According to guideline from JWWA, the standard of earth cover is 120cm. If there is other underground installation and the earth cover with 120cm is not possible to ensure, it can reduce to 60cm after the mutual agreement with relative organizations.
As for the backfill in the bottom of trench, the sand should be paved to protect the installed pipe. The depth of each layer in the trench is drawn in the figure.



- Adequate materials use

Except for the leakage from pipe mains, the house connection work also causes large leakage. The main reason is that house connection materials are inferior in quality. The inadequate materials include

- ✓ Saddle: it is hand made by blacksmith, however, the quality is not same
- ✓ Rubber pad: Instead of genuine products, UWC is using rubber slipper
- ✓ Rubber band: Instead of genuine products, UWC is using tire tube

In order to prevent water leakage from house connections and pipes with small diameter, UWC should procure genuine products.

		
Handmade saddle	Corroded rubber and saddle	Slipper used for waterproof rubber

4. MANAGEMENT OF DISTRIBUTION AREA INFORMATION

4.1. MANAGEMENT OF DISTRIBUTION NETWORK

As an initial step in system planning and O&M of distribution network, several types of map should be prepared to show both the existing system and the areas that may have to be served in the future. Currently, UWC doesn't manage any kind of maps including topographic map, distribution network map and comprehensive map, etc.

Permanent record of the existing transmission and distribution main facilities and its appurtenances are essential to make appropriate decisions for operation and maintenance. Some of the essential information regarding distribution network that should be included is as follows:

Table 3-9 Information of Distribution Network

Category	Detail
Pipe	Installation year, pipe material, thickness, nominal diameter, length, site address, no. of pipeline, appurtenances (valve, hydrant and air valve, etc.), polyethylene sleeve, electric protection, record of pipe work, pipe condition (corrosion, exterior damage, occlusion, fitting, and bolt and nut, etc.), Supervisor
Installation site's environment	Earth cover, pavement condition, occupation type, traffic condition, soil condition, groundwater level, other underground installation and stray current, etc.)

Category	Detail
Hydraulic and water quality	Water flow quantity, water pressure, water quality, flow direction, C value (Hazen-Williams coefficient)
Leakage	Date, reason, address, detail, repair method, impact of leakage
Complaint	Date, reason, address, detail, response
Social information	No. of served households, water consumption, urbanization condition, existence of water supply facilities and other important facilities

As-build drawing, service ledger, recording of leakage, other installation documents and field survey provide the essential information regarding distribution network. One of the appropriate methods of information management is GIS (Geographic Information System) program and it was procured in distribution department in UWC currently. The following show the current condition of the collected GIS data of Juba city existing distribution network.

Distribution network usually occupies road, river and railway and UWC needs to get permission from landowner and responsible persons. The procedure of apply and renewal for occupancy should be recorded in UWC. Documents and permission should be saved in the appropriate section in UWC.

4.2. MANAGEMENT OF MAPPED RECORDS

Three principal types of mapped records are

- ✓ Transmission and distribution network drawings
- ✓ Detail drawings
- ✓ As-build drawings

- Transmission and distribution network drawing

The small-scale drawing should be used for understanding of topographic condition, location of facilities, distribution plan, construction plan and countermeasure plan against disaster, etc. The range of small scale is from 1/10,000 to 1/50,000. The small-scale drawing should not be cluttered with distracting information. Important information to put on a small-scale drawing includes

- ✓ Location of main facilities, such as water treatment plant, pump station and distribution reservoir, etc.
- ✓ Main transmission and distribution pipelines
- ✓ Location of main valve
- ✓ Location of the other important facilities regarding operation and maintenance for transmission and distribution facilities

The medium scale drawing should be used for distribution plan and arrangement of distribution. The range of medium scale drawing is from 1/2,500 to 1/5,000. Important information to put on a medium scale drawing includes the followings:

- ✓ Pipe material
- ✓ Pipe diameter
- ✓ Valve
- ✓ Air valve
- ✓ Hydrant
- ✓ Pressure Reducing Valve (PRV)
- ✓ Discharging pipe
- ✓ Siphon culvert
- ✓ Pipe bridge or attached pipe of bridge

The large-scale drawing is most accurate drawing as network map and it provides transmission and distribution pipe and house connection. The scale is normally 1/500. Important information to put on a large-scale drawing includes the followings:

- ✓ House connection materials
- ✓ Branch diameter from main pipe
- ✓ Location of saddle
- ✓ Meter diameter
- ✓ Existing of receiving tank

- Detail drawings

The detail drawing should be prepared for main pipelines and valves. It consists of a longitudinal section and a plain view. Especially, valve needs the detailed structural drawing as much as possible. Important information to put on a large scale drawing includes the followings:

- ✓ Elongation from main landmark, river, railway, other underground installation

- As-build drawing

As-build drawing is basic materials for preparation of network drawing and its modification. When the UWC has stack of as-build drawings, it is necessary to store these drawings as microfilm and/or filing system.

5. PROCEDURE OF RECORDING WORK

5.1. PIPE INSTALLATION/ WATER LEAKAGE REPAIR

Preparation of recording

When the distribution department staff receives information or complaint about water leakage and/or pipe installation/replacement, the responsible person shall bring required format, equipment and tools to the site. The required things are mentioned below.

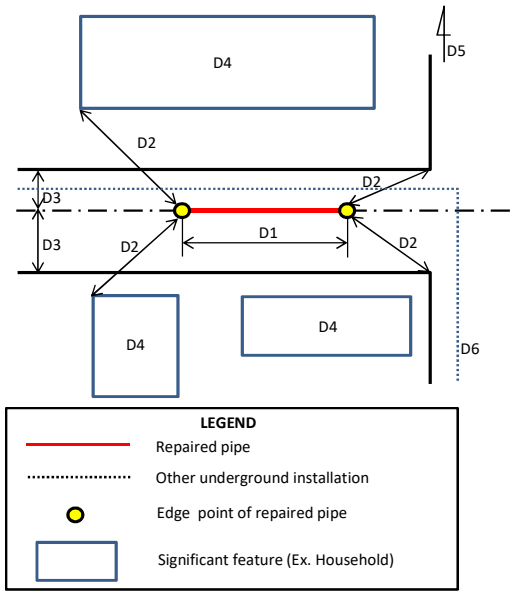
- ✓ GPS (Global Positioning System): The topography map and point shapefile for record with ArcPad format shall be set in the GPS. The manual of the preparation of shapefile is mentioned in GPS manual and GIS manual.
- ✓ Record format (form1)
- ✓ Digital camera: Provided from administration department
- ✓ Convex: 5 meters

At the site for pipe installation/ water leakage repair

At the site, the reporter shall take positioning data by using GPS, then, shall take record items of general, existing pipe, traffic condition, cause of accident and repair condition by using the format of "Form1". As for the plan and section drawing, the recorder shall draw by hand and shall mention 0the required information, which is described below.

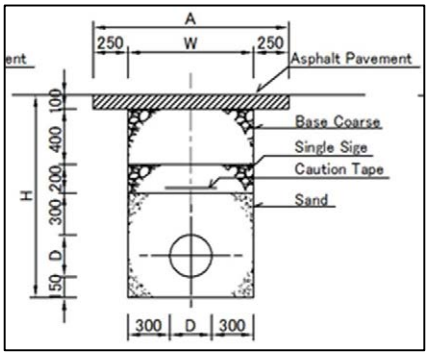
Plan drawing

- ✓ Length of the existing pipe to be repaired (D1)
- ✓ Distance between the two sides of the repaired pipe and landmark, such as building, street corner and manhole etc. (D2)
- ✓ Distance between the center of the repaired pipe and nearside (D3)
- ✓ Significant features (D4)
- ✓ Angle of direction (D5)
- ✓ Other underground installation, such as electric cable, sewer line and gas pipe etc. (D6)



Section drawing

- ✓ Length between the top of the repaired pipe and ground surface
- ✓ Length between the bottom of the repaired pipe and excavation depth
- ✓ Excavation width
- ✓ Details of soil layer for backfilling
- ✓ Location of other underground installation



Picture recording

After recording, the recorder shall take pictures of the site and make picture's ID and its explanation by using the format of "Form 1".

After recording at the site

After finishing of recording of detail of leakage repair and taking of pictures, the recorder shall go back to distribution department office in water treatment plant and input the recorded data into database (Form 1-2).

As for the positioning data by GPS, the recorder shall remove flash memory from GPS and insert it into desktop computer, which is installed GIS (Geographic Information System) software.

Open the folder of flash memory, then, copy the point shapefile and paste it in the proper folder in the desktop.

Open the GIS software, add the point shapefile by using Arc catalog tool, and secure the positioning data from attribute data.

As for taken pictures, the picture ID shall be named as jpg format file.

After data input, recorder in distribution department shall count the number of water leakage and its repair numbers by using the "Format 2 Monthly Number of Leakage and Repair" and "Format 3 Monthly Length of Pipe Installation/replacement".

5.2. PROCEDURE OF MONITORING OF WATER FLOW

Water flow meters to be monitored

The list of flow meter locations and condition to be monitored is shown the table -10. The purification department shall monitor the daily water flow in WTP (Water Treatment Plant) and pumping station, such as Hospital pumping station and Konyokonyo pumping station. The distribution department shall monitor daily

water flow in Parliament, Buluk and Kator reservoir. The meter reading team shall be responsibility for monitoring daily water flow in Tanker Filing Station (TFS).

Table -10 The Locations and Condition of Flow Meters

Location	Location ID	Detail Location	Type of Flow Meter	Gate Valve	Condition of Meter
WTP in Juba Station	**1**	300 mm Steel, Outlet of 3 Intake Pumps	EM	Working	Not Working
	2	300 mm Steel, Outlet of Transmission Pump	Turbine		Not Working
	3	200 mm AC, to Tanker Filling Station (Hamza)	Turbine	Working	Working
	5	50 mm HDPE, to Power Plant (The line has been closed)	-	-	-
	6	200mm AC, to Konyokonyo Near HQ	Turbine	Working	Working
	7	200mm AC, near the Main Gate	Turbine	Working	Working
Konyokonyo	**8**	200 mm Outlet of Pump	Electromagnetic	Not Working	Not Working
Kator Tank	**9**	200mm Outlet of Elevated Tank	Turbine	Working	Not Working
Hospital	**10**	200mm PVC, Outside of Hospital to Amarat, Hai Game, Hai Thoura	Turbine	Working	Working
	11	50 mm to Hospital Reservoir	Turbine	Working	Working
	12	150mm, PVC to Juba City	Turbine	Working	Working
	13	300mm, to Parliament	Turbine	Working	Not Working
	T1-1	100mm, TFS	Turbine	Working	Not Working
	T1-2	100mm, TFS	Turbine	Working	Not Working
Parliament	**14**	100mm, to the Ministerial Area (Closed due to building)	Turbine	Closed	Closed
	15	200 mm, to Munuki	Turbine	Working	Working
Buluk	**16**	150mm to Juba University	Turbine	Closed	Not Working
JIT Tanker Filling Station	**17**	150mm Tanker Filing Station	Turbine	Working	Not working
	T2-1	100mm TFS	Turbine	Working	Not Working
	T2-2	100mm, TFS	Turbine	Working	Not Working
	T2-3	100mm, TFS	Turbine	Working	Not Working
Hai Cinema	**18**	100mm Test field Distribution line	Turbine	Working	Not Working
Munuki	**19**	200mm under the bridge	Turbine	Working	Working but cannot read

Procedure of monitoring

The procedure of monitoring of flow meter for each staff is described below.

A. Flow meter from No.1 to No.7

1. The purification staff shall monitor daily water flow from No. 1 to No.6
2. After recording, purification staff shall submit to director of purification department.
3. The director of purification department shall input data into desktop computer.

B. Flow meter No.8 and from No.11 to No.13

1. The shift member in Hospital pumping station and Konyokonyo shall monitor the flow data. Recording shall be done in the morning.
2. The shift member in Hospital and Konyokonyo pumping station shall send the recorded flow data to the director of purification department who is in WTP.
3. The director of purification department shall input the data into desktop computer.

C. Flow meter No. 9, 10, and from No.14 to 16 and No.18,19

1. The distribution staff shall monitor the flow data. Recording shall be done in the morning.
2. The shift member in Kator elevated tank shall monitor the No.9 flow data.
3. After recording, the distribution staffs and Kator shift member shall input the data into desktop computer.

D. Tanker Filling Point Flow meter T1-1, 2 and T2-1, 2, 3

1. Meter Reading team shall monitor the flow data at Tanker Filling points, such as Hospital T1-1 and T1-2 and JIT T2-1, 2, 3.
2. After recording, the meter reading staff shall report/share data with the purification department and distribution department staff.

Annex-5: Water Treatment and Water Quality Monitoring O&M Manual (revised edition)

OPERATION AND MAINTENANCE MANUALS

PURIFICATION PLANT AND WATER QUALITY MONITORING

Version-4: DRAFT (7 Mar 2019)

February 2012
1st Revision in September 2013 (Version-3)
2nd Revision in March 2019 (Version-4)

SOUTH SUDAN URBAN WATER CORPORATION (SSUWC) JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

PREPARED UNDER
THE PROJECT FOR MANAGEMENT CAPACITY ENHANCEMENT OF SOUTHERN SUDAN URBAN WATER CORPORATION

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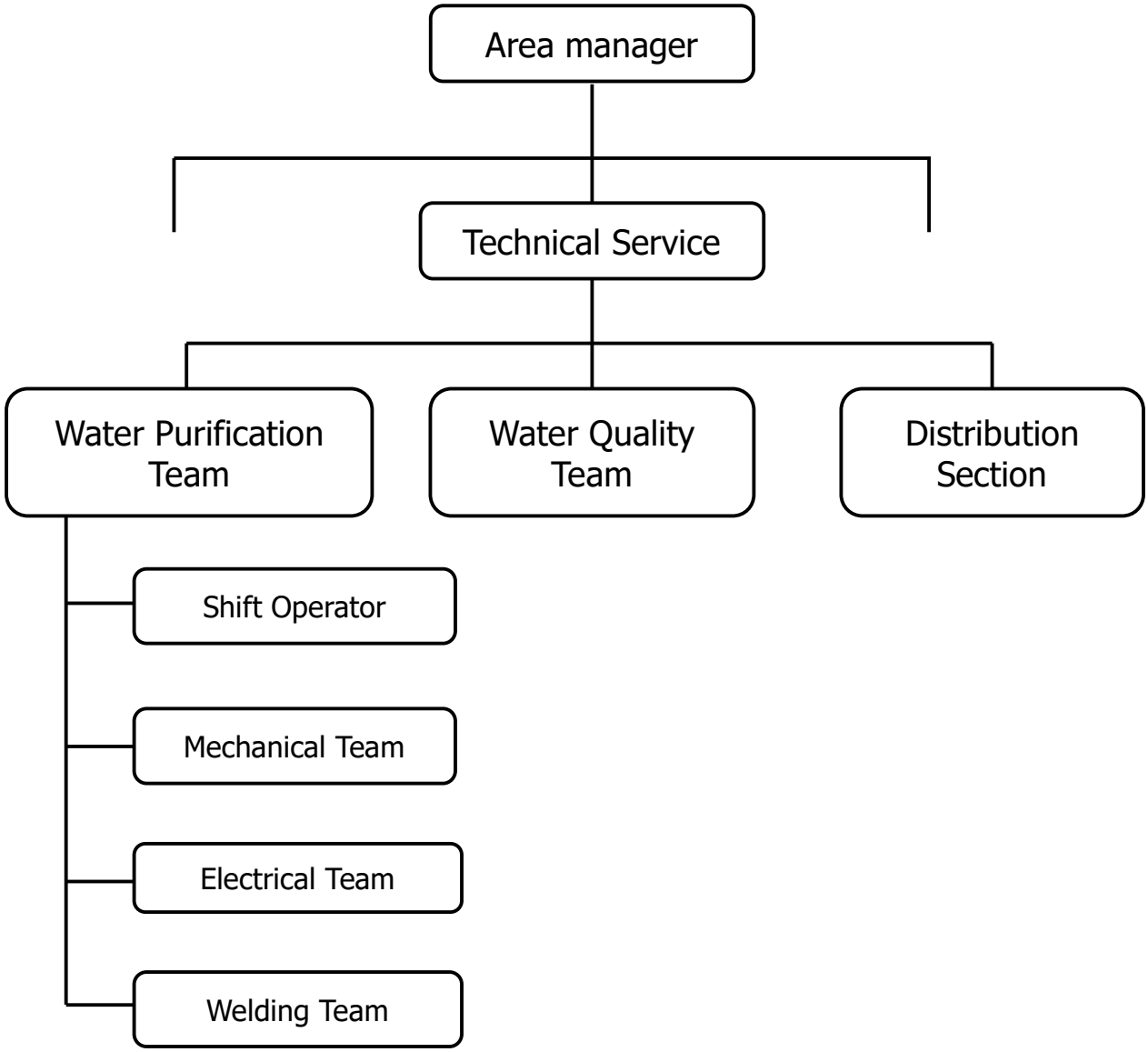
PART I: STANDARD OPERATING PROCEDURES

PART I:

STANDARD OPERATION PROCEDURES

1. General

1.1 Organization



1.2 Duty

Water Quality Team

- ✓ Water sampling and analysis of Daily Water Monitoring
- ✓ Implement Jar test and report to Water Purification Team
- ✓ Implement Chlorine demand test and report to Water Purification Team
- ✓ Attend discussion on result daily water quality analysis at Area Manager Office

Water Purification Team

- ✓ Manage Shift operators, Mechanical maintenance team and Electrical maintenance team
- ✓ Daily Meeting with shift operators
- ✓ Attend discussion on result daily water quality analysis at Area Manager Office

Shift Operators

- ✓ Daily sludge removing
- ✓ Backwash
- ✓ Power failure and restart
- ✓ Chlorine tank cleaning
- ✓ Alum tank cleaning

- ✓ Adjust chlorine dosing

Mechanical Maintenance Team

Maintenance following equipment;

- ✓ Pumps: Raw water pump and High lift pump
- ✓ Generator
- ✓ Blower
- ✓ Valves
- ✓ Chemical mixers

Electrical Maintenance Team

Check following electrical equipment;

- ✓ Motors
- ✓ Control panel
- ✓ Generators and Change over switch
- ✓ Blowers
- ✓ Chemical mixers
- ✓ General electrical connections

1.3 Discussion on Result of Daily Water Quality Analysis at Area Manager Office

Participants

- ✓ Water Quality Team
- ✓ Water Purification Team

Date and Time

- ✓ If necessary at 10:00

Agenda

1. Carry out water quality test in the morning
2. Evaluate the result with Laboratory staffs and purification staffs
3. Discuss the Result
4. If the results are not satisfied, discuss the causes and solutions
    - ✓ Chemical dosing rates (Alum and Chlorine)
    - ✓ Filter backwash method
    - ✓ Remove sludge
5. Inform the solutions to shift operators

2. Water Quality Team

2.1 Water Sampling of Daily Water Monitoring

Every day

Test day within treatment plant

: Every day on regular working days

Time : Start at 10:00

To be carried out considering the pump operating time

Water sampling sequence :

1. Treated water (distribution reservoir No. 2)
2. Filtered water (filtered water gallery No. 2)
3. Settled water (settling tank trough)
4. Raw water (intake)

2.2 Water Sampling of Weekly Water Analysis

Every Tuesday and Wednesday

Test day within treatment plant

: Tuesday every week

Test day outside treatment plant

Suspend: Recommence considering security and safety condition, sample transportation measure

~~: To be carried out considering the pump operating time~~

2.3 Water Sampling of Monthly Water Analysis

Tuesday of the first week every month

Wednesday of the second week every month

Thursday of the third week every month

Test day within treatment plant

: Tuesday of the first week every month

Test day at tanks and TFS outside treatment plant

Suspend: Recommence considering security and safety condition, sample transportation measure

Test day at taps outside treatment plant

Suspend: Recommence considering security and safety condition, sample transportation measure

~~: Thursday of the third week every month (Sampling at taps outside treatment plant)~~

2.4 Procedure of Jar Test

Frequency of Jar Test

Every day

- ✓ Dry season: 1 time / day
- ✓ Rainy season: 2 times / day

Procedure

1. Prepare a 10,000mg/L solution (1% solution).
2. Prepare 1 L of raw water in each of the six beakers.
3. Add the aluminum sulfate dosage of 10,000 mg/L solution to each beaker.

   Note: Inject 0, 2, 4, 6, 8, 10 ml as 0, 20, 40, 60, 80, 100 mg/L.
4. Take rapid rotation at 120 rpm for 2 minutes.
5. Take slow rotation at 60 rpm for 10 minutes.
6. Allow the samples to stand for 10 minutes.
7. Observe each beaker during the test, the floc formation status and the settling status.
8. Sample the supernatant.
9. Measure the turbidity, pH value, alkalinity, and color of the supernatant sampled.
10. Determine the appropriate injection rate with considering actual plant operation.

11. Report to Water Purification Team.

2.5 Procedure of Chlorine Demand Test

Frequency of Chlorine Demand Test

1 time / Month

Procedure

1. Prepare a 100 mg/L solution.

   Note: Please see the manuals for preparation of solution.

2. Prepare 11 such specimens of 100 ml each.

3. Add the required chlorine dosage of 100 mg/L solution to each beaker.

   Note: Inject 0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 mL as 0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0mg/L.

4. After gradually mixing the chlorine such that it is fully dispersed, allow the mixed solution to stand still for one hour.

5. After one hour, measure the concentration using a residual chlorine meter.

6. Draw the figure of the residual chlorine results.

   Note: Figure in which there are chlorine dosage as horizontal axis and residual chlorine as vertical axis.

7. Determine the appropriate injection rate by the breakpoint of the figure with considering actual plant operation.

8. Report to Water Purification Team.

3. Water Purification Team

3.1 Procedure of Intake Maintenance

Daily and Regular Cleaning at the Intake

(1) Strainer

Time: Every day, All day of operation when flow rate reduced

Responsible: Shift operators

Equipment used: Using personal hands

What to be removed: Debris which clogs strainers, Grass and any materials that removable

(2) Surrounding of intake

Tame: Every three (3) to five (5) months, 10:00 AM (Morning) for 2 – 3 hours

Responsible: Shift operators and Maintenance team

Equipment used: Necessary tools such as scrapers

What to be removed: Grass, Small rocks and Mud

Check the Intake Facilities

Time: Every twice a week, 10:00 AM (Morning) for 1 hour

Responsible: Maintenance team

Equipment used: Necessary mechanical tools and visual checking

Purpose;

(1) Operation and maintenance precautions

(2) Prevent air clogging

(3) Keep condition of intake facility

Check item

(1) Flexible pipes: Joints, Flanges, Air leakage

(2) Conduct pipes: Flanges, Bolts and Nuts

(3) Strainers: Bolts and nuts

(4) Foot valve: Bolts and nuts

(5) Float: Breakage of float, Float lashing (rope), Bolts and nuts

3.2 Cleaning of receiving raw water tank

Time: Every 2 – 3 months for 2 hours

Responsible;

Cleaning work: Water treatment team, Maintenance team and Shift operators (about 5 -10 people)

Disinfection after cleaning: Water quality team

Equipment used: Soft and hard brooms, Containers and Pump to remove water, Horse and Pipe

: Grasses, Mud and any irrelevant materials

Procedure

(1) Stop raw water pump

(2) Open drain valve to remove water

(3) Shift operator collect escaped grasses and debris from strainer at intake

(4) Shift operator brushing and wash inside of tank

(5) Disinfection inside tank using chlorine

Comment: Biological safety of water is assured by chlorination in treatment process.

Keep clean of working wear and equipment. It is desirable to prepare decided wear, boots and cleaning

equipment (Only use for raw water tank cleaning).

(Reference) Measurement Water level at the Intake

Time: 10:00 AM (Morning) and 18:00 (Evening)

Responsible: Assistant inspector or any, Shift operators

Equipment used: Measuring stick or any water depth measuring instrument

Comment: For Water level monitoring, water label should be measure at same point (Fixed point).

Installation of **Level gauge** is desirable

Purpose;

(1) Measuring water level at source

(2) Take water level data for future forecast of water level

(3) Take precautions and early warning

3.3 Procedure of Determination of Chemical Dosing Rates (Alum and Chlorine)

Regularly

1. Decide Alum and Chlorine doing rates (mg/l) by Water Quality Team.
2. Write alum dosing rates (L/hr.) on white board by Water Quality Team at the beginning.
3. Write chlorine dosing rates (L/hr.) on white board by Water Quality Team at the beginning.

If raw water turbidity is changed very much from the previous day.

1. Carry out jar test by Water Quality Team.
2. Decide alum dosing rate (mg/l) by Water Treatment Team and Water Quality Team.
3. Record alum dosing rate (L/hr.) by Water Quality Team.
4. Daily meeting between Water Quality Team and Water Treatment Team is held.

Normal dosing rate of Alum (Reference)

1. Dry season: 80 to 120 L/hr.
2. Rainy season: 150 to 200 L/hr.

3.4 Daily Sludge Removing Procedure

Basic

1. Once a day of each sedimentation tank at noon 12:00
2. Sludge removing time : 10 minutes (in dry season)
   : 15 minutes (in rainy season)

Procedure

1. To open the sludge removing valve for 10 - 15 minutes
   Sludge removing valve is inside of pit on the ground
2. To close the sludge removing valve after prescribed minutes

(When water in sedimentation tank is whitish and higher turbidity)

1. To close the inlet valve of the troubled sedimentation tank with stopping one of raw water pumps
2. To open the sludge removing valve for 20 minutes
   Sludge removing valve is inside of pit on the ground
3. To close the sludge removing valve
4. To adjust alum dosing rate helped by laboratory staff
5. To open the inlet valve one hour later and turn on a raw water pump

3.5 Backwash Procedure

Filter Backwash Time

Once a day

Filter Tank No.1 & No.3: 07.00

Filter Tank No.2 & No.4: 15.00

Proposal by Expert

Twice a day
Filter Tank No.1 & No.3: 07.00 and 15:00
Filter Tank No.2 & No.4: 08.00 and 16:00

Step 1-Air blow

Rainy season; Air blow time: 7 minutes

Dry season; 5 minutes

Step 2-Water Backwash

Rainy season; Water washing time: 12 minutes

Dry season; Water washing time: 10 minutes

3.6 Procedure at the Power Failure and Restart

A. When the power failure has happened

A.1 A generator cannot start within 10 minutes

1. To stop coagulant dosing
2. To stop chlorine dosing
3. To close outlet valve of each filter tank

A.2 A generator can start within 10 minutes

1. Nothing to do

B. When a generator starts operating

1. To confirm raw/High lift pump workings
2. To confirm old pumps on/off
3. To open outlet valve of each filter tank
4. Coagulant dosing starts with watching coagulation process
5. Chlorine dosing starts

C. When a generator is changed to the power

1. Nothing to do

3.7 Daily Meeting with Operators

If necessary at the beginning

Participants: Leaders of purification section and Shift Members

Instruction of daily procedures

1. Confirmation of Today's Chemical Dosing Rates
2. Daily Sludge Removing Procedure
3. Backwash Procedure
4. Procedure at the Power Failure

3.8 Procedure of Chlorine Tank/Dosing Facility Cleaning and Preparation

Tank Cleaning: Twice a week

Dosing facility cleaning: Every Day

1. Remove the hose from the injection pipe
2. Wash out chlorine residue
   (1) in the tank by water
   (2) in the filter by water
   (3) in the injection pipe by water
   (4) inside of the flowmeter by brash and water
3. Connect hose with injection pipe
4. Adjust chlorine dozing rate

Revise and Add time schedule of tank cleaning

Preparation of Chlorine

Twice a week (When other tank reach to empty)

1. Bring 1 drum of chlorine bin
2. Fill water in the tank
3. Put chlorine in the tank
4. Mix chlorine by mixer for 15 minutes

3.9 Procedure of Alum Tank Cleaning/Dosing Facility and Preparation

Tank Cleaning: Twice a month

Dosing Facility: Every day

1. Remove the hose from the injection pipe
2. Wash out Alum residue
   (1) in the tank by water
   (2) in the filter by water
   (3) in the injection pipe by water
   (4) inside of the flow meter by brash and water
3. Connect hose with injection pipe
4. Adjust Alum dozing rate

Revise and Add time schedule of tank cleaning

Preparation of Alum

When tank reach to empty

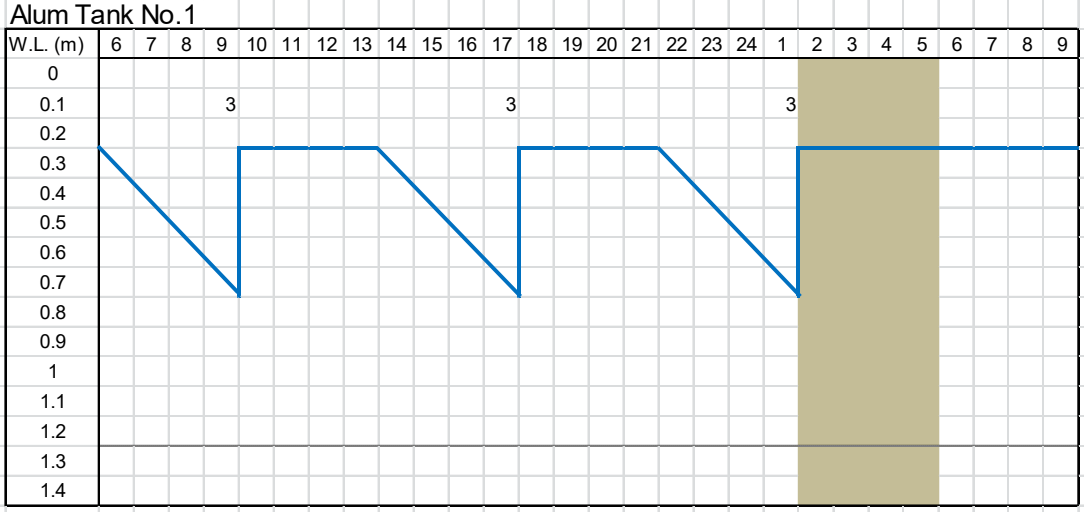
1. Bring 18 bags of Alum
2. Fill water in the tank
3. Put Alum bags in the tank
4. Mix the Alum by Mixer for 1 hours

Supplement: SOP of Alum tank operation

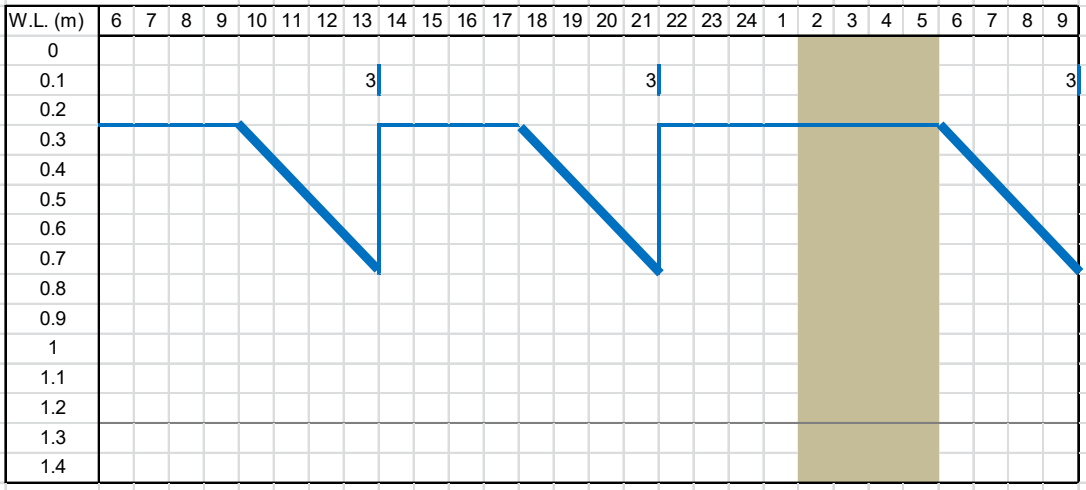
- ✓ W.L. of Alum tank 0.7m: Add new Alum bag (3 bags / tank). Usually, 12bags/ day. However, **if high turbidity condition**, more than 12 bags / day **can use**
- ✓ Keep W.L. of Alum tank: 0.7m
- ✓ Actual time schedule of adding new alum bag is decided by an actual operation condition (Alum flow rate)

Example of usual turbidity condition

Alum Tank No.1



Alum Tank No.2



3.10 Procedure of Residual Chlorine Test and Dosing Adjustment by Operators

Time

Every Shift

1. 08:00
2. 16:00
3. 00:00

Procedure

1. Take sample from the clear water tank
2. Prepare chlorine test kit
3. Test water sample
4. If test kit indicator blinks, dilute and try again
5. Record the result
6. Check and adjust chlorine doing rate, if require

3.11 Time Schedule of Plant Manager

When any problems were happened

09:00

- ✓ Grasping problems the station is facing now
- ✓ Checking Yesterday's Operation Record
  - ➢ Inspecting whole purification plant and power
  - ➢ Confirming filter backwashing

10:00

- ✓ Discussion how to solve the problems with Shift members and Laboratory staffs at Area manager's Office

10:30 ~12:00

- ✓ Instruct operators to change the operation, if required
- ✓ Checking chemical dosing rates
- ✓ Checking sedimentation tanks and filters

12:00

- ✓ Checking sludge removing work

16.00

- ✓ Reporting Area manager regarding the Situation of Purification Plant and Power

3.12 Time Schedule of Sub Plant Manager

9:00 ~10:00

- ✓ Supporting Plant manager
- ✓ Collecting record sheets
  - ➢ Inputting daily data into the database

10:00~12:00

- ✓ If necessary attending discussion on result of daily water quality analysis with laboratory staffs at Area Manager's office
- ✓ Supporting Director of Technical Service to instruct operators changing the operation, if required

12:00

Supporting sludge removing work

- ✓ If any problems happened, reporting Area manager regarding the Situation of Purification Plant and Power instead of Plant manager

4. Shift Operators

(add. Nov 2012)

4.1 Time Schedule of Shift Operators

(add. Nov 2012)

1st Shift (08:00 – 16:00)

08:00

- ✓ Sharing with previous shift operators (backwash (filter No. & time), condition of pump, desludge, cleaning intake, floc condition in sedimentation tank)
- ✓ Residual chlorine Test : SEE procedure "3.8"
- ✓ Chlorine dosing adjustment : SEE procedure "3.8"

10:30

- ✓ Daily meeting with plant operators if necessary : SEE procedure "3.5"
- ✓ Alum dosing adjustment

12:00

- ✓ Daily sludge removing: SEE procedure "3.2"

15:00

- ✓ Backwashing: SEE procedure "3.3"

16:00

- ✓ Sharing with next shift operators

At the Power Failure and Restart SEE procedure "2.5"**(add. Nov 2012)**

4.2 Time Schedule of Shift Operators

2nd Shift (16:00 – 00:00)

16:00

- ✓ Sharing with previous shift operators (backwash (filter No. & time), condition of pump, desludge, cleaning intake, floc condition in sedimentation tank)
- ✓ Residual Chlorine Test : SEE procedure "3.8"
- ✓ Chlorine dosing adjustment : SEE procedure "3.8"

00:00

- ✓ Sharing with next shift operators

At the Power Failure and Restart SEE procedure "3.4"

(add. Nov 2012)

4.3 Time Schedule of Shift Operators

3rd Shift (00:00 – 08:00)

00:00

- ✓ Sharing with previous shift operators (backwash (filter No. & time), condition of pump, desludge, cleaning intake, floc condition in sedimentation tank)
- ✓ Residual Chlorine Test : SEE procedure "3.8"
- ✓ Chlorine dosing adjustment : SEE procedure "3.8"

07:00 (next day)

- ✓ Backwash : SEE procedure "3.3"

08:00

- ✓ Sharing with next shift operators

At the Power Failure and Restart: SEE procedure "3.4"

5. Mechanical Maintenance Team

5.1 Check all equipment

Pumps: Raw water pump and High lift pump

Frequency: Every day

Check item: Bolts and Nuts, Temperature, Vibration, Sound, Alignment, Bearings, Coupling, Motor conditions, Ground packing or Mechanical seal, Lubrication and Cleaning.

Generator

Frequency: Every day, Prepare operation

Check item: Bolts and Nuts, Temperature, Engine oil, Fuel, Radiator, Battery, Coolant, Air filter, Fuel filters, Lubrication, Vibration and Sound, and Cleaning.

Blower

Frequency: Every day

Check item: Bolts and Nuts, Bearings, Vibration, Lubrication, Belts and Cleaning.

Valves

Frequency: Every day

Check items: Bolts and Nuts, Shafts, Lubrication and Cleaning.

Chemical mixers

Frequency: Every day

Check items: Bolts and Nuts, Shafts, Lubrication and Cleaning.

6. Electrical Maintenance Team

6.1 Check all equipment

Motors

Frequency: Every day

Check item: Wires

Object

- ✓ Pumps: Raw water pump and High lift pump
- ✓ Blower
- ✓ Chemical mixers
- ✓ Other motors

Generator

Frequency: Every day, Operation of generator, Operation Change-over switch

Check item: Wires, Generator output voltage and ampere and Condition of Change-over switch

Control panel

Frequency: Every day

Check item: Wires, Running time, and Voltage and amperes of all electric machines and general electrical connections

Other electrical items

Frequency: Every day

Items: Distribution board, Power lines, Inside wiring and Electrical apparatus

Important facility

- ✓ Security light
- ✓ SSUWC HQ
- ✓ Urban Water Corporation offices (Juba station)
- ✓ Other project offices

Annex-6: Material and Equipment Inventory Management Manual

SSUWC Juba Station

SOP FOR STOCK MANAGEMENT

1. Overall Flow of Stock Management

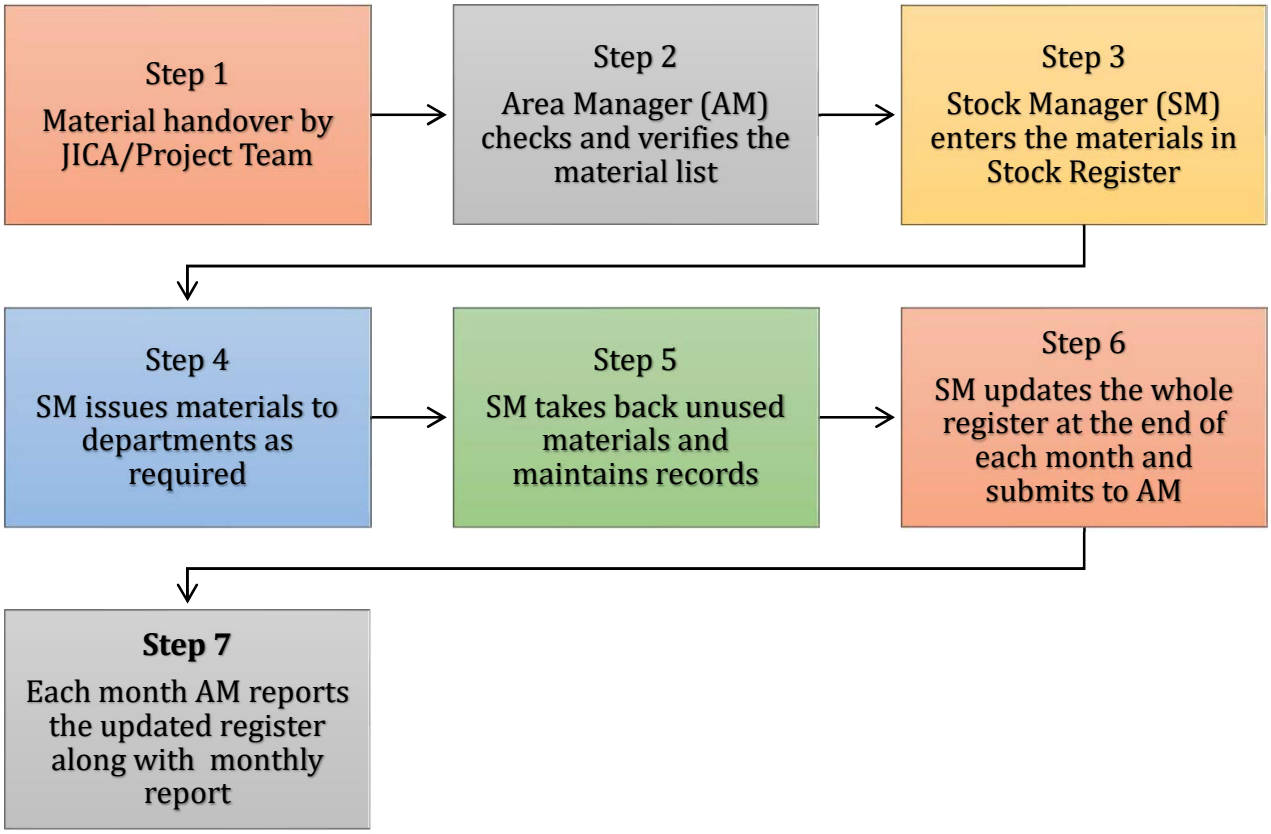
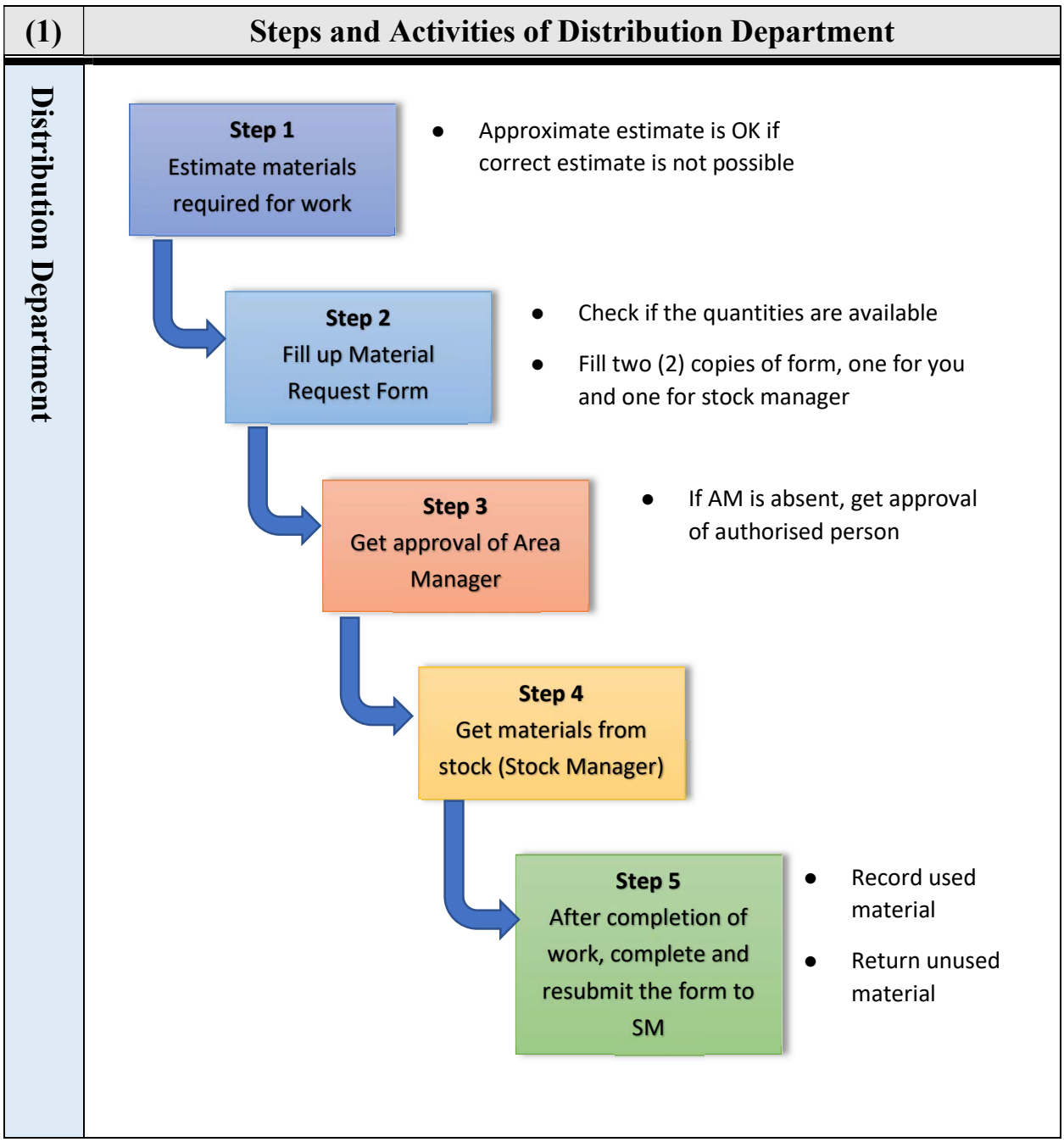
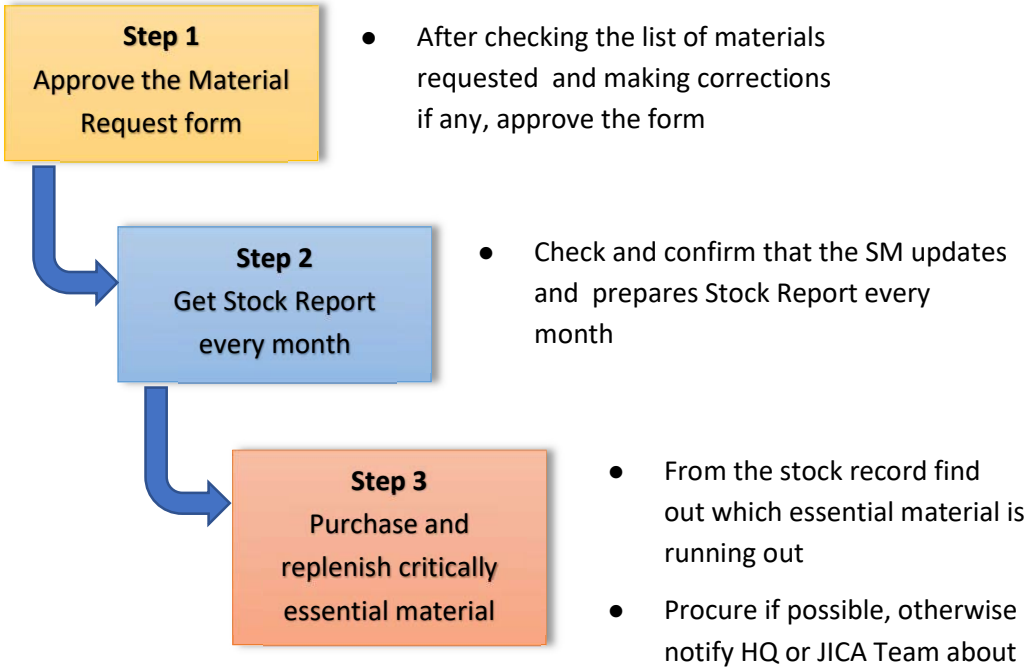


Figure 1: Overall Flow of Stock Management

2. Flow of Material Requisition and Material Registry Update

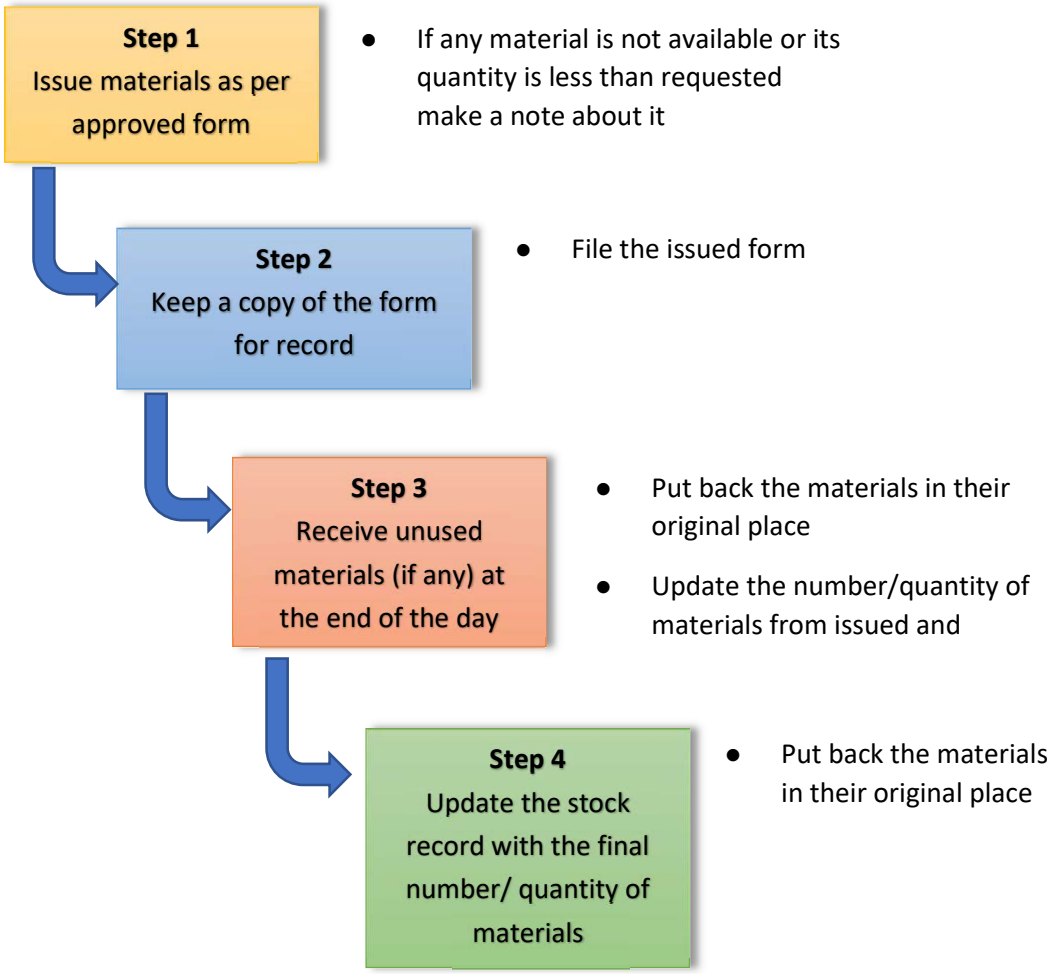
The main process starts with the Distribution Department. It filles the Form, gets materials and completes the work and submits the unused material. The Stock Manager updates the registry on daily basis. The work flow is as shown below.



(2)	Steps and Activities of Area Manager
Area Manager	

Steps and Activities of Stock Manager

(3) Store Manager



Appendix-1: Material Issue Form

Stock Management of Juba Station

MATERIAL ISSUE FORM

Department:			Date:		Work Name:		Site Name:
Working Member:							
S. No.	**Material Description**	**Unit**	**Quantity Requested**	**Quantity Issued**	**Quantity Used**	**Quantity Returned**	**Remarks**
Ex	50 mm HDPE pipe	m	30	30	25	5	Example
1							
2							
3							
4							
5							
6							
7							

Requested & Received By:	Approved By:	Issued and Recorded By:	Returned Material Received and Recorded By:
Name: Sign:	Area Manager Sign:	Name: Sign:	Name: Sign: Date:

1

Appendix-2: Stock List for Water Supply Equipment

Stock List for Water Supply Equipment (Procured by JICA)

Category	No.	Items	Unit	Balance in the end of March	Procured in April	Issued in April 2021					Balance in the end of April	Procured in May	Issued in May 2021						Balance in the end of May
						/	/	/	/	/			/	/	/	/	/	/	
1. Equipment & tools	1.1	Backhoe	num.	1															
	1.2	Car	num.																
	1.3	Motorbike	num.																
	1.4	Bicycle	num.																
	1.5	Portable water meter test bench (Honeywell Elster DN15)	set	1															
	1.6	Manual pipe threading machine (REMS eva)	set	1															
	1.7	Drainage pump	set	1															
	1.8	Pipe wrench (medium duty)	num.	2															
2. Flowmeter	2.1	Electromagnetic flowmeter (SOMAG Flowiz ML255)	num.	1															
	2.2	Mechanical flowmeter (Bladed wheel) (Elster Kent HelixH4000)	num.	2															
	2.3	Mechanical flowmeter 12" (Dia.=300mm), 16 bar	num.	1															
3. Water meter	3.1	DN 1/2"	num.																
	3.2	DN 3/4"	num.		20														
	3.3	DN 1"	num.		20														
4. Valve	4.1	Sluice valve & Flange adapter (HAWLE E3) size?	num.	3															
	4.2	Sluice valve & Flange adapter (HAWLE E3) size?	num.	2															
	4.3	Brass gate valve (PEGLER 1065) size?	num.	173															
	4.4	Brass gate valve (PEGLER 1065) size?	num.	6															
	4.5	DN 3/4"	num.		20														
	4.6	DN 1"	num.		20														
5. Coupling (DI couplings set complete with nuts, bolts and rubber rings)	5.1	DN 12"	set	0	4														
	5.2	DN 8"	set	4	12														
	5.3	DN 6"	set	5	16														
	5.4	DN 4"	set	0	50														
	5.5	DN 3"	set	0	50														
6. Pipe	uPVC pipe PN16																		
	6.1	DN 8"	m	12	90														

Category	No.	Items	Unit	Balance in the end of March	Procured in April	Issued in April 2021						Balance in the end of April	Procured in May	Issued in May 2021						Balance in the end of May
						/	/	/	/	/	/			/	/	/	/	/	/	
	6.2	DN 4"	m	0	180															
	6.3	DN 3"	m	0	180															
	GI pipe																			
	6.4	GI pipe size?	m	144																
	6.5	GI pipe size?	m	165																
	HDPE pipe																			
	6.6	HDPE pipe 2"	m		100															
	6.7	HDPE pipe 1"	m		100															
7. Other fittings	7.1	GI Union 3/4"	num.	15	90															
	7.2	GI Union 1"	num.	28	90															
	7.3	GI elbow 3/4"	num.	677	50															
	7.4	GI elbow 1"	num.	175	50															
	7.5	GI nipple 3/4"	num.	144	50															
	7.6	GI nipple 1"	num.	64	50															
	7.7	Plumbing tape	m	60																

Eng.Joseph Ebere
Area Manager
SSUWC Juba Station

Amol Barach Kuany
Inspector for Stores
SSUWC Juba Station

Amol Barach Kuany
Inspector for Stores
SSUWC Juba Station

Annex-7: Study Report on Management of Taker Filling Station and Public Tap Stand

THE REPUBLIC OF SOUTH SUDAN
MINISTRY OF WATER RESOURCE AND IRRIGATION (MWRI)
SOUTH SUDAN URBAN WATER CORPORATION (SSUWC)

The Project for Management Capacity Enhancement of South Sudan Urban Water Cooperation Phase 2 in South Sudan

Study Report for Management of Tanker Filling Station and Public Tap Stand

February 2022

TEC International Co.,Ltd

Table of Contents

Reference Materials:

1. World Bank (2018)"Water Supply in a War Zone - A Preliminary Analysis of Two Urban Water Tanker Supply Systems in the Republic of Yemen"
2. International Water and Sanitation (IRC)(2000)"Independent Water and Sanitation Providers in African Cities"
3. Water Utility Partnership for Capacity Building (WUP) AFRICA (2003)"Beteer Water and Sanitation for the Urban Poor"
4. African Development Bank (2015) "Water Supply & Sanitation in Africa: Findings, Lessons and Good Practices to Improve Delivery"
5. Water and Sanitation Program (2002) "Water Services in Small Towns in Africa: The Role of Small and Medium-Sized Organisations

Abbriviation

Abbriviation	Full Spelling
AfDB	African Development Bank
GWCL	Ghana Water Company Limited
PTS	Public Tap Stand
SSUWC	South Sudan Urban Water Corporation
TFS	Tanker Filling Station
USAID	U.S. Agency for International Development

Chapter 1. Management of Tanker Filling Station (TFS)

1.1. Status of TFSs in Juba City of South Sudan

1.1.1. Background

In Juba City, South Sudan, water tankers are the most popular means of supplying water to residents in terms of both water volume supplied and the number of beneficiaries although piped water supply exists. In order to respond to the rapidly expanding urban population and water demand in Juba City, water tankers are characterized as the most rapid and flexible way to cover the water supply to the residents in Juba City.

According to a customer survey conducted in 2016, 98% of the piped customers purchases water from water tanker selling SSUWC water and 44% of the piped customer purchases water from water tanker selling non-SSUWC water. Among the customers who are not connected to piped water supply, 82% of the residents uses non-SSUWC water by water takers and 31% uses SSUWC water by water tankers. It indicates that water tanlers are an important water source for many residents.

1.1.2. Existing Tanker Fillng Station

In the past, when there were no water supply points for water tankers with water purification facilities, there were 18 private water intake points along the Nile River. Raw water from the Nile River is directly supplied from these points and sold to the residents, which posed a major hygiene challenge. After that, UNICEF provided support for disinfection of the river water by installing chemical tanks and providing chlorine free of charge.

Currently, the SSUWC Juba station and private water service providers are providing water to the water tankers.

(1) Tanker Filling Station (owned by SSUWC Juba Station)

Within the coverage area of the SSUWC Juba station, three TFSs were constructed in 2010 with support from USAID. One of them, near the former Hamza Inn, was relocated to the premises near JIT Supermarket in 2019. This and the TFS near the Juba Hospital are the only two currently in operation.

The capacity of the water treatment plant at the SSUWC Juba station is 7,200 m^3/day and the actual water distribution is 3,000-4,000 m^3/day in total. Because flow meters at TFSs are not functional, the accurate supply water volume to TFSs is not clear. It is, however, assumed that 60-70% of the total water volume supplied is allocated to TFSs. As of August 2021, the selling price of SSUWC to water tankers is 250 SSP/m^3. The selling price of SSUWC has been set at a level almost equal to the lowest selling price of private water companies.

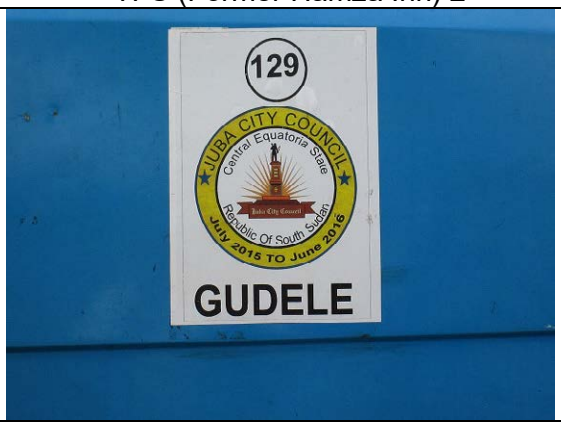
Table 1-1 TFSs owned by SSUWC

Location	1. JIT Supermarket (Former Hamza Inn)	2. Juba Hosputal	3. Firebrigate
Area	Jebel Nyoka	Amarat	Juba Na Bari
Faclity	SSUWC	SSUWC	SSUWC
– Cinstruction year	2011	2011	2011
– Owner	SSUWC	SSUWC	SSUWC
– O&M	SSUWC	SSUWC	SSUWC
Status	• Constructed with support from USAID • To be relocated from Hamza Inn in 2019 due to low water pressure and deteriorating road conditions	• Constructed with support from USAID • Operation will be suspended in 2019 due to deteriorating road conditions, and resumed after simple road repairs by JICA.	• Constructed with support from USAID • Although the pipeline is connected, it was shut down because the area does not have sufficient water supply on a regular basis. It was removed.

TFS (Former Hamza Inn) 1

TFS (Former Hamza Inn) 2

TFS (Former Hamza Inn) 3



Certified Seal from City Council

	
TFS　Flowmeter	TFS (near Juba Hospital)

(2) Tanker Filling Station (owned by private company)

Water companies are located along the tributaries of the Nile River and sell purified river water to water tankers. As of August 2021, there are nine private water companies in Juba. The following table shows the water supply capacity and selling prices of private water companies.

Table 1-2　Private Water Company and Production Capacity, Selling Price

No.	Company name	Supply capacity (m^3/day)	Supply hours	Selling price to tanker (m^3/SSP)
1	Abraham Water Abstraction	1,800	12	420
2	May Beles Water Kator	2,700	12	300
3	Nile Crystal	720	14	300
4	Alphones Kenyi	270	12	300
5	Mohamed Mahmoud	200	10	300
6	Ewan Water Company	1,200	12	300
7	Dahame Water Company Gabat	1,200	12	300
8	Fankil General Trading & Investment	900	13	250
9	Dahame Water Company Kator	1,080	11	300
	Total	10,070		

1.1.3. Tanker Filling Station to be Constructed

(1) Tanker Filling Station by JICA rant Aid Project

Eight TFSs are currently being constructed in Juba City by the Japan's grant aid project. The construction is scheduled to be completed until the end of 2022, and the operation is scheduled to start in 2023.

TFS	Tanker filling station: water tap, Kiosk for management	8 stations (40 water taps)
PTS	Kiosk: constructed by brick blocks, width 2m× length 2.5m	120 locations

(2) African Development Bank (AfDB)

The AfDB is implementing a project to rehabilitate existing water supply facilities in Juba in urban

areas and to expand new facilities in rural areas. The project includes the construction of 3,000 new piped connections, as well as the construction of 16 TFSs and 50 PTSs. According to hearing from SSUWC, SSUWC have not yet discussed with AfDB how to manage the TFSs and PTSs.

1.1.4. Management of Water Tanker

(1) Registered Number of Water Tankers

According to the Juba City Council, which registers and manages water tankers, there are approximately 800 registered water tankers in the city as of August 2021. The owners of the water tankers are mainly Eritreans, with a few Ugandans and Ethiopians as well. Each country has its own water tanker association, but they are not unified into a single association.

(2) Management of Water Tankers by Juba City Council

Juba City Council is responsible for (i) managing the registration of water tankers and (ii) determining the selling price of water tankers. With regard to (i), water tankers are registered, and a system has been introduced whereby the license is renewed every year by the private operator who operates the water tanker or the individual owner of the water tanker. Once registered, the operator receives a sticker for the water tanker and attaches it to the owned water tanker. The area of operation of the water tanker is also applied at the time of registration, and the area of operation of the water tanker is clearly indicated on the sticker. The cost of the sticker registered is 15,000 to 25,000 SSP/unit. The registration fee varies depending on the capacity of water tanker and sales area. Normally, the registration is renewed in July every year, but due to the absence of the person in charge, the registration has been delayed and started in September for 2021.

The city health officer checks all water tankers for cleaning inside the tanks, etc. Health cards of water tanker drivers and assistants are also checked. Both drivers and assistants have to go to the hospital for health check and get health cards. They are then approved and registered with a sticker.

1.1.5. Water Price of Water Tanker Seling to Customers

Juba City Council sets and notifies registered water tankers about the price of selling water to their customers.

The price of water sold by water tanker depends on the transportation distance to the area to be sold. In setting the sales price of the water tankers, exchange rate fluctuations and vehicle maintenance costs are taken into consideration. Since the diesel fuel for the water tankers depends on imports from abroad, the former exchange rate fluctuation has a particularly large impact on the selling price. Even within the same city of Juba, the sales price of diesel fuel is relatively higher in the target areas that are far from the water tanker supply base, because the consumption of diesel fuel is higher in those areas. The selling price of water per drum, which is equivalent to 250L, by area is as follows

Table 1-3　Selling Price of Water Tanker to Customer

No.	Residential Area	Sellign Price (SSP/drum)
1	Juba Town	500
2	Kator Area	500
3	Lologo Area	600
4	Shirkat Area	600
5	Jebel Area	700
6	Munuki Area	700
7	Gudele One Area	700
8	Nyakuron Area	700
9	Gudele Two Area	800
10	New Site Area (Gumbo)	800
11	Jebel Dinka Area	1000

[Note]

Selling price is per 1 drum (250L)

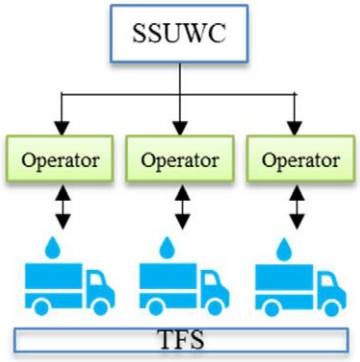
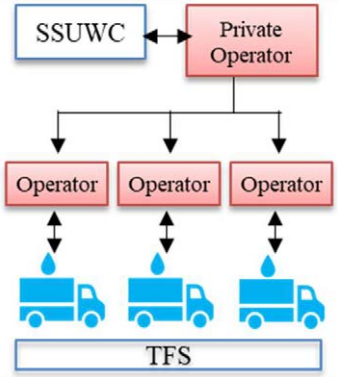
1.1.6. Management System of Tanker Filling Station

(1) Proposed Management Model for TFSs

There could be two options for the operation model of TFSs such as direct management of SSUWC and private management. After construction of three TFSs by USAID, the operation was contracted out to a private company in Juba. However, the management style was shifted from the private operation to the direct operation of SSUWC in 2018 once, then it was backed to a private operation again in December 2021. By looking at a series of operation status, the main features of both management models can be summarized in the following table.

The most important issue is to secure the transparency of reporting the collected revenue. It was told that the false reporting of underestimation could be occurred in the past under the direct management. The average monthly sales amount from TFS in 2021 was in the range of 2-3 million SSP. In December 2021, the operation has been contracted out to private company, and the sales amount of TFS in December is estimated with 8 million SSP. Even considering increase of operation hours in December, the sales is suddenly increased without any logical reason.

Table 1-4 Main Features of Management Models of TFSs

	SSUWC Management Model	Private Management Model
Concept		
Operation skill and knowledge	- They have a relatively basic knowledge of the operation of the facility. However, since meter readers are often assigned as an operator, it is difficult to see a significant difference from private management.	- Since the operation of the facility is not complicated, it is expected that the necessary knowledge and skills can be acquired by taking a short training course at the beginning.
Management capacity	- The number of TFSs to be constructed under the grant aid project is eight, for which SSUWC Juba station does not have enough capacity to to manage by existing human resources of SSUWC. - While, it may be not efficient to employ full-time staffs only to manage the TFS.	- In case of private model, it is possible to manage all TFSs by increasing the number of contractors according to the target number of TFSs. - A challenge is that the number and capacity of private operators with sufficient experience and financial capacity may be limited in Juba.
Transparancy	- The appointed staff is required to report the selling water volume and revenue collection amount. - However, the reliability depends on humanity of appointed person. - It is told that false reporting could be occurred by underestimating revenue amount in the past.	- By taking a measure to prevent false reporting, transparancy can be increased. - To do so, meter installation, double check by SSUWC's monitoring is necessary. - The contract should stipulate penalties for false reports and stolen water. - Once it happens, the company can't enter the market again, therefore the transparency is relatively high.
Efficiency	- Incentives to work efficiently are difficult to work with because the salary is not changed even if sales is increased.	- High efficiency is expected because increase of selling water volume is directly related to revenue increase.

(2) Role and Responsibility of SSUWC and Private Operator

In the existing system built by USAID, the operation and management of the system is outsourced to a third party, a private operator.

The operation and management of TFS does not require any special and advanced skills, and anyone with a secondary education level can learn the functions and operation of the facility through a few days of OJT. The scope of responsibility between SSUWC and the private sector is shown below.

Table 1-5 Scope of Responsibility between SSUWC and Private Operator

SSUWC	Private Operator
- Supply safe water - Supply stable water at water pressure set	- Assignment of operation supervisor during prescribed business hours - Operation of water supply facilities
- Management and monitoring by the contractor based on the contract and the selection of the contractor - Permission to occupy and use facilities	- Daily inspection and maintenance of water supply facilities - Reports and requests for facility breakdowns and repairs - Environmental protection of water supply facilities
- Setting of selling price for the contractor - Setting of retail prices for water tankers from the contractor	- Revenue ollection from water tanker operators based on stipulated retail prices
- Inspection of flow meters and requisition and collection of fees	- Payment to the collected revenue to SSUWC
- Suspension of water supply and termination of contracts for businesses that violate the terms and conditions, such as late payment	- Response to claim on operation of TFSs
- Response to periodic inspections and repairs of facilities	- Paying salary to caretakers - Payment of repair costs for facility repairs

(3) Items to be indicated in Contract for Private Operator

In order for SSUWC to properly manage the performance of the private sector, the contents of the contract with the private sector are extremely important. The following table shows the items that should be included in the contract with the private sector.

Table 1-6 Items to be included in Private Operator's Contract

Area	Items
Basics	Scope of responsibility of both parties, terms of consignment, terms and method of payment of consignment fees, liability for defects, termination of contract, penalty, terms of indemnity
Conract duration	Single year/ Multiple years
Operating system	Facility operating hours, operating days (weekdays, holidays), rest periods
Selling record	Sales hours/ Sales volume/ Purchaser recording method and submission, Daily and monthly sales tally and reporting
Revenue collection	Compliance with sales and retail prices, method and timing of payment of collected fees to SSUWC
Repair and rehabilitation	Periodical inspection of facilities, reporting system in case of malfunction or damage, clarification of responsibilities of SSUWC/private sector depending on the nature of repair/repair, burden of repair/repair costs
Hygiene environment	Cleaning and environmental maintenance of the subject facility
Operational stoppage	Conditions to suspend operation of the facility
Training	Obligation to attend training by SSUWC

(4) Selling Price of Water Tanker to Customer

The price of water sold by water tankers to customers has been regulated by the Juba City Council.

In addition to the City Council, the Ministry of Water Resource and Irrigation (MWRI) and the SSUWC have been members of the council to review and decide the selling price. Therefore, it is expected that the regulation by Juba City Council will be continued in the future. On the other hand, it is necessary to re-consult with the City Council about the new water selling price when new TFSs are established by the grand aid project.

The current pricing is based on the transportation distance from the location of private water companies to the water supply area in principle. Most of private water companies are located along the tributaries of the Nile River. While, in the grant aid project, most of TFSs will be constructed in the inland areas of Juba City. If the water tankers will use the TFSs owned by SSUWC and that if the same selling price is applied, the transportation distance of the tankers from the TFSs to the customers will be shorter than before. Therefore, it is assumed that the tanker purchasing SSUWC water can save the fuel costs in comparison to the tanker purchasing private water companies. As the results, this would be an advantage of SSUWC in this market.

1.2. Case Study of TFSs in Other Countries

Water tankers are likely to be the most expensive means of supplying water. Freight costs constitute as much as 75% of the price, according to the study report[1]. Tanker services are typically offered to customers with large storage tanks such as households, construction sites or water kiosks and vendors. They are common in countries with growing middle and high-income households but where network supply is still very limited. For example, Ghana, Kenya, Haiti, Tanzania and Mauritania are under this situation.

While, in some cities in Africa such as Accra in Ghana, Addis Ababa in Ethiopia, Luanda in Angola and Johannesburg in South Africa, tankers are also utilized to supply water to low-income households.

However, the more detail information on management of TFSs is difficult to obtain through only internet search. Therefore, this report is limited to introduce only available information on case study and experiences from the country where water supply by tanker is more polular.

1.2.1. Water Supply by Tanker in Sana'a and Aden of Yemen

Prior to the onset of conflict since 2010, Yemen's urban population gained access to water from a variety of sources, including both formal municipal water supply systems as well as informal sources including privately-operated tankers, kiosks, and private wells. Specifically, private tankers have become more prominent in the water delivery supply chain in the urban area of Yemen. Tanker system plays a critical role in filling this gap in the formal water supply system, while it raises key challenges with respect to affordability, health, environment, and water resources management. For the details, refer to reference material.

1. World Bank (2018), "Water Supply in a War Zone - A Preliminary Analysis of Two Urban Water Tanker Supply Systems in the Republic of Yemen"

[1] Water Utility Partnership for Capacity Building for Africa (2003) "Better Water and Sanitation for the Urban Poor"

1.2.2. Water Supply by Tanker in Sana'a and Aden of Yemen

In the three East African cities, independent operators have filled the gap left by the public water agencies by trucking water to higher income areas, taking over operation of most standpipes, and drilling boreholes which supply private water networks. In Kampala, the small private borehole networks offer service comparable to that of NWSC; a private borehole operator in Nairobi sends the water out via tanker. Some information of Kenya and Mortitania is indicated in the report. For the details, refer to reference material.

2. International Water and Sanitation (IRC), (2000), "Independent Water and Sanitation Providers in African Cities"

1.2.3. Tanker Water Association in Accra of Ghana

In order to limit water theft from fire hydrants by tanker drivers in Accra, the utility supported the creation of tanker-owner associations and developed a means to supply these associations with bulk water through specially installed large flow hydrant filling points. The tanker filling points are managed by tanker associations (one per association), to which the utility, Ghana Water Company Limited (GWCL), sells bulk water, measured by the meter. Associations also ensure that tankers are sufficiently clean for the transport of
drinking water.

Several individual tanker operators initiated the establishment of the first association. The founding association has since been split into 3 separate associations, one of which is the Teshie Tanker Owners Association. As a direct result of the establishment of the association, a growing number of tankers have since formally entered into the water supply market. In 2000, the main tanker association in Accra had a membership of over 100 tanker owners, while the Teshie Tankers Association has a membership of 24 tanker owners. The association offers improved conditions of service for tankers, including regularization of previously illegal operations, access to a reliable water supply and a favourable bulk rate through association service stations.

Through their membership in the association, the tanker owners:

- Guarantee payment to GWCL for water consumed at the negotiated tariff. The association invoices its members according to volumes individually obtained and pays the invoices made out by GWCL.
- Improve the service provided to the customer by committing tankers to standards of cleanliness agreed with the utility.

For the details, refer to reference material.

3. Water Utility Partnership for Capacity Building (WUP) AFRICA (2003), "Better Water and Sanitation for the Urban Poor"

Chapter 2. Management of Public Tap Stand (PTS)

2.1. Status of Juba City

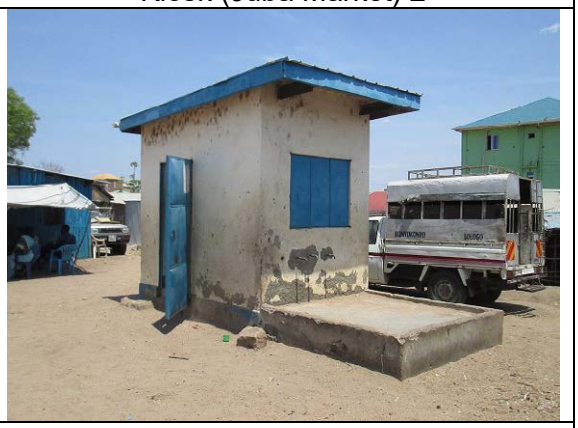
2.1.1. Existing Public Tap Stand

Previously, more than 60 PTSs were registered in Juba city. As of 2021, the inspection of registered connection was carried out and the present existing number is accounted for 17 in 2021. Of these, 8 PTSs were installed in the Munuki area as a pilot project in the JICA study on Juba Water Supply Master Plan (2009). The public tap stands in the Munuki had been in use, but they are currently not used due to inadequate water supply by less water production in water treatment plant.

In addition, three PTSs, called kiosks, were installed in 2012 during the JICA Technical Cooperatin Project (Phase 1). The kiosks installed in Juba Market have relatively sufficient water supply as they are located on the water distribution pipelines to the presidentional house and other top officials where water is always distributed with the priority. In addition, the location of the kiosks is in the center of the market and there are many water bycycle venders who come and go. For this reason, when we visited the site in the first year of Phase 2 of the Project, the kiosk was crowded with the surrounding residents, market workers, and bicycle water vendors who constantly brought jerry cans and piled up jerry cans.

Among the kiosks installed by the project, Munuki and Konyo-Konyo were in operation when they were first installed, but water is not being supplied due to chronic shortage of water supply and damage on the distribution pipelines caused by replacement and construction work, which have not been repaired for a long time. While, it was confirmed in Phase 2 (the Project) that the facilities of both kiosks did not have a critical damage, so that it can be ready for operation once the water supply is restored and minor rehabilitation is secured

	
PTS Munuki Community No.2	PTS Munuki Community No.4

	
PTS Munuki Community No.6	PTS Munuki Community No.8
	
Kiosk (Juba Market) 1	Kiosk (Juba Market) 2
	
Kiosk (Munuki)	Kiosk (Konyokonyo)

2.1.2. Management System of Public Tap Stand (PTS)

In Juba, there are public tap stands supported by JICA and USAID, and during the JICA Technicaal Cooperation Project (Phase 1), the expert team assessed the operational management status of the existing public tap stands based on past experiences.

(1) Operation and Management Model and Evaluation

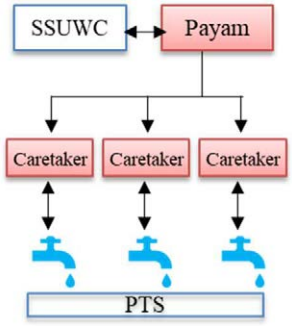
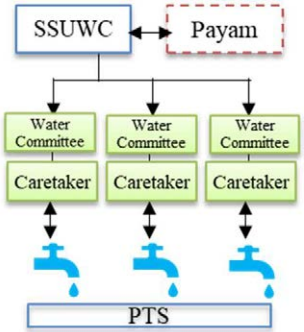
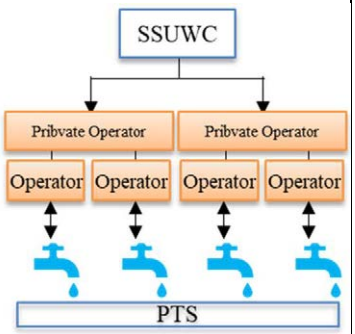
In Juba City, there are generally three types of models for the operation and management of PTS.

Operation and Management Models of PTS

The following table outlines the three types of operation and management models of PTS. In the

"Payam Management Model", SSUWC enters into a contract with Payam for operation and management, and Payam organizes a water committee for operation and management. In the "Community Management Model", SSUWC enters into a contract with a management committee organized in each community. The water committee will select a caretaker (water seller) to manage the operation of the PTS. In the "Private Operator Management Model", SSUWC will enter into a contract with a private ccompany, which will select a caretaker (water seller) to operate and manage the PTS.

Table 2-1 Management Model and Main Concept

	A. Payam Management	B. Community Management	C. Private Management
Management Structure			
Features	- Operated by Payam (local municipality). - Management costs are required. - Taking time for maintenance.	- Operated by community - Response to maintenance is quick. - Water is allocated even to the poor	- Efficient management is possible following market principles - No-response to the poor

Features of Management Models

The main features of management models of PTS are shown as below.

Table 2-2 Main Features of Management Models for PTSs

Aspect		Payam (Local government) Management Method	Community Management Method	Private Management Method
1	Ownership	The facility was set up by aid agencies and is located on public land. The management of the facility has been transferred to Payam. The aid agencies introduced the Payam management approach.	The facility was set up by an aid agency and is located on public land. However, after it was transferred to Payam, Payam entrusted the management of the PTSs to the neighboring community. The community participates in the maintenance and management of the facilities.	The facilities are privately owned, although they are installed by individuals, located on public land, and have public permits. All decisions, including the maintenance of PTSs, are left to the private operator.
2	Management	Payam has organized a cooperative for the maintenance of PTSs. The association includes neighbors and people from the Payam headquarters. Each PTS has two caretakers. These caretakers are responsible for selling water, collecting fees, sending money to	The community has organized a committee for the maintenance of the PTSs. This association elects a caretaker, and residents living near the facility are appointed as caretakers. These caretakers are responsible for locking the taps, selling water, and collecting water tariff.	The owner decides for a caretaker to run PTS. Some of them are operated by the owners themselves.

Aspect		Payam (Local government) Management Method	Community Management Method	Private Management Method
		Payam, and providing security.		
3	Maintenance/ Repair	Payam is responsible for the maintenance and repair of PTSs. When facilities are damaged or faulty, it is necessary to raise available funds, purchase parts, and repair the damaged parts. The motivation for repair and maintenance is to provide a service to the people, but the people who do the repairs are from outside the community, which causes delays in repairs.	The management association is responsible for maintenance and repair/repair. Any damage to the facility is reported to the committee and funds are taken from previous fee collections to make repairs. Repairs are done quickly because members pay from their previous income.	The owner has full responsibility for repairs and maintenance. The maintenance and repair motive is the loss of income due to interruption of operation.
4	Revenue Collection	water bill payments to the UWC. The problem is that some of the union administrators are chosen by residents who have no connection with the facility. Once the income is entered in the payam account book, the payam bureaucracy is extremely slow in responding to repairs and other issues.	The fees collected are sent to the union. In many cases, virtually the only members of the union are the opetrators and the chairperson, and other committee members are not actively involved. The union makes the decision to repair, and it does so quickly. The reason for this is that the committee members who make the decisions and the beneficiaries are the same person or group, and there is no bureaucracy involved. However, because it is an informal form of fund management, there is a possibility that when the need for funds arises, there will be no funds at all. However, this is not a problem unique to this model.	The fee is collected by the caretaker and paid to the owner. In some cases, the owners themselves are the toll collectors. Since loss of water supply time is loss of money, repairs are done very quickly. On the other hand, no attention or money is paid to unimportant maintenance items such as sanitation.
5	Satisfaction for water service	In general, users are not very satisfied with this model. The main problem is due to the fact that much of the time the water does not come. Others are that the facilities are not kept clean.	Prolonged water cutoffs are a cause of complaints as well. However, there is less complaining than in Payam management.	Despite the clutter of the facilities, there were few complaints from the users. Privately owned facilities seemed to have water running longer than others. In one case, there was a public faucet with a water storage tank, which helped to extend the water supply time.
6	Design	The facilities are all designed the same. The caretakers keep the faucets off during un-watered hours to avoid any damage to the facility. The problem is that this design makes the faucet connections loose and causes leakage. An improvement for this facility is the installation of a protective fence. Another improvement is to design the facility so that sand and other materials in the	This facility has a fence to prevent breakage. However, respondents noted that this fence is occasionally damaged due to busy water supply times and narrow entrances. No specific improvements were pointed out for this facility. However, the meter box does not have a lock, which makes it easy to become a garbage dump.	There is no specific standard design for this facility. However, since most facilities have only the minimum required facilities, many improvements can be found.

Aspect		Payam (Local government) Management Method	Community Management Method	Private Management Method
		immersion pit can be easily removed.		

Past Evaluation of Management Model of PTS

In the Phase 1, the above three management practices in place in Juba City were compared and evaluated in the following table. The evaluation covered only the eight PTSs implemented in the pilot project.

The results of the evaluation are shown below.

Table 2-3 Evaluation results of PTSs in the Past Project

Indicater	Payam Management Method	Community Management Method	Private Management Method
Efficiency from the supply side • Management cost • Ease of monitoring • Speed of payment	This model is the most expensive and most inconvenient model to manage and monitor. The cost is not so great, but it takes a lot of time. The major complaint is that the payment of fees is not done according to the contract. This is probably due to the bureaucracy of Payam, as the income goes into the Payam's account book. Furthermore, some of the residents who use this facility have the perception that the water supply is a free service provided by the government. Hence, the payment of fees by some residents is not good. (4/10)	Facilities managed under this model are easy to monitor. This is because decisions are made quickly and fees are retained within the association so that they can be paid as soon as the bill arrives. It is also more transparent because the people who manage and make decisions and the people who use the facilities are the same and live in the same area as the beneficiaries. High transparency translates into quick action. (6/10)	This model is the easiest to manage and monitor. The payment of fees by the manager is very prompt, as any delinquency in payment of fees leads to immediate suspension of water service and loss of revenue. (8/10)
Effectiveness from the supply side • Water supply to the poor group	From this perspective, this model is better than private management but worse than community management. The reason is that the tariffs are the same but the tariff payment is poor, hence the water supply is given less priority. (6/10)*1	From this perspective, this model is the best model. The advantage is the speedy payment of the fee. The decision makers are part of the beneficiaries and if the water supply is interrupted, the decision makers will also suffer and they will be accountable to other members of the community. (8/10)	From this perspective, this model is moderate. The advantage is that the water is allowed to flow for a longer period of time than other models. In some cases, the water is cheaper than the other model (1 SDG/100L compared to 1 SDG/80L for the other model). However, the location of this model is in an area that is not associated with the poor. (5/10)

Indicater	Payam Management Method	Community Management Method	Private Management Method
• Appropriateness of sanitary environment	It is relatively better than the private management approach, but worse than the community approach. This may be attributed to the fact that the caretakers are not paid enough. (5/10)	Sanitation facilities are well maintained and PTSs are in sanitary condition in most facilities. This is due to the direct accountability to the beneficiaries and the fact that the manager is also one of the beneficiaries. (7/10)	Sanitation is not taken into account at all. (There is a possibility of improving sanitation facilities if regulations are made to take them into account.) (3/10)
Effectiveness (user aspect) • Accessibility • Water quality • Water quantity • Cultural aspects • Environmental aspects • Sanitation	The location of PTSs is conveniently located by residents, but due to the short water flow time of those public taps, the real accessibility is not good. Community management practices are more unsanitary and the drains are clogged. These are affected by the low motivation of the caretakers. (6/10)	The locations of PTSs are conveniently located by residents. Access to water is better than in Payam management. The facilities are clean and hygienic. (8/10)	The facilities are only located close to the existing water pipes, and no consideration has been given to the residential areas of the poor. There is also no consideration for culture, environment, or sanitation. (3/10)
Efficiency (user aspect) • Cost	80L/SDG (Same amount as Community Management Method) (6/10) 80L/SDG (Same amount as community management approach) (6/10)	80L/SDG (Same amount as Payam Management Method) (6/10) 80L/SDG (Same amount as payam management approach) (6/10)	100L/SDG (Cheaper than other 2 methods) (7/10) 100L/SDG (cheaper than other methods in many cases) (7/10)
• Time it takes to get water	4 minutes in average (Same as community management approach) (8/10) Average 4 minutes (Same as community management method) (8/10)	4 minutes in average (Same as payam management approach) (8/10) Average 4 minutes (Same as payam management method) (8/10)	More than 4 minutes It is not a management problem, but the time it takes to get water due to the high demand. (5/10)
• Self-sustainability	- This model of self-sustainability is the lowest. - Due to bureaucracy, cost recovery, maintenance, and repair are not done very well. - Collected fees tend to be used for other purposes. (5/10)	- It has better cost recovery and self-sustaining development potential than the payam management method because it has procedures for handling revenur collection amount and there is self-sustainability. (7/10)	- Best cost recovery and high self-sustainability (8/10)

[Note]

*1 --- Evaluation scores in each indicators. Full score is 10.

As shown above, each management model has its own advantages and disadvantages. From the perspective of cost recovery and self-sustaining development, the private company management model is the best. On the other hand, the community management model was evaluated to be superior

not only in terms of cost recovery and self-sustainability, but also in terms of hygienic management of facilities, water supply to the poor, and other considerations.

Subsequently, in the Phase 1, public tap stands in the form of kiosk were constructed in three locations (Malakia, Juba Market, and Munuki) as pilot projects. For these facilities, the contract with SSUWC was not with payams or communities as mentioned above, but with private persons (individuals) livinging in areas close to the constructed kiosks as operators. These operators were introduced by the community or through the contacts of SSUWC's acquaintance. The "C Private Management Model" was applied as the operation and management model on a trial basis, with advice from the community in selecting the operators.

In Phase 2, the status of operation and maintenance of these three sites was checked and problems were reviewed. 2 sites, Malakia and Juba Market, were well managed. For Munuki, the issue was that the contracted operator was not fully functioning due to intermittent water supply conditions and limited water supply hours.

Table 2-4 Number of Public Taps, Pupulation served and Grouping by Area

	Place	O&M status	Issues	Improvement measure/ Action
1	Malakia (near Kator Payam Konyokonyo)	- Facility is operational - Facilities are clean and well maintained; - UWC reports good payment status.	- Water supply is intermittent due to power shortage problem at Konyokonyo pumping station. - For safety reasons, the water storage tank is located in a nearby compound. -	- Operation and management of the facility is good - Water is being supplied to a large number of people when it is available. - Therefore, the challenge for UWC is to improve the provision of water to users if the water supply situation to the facility is improved.
2	Juba Market (in Juba Payam)	- Facilities are operational. According to UWC, the payment of collection charges needs improvement, but the payments are made regularly.	- The water supply to the facility is good, but the demand is so high that all water supplies are drained. - No one is able to implement the project because the water can only be stored in the tanks during the night.	- A water storage tank, pipelines and ball valves are needed. - With these materials, it will be possible to store water at night when no one is around. - This maintenance work can be done by the UWC management.
3	Munuki (in the Payam)	The water supply to the facility is intermittent. The contracted manager is not functioning and the tap has not been opened	- The main problem is the admin, which needs to be replaced; an agreement was made with UWC in June to do the replacement, but it has not been done.	- The contract with the 1st operator was scrapped and the selection of other operator is implemented.

(2) Proposal for Adoption of Private Operator Model

The evaluation was conducted in the first half of Phase 1 targeted only conventional 8 PTSs, and

the results were showed that community management method is better than other methods. On the other hand, the number of PTS to be constructed under the grant aid project is large-scale with 120 locations. It is judged to be difficult to operate and manage PTSs directly by the SSUWC Juba station, which has limited staff and management capacity, in accordance with the community management approach.

For the operation and management of the PTSs (kiosk type) constructed in Phase 1, the expert team tried to use a private management approach although we received support from the community in the process of caretaker selection. It was demonstrated that the operation and management could be basically done well with this management mdel if the water supply from the SSUWC was sufficient. In this connection, the expert team believes that the most appropriate model for the operation and management of PTSs (kiosk type) to be constructed under the grant aid project is to use the private sector, and the expert team recommend that this model be adopted as the basic approach.

(3) For Application of Private Operator Model

Group Management of Public Tap Stand (Kiosk Type)

In order to outsource the operation of PTSs to the private sector, the expert team propose to contract out the PTSs by grouping on the basis of region. The detail of number and scale of the groupings shall be determined in the next phase of the project (the next project), by taking into account the number of potential private operators and their management and financial capabilities. At the beginning of the next project, a preliminary survey shall be conducted about potential and eligible private operators who have interest to participate in. Then, the appropriate grouping of PTSs on the regional basis shall be considered.

For example, if there are more than three potential private operators with interest, it is recommended that some of the original areas are efficiently grouped into three, and that SSUWC will contract out the operation of PTSs to three private operators. In this grouping, one private operating company will cover around 35-43 PTSs.

On the other hand, if only small and medium-sized private companies are interested in participating, it is assumed that the operation of PTSs at nine areas will be contracted out. Alternatively, depending on the regional situation, mixed grouping of small and large private operating companies could be considered flexiblly.

Table 2-5 Number of Public Tap Stands, Pupulation served and Grouping by Area

Group	Area	Population served	Number of Tap	Supply Water Volume (Design capacity)
Group 1	1. Gudele	7 500	15	559 m^3/day
	2. Munuki	1 1500	23	
	3. Juba na bari	2,500	5	
Group 2	4. Moura	3 500	7	455 m^3/day
	5. Jebel Market	11,000	22	
	6. Nyakuron	3,000	6	
Group 3	7. Juba Town	7,500	15	546 m^3/day

Group	Area	Population served	Number of Tap	Supply Water Volume (Design capacity)
	8. Kator	8,000	16	
	9. Lologo	5,500	11	

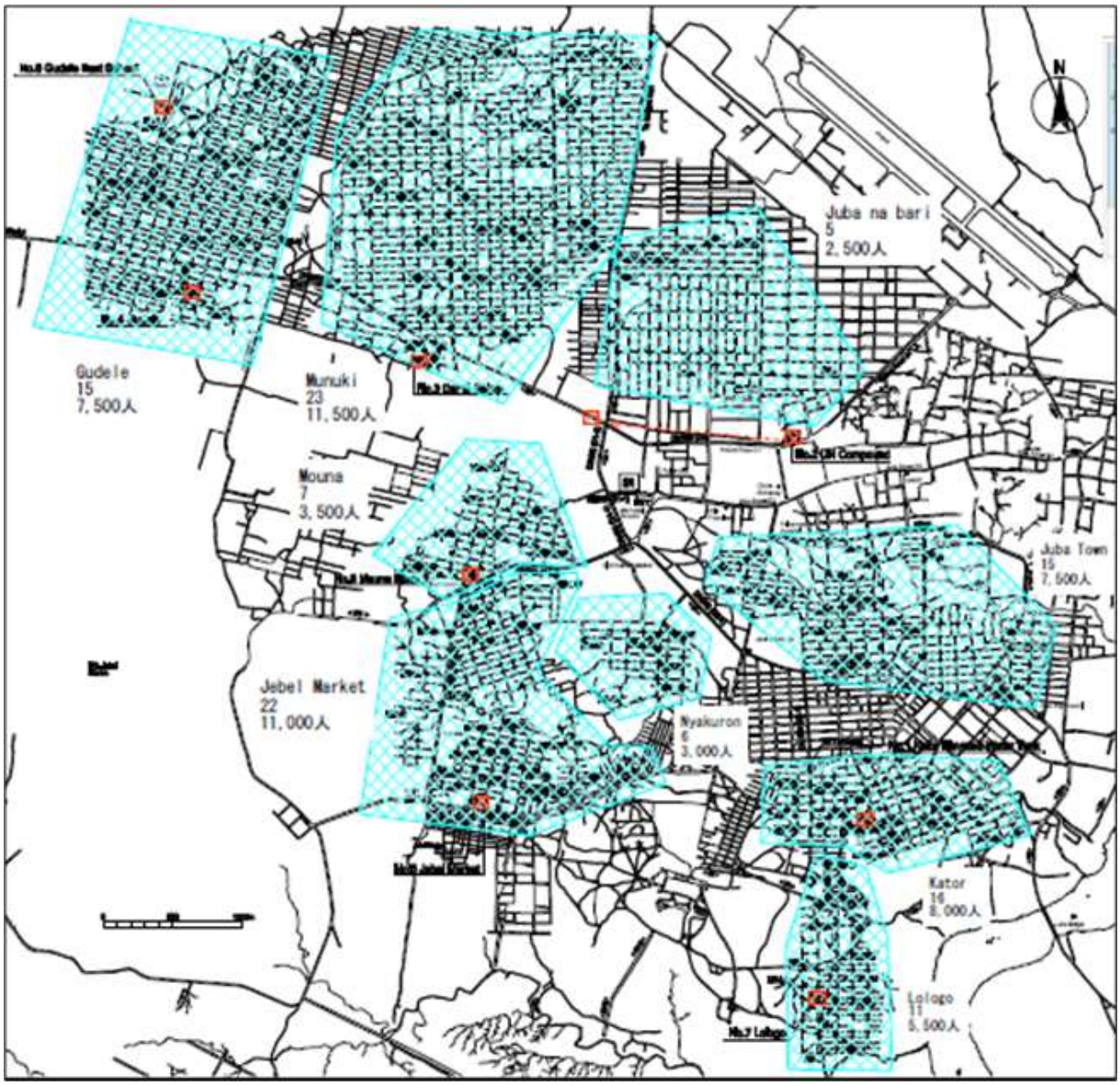


Figure 2-11　9 Groups of PTSs designed by the Grant Aid Project

The method of selecting the private operators, criteria, supply regulations, etc. will be discussed in detail in the next project, but the scope of responsibility between the SSUWC and the operator is expected to be almost the same as that of the aforementioned TFSs.

Issues to be Considered

The following table shows the issues to be considered when outsourcing operation and management to the private sector. In the next project, it will be necessary to take into account these points and establish a more appropriate operation and management system.

The PTSs to be constructed by the grant aid are extensive and large-scale, and even in neighboring countries in Africa, these are rare cases and challenging endeavors. Therefore, it is important not to seek for perfection from the beginning, but to gradually improve them as they are put into operation to get closer to the optimal operation and management model.

Table 2-6 Main Issues to be Considered for Private Management Model

Item	Remark
Selection of Caretaker (water seller)	• The caretaker should be be a resident as close as possible to the PTS to be constructed. The facility will be operated and manned early in the morning every day. • The caretaker should be a resident as close as possible to PTS that will be constructed. Since the facility will be in operation and stationed early in the morning every day, the closer the physical distance to the PTS is better. • Also, as practiced in Phase 2, a clause could be included in the contract with the private operator that the community will be fully consulted in the selection of personnel, or that they will be hired from the community, and that a manager will be stationed at the facility. • The users of PTSs are generally local residents living near the facilities, and a manager with ties to the community is expected to be more morally aware and provide smoother service. We have received advice from the Juba City Council on this matter.
Capacity building of operator	• Lessons learned from the master plan study show that if the operators are hired from residents living in the area who have no experience working for a company or government agency, the challenge will be that they will not have much knowledge about the operation of the kiosk's euipment and accounting. Therefore, it is necessary to include a clause in the contract that the contractor should provide training to the managers. • It is also desirable to include in the requirements for selecting private sector providers the ability to provide training to operators. • In the initial stage, SSUWC will also need to explain to the contractor the operation of the equipment and, if necessary, the accounting method.
Selection of private operator and capacity building	• The private operator is judged to be the most appropriate model, but the challenge is that there are few private operators with experience in contracting out the management of large numbers of PTSs. This type of management in Juba is unique and has not been seen in other neighboring countries. • The SSUWC needs to take a medium- to long-term perspective to improve the operation and management of PTSs in a more appropriate manner while fostering private sector operators. For this purpose, it is important to improve the capacity of SSUWC to manage the contract.
Attention to poor people	• Past analysis has indicated that the management approach by the private sector is worse to the community management approach in terms of consideration for the poor people. In particular, the users of PTSs are relatively poor. In order to compensate for this disadvantage of the private management approach, the selling price of PTSs should be carefully set from the perspective of cross-subsidization so that it satisfies the residents' affordability and is cheaper than other water supply methods. In setting the price, the price setting guidelines should be observed.
Clear division of repair and rehabilitation	• It is necessary to clearly stipulate in the contract between SSUWC and the private sector on the division of repair and maintenance work.

Item	Remark
between SSUWC and private operators	• As for the repair and maintenance, the private oerator should be responsible for those that are commonly available materials and equipment in Juba.While SSUWC should purchase and keep in stock special equipment and materials (water meters) and spare parts that require importation, and sell them to the third party contractor when they are needed.
Monitoring and inspection of facilities	• SSUWC is required to monitor and inspect the condition of the facilities of PTSs on a regular basis. Routine inspections are the responsibility of the private operator and should be included in the terms of the contract. • SSUWC should review the inspection records and periodically check the facilities for defects or malfunctions and monitor the facilities to ensure that they are operational at all times.
Compliance of selling price and revenue collection management	• Sales prices should be uniform without exception, and operators should be made aware of this through consignment providers. Manipulation of selling prices may cause inequality and dissatisfaction among customers. • The amount of water sold and the revenue amount collected should be matched, and regular reporting to the contractor should be included in the contract as a clause. • SSUWC should ensure that the amount of water sold and the fees collected are monitored and confirmed through water meter reading.
Reconsideration of revenue collection methods	• As reported in cases in other countries, the direct exchange of cash is a cause of corruption and stolen money. In all past pilot projects of PTSs, cash collection was used, but to avoid the above-mentioned risks, we propose the trial introduction of token coupon tickets system. • The introduction of token coupon tickets will reduce the chances of cash exchange between customers and operators as much as possible, and will also reduce cumbersome operations. • It is better to sell token coupon ticket not at the place of PTSs if possible, but at the one place in the center of responsible area. So the cost of this arrangement is included in the bidding price of candidate contractors. • The disadvantage of this is the additional cost of producing the coupons is occured. In order to produce a standard token coupon ticket, it may be better for SSUWC to be responsible for this.

2.2. Case Study of PTSs in Other Countries

In African countries, many PTSs are in practice, while, similar to TFSs, the more detail information of good practice of PTSs' management is not sufficiently identified through only internet search. Therefore, this report is limited to introduce only available information on case study and experiences from the country where private sector is involved.

2.2.1. PTSs using PPP approach in Ruwanda Rural Water Supply

Community management was implemented in Rwanda from 1987-1994. Standpipe users were grouped into committees whose members were elected by the users. The model very quickly showed its limits. Ruwanda adopted a private-operator management method under PPPs, which the government encouraged. By the improved management, the government decided the experience in

utility management to extend its mandate to engage the private sector directly to manage rural water infrastructure. For the details, refer to reference material.

4. African Development Bank (2015) “Water Supply & Sanitation in Africa: Findings, Lessons and Good Practices to Improve Delivery”

2.2.2. PTSs managed by Semall-Medium Size Private Company

A small-medium size company started the business as a drilling contractor. Then, they are working with a community on the outskirts of Kampala and built a small, pumped supply system serving coin-operated public tapstands. These automatic machines provide a 24-hour service, reduce staff costs, reduce wastage through pre-measurement and have low maintenance requirements. For the details, refer to reference material.

5. Water and Sanitation Program (2002) “Water Services in Small Towns in Africa: The Role of Small and Medium-Sized Organisations

Annex-8: Remote Training Report

THE GOVERNMENT OF SOUTH SUDAN
MINISTRY OF WATER RESOURCE AND IRRIGATION (MWRI)
SOUTH SUDAN URBAN WATER CORPORATION (SSUWC)

THE PROJECT FOR MANAGEMENT CAPACITY ENHANCEMENT OF SOUTH SUDAN URBAN WATER CORPORATION PHASE 2

REMOTE TRAINING REPORT

FEBRUARY 2022

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

TEC INTERNATIONAL CO., LTD.

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1. Outline of Remote Training

1.1. Background

Due to the political conflict that occurred on 8 July 2016, JICA Experts suspended the Project activities in Juba city and evacuated from South Sudan. Based on this situation, Project activities were continued as a remote training until entering in South Sudan was permitted. Remote trainings were implemented in neighboring countries namely Uganda and Kenya.

Based on the discussion with SSUWC in Uganda, National Water and Sewerage Corporation (NWSC) of Uganda accepted to implement the training for SSUWC trainees, and the remote trainings were started from November 2016 in Term 1 in cooperation with NWSC and JICA Experts. As for Kenya Water Institute (KEWI), they accepted SSUWC trainees from November 2016 as they had implemented third country training in the Phase 1 of the Project. Host institution for this remote training was centralized to only NWSC from May 2017 in Term 2. Training for SSUWC Headquarters (HQ) in Japan and Cambodia was also implemented in Term 2. The remote training continued in Term 3 and was completed in April 2019 and the field work in South Sudan started in the same month.

Remote training consists of not only classroom lecture by JICA Experts but also practical training and classroom lecture by NWSC and KEWI.

1.2. Overall Targets

Basic knowledge and skills on management of water utility and operation and maintenance (O&M) of water facilities will be acquired in remote training by JICA experts, NWSC and KEWI. Based on the acquired knowledge and skills, the counterparts will efficiently operate the facilities and manage the utility, finding the problems in actual work and improving O&M of water supply system.

In Term 1 and Term 2, main staff members of SSUWC were targeted as trainees, and in Term 3, the remote training will be given to new counterparts who have not yet received any remote training. The counterpart who has received remote training in Term 1 and Term 2 will be a training leader in remote training.

1.3. Outline

1.3.1. Training environment

(1) National Water Supply Cooperation (NWSC)

The following training facilities and venues of NWSC were utilized for remote training.

- International Research Center (IREC)
- Ggaba vocational skill development training center in Ggaba water treatment plant
- NWSC company and stations
- Water treatment plants and pipeline network for OJT

IREC

Ggaba vocational skill development training center

(2) Kenya Water Institute (KEWI)

Training facilities of KEWI were utilized for remote training.

- KEWI training center

Lab training in the center

Discussion room in the center

1.3.2. Training subjects and trainers/ Lecturers

Training subjects and trainers/ Lecturers are listed in the table below.

Table 1 Training subjects and trainers/ Lecturers

Subject	Trainer/Lecturer
1. Financial Management/ Management of tanker filling station (TFS) and public tap stand (PTS)	Yamada Shoko/ Ohno Atsuo
2. Public Awareness	Sawazaki Yasushi
3. O&M of Distribution Pipeline Network	Sato Yarai
4. Non-Revenue Water Management	Phatta Thapa
5. GIS	Alok Kumar/Phatta Thapa
6. O&M of Purification Plant (Elc&Mech and Water Treatment)	Matsumoto Naohide
7. Water Quality Management	Morita Yasuhiko
8. Headquarters (HQ) Management	Sato Hirotaka

1.3.3. Training period and schedule

The period and schedule of training by term is shown in the table below.

Table 2 The period and schedule of training by term

Term	No.	Period	Content
1	0	31st October 2016 – 5th November 2016	Preparation work (Discussion with SSUWC on remote training in Uganda and visiting NWSC and their training facilities and discussion with NWSC)
	1	20th November 2016– 3rd December 2016	1st training in Uganda and Kenya
	2	8th January 2017 – 21st January 2017	2nd training in Uganda and Kenya
2	3	6th June 2017 – 15th July 2017	1st training in Uganda
	J	28th June 2017 – 7th July 2017	Training in Japan
	C	10th July 2017 – 14th July 2017	Training in Cambodia
	4	4th September 2017 – 28th September 2017	2nd training in Uganda
	5	1st November 2017 – 9th November 2017	3rd training in Uganda
	6	28th November 2017 –22nd December 2017	4th training in Uganda
	7	1st February 2018- 10th March 2018	5th training in Uganda
	8	16th April 2018 – 21st April 2018	6th training in Uganda
3	9	30th October 2018 – 6th November 2018	1st training in Uganda
	10	4th December 2018 – 15th December 2018	2nd training in Uganda
	11	29th January 2018 – 7th March 2018	3rd training in Uganda
	12	9th April 2019 – 13rd April 2019	4th training in Uganda

The number of trainings by subject is shown in table below.

Table 3 The number of trainings by subject

Item	Term 1(2016/2017)			Term 2 (2017/2018)						Term 3 (2018/2019)			
	Prep.	1	2	3	4	5	6	7	8	9	10	11	12
	Oct.	Nov.	Jan.	Jun.- Jul.	Sep.	Nov.	Nov. - Dec.	Feb.- Mar.	Apr	Oct.- Nov.	Dec.	Jan.. - Mar.	Apr.
1. Financial Management/ Management of tanker filling station (TFS) and public tap stand (PTS)		1	2	3	4	5	6	7		8	9	10	11
2. Public Awareness		1	2		3	4	5	6		7			
3. O&M of Distribution Pipeline Network		1	2	3	4		5	6		7		8	
4. Non-Revenue Water Management		1	2	3	4		5	6		7		8	
5. GIS		1	2	3			4	5				6	
6.1 O&M of Purification Plant (Elc&Mech)		1	2	3	4		5				6	7	
6.2. O&M of Purification Plant (Elc&Mech) (Water Treatment)		1	2	3	4		5				6	7	
7. Water Quality Management		1	2	3	4		5				6	7	
8. Headquarters (HQ) Management	○	1	2	3			4	5	6	7		8	

1.3.4. Attendance of trainees

A list of attendance of trainees/counterparts (C/P) in remote training is give in Appendix 1, and a summary of the number of participants by output are shown below.

Table 4 Ssummary of the number of participants by output

Subject	Term 1	Term 2	Term 3
1. Financial Management/ Management of tanker filling station (TFS) and public tap stand (PTS)	11	29	22
2. Public Awareness	10	20	5
3. Distribution Pipeline Network 4. Non-Revenue Water Management	10	27	14
5. GIS	6	9	3
6. O&M of Purification Plant (Elc&Mech) (Water Treatment)	12	20	20
7. Water Quality Management	6	9	7
8. Headquarters (HQ) Management	12	22	37
Total	67	136	108

Remarks: the number indicates cumulative total numbers.

2. Contents of Remote Training

2.1. Topics of training

The detail topics that C/P learned in the remote training are shown below.

（1） Financial management/Water tariff setting

Items	Term 1
1	- Meaning, definition and calculation method of PIs on finance, billing and collection, PI calculation by calculator - Calculation of PIs on finance, billing and collection by calculator and Excel - Action plan and strategy of NWSC for improvement of billing and collection - Management of financial and budget management, accounting of cash flow
2	- Check of the homework (monthly report and PIs) - Progress of strategy action plan for billing & collection improvement - Training for MS Access, water tariff collection database - Review of preliminary list of large outstanding customers and discussion of arrears collection - Preparation on meter installation plan - Water meter utilized in NWSC, Specification and Procurement - Identification of challenges on billing & collection and updating of the action plan for improvement - Billing & collection practice of NWSC - Site visit (Teller's office, meter reading practice etc.) - Modification of Customer Management Database (MS Access) - Joint discussion with PR Team on cooperation of arrear collection and meter installation - Check of the draft water meter installation plan and modification, as necessary - Check and review of draft contract form, terms & conditions - Discussion on billing & collection report format based on the draft idea - Analysis of billing ratio by area (MS Access and Excel) - Working together with GIS team. Linkage between customer database and GIS information - Tariff setting principle and guideline
3	- Checking homework (monthly report, PI data sheet) - Implementation monitoring of action plan about tariff billing and collection - Update customer list (especially institutional customer)

Items	Term 1
	- Survey of water supply equipment and meter procurement (Uganda, Kenya) - Visit supplier and ask for quotation - Find issues of tariff collection and update action plan - Plan and implementation of NWSC asset management training - Site visit (HQ, Asset management system) - Revise water meter installation plan (draft) - Demonstration of water tariff calculation (considering operation hours and NRW rate) - Trainings and presentation about water tariff calculation with SSUWC HQ - Review of tariff setting guideline (Draft)

Management of tanker filling station (TFS) and public tap stand (PTS)

Term	Term 1
1	- Lecture on sustainable operation and management of PTS & TFS in African countries - Case study: Management of PTS & TFS of NWSC - Lecture on financial management for financial situation, budget management, accountant and cash flow - Operation cost estimation for ten years in Juba branch. Worksheet preparation - Outline of the 1st guideline of tariff setting and discussion on water tariff - Site visit at PTS & TFS of NWSC - Selection of core problems through PCM workshop and objective analysis
2	- No implementation.
3	- No implementation.

（2） Public awareness (PA)

Term	Contents
1	- Brainstorming on meaning, importance of PA and why it is required. - Preparation of detail PA activity plan, finalizing a proposal and estimation sheet. - Confirmation of contents of PA pamphlet.
2	- Establishing a customer section at Juba Station - Discussion on establishment of the customer section in Juba with staff in charge of customers section in NWSC - Learning of PA reporting system from Uganda example - Discussion on PA for clean water provision to citizens and bill payment - Workshop: Planning and budgeting for PA - Finalization of the detailed plan of the PA activities - Practice of evaluation and feedback of PA activities (Report writing) - Recording of data and analysis to evaluative PA activities - Joint discussion on cooperation of arrear collection and meter installation - Field observation for the customer care services of NWSC in Kampala town
3	- To Review the Monitoring and Evaluation for Public Awareness Activities - To plan Customer section Planning:　Aim and method - learn the experience and examples in Japan (Tokyo metropolitan government, (Yokohama city) - Field Observation of front line for the customer care services in Kampala town NWSC to drafting the manual for plan Customer section

（3） Operation and maintenance of distribution pipe network

Term	Contents
1	- Basic mathematics (Addition, subtraction, multiplication and division, common fraction, unit conversion, square and cubic) - Maintenance of pipe network (Pipe material, corroding and corrosion proof, pipe washing, durable

	years) - Distribution pipe information and pipe material inspection - Hydraulics-1 (Kind of flow, supply amount and current velocity, water pressure, principle of Archimedes and friction loss) - Management method of water distribution network (How to control pipe network) - Hydraulics-2 (Supply amount, current velocity, cross section, and supply amount formula) - Running management (Customer satisfaction, water tariff, NRW and asset management - Lecture on PIs (Necessity and meaning of PI) - Review (Basic mathematics and hydraulics) - Service pipe connection (Meaning, method, procedure, and type of service connection) - Stock management - Learning PC for the monthly report - Lecture for NRW calculation, monitoring plan, NRW calculation and NRW prevention
2	- Discuss with WTP team how to increase water volume in Juba Station - Install house connection using HDPE - Training on pipe fitting and jointing at VSDF workshop - Maintain mechanical flow meters and valves and meter reading at NWSC - Visit pipe material supply companies and collect price data - Weld pipes and fittings conducted at VSDF - Study monthly report and PIs at IREC - Practice on reporting O&M and pipe pluming works
3	- Lecture on pipe materials, parts and valves for maintenance of pipe network both in classroom and workshop - Learn actual works for repairing leakage pipe on sites conducted by NWSC - Lecture on how to use leak detection equipment at NWSC workshop - Lecture on dismantling and assembling bulk flowmeter both in classroom and sites - Practical training on connecting/ dismantling different pipe materials, valve, flowmeter using fitting parts at the VSDF demonstration field. - Discuss what kinds of pipe materials, parts, tools and vehicles needed in Juba Station - Trainees gave JICA expert the presentation regarding the current operational situation of Juba Station using PPT.

（4） NRW management

Term	Contents
1	- Lecture and practical training IWA criteria, water balance and Non-Revenue water - Lecture on reduction approach for commercial loss and physical loss - Group discussion on water leak detection method in Juba - Concept of a water supply division plan separable by valves - Finding method of buried pipe and introduction on flow and pressure measurement - Lecture on water leakage mechanism, water leakage prevention and effective water leakage detection - A water supply division plan separable on GIS by valves is drawn up - Buried pipe, leakage detection, flow meter and pressure gauge in NWSC branch was visited - Gentex factory in Kampala was visited and understood on pipe fittings and connection method - Outline explanation on operation and management index and its importance - Lecture on data collection for monthly report - Safety management (labor hygiene/health safety) - Stockyard management and the record - Leak repair method for various pipe materials - Lecture on detection method of high potential of NRW - Water leakage prevention method in planning and design phase - Updating of water supply division plan of Juba city with C/Ps - Discussion on the contents of NRW management manual draft
2	- Training as below; ・Repairing leaks ・Preparing reports of leak repair at site

	・Pipes installment and connection ・House connection ・Selecting tools and equipment required for pipe repair and plumbing ・Maintenance of valves, change parts, stop leakage, mechanical flow meter ・Welding pipes and fittings - Select pipe repair and plumbing tools required for Juba Station - Select pipe, saddle snap tap, and fitting materials and their specifications required for Juba Station - Visit pipe, fitting and tools companies and collect data such as specifications, price, etc. - Following items were prepared ・Report format of pipe repairs ・Leakage repair action plan ・Plan of pipe connection and house connection work ・List of tools and equipment for leakage repair and pipe connection - Review of causes and countermeasures of NRW - Practice for disassembling, repairing and assembling mechanical bulk meter and meter - Updating of DMA plan, pipe network and customer information - Estimate of valve and DMA meters - To report and grasp the current operation situation and distribution network in Juba WTP by SSUWC distribution and WTP staffs - To make the plan for supplying water to consumers equally in Juba Station - Practical training on how to calculate Performance Indicators - To learn about NRW reduction and DMA management of Entebbe branch of NWSC - Drafting of action plan for leakage reduction - Explanation of zoning system in Juba - Monitoring format preparation for water sales by tanker - Exercise on equitable supply and water distribution management in Juba - Preparation of a draft manual on leakage reduction, and equitable water distribution - Exercise on meter reading - Practice on recording leakage report and leak repair report
3	- Lecture on overall maintenance procedure of distribution by NWSC; maintenance process, leak detection process, and leak repair process - Explanation and demonstration of equipment and materials of leak detection and distribution management in NWSC - OJT of leak repair at 3 sites; Muyanga, Nakawa, and Salama road - Practical training on maintenance of bulk meters; how to open, clean, and repair - Practical training on connecting various types of pipe materials at Ggaba training site - Exercise on preparation of leak repair report - Exercise on preparation of monthly report of distribution, review of report prepared by SSUWC counterparts - OJT on making new branch and installation of house connection at two sites; Markandya area and Bunga area

（5）GIS

Term	Contents
1	- Water treatment plan, water distribution and customer information update - Potential customer visualization by GIS in water supply area - Customer who are not enrolled in water supply services, searching by GIS - Linking to customer location information on GIS and customer information in financial department
2	- Review of data and information brought from Juba - Update of GIS manuals - Updating of pipe network and water facilities map and map for customer survey data on GIS. - Installation and updating of QGIS software in new computers - Basic GIS skills (editing layer, creating new layers, coordinate reference system, symbolizing etc.) - Medium level GIS skills (labelling, querying etc.) - Advanced GIS skills (map and map book preparation, new symbol preparation with Inkscape

	software etc.) - Update of pipe network, valve, flowmeter, tank, and WTP information - Review of final result of customer mapping - Lessons and practice on linking customer data (MS Access) to customer points in GIS
3	- Refresher training on GIS using QGIS; basic, intermediate, and advance level skills - Updating GIS map of Juba pipe network and water facilities - Practice on preparation of GIS basemap and mapping of customers of Wau city - Preparation of draft SOP for updating pipe network and customer data

（6） Operation and maintenance on water purification facilities

Term	Contents
1	- Organization and duties of purification department - Countermeasure in case of accident - Water treatment theory and equipment for sedimentation - Preparation of operation and maintenance manuals and comparison with current situation - Confirmation of content of Monthly Report - Site visit at Ggaba WTP and explanation of operation and maintenance - Lecture and practical lesson on the generator - Lecture of water treatment plant operation - Lecture on procurement of chemicals, materials and spare parts - Discussion on current problem of water treatment O&M - Cleaning for recovering of function of sand in filtration - Lecture and practical lesson on pump - Basic knowledge on procurement method including inventory management - DAVIS & SHIRTLIFF (INTL) LTD, electrical equipment supplier visiting - Equitable water distribution plan preparation for each area in Juba by pump operation - O&M fee (fuel cost) calculation method
2	- Generator: practice (repair and inspection) - Practice at Ggaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control) - Equipment list, spare parts list, expendable list - Lecture for safety management and storage management - Visit at supplier of generator, pumps, electrical parts - Pump, blower and valve: practice (repair and inspection) - Chemical feeding equipment: practice (repair and inspection) - Electrical equipment (Panel, wiring, instrument): practice (repair and inspection) - Practice of electrical equipment, panel wiring - Repair and inspection (wiring, panels, change over switch, contactor, meter, cable, tool etc.) - Visit at manufacturer of electric panel - Lecture for maintenance procedure - Practice of generator (overhauling, trouble shooting, Generator panel electrical wiring) - Equipment spare parts consumable list - Equitable water supply and water quality monitoring - Training of electrical (flow meter, motor, panel, wiring, protection system).
3	- Organization and duties of purification department - Countermeasure in case of accident - Water treatment theory and equipment for sedimentation - Preparation of operation and maintenance manuals and comparison with current situation - Confirmation of content of Monthly Report - Site visit at Ggaba WTP, - Lecture and Practice of operation and maintenance - Lecture and practical lesson on the generator, motor, pump, blower, valve. - Lecture of water treatment plant operation - Lecture on procurement of chemicals, materials and spare parts - Discussion on current problem of water treatment O&M - Cleaning for recovering of function of sand in filtration

Term	Contents
	- Lecture and practical lesson on pump - Basic knowledge on procurement method including inventory management - Equitable water distribution plan preparation for each area in Juba by pump operation - O&M fee (fuel cost) calculation method

（7） Water quality management

Item	Term 1
1	- Unit for water quality analysis and unit conversion - Theory and process management of coagulation, sedimentation, sand filtration and chlorination - Introduction of biological test - Laboratory training of Jar test - Laboratory training of chlorine demand test - Calculation of coagulant injection ratio using Jar test data - Calculation of chlorine injection ratio using chlorine demand test data - Water quality data review and monthly report preparation including water quality data analysis training using Excel - Jar test data review and monthly report preparation - Site visit at National Water Quality Laboratory (Nairobi city) - Site visit at Nairobi Water Kabete WTP and water quality analysis company - Site visit at Ticka water and sewerage company (THIWASCO) - Visit to water quality monitoring equipment / reagent distributors in Nairobi (Aqua treat solutions, Aqua tech industries)
2	- Interview and discussion about actual water quality condition and issue in Juba City - Theory of water treatment - Water quality data review and monthly report preparation - Jar test data review and monthly report preparation - Calculation of coagulant and chlorine injection - Quality control of water quality monitoring data (Lecturer: NWSC) - Introduction of Ggaba WTP I, II and III (Lecturer: NWSC) - Preparation of SOPs for pH meter calibration and EC meter calibration - Training about water quality monitoring data quality and accuracy management - Joint workshop with SSUWC WTP C/P: Improvement of water treatment process - Joint workshop with SSUWC WTP C/P: Calculation of coagulant and chlorine injection - Proficiency test and follow up - Laboratory training of pH and EC meter calibration and analysis - Laboratory training of turbidity and residual chlorine meter calibration and analysis - Laboratory training of chlorine demand test - Practical training at Ggaba WTP with SSUWC WTP C/P - Site visit at Ggaba WTP (Water quality laboratory and water monitoring system) - Site visit at WWTP in Kampala - Site visit at Jinja WTP with SSUWC WTP C/P - Site visit at Masaka WTP with SSUWC WTP C/P - Visit to water quality monitoring equipment / reagent distributors in Kampala (Palin test, Mulago hill, Vision scientific)

3	- Water quality data review and monthly report preparation - Quality and accuracy control of water quality monitoring data - Joint workshop with SSUWC WTP C/P: Rapid sand filtration - Joint workshop with SSUWC WTP C/P: Revision of existing SOP for WTP operation and WQ monitoring - Training of occupation health and workplace safety (Instructor: NWSC) - Training of water quality data analysis - Site visit at service reservoir in Kampala city - Visit to water quality monitoring equipment / reagent distributor in Kampala (Palin test)

（8） SSUWC Headquarters (HQ) management

Term	Contents
1	- Review of problem analysis for Juba Station - Review of baseline survey result on Juba Station - Review of capacity assessment result on Juba branch - Preparation of report, plan and evaluation manuals - Performance indicators and record format - Role of SSUWC headquarters and duties of sections - Reform history of NWSC, Implementation of improvement program and the result - Brainstorming for improvement plan - Water tariff policy and guideline - Plan preparation method and budget estimation method in Juba branch - SWOT analysis and action plan preparation
2	- Progress of action plan by SSUWC HQ and discussion on issues for implementation - How to establish communication system between JICA Team and SSUWC HQ/Juba Station - Whole structure of standards, guidelines, manuals, and standard operation procedure (SOPs) of NWSC - How to prepare manuals and SOPs - Organization structure of NWSC and functions of sections/departments and Stations / Areas and job description - How to prepare job descriptions - Exercise of preparation of job description - How to strengthen leadership and problem-solving capacity - Update of action plan by SSUWC HQ - Preparation on table of contents of operation manuals of HQ - Presentation of problem analysis by newly appointed area manager of Juba - Communication method between HQ and Juba Station/ other stations - Progress of Juba Station improvement plan and challenges for implementation - Progress of SSUWC reform plan and discussion on challenges for implementation - Governance of water utilities, experience from Cambodia training - Meeting with JICA on PDM function of Board of Directors and Headquarters - Responsibility of Headquarters and Stations - Evaluation of monthly report of Juba Station - Preparation of Responsibility and duties of Directorates in HQ - Progress of evaluation of Monthly report of Juba Station by SSUWC HQ - Action plan presentation by each department - Follow up presentation of action plans after improvement by Juba Station - Follow up presentation of action plans after improvement by HQs
3	- Progress report and monitoring of HQ action plan - Progress report and monitoring of Juba Station action plan - Visit to NWSC branch office (Kampala Water Corporation, Kampala Water Corporation Branch) and NWSC HQ to interview of operation management - Evaluation of presentation by finance management team about water tariff at Juba Station - Development of Performance Contract between SUWC HQ and Juba Station - Evaluation and feedback from HQ regarding monthly report by Juba Station

2.2. Training program

The training program is given in the appendix 2.

2.3. Training materials

The summary of training materials is shown in the table below.

(N): NWSC, (J) JICA expert, (S) SSUWC

Subject	Term	Serial No.	Material/File name
1. Financial Management/ Management of TFS and PTS	1	1-1 (J) 1-2 (N) 1-3 (N) 1-4 (J) 1-5(N) 1-6(N) 1-7(N) 1-8(J) 1-9(N) 1-10(N) 1-11(N) 1-12(N)	・ Performance Indicators 20161122 ・ Billing Management ・ Revenue Management Training ・ Strategy Action plan to Improve Billing (draft) 291116 ・ Financial management and related topics-Nwsc ・ Over view of Tariff Setting and Tariff Structures ・ Introduction to Practical Exercises in Tariff Modelling ・ Guideline for water tariff setting (first draft) ・ Regulation and Adjustment Mechanisms of Tariffs SS ・ Introduction to Practical Exercises in Tariff Modelling ・ SS DEL Tariff Training ・ SS DEL_Evaluation -Tariff review and affordability study
	2	1-13 (J) 1-14 (N) 1-15 (J) 1-16 (J) 1-17 (J) 1-18 (J)	・ Strategy Action plan to Improve Billing ・ Water Meter specification and procurement ・ Ideas of brochure for meter installation ・ Notice For Bill settlement ・ METER READING SHEET ・ Complainers Registration Form
	3	1-19 (J) 1-20 (J) 1-21 (J) 1-22 (N) 1-23 (N)	・ Annual report (sales, finance) ・ 24h_Simplified Tariff Setting Estimation_Practice_190215 ・ Meter Installation Plan Draft ・ Concept and basic knowledge of NWSC Asset Management ・ NWSC_Netbook value report details
	4 (TFS&PTS)	1-24 (J) 1-25 (J)	・ Sustainable Operation & Management of PTS&TFS (PPT) ・ Project Analysis and Objective Analysis
2. Public Awareness	1	2-1 (J) 2-2 (J) 2-3 (J)	・ Pamphlet 2016 Nov 25 ・ Proposal of Public Awareness in Juba ・ Assessment tool draft
	2	2-4(J) 2-5(J) 2-6	・ Inventory of PA Material ・ Knowledge, Attitude Assessment Sheet ・ Banners, T-shirt, Caps
	3	2-7 2-8 2-9(J) 2-10(J) 2-11(J) 2-12(J) 2-13(N) 2-14 (N) 2-15(N)	・ Tokyo metropolitan government (Water Supply in Tokyo) ・ Yokohama city (Public relation of Yokohama Waterworks Bureau) ・ Assessment Data Analysis ・ Report on Assessment on Knowledge, Attitude in Juba ・ Proposal on Customer Service Section Manual ・ Customer Service Operational Manual ・ The establishment of customers section-A case of NWSC ・ Commercial and Customer Service Directorate Nov2 2017 ・ Key Pillars of Customer Care Service & Customer Centeredness
3. O&M of Distribution Pipeline Network 4. Non-Revenue Water Management	1	3-1 (J) 4-1 (J)	Math-Text 1,2,3,4,5,6,7,8,9,10,11,12, Preliminary Test MS Word files: (1) Introduction to NRW and its composition, (2) Performance indicators, (3) Leak detection tools and methods, (4) Pipe location and flow measurement, (5) DMA formation and management, (6) Metering, (7) NRW reduction measures, (8) Evaluation Test Questions_Test (1), (9) Evaluation Test Questions_Test (2), (10) Group Homework for NRW Team, (11) Leakage prevention, MS PowerPoint Presentation files: (1) Introduction to NRW and its composition, (2) Performance indicators, (3) Leak detection tools

Subject	Term	Serial No.	Material/File name
			and methods, (4) Pipe location and flow measurement, (5) DMA formation and management, (6) Metering, (7) NRW reduction measures, (11) Leakage prevention,
		4-1 (N)	(1) Basic Knowledge on NRW-NWSC, (2) NRW presentation-NWSC, (3) NRW Self Assessment Matrix-NWSC, (4) Customer service Connection-NWSC, (5) Water meter, Valve and Gauge presentation-NWSC, (6) Leak Form-NWSC, (7) Leakage Monthly Report-NWSC, (8) NRW Management_Leakage Management-NWSC, (9) Record Keeping-NWSC
	2	3-2 (J)	PI of Distribution Dpt. PI of Essential
		4-2 (J)	(1) Leak repair methods and tools, (2) Evaluation test questions, (3) Homework, (4) Best practices for meter installation and reading, (5) Performance indicators, (6) Test Questions_Test (1), (7) Lessons from Entebby site visit, (8) Evaluation test questions, (9) Homework, (10) Self Assessment Matrix of Juba, (11) Leak reduction and equitable distribution manual Draft201803, (12) NRW Reduction Guideline - Draft Feb 2018, (13) Equitable water distribution plan for Juba-training Mar 2018, (14) Leak Report and Leak Repair Report format 201803, (15) NRW Achievement test questions with answers
		4-2 (N)	(1) Water meters and metering SSUWC-NWSC, (2) Entebbe Area Operations Presentation
	3	3-3 (J)	· PPT Text on Current Situation of Distribution Dpt. · RD on Distribution Group · Format made by C/Ps in Ggaba
		4-3 (J)	· (1) Lessons learned from site visits, (2) Achievement test questions, (3) NRW & Distribution-Homework, (4) Leak Repair Report format-updated,
		4-3 (S)	· (1) Presentation of SSUWC Juba Station, (2) Hamza Inn TFS Record Sept 2018, (3) Monthly Report for August 2018, (4) Monthly Report for July 2018, (5) Monthly Report for September 2018 rev
		4-3 (N)	· (1) Hands on Training-SSUWC, (2) Hidden leak detection work Instruction-SSUWC, (3) Leak Detection Training SSUWC, (4) Network Training SSUWC, (5) Plumbers work Instruction SSUWC
5. GIS	1	5-1 (J)	· (1) GIS and QGIS Intro, (2) Add Vec and Raster Data QGIS, (3) Editing of Shape Files, (4) Symbolizing features n Data Query, (5) Creation of Map for Printing, (6) GPS Operation marking and data import, (7) Update of Existing data WS Facilities, (8) Input of Data on New Customers, (9) Visualization of customer data, (10) Checking of customer data in GIS n Revenue Database, (11) Questions
		5-1 (N)	· (1) Gilbert_ SSUWC_JICA-NWSC
	2	5-2 (J)	· (1) GIS layers and database structure, (2) Updating pipe network and water facilities, (3) Initial assessment and final achievement test questions, (4) Homework, (5) How to link customer accounts to points in GIS map, (6) Initial assessment test questions, (7) Achievement test questions, (8) Homework, (9) Steps for rule based symboligy and labelling, (10) Using Inkscape for preparing new symbols

Subject	Term	Serial No.	Material/File name
	3	5-2 (J)	· (1) Juba Pipe Network and Proposed DMAs Atlas, (2) SOP for updating pipe network, water facilities, and customer data (draft), (3) Achievement test questions, (4) Homework
6. 1 O&M of Purification Plant (Elc&Mech)	1	6-1 (J) 6-2 (N) 6-3 (J) 6-4a (J) 6-4b (N) 6-5 (J) 6-6 (J) 6-7a (N) 6-7b (J) 6-7c (J) 6-8a (J) 6-8b (J) 6-9 (J)	· SSUWC organization and role · Ocupational, Environmental Health & Safety · Standard Operating Procedure · OM Manual for Purification · Operation and Maintenance of Gaba1 · Electric-mechanical Equipment · Checklist of Operation Procedures · INVENTORY MANGEMENT JICA · Spare Parts List · Equipment List · Arithmetic-2 · Arithmetic-3 · Unit Conversion
	2	6-10 (N) 6-11 (N) 6-12 (N) 6-13 (N) 6-14 (N) 6-15 (N) 6-16 (J) 6-17 (N) 6-18 (N) 6-19 (N) 6-20 (N) 6-21 (N) 6-22 (N) 6-23 (N)	· Tech specs Crimping tool · Tech specs EM Wshop tools · Tech specs for Welding Machine · Tech specs static plant workshop bench Eastern Regional · Tech specs vernier callipers · Tech specs wshop tools Lot 1 · Spare Parts Consumable List · Technical specifications for Workshop Requirements · WORKSHOP MACHINE TOOLBITS · TJC Multi-application Portable floor Crane · INSTRUMENTATION WORKSHOP TOOLS · Installation of Electromechanical Equipment · Electromechanical tools · Check List of Electrical and mechanical Equipment
	3	6-24 (N) 6-25 (N) 6-26a (N) 6-26b (N) 6-26c (N) 6-27 (N) 6-28 (N) 6-29 (N) 6-30 (J)	· O & M Generators · Perform Generator service SSUWC · O & M pumps 2 Final · Blowers and Compressors Notes · Water meter, Valve and Gauge presentation · Perform Pump Service SSUWC · Perform rewinding electric motor and Welding machine · Perform Service of control panels SSUWC · Pump Operation hour and cost
6.2 O&M of Purification Plant (Water Treatment)	1	6-31 (J) 6-32 (J) 6-33a (J) 6-33b (J) 6-33c (J) 6-34 (J)	· GIBB(calculation of WTP) · Purification Plant Drawings · Coagulation-Sedimentation · Issue on chemical consumption in Juba station · Presentation Water Treatment · Monthly Report for the Month of November 2014
	2	6-35 (J) 6-36 (J) 6-37 (N) 6-38 (N) 6-39 (N) 6-40 (N) 6-41 (N)	· Chlorine demand · Jar test · NWSC Water Quality SOP · Water Quality Monitoring Program · Daily Water Test Result 16082021 · GABA WTP 1, 2 & 3 LAYOUT AND PROCESSES · Water Quality Data
	3	6-42 (J) 6-43 (J)	· Standard Operating Procedure · Basic Hydraulic
7. Water Quality Management	1	7-1(J)	· Interview about SSUWC activity 2016 Nov. · Unit for water quality monitoring · Coagulation-sedimentation · Calculation of alum injection · Discussion with SSUWC CP coagulation sedimentation · Sand filtration · Chlorination · Data assessment · SSUWC data review Nov 2016 · Biological test · Jar test

Subject	Term	Serial No.	Material/File name
			· Jar test data analysis
		7-2(J)	· SSUWC Jar test data review Dec 2016 · SSUWC data review Dec 2016 · Presentation SSUWC data · Lecture Chlorine demand test data · Chlorine demand and consumption test
	2	7-3(J)	· Interview about SSUWC activity 2017 Jul · Chlorine demand test data · Jar test data · Revised monthly report July 2017 · SSUWC data review July 2017 · Training coagulation-Sedimentation · Training Sand filtration · Training Chlorination · WQ monitoring for treatment process management
		7-3(N)	· NWSC Chlorine demand test and Jar test SOP
		7-4(J)	· Review of previous training · SSUWC data review Sep 2017 · Comparison turbidity meter SSUWC and NWSC · Alum tank operation timetable · Calculation of chemical injection · Chemical calculator for SSUWC
		7-4(N)	· Quality control of Water quality monitoring data · SSUWC Training - Understanding GABA WTP 1,2 &3 layout and processes
		7-5(J)	· Proficiency test follow up Part1 · Chlorine demand test data sheet Dec.11 · Monthly report Jan – Nov 2017 · Proficiency test follow up Part2 · Standard operation procedure pH · Standard operation procedure EC · Standard operation procedure Turbidity
	3	7-6(J)	· Chlorine demand test data · Monthly report 2018 (Jan. -Dec.) · SSUWC Juba station 2018 data · Data quality management · Statistic item S.Sudan · Comparison table Type of Filtration · Tank operation · Revised SOP, Dec. 12-13 2018
		7-6(N)	· Module Perform occupational health and safety practices
		7-7(J)	· Monthly report Q and A · Turbidity and Treatment process Data sheet · Turbidity and Treatment process Graph · Revised SOP, Mar.7 2019
8. Headquarters (HQ) Management	1	8-1(J)05 8-1(J)07 8-1(J)08 8-1(J)01 8-1(J)02 8-2(J) 8-3(N) 8-4(N) 8-5(S) 1-16 (N) 8-1(J)01 8-1(J)01 8-1(J)02 8-6(N) 8-7(N) 8-8(S)	· 05_Problem and Objective trees · 01_JCC1final presentation · Report on Capacity Assessmen_20160629 · Manual for Reporting and Planning System for Juba Station · Roles of SSUWC Headquarter Reporting and Planning System Database of Stations · SSUWC CP Presentation LLM May 2015 · NWSC CORPORATE PLANNING PROCESS · Reform History NWSC 25.Nov.2016 · SSUWC Management Training Daily Report 2016 Nov 26 · Regulation and Adjustment Mechanisms of Tariffs SS · Manual for Reporting and Planning System for Juba Station · Manual for Reporting and Planning System for Juba Station · Roles of SSUWC Headquarter Reporting and Planning System Database of Stations · Reform History NWSC 12.Jan.2017 · Reform History NWSC 13.Jan.2017 Exercise · SSUWC Management Training Daily Report 2017 Jan 25

Subject	Term	Serial No.	Material/File name
		8-9(S)	· HQ management memorandum
	2	8-13(J)	· Work Plan (Term 2)
		8-10(S)	· SSUWC HQs Management Reform Agenda
		8-11(N)	· O & M Manual for Wakiso February 2013
			· O&M Manual Oct 09 NWWS
			· Operations Manual ppt to SSUWC 07062017
			· Procedure - M&E NWSC Edited
			· Procedure - New connections-NWSC Edited
			· Job Description
		8-12(N)	· Human resource management
		8-14(S)	· SSUWC Management Training Daily Report June 2017
		8-15(S)	· Day 1-1 Reform Progress HQ-20171128
		8-16(J)	· Day 2-1 (JICA E) Governance (Sustainable utility) SSUWC-20171129
		8-17(N)	· Day 2-2 (NWSC) NWSC at a Glance-20171129
		8-18(N)	· Day 2-3 (NWSC) Corporate Governance-20171129
		8-19(S)	· Day 3-1 Progress Report Juba-20171130
		8-20(S)	· SSUWC Management Training Daily Report 2017 Dec 2
		8-21(N)	· NWSC At a Glance_JICA, SSUWC_12th Feb 2018
		8-22(S)	· Progress of reform activities of Juba station and HQ
		8-23(S)	· SSUWC Management Training Daily Report 2018 Feb 16
		8-24(S)	· Juba Action Plan Osama Juba Station One Table combined
		8-25(S)	· SSUWC HQs Action plan (New format_v2)
		8-26(S)	· SSUWC Management Training Daily Report 2018 Apr 20
	3	8-27(J)	· SSUWC-TC Term3-1_20181030
		8-32(S)	· SSUWC HQs Action Plan 2018
		8-33(S)	· SSUWC Reforms Action Plan Progress Report
		8-28(S)	· SSUWC CP 2015-18 Performance Review Analysis
		8-29(J)	· Questionnaire to NWSC
		8-30(S)	· Action Plan Juba Station Final.V2
		8-31(S)	· Site visit summary and discussion 20181103
		8-34(S)	· SSUWC Management Training Daily Report 2018 Nov 4
		8-35(J)	· SSUWC-TC Term3-3_20190211
		8-36(S)	· Action Plan Presentation Feb 2019
		8-37(S)	· Action Plan Juba Station 2019v
		8-38(S)	· SSUWC Management Training Daily Report 2019 Feb 18

2.4. Training photos

(1) Financial Management/ Management of TFS and PTS

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Lecture by JICA Expert</td><td>Site visit to Branch office</td><td>Lecture by NWSC</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Joint discussion with PR Team</td><td>Update of PI datasheet</td><td>Joint work with GIS team</td></tr>
</table>

		
Presentaiton to HQ (Term 3)	Preparation of Meter Test Report	Training in Meter Laboratory
		
Training of Meter Reading at Site	Supplier Survey on Water Meter	Estimation of Water Tariff Rates
		
Training of Asset Management		

(2) Public Awareness

		
Workshop at IREC, NWSC	Water souce of River Nile, Jinja	Lecture by NWSC staff

		
Baseline survey, Juba	Banner, one of PA Materials	Original T shirts, for PA activities
		
Visiting Entebbe NWSC	Joint session with Bill collection	Certificate Receiving Ceremony

(3) Distribution Pipeline Network (OJT, training center, study tour, etc)

		
Meter lab practice (Meter mechanism and O&M)	Distribution pipe connection	Pipe mapping with distribution & O&M team and GIS team
		
Customer meter O&M（NRW）	Water leakage repair (200mm uPVC)	Water meter confirmation by meter test bench

		
Welding Training	On-Site Training by NWSC	Demonstration Field Work
		
PC Training at IREC		

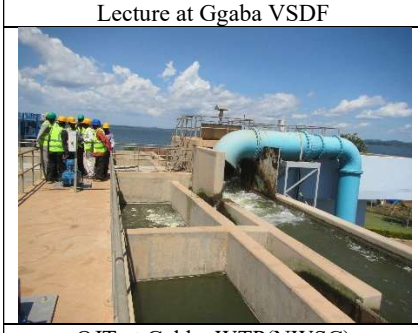
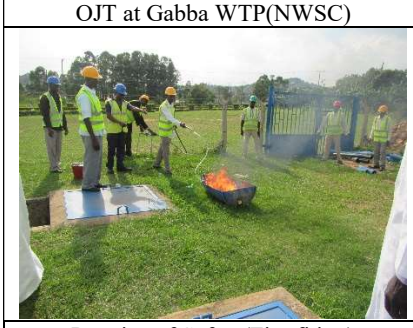
(4) Non-Revenue Water Management

		
Explanation and demonstration of leak detection equipment by NWSC	Study visit of NWSC Entebbe area to learn about NRW management	NRW lecture in Ggaba VSDF

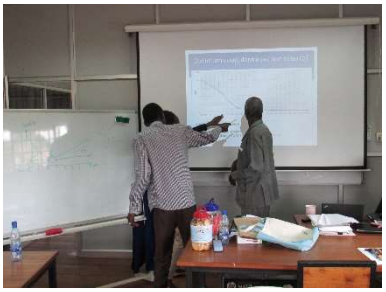
(5) GIS

		
Practice on editing of pipeline data	Practice on editing of customer data	Lecture on NWSC data

(6) O&M of Purification Plant (Elc&Mech) (Water Treatment) (OJT, training center, study tour, etc)

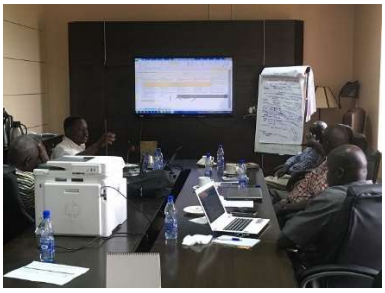
		
Lecture at Ggaba VSDF	Visit to Manufacture(Generator)	OJT at Gabba WTP(NWSC)
		
OJT at Gabba WTP(NWSC)	Practice of Electrical Panel	Practice of Motor wiring
		
Practice of Safety(Fire fiting)	Practice of Safety(Fire fiting)	Study tour to ENTEBE WTP(NWSC)

(7) Water Quality Management (OJT, laboratory, study tour, etc)

		
Lecture and group discussion at KEWI	Laboratory training at KEWI	Site visit: Central water testing laboratories Nairobi
		

Lecture and group discussion at VSDN	Joint workshop WTP C/P and Water quality monitoring C/P at VSDN	Laboratory training at VSDN training laboratory
		
Site visit: Jinja WTP Uganda	Site visit: Jinja WTP Uganda	Site visit: Masaka WTP Uganda
		
Site visit: Masaka WTP Uganda	Site visit: Ticka water sewerage company Uganda	Site visit: Ticka water sewerage company Uganda
		
Site visit: Service reservoir near Ggaba WTP Uganda	Site visit: Service reservoir near Ggaba WTP Uganda	Site visit: Lubidi WWTP Uganda
		
Site visit: Lubidi WWTP Uganda	Site visit: Kampala Sewage disposal works Uganda	Site visit: Kampala Sewage disposal works Uganda

(8) Headquarters (HQ) Management

		
Training for NWSC reform history IREC	Training for NWSC reform history IREC	Practical lecture in Kampara Branch
		
Practical lecture in Kampala Central City Brach office	Practical lecture in Entebe Station	Discussion on sustanable organization

3. Evaluation and Challenges

In this chapter, evaluation of the remote training is made in terms of what SSUWC learned, what are challenges and issues and what they need more.

3.1. Financial Management/ Management of TFS and PTS

3.1.1. Financial Management

	Main topic learned	Challenge/issues	What to do more
(1)	Preparation of monthly report/PIs (sales, finance) - Preparation of PI datasheet and calculation of PI - Preparation of monthly report, annual report	- The staff who input the financial data into excel file and prepare monthly report is gone, and training to another staff is required. - Annual report is prepared for one time only, need practice more.	- Assign the person in charge of PI and monthly report of finance. -
(2)	Preparation of billing & collection improvement action plan and implementation - Analysis of the problem of billing & collection - Identification of countermeasures - Implementation of action plan	- C/P continues the implementation of action plan but it is not monitored.	- Continuous periodical monitoring and intervention for improvement action
(3)	Customer management database - Update of customer data - Add the customer ID number	- Some customers are remained to update.	- After Covid-19 is settled down, the updating activity should restart.
(4)	Water meter installation for flat rate large customer - List up of the flat rate large customers from the customer management database - Preparation of installation plan	- Installation is going on by two teams, but those results are not described in monthly report. - Update of GIS database and customer management database is required.	- Add the progress of this activity in the monthly report - Cooperation with GIS team to update the metered customer information
(5)	Tariff setting principle and guideline -	-	-

3.1.2. Management of TFS and PTS

	Main topic learned	Challenge/issues	What to do more
(6)	Setting of sales price - Calculation of unit water cost - Consideration of an appropriate level of sale water price at PTS and TFS	- Since separate cost calculation of PTS and TFS was difficult, the unit cost for overall water supply was applied. - Sales water price is not necessarily determined not only by SSUWC decision, but also by Juba council's decision	- Need to collect more information on the policy of Juba Council and the competitor's activities in Juba
(7)	Development of revenue collection plan - Projection of revenue collection from PTS and TFS	- Revenue collection was mostly depend upon the operational hours of WTP and the supply volume to PTS and TFS. Hence, careful monitoring is necessary to check the gap between the plan and the actual. - Water supply by TFS was very limited in case of NWSC, thus the situation was different from SSUWC.	- Need to study and consider the management mode from the other African experiences - Need to collect more information of PTS and TFS in the local context in Juba.

		- New construction of PTS and TFS has been suspended by COVID-19, thus the exact schedule is not decided yet.	
(8)	Preliminary preparation of a manual for Operation and Management of PTS and TFS - Identification of challenges and improvement points of Operation and Management of PTS and TFS (PCM workshop) - Consideration of countermeasures - Preliminary brainstorming for the preparation of the manual - Consideration of the improvement points on contract, record sheet and inspection sheet	- Further consideration was necessary on management mode of PS and TFS, selection criteria of private operator, demarcation of maintenance roles, etc. - Water supply by TFS was limited in case of NWSC, thus the situation was different from SSUWC.	- Need to study and consider the management mode from the other African experiences Need to collect more information of PTS and TFS in the local context in Juba.

3.2. Public Awareness

	Main topic learned	Challenge/issues	What to do more
(1)	Public Awareness - Brainstorming on meaning, importance of PA and why it is required. - Preparation of detail PA activity plan, finalizing a proposal and estimation sheet. - Discussion on PA for clean water provision to citizens and bill payment - Workshop: Planning and budgeting for PA - Finalization of the detailed plan of the PA activities	- Even though trainees understand the importance of the Public awareness, the clean water was not provided by SSUWC and customers were very dissatisfied the service, it was very difficult to outreach customers - Staffs were not paid the salary and no water service, so the motivation on engaging the activities were very low.	- One the SSUWC get back water supply service, they should conduct the Public Awareness activities very first, let the customer know their service back
(2)	Preparation of action for PA to customers - Confirmation of contents of PA pamphlet. - Design the T-shirts and banners - Making use of T shirt and banners - Visiting customers	- Same above: the motivation was low as they had no salary, no work as no water supply. - T shirts were kept stored but they started by distributing paying customers,	- Providing additional T shirts, but have to be careful so that they distribute strategically to let the customer pay.
(3)	Customer Section - Establishing a customer section at Juba Station - Discussion on establishment of the customer section in Juba with staff in charge of customers section in NWSC - To plan Customer section Planning: Aim and method - learn the experience and examples in Japan (Tokyo metropolitan government, Yokohama city) - Field Observation of front line for the customer care services in Kampala town NWSC to drafting the manual for plan Customer section - Drafting the customer section manual	- Although trainee leaned and understand the needs of customers section, and even plannedthe provision of the services, it was difficult to establish customer session counters as they were actualy no water supplu service at SSUWC. - - Even though we md the mannula, staffs are not get accustomed to use the manuals in their daiy work	- Once the water supply are getting back normal as before at SSUWC, they are ready to establish the customer session as trainees have learned and understand well, and even they have made customer service manuals
(4)	Baseline survey for the customers - To plan and design the surveillance sheet - Implement the survey - Data analysis by using Excel - Report writing	- The result of the baseline survey found that there were very low satisfaction for the SSUWC service - Trainees want to learn more computer, but they are rare to access to PC in Juba.	- We will conduct the another survey again after implementation of many other PA activities
(5)	Field observation - Entebbe branch - Jinja Branch - Kampala Town customer service: front line for the customer care services in Kampala town	- Trainees could learn the many good examples in Uganda like Kampala city service center, Entebbe and Juba, and even learned from Tokyo, Yokohama's service, they are still very far way to provide those service in Juba like model.	- They should keep tohose model case in mind until they can realize it in juba

3.3. Distribution Pipeline Network

S.N.	Main topic learned	Challenge/issues	What to do more
(6)	- **Learned comprehension at classroom lectures** - Basic mathematics, Pipeline maintenance method, Hydraulics, Customer service, Equipment and materials of pipeline network	- Some trainees cannot read and write English. - Most of trainees are lack of education background, therefor hydraulics is difficult to understand.	- Need to study English on reading and writing - Unit conversion is not good
(7)	- **Learned how to use PC, Word and Excel** - Meaning of monthly report and PI, Making monthly report and calculate PIs	- Most trainees touched PC for the first time. It seems there is a long way to use PC - It is good a few leaders can use PC and make monthly report and calculate PIS	- Need to employ new staffs who can use PC
(8)	- **Watched and learned plumbing work by OJT** - Leakage repair on-site, Service pipe connection, Dismantle and assemble big valves and flow meters, Welding steel pipe	- OJT for welding steel pipe was done only at VSDF. - Trainees watched NWSC repaired leakage pipe not so efficiently.	- Need to do electric diffusion of HDPE pipe
(9)	- **Learned the procurement process of pipe material and fitting parts** - How to select pipe material and fittings/parts - Companies survey for pipe material and price data,	- Trainees knew many fittings and part needed with works of pipe network maintenance - Prices are cheaper than procuring materials in Juba sity	- How to get materials sooner when they are needed
(10)	- **Practical training at the Demonstration Field in VSDF, Uganda** - Connecting different kind of material pipe/valves and parts with group members	- Some fittings and parts are not in Juba Station. - Trainees experienced some tools and equipment for the first time.	- Need to prepare tools and equipment in Juba Station - ACP is used so much in Juba Station
(11)	- **Discussing and making plan on the distribution system in Juba Station** - Required equipment and pipe material, Try to increase supply water volume, Current challenge and issues	- Trainees recognized challenges and issues on distribution maintenance system in Juba Station. - Trainees seem to improve O&M in Juba Station	- All trainees who received the remote training in Uganda should come to work for Juba Station every day

3.4. NRW Reduction

S.N.	Main topic learned	Challenge/issues	What to do more
(1)	- IWA standard water balance NRW components - Commercial and physical loss reduction measures - Concept of DMA, how to design and manage DMAs - Introduction to pipe location, flow and pressure measurement tools and methods - Lesson on how and why leak happens, how to detect, and what tools are used to detect - NWSC's NRW status and steps taken to reduce NRW - Type and accuracy of customer meters - Types, importance, and method of calculating performance indicators	- Since the trainees only had primary or junior secondary school level education, they had difficulty in properly reading and expressing their opinion in English. - The initial assessment test indicated that they didn't have any knowledge of NRW and their math skill was primitive. - The lessons by NWSC were more practical but their levels were higher than desirable to the level of these trainees.	- It will be better for them to have more practical trainings. Theoretical trainings should be given to higher level staff who have at least high school level education. - Simplify the lessons
(2)	- Occupational health and safety - Store management - how to manage materials flow and keep their record - Leak repair methods and record keeping - Methods to identify leak-prone area - Measures to protect against the occurrence of leak	- Low academic qualification of the participants, they have difficulty writing and reading and cannot understand theoretical concepts. They also have problems in math. Thus, it may be difficult for them to prepare any	- Change the training approach, focus more on hands-on training rather than on theories

		reports.	
(3)	- Practical training at site for leak repair and recording - Process of house connection application and approval, method of materials issue, store management - Practical training at site on distribution pipe connection, and house connection methods	- NWSC's practices were sometimes not so good, especially with regard to timing. So the participants wasted a lot of time waiting at site. - The trainees complained that they know how to join pipe etc but their problem is they do not have necessary fittings and tools	- Followed up with higher management in NWSC to stick to given schedule - Proposed to buy some fittings and tools for demonstration purpose in Juba
(4)	- Practical demonstration and practice of meter maintenance - Practical demonstration of meter accuracy check using test bench - Theory and practical of water pressure measurement - Practical on mechanical bulk meter maintenance - Best practices on customer meter installation and reading - Basic performance indicators - collection of data and monthly report preparation	- Same as above	Same as above
(5)	- Study visit of NWSC Greater Entebbe area, understanding of the challenges in water supply system and methods to solve them, - Simplified action plan for reducing visible leakage in Juba	-	
(6)	- Formats and method of monitoring of water sales by tanker in Juba - Equitable water supply in Juba - Self-evaluation matrix on NRW of Juba - Practice for correctly filling Leak Record and Leak Repair Record	-	
(7)	- Overall maintenance procedure of distribution by NWSC - Equipment and materials of leak detection and distribution management in NWSC - OJT on leak repair - Practical on maintenance of bulk meters - OJT on installation of house connection	-	
(8)	- Overall procedure, equipment, and materials for maintenance of distribution pipe - OJT on leak repair - Practical training on dismantling/assembling large bulk flow meters - Practical training on connecting different kind of material pipe/parts	-	

3.5. GIS

S.N.	Main topic learned	Challenge/issues	What to do more
(1)	- Introduction to GIS and Quantum GIS (QGIS) software - Importing/adding Raster and Vector data - Editing of Shape files - NWSC GIS implementation - Symbolizing features and querying data - Creation of a map for printing - Recording of location data in GPS and importing data from GPS to QGIS map - Update of data on existing water supply facilities - Input of data on new customers - Visualization of customer data - Checking of customer data and joining data - GIS data of Wau water supply facilities	- The pace of teaching was faster than they could catch up - The computer literacy level of two of the three trainees was inadequate for GIS learning	- Teach slowly - Give ample time for them to practice

(2)	- Hands on practice of GIS basic and essential operations which included grouping layers, preparing maps for printing, labelling, searching, creating new shape files - Observation of NWSC's GIS system - Joining customer data	- Two trainees were not able to use computer even for basic filing system - Short attention span of the trainees, they would lose concentration very soon - Level difference of the trainees; one was well versed and an expert in IT while the other two were struggling even to know where they saved a file. This made difficult to find the suitable level and pace of training. - NWSC's GIS system was based on proprietary GIS software ArcGIS but we were using open source free program QGIS, thus there was not much to learn from NWSC. Also NWSC mostly used AutoCAD for day-to-day mapping and updating. We don't have that in SSUWC due to its high cost and sustainability issue.	- Work with patience, slowly and giving more time for them to practice - Give practice works of different levels depending upon their levels - Give warning not to waste time and focus on learning
(3)	- OJT on updating of pipe network and water facilities map, - More practice on basic essential GIS skills taught in earlier trainings	- Performance of one trainee did not improve at all - Another trainee's performance improved reasonably - They said they did not have any chance to practice GIS after returning to SSUWC as their computers were stored somewhere and they were assigned to other works	- Replace the non-performing trainee by a better candidate - Give homework and ask their managers to allow them access to the computers
(4)	- Refresher lessons of basic and medium level GIS - Cleaning customer data in GIS - Preparing unique IDs of customer - Joining of customers in GIS to billing database	- Preparation work to match customer points in GIS and customer information in billing system was not very successful because of unorganized customer name entries and uncleaned old database - The lowest performing trainee in the last training was replaced by a technician, he was slightly better but not as desired - Their appetite to learn new things was limited	- Tried to encourage them to be more curious and learn
(5)	- Refresher lessons on medium level GIS skills, and practice - Lessons on advance level GIS skills, and practice - Working together with Finance team to clean customer data for linking customer database with GIS	- Learning speed was still slow	- Gave them plenty of time to practice
(6)	- Introduction to new version of QGIS - Refresher of basic tools and operation; lecture and practice - Advance topics in GIS; lecture and practice - Using vector tools, and preparation of image basemap		- Prepared video tutorials of many important lessons so that they could watch them if they forget how to do a certain task

3.6. O&M of Purification Plant

(Elc&Mech) / (Water Treatment)

S.N.	Main topic learned	Challenge/issues	What to do more

(1)	Theory of water treatment - Theory and process management of coagulation and sedimentation process, sand filtration and chlorination	- To understand water treatment process in WTP -	- Utilize this knowledge to management water treatment process
(2)	Lecture and Practice of operation and maintenance. Review of SOP	- Consider a better driving method	- To continue
(3)	Safety management and storage management: Lecture and Practice	- Keep safety during working	- Remind
(4)	Equipment List: Lecture and Discussion	- -Create a device list and use it as data management / update material.	- To continue
(5)	Pump: practice (repair and inspection) Blower: practice (repair and inspection) Valves: practice (repair and inspection) Chemical feeding Equipments: practice (repair and inspection) Electrical equipment, panel wiring: practice (repair and inspection) Equipment list, spare parts list, consumable list	- Acquire maintenance and repair methods by understanding the structure of equipment.	- Completed
(6)	Practice at Ggaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	- By experiencing the operation of other WTP, it will be useful for the operation management of WTP of Juba Station.	- Completed
(7)	Site visit: ENTEBE WTP, JINJA WTP, MASAKA WTP	- Tour different types of WTP to help manage WTP operation at Juba Station.	- Completed

3.7. Water Quality Management

	Main topic learned	Challenge/issues	What to do more
(9)	Theory of water treatment - Theory and process management of coagulation and sedimentation process, sand filtration and chlorination	- To understand water treatment process in WTP	- Utilize this knowledge to management water treatment process
(10)	Laboratory training of Jar test and chlorine demand test	- Capacity enhancement of experiment for WTP operation control	- Periodical implementation and accumulation of data - Implement an advice to WTP operation team
(11)	Data processing - Water quality data review and monthly report preparation - Training of graph drawing - Joint workshop with SSUWC WTP C/P	- To understand changes in raw water quality over time - To understand the changes of water quality by each water treatment processes - Find out a water quality accident to compare with a usual raw water quality - Find out a problem of water treatment process in WTP operation	- Establish a system to utilize water quality data to WTP operation - Enhancement of cooperation with WTP operation team
(12)	Laboratory training of calibration of water quality measurement equipment − Calibration of pH, EC meter − Revise SOP for calibration	- Capacity enhancement of maintenance of water quality monitoring equipment - To understand an importance of calibration to obtain correct measurement data	- Implement calibration continuously - Make a record of calibration continuously to avoid a trouble of equipment
(13)	Quality and accuracy control of water quality monitoring data − Simple calculation tool for precision / accuracy management − Introduction of PDCA cycle	- To understand a method of precision / accuracy control of monitoring data - To understand an importance of precision / accuracy management	- Establish a data precision / accuracy management system - Rooting a PDCA cycle in daily

		to obtain correct measurement data	monitoring work
(14)	Visit distributor in Nairobi and Kampala − Nairobi: Aqua treat solutions, Aqua tech industries − Kampala: Palin test, Mulago hill, Vision scientific	- Establish a procurement channel of equipment, reagent and spare parts	- Implementation of sustainable procurement of reagent and spare parts

3.8. Headquarter Management

	Main topic learned	Challenge/issues	What to do more
(15)	Good governance - PPWSA case (reform history) - NWSC (general governance, corporate governance, governance by board)	- Governance of HQ and Juba station needs to be strengthened. - Top management of SSUWC considers that reform will not be implemented smoothly without functioning of the board, and training of governance to board members are required. - Under revision of SSUWC Act to become an independent authority. - Under implementation of strengthening of human resources/staff	- A strategy for independent authority should be prepared and implemented. - Financial strengthening is required for sustainable authority.
(16)	Preparation of action/reform/improvement plan and performance contract - Reform history of NWSC - Problem analysis of Juba station and Headquarters - Unification of template of planning - Site visit of Jinja branch of NWSC (through job activity of branch office and site visit, trainees understood how to prepare the performance improvement plan) - Suggestions and proposal to the reform of SSUWC based on the experience of NWSC	- Both action plans for Juba station and HQ have been prepared but continuation of activities and monitoring capacity need to be improved further.	- Continuous periodical monitoring and intervention for improvement action by management and HQ. - PDCA cycle management should be operated.
(17)	Reporting system - Preparation of report - PIs	- The reporting system are understood by C/P but no periodical monitoring of the monthly report including PI data has been made. - Improvement of internal communication is the first step and regular meeting are crucial.	- HQ need to monitor the monthly report and PIs and give comments and instruction for improvement.
(18)	Water tariff policy - NWSC - Evaluation of presentation by finance management team about water tariff at Juba Station	- Water tariff policy has been understood by HQ but tariff setting procedure was not been is not formalized.	- Tariff of Juba station should be prepared together with Juba station staff who know the cost structure. Periodical review and revision are required. Need to establish tariff revision committee.
(19)	Structure of standards, guidelines, manuals, and standard operation procedure (SOPs) - Case of NWSC - How to prepare manuals, SOPs, and job descriptions - HQ management manuals	- Finalization should be expedited. - First prepared first utilized.	- HQ started preparing management manuals of and needs to start to utilize them. - Juba station started preparing job description and should finalize and utilize them.
(20)	HQ and Station management	- HQ management learned station	- Performance contract

	- Organization structure of NWSC and functions of sections/departments and Stations / Areas and job description - Visit to NWSC branch office (Kampala Water Corporation, Kampala Water Corporation Branch) and NWSC HQ to interview of operation management - Development of Performance Contract (PC) between SUWC HQ and Juba Station	management method and prepared performance contract, but it has not yet signed nor implemented. - The number of staff and skills are not enough so that not all departments are functioning. - Main issue of Juba station operation is provision of fuel and chemicals, without which C/P is difficult to implement PC. - Low motivation due to delay of salary payment and depreciation of salary is critical. Payment are delayed for several months.	should be signed, and improvement measure should be implemented. - It needs more delegation of the operation through contract among staff.

3.9. Contribution to meet the Project targets and outcomes

（1） Project purpose:

The capacity of SSUWC Juba Station regarding sustainable service delivery (financial management, non-revenue water management, facilities operation and maintenance) is strengthened.

Objective Verifiable Indicator	Relation to remote training
− More than 80% of the indicators of the Juba reform action plan are improved from the baseline figures	
− 100 % of operation and maintenance expenses excluding personnel costs and chemical costs are recovered from water sale revenue. (Assumption: more than 70% of fuel for generator will be procured from subsidized fuel and the rest from market fuel or 100% of power supply of water supply facilities will be provided form city power supply.)	− The NRW and distribution O&M training will help them to reduce NRW, thus generate more revenue

（2） Outputs

Output	Indicators	Relation to remote training
1. Juba Station's water charge collection capacity is strengthened.	1-1 Customer information is updated.	- Customer information and GIS database are updated together with GIS team
	1-2 Water sale revenue has an increasing trend.	- The billing & collection improvement action plan is prepared. - The progress of implementation of this action plan is monitored
	1-3 Water tariff is proposed based on the principles and guideline to be developed in the Project.	- The principles for water tariff setting is trained. - The guideline for water tariff setting is developed and revised.
	1-4 The number of water meters installed at large-consumption customers is increased from 45 to 220.	- Installation plan of water meter for flat rate large customer is prepared. - The progress of implementation of this plan is monitored.
2. Public awareness activities for Juba citizens by Juba Station are enhanced.	2-1 Public awareness raising activities plan is developed.	Public awareness raising activities plan were developed with many discussion and brains storming in remote workshop
	2-2 Public awareness raising activities are conducted in accordance with the plan	In remote training, we prepared the pamphlet and developed PA awareness activities materials such as banners, T-shirts and cap, and discussed how to make use of them at the workshops
	2-3 The better understanding of the sampled citizens on water supply service provided by SSUWC is improved from the baseline.	We planned the baseline survey and collected data, analyzed data and reported in remote workshop. In the remote, we also discussed the customer service and developed customer service

		operational manual.
3. Non-revenue water management capacity of Juba Station is strengthened.	3-1 Non-revenue water management manuals are prepared.	Simplified draft Manual has been prepared, updating is ongoing
	3-2 GIS map for existing water supply facilities, pipes and valves are prepared.	Updated GIS map has been prepared
	3-3 GIS customer database is prepared.	Only limited numbers (about 600) could be identified on GIS so far, needs more field work for verification
	3-4 SOP of leakage repair is prepared.	Materials for SOP have been prepared, they need to be organized in the form of SOP
	3-5 Leakage monitoring report is prepared.	Formats have been prepared and their use has started by SSUWC
4. Operation and maintenance capacity for existing water supply facilities by Juba Station is strengthened.	4-1 Study report of management method of new water filling stations is prepared.	
	4-2 Study report of management method of new water kiosks is prepared.	
	4-3 Operation and maintenance data of existing water supply facilities are compiled in monthly and annual reports and shared among the concerned persons.	C/P are trying to make the monthly and annual report, but the reports were immature yet. C/P has to improve on making reports. WTP operation：The amount of water supply has been achieved in proportion to the amount of fuel supplied. Although the water quality has not been confirmed, the consumption of Coagulant and Chlorine has been confirmed, so it can be inferred that the water quality machine gun has been achieved. It has been confirmed that the pump and filtration pond can be repaired. **Water quality monitoring** Monthly report of Juba Station was developed in remote training, but evaluation has not been implemented periodically.
5. Support and supervisory function of SSUWC headquarters toward Juba Station is strengthened.	5-1 Training plan for Juba Station is developed by SSUWC Headquarters.	No activity in remote training.
	5-2 Remote training report including all outputs of the project is prepared by the headquarters.	This report.
	5-3 Annual report, annual plan, and monthly report of Juba Station are examined for feedbacks provided by SSUWC Headquarters to Juba Station for more than one year.	- Monthly report of Juba Station was examined in a couple of times in remote training, but evaluation has not been implemented periodically. - Annual report and annual plan have not been developed.
	5-4 Juba Station improvement action plan is prepared.	- Juba Station improvement action plan was prepared in the remote training.
	5-5 SSUWC Headquarters reform action plan is prepared.	- SSUWC Headquarters reform action plan was prepared in the remote training.
	5-6 SSUWC headquarters operation manuals are prepared.	- Part of SSUWC headquarters operation manuals was prepared and on-going.

（3） Activities

Activities	Relation to and achievement of remote training
1-1 Conduct a baseline survey regarding water works management, facilities operation and maintenance and customer satisfaction.	No activity in remote training.
1-2 Understand the latest cost structure and review of the current water tariff.	Training was done

1-3 Update the customer information.	Customer information and GIS database are updated together with GIS team
1-4 Visualize the customer information utilizing GIS and to understand actual situation of water bill collection.	Customer information and GIS database are updated together with GIS team About 600 customer points in GIS have been linked with the billing data
1-5 Develop a guideline for appropriate water pricing for Juba Station and the guideline is approved by the Headquarters.	The guideline for water tariff is prepared.
1-6 Based on the guideline developed in the activity 1-5, develop a revenue and expenditure plan.	
1-7 Develop an activity plan for improvement of billing and bill collection.	The billing & collection improvement action plan is prepared.
1-8 Conduct bill collection based on the activity plan developed in the activity 1-7 and monitor the bill collection activities.	The implementation of the action plan is on progress by C/P. The implementation is monitored.
1-9 Take a measure for the customers without payments and to monitor these activities.	This is included in the billing & collection improvement action plan. And the progress is monitored.
1-10 Promote installation of a meter for large-consumption customers.	Installation plan of water meter for flat rate large customer is prepared. The progress of implementation of this plan is monitored.
1-11 Conduct the support activities in response to the COVID-19 emergency	
2-1 Create a customer (commercial) section at Juba Station.	Discussed the needs, benefit and all the rational of customers section, and Plan the establishment and create the Customer service manual
2-2 Develop a public awareness activities plan.	Done in remote training
2-3 Develop training materials for public awareness activities.	Developed pamphlet, T-shirts and banners for public places and discussed how to make use of them
2-4 Conduct public awareness activities on SSUWC activities.	Prepared in remote training, but not sure of conducting in Juba
2-4-1 Conduct public awareness activities for public in collaboration with relevant organization (such as MWRI, Juba city, payam, schools, churches and media) 2-4- 2 Conduct public awareness activities for existing customers.	By making use of T-shirt and pamphlet, conducting the public awareness for existing customers
3-1 Formulate a non-revenue water management task force team at Juba Station.	No activity in remote training
3-2 Prepare GIS map for existing water supply facilities, pipes and valves.	This has been done
3-3 Identify customers in GIS and prepare GIS customer database.	About 600 customers have been identified and linked with the billing system
3-4 Prepare standard operation procedure (SOP) for updating GIS mapping for facilities and customers.	This has been done, continual updating is required to match with the newer version of QGIS
3-5 Prepare manuals for non-revenue management.	Draft manuals have been prepared
3-6 Prepare a plan of zoning which can be isolated by valve.	Done
3-7 Prepare leakage report.	Done
3-8 Conduct leakage repair.	SSUWC is repairing leaks regularly but availability of fittings has been a constraint
3-9 Conduct commercial loss management activities.	SSUWC is doing site checking of suspected illegal users
3-10 Install service pipes and meters for house connections.	SSUWC is installing meters on existing unmetered customers, new service pipe installation is not done yet
3-11 Conduct meter management.	The remote training covered extensively on meter management but actual work in Juba is not done

	yet.
4-1 Follow up operation and maintenance for existing water intake facilities, raw water transmission facilities, water purification facilities and water transmission and distribution facilities.	SOP for water treatment plant operation is revised. SOP for pH and EC meter calibration were revised. But finalization of both SOPs was not done.
4-2 Understand the situation of water distribution and develop a plan for promoting equal water distribution regarding existing water supply facilities.	A plan to distribute water equitably was prepared
4-3 Operate water distribution facilities based on the plan developed in the activity 4-2.	
4-4 Study management method of new water filling stations.	A preliminary examination of current situation was made once.
4-5 Study management method of new water kiosks.	A preliminary examination of current situation was made once.
4-6 Develop manuals for procurement of materials for operation and maintenance for facilities.	
5-1 Conduct an assessment for training needs of Juba Station.	No activity in remote training.
5-2 Develop a training plan including training materials, manuals and budget based on training needs.	No activity in remote training.
5-3 Conduct remote training for Headquarters and Juba Station.	Done in remote training.
5-4 Examine for feedbacks on Juba Station's monthly and annual reports, and annual plans provided by Headquarters.	The examination was made in a couple of times in the report training but it is not periodical evaluation. Need to enhance this activities further.
5-5 Develop management database for Juba Station and update the data regularly.	No activity in remote training.
5-6 Prepare remote training report including all outputs of the project.	This activity.
5-7 Prepare Juba Station improvement action plan.	Has ben prepared in remote training.
5-8 Prepare SSUWC Headquarters reform action plan.	Has been prepared in remote training.
5-9 Prepare SSUWC headquarters operation manuals.	Has been prepared and on-going.

3.10. Evaluation of Training Environment (training facilities, accommodations, etc.)

(1) Distribution pipe network and NRW reduction:

1. The training facilities provided by NWSC were excellent. The environment was mostly quiet and conductive for a good training.
2. SSUWC staffs learned a lot of practical skill at the demonstration field in VSDF.
3. The support staff assigned by NWSC were excellent, very helpful and responsive to any need of the training.
4. Accommodation and other logistics were also good.
5. Site visits organized by NWSC were not so good, mostly there was a problem of time management. They would give time of early morning but the actual work would not start until late afternoon. This aspect did not improve despite reporting several times to the NWSC coordinator.

(2) GIS:

1. The training facilities provided by NWSC were excellent.
2. Accommodation and other logistics were also good.

3. The support staff assigned by NWSC were excellent, very helpful and responsive to any need of the training.

(3) KEWI

Training facilities − Training laboratory and lecture room − Training of basic monitoring item (Jar test, residual chlorine, turbidity, biological test) is available
Accommodation − Student residence (2-3 persons/room) − Canteen (Breakfast, lunch and dinner), meal allowance is not necessary
Staffs − KEWI is a major water quality training institute in Eastern Africa and regularly receives trainees from neighboring countries. − Staffs have a lot of experience in accepting and training trainees.

	
Training laboratory	Lecture room
	
Sample preparation room	Chemical closet

(4) NWSC (VSDN, Ggaba WTP)

Training facilities − Training laboratory and lecture room − Training of basic monitoring item (Jar test, residual chlorine, turbidity, biological test) is available − Compared to KEWI, the lab is equipped with relatively modern equipment − Practical training in WTP (Ggaba I, II and III) is available
Accommodation

− Student residence and canteen are not prepared − Preparation of lodgment and meal allowance are necessary
Staffs − Capacity of staffs is acceptable − However, sometimes had trouble about coordination among staffs (e.g. lecture room or laboratory was not prepared, trainer was absent, double booking with other training course)

 Training laboratory	 Equipment in training laboratory
 Lecture room in laboratory building	 Lecture room in workshop building

Appendix1: Attendance of Trainees in Remote Training

Item	No.	Trainee's Name	Position	Term 1(2016/2017)			Term 2 (2017/2018)						Term 3 (2018/2019)			
				Prep	1	2	3	4	5	6	7	8	9	10	11	12
				Oct.	Nov.	Jan.	Jun.-Jul.	Sep.	Nov.	Nov.-Dec.	Feb.-Mar.	Apr	Oct.-Nov.	Dec.	Jan..-Mar.	Apr.
1. Financial Management and Tariff Setting/ Management of tanker filling station (TFS) and public tap stand (PTS)					1	2	3	4	5	6	7		8	9	10	11
	1	Keneeth Gideon Dayaka	Ag/Director for Revenue		○	○	○	○	○	○	○		○	○	○	○
	2	Simon Boss Yoasa	S/Inspector of Accounts		○	○	○	○	○	○	○		○	○	○	○
	3	Diana Umjuma	Finance		○	○	○									
	4	Jennifer Achiro Peter	Assist/ Inspector for Revenue			○	○		○	○			○			
	5	Lona Wani						○		○	○			○	○	○
	6	Peter Loro	Meter Reader					○	○	○	○		○	○	○	○
	7	William Lokuji	Administration		○	○	○									
	8	Hakim Emmanuel	Finance		○	○	○	○	○	○	○		○	○	○	○
	9	Geoge Okee Salvator	Head Meter Reader							○						
	10	Primo Joseph Logalle														
	11	Taban Peter Agellam												○		
	12	Kongs Towaro Ononga	Head Meter Reader							○				○		
2.Public Awareness					1	2		3	4	5	6		7			
	13	Jonathan Winston	Distribution		○	○		○	○	○	○		○			
	14	Christopher Phillip	Distribution		○	○		○	○	○	○		○			
	15	Geoge Okee Salvator (No.9)			○	○		○	○	○	○		○			
	16	Kongs Towaro Ononga (No.12)			○	○		○	○	○	○		○			
	17	Peter Loro (same as No.6)			○	○		○	○	○	○		○			
3.O&M of Distribution Pipeline Network					1	2	3	4		5	6		7		8	
	18	Peter Garbino	Water Supply Technician		○	○	○	○		○	○					
	19	Angelo Appollo	Water Supply Technician		○	○	○	○		○	○					
	20	Macok Idris Dominic Michael	Engineer										○			
	21	Abate Francis Simon Stephen	Water Supply Technician										○			
	22	Rume Nancy Eluzai Manasseh	Distribution Technician												○	
	23	Abdu Adam Sarfadin	Distribution Technician												○	
	24	Modi Francis Taban													○	
	25	Primo Joseph Logalle	Water Supply Technician										○			
	26	Ceaser Lado	Water Supply Technician		○	○	○			○	○					
4.Non-Revenue Water Management	27	Dousa Joseph	Distribution Technician		○	○	○	○		○	○					
	28	Joseph Oniek Salvator	Distribution Technician		○	○	○	○		○	○					
	29	Cieggen Mading	Distribution Dept. Head				○	○		○	○		○			
	30	Phillimona Luka Malis	Distribution Technician										○			
	31	Ladu Christopher Pitia	Distribution Technician												○	
	32	Ladu Zakaria Wani	Distribution Technician												○	
	33	Jada Clement Swaka	Distribution Technician												○	
	34	Lado Christopher Philip	Distribution Technician										○			
	35	Jonathan Winston (No. 13)					○	○		○	○		○		○	

Item	No.	Trainee's Name	Position	Term 1(2016/2017)			Term 2 (2017/2018)						Term 3 (2018/2019)			
				Prep	1	2	3	4	5	6	7	8	9	10	11	12
				Oct.	Nov.	Jan.	Jun.-Jul.	Sep.	Nov.	Nov.-Dec.	Feb.-Mar.	Apr	Oct.-Nov.	Dec.	Jan..-Mar.	Apr.
5.GIS					1	2	3			4	5				6	
	36	Cieggen Mading (No.29)			○	○	○			○	○				○	
	37	Peter Pisa	IT section		○	○	○			○	○				○	
	38	Daniel Antasio	Meter reader							○	○				○	
	39	Duku David Anyansio	Assist/ Inspector for Revenue		○	○	○									
6.1.O&M of Purification Plant (Elc&Mech)					1	2	3	4		5				6	7	
	40	Julius Mobruk	Purification Electrical		○	○	○	○		○				○	○	
	41	Martin Rume Olimpio	Purification Electrical		○	○	○	○		○						
	42	Anjello Peter Igye	Purification/Mechnical			○	○	○		○						
	43	Mulai Lucky Eluzai	Shift Operator											○		
	44	Jada Stephen Lako	Purification Electrical											○		
	45	Loro David Wani Kolombo	Purification/Mechnical											○		
	46	Sule Marchelo Tombe Lado	Purification/Mechnical											○		
	47	Kiringa James John Badi	Purification Electrical											○		
	48	Latiyu Emmanuel Khamis Ayobu	Shift Operator											○		
	49	Yengoa Fham Kapip Maleri	Purification/Mechnical												○	
	50	Kiringa James John Badi	Purification Electrical												○	
	51	Agata Mario Yanga Cirilo	Purification Electrical												○	
	52	Logoro Charles Mogga Laku	Purification/Mechnical												○	
	53	Elisapana Robert Daya	Shift Operator												○	
	54	Kenyi Hillary Laku Loro	Shift Operator												○	
	55	Manase Lokule Wani	Purification/Mechnical			○	○	○		○						
6.2.O&M of Purification Plant (Water Treatment)					1	2	3	4		5				6	7	
	56	Peter Tabura	Planning		○	○	○			○						
	57	El-Fateh Rihan	Purification		○	○	○	○		○				○	○	
	58	Wani George Wani Marcello Pitia	Purification											○	○	
	59	Emmanuel Lado	Purification		○	○	○	○		○				○	○	
7.Water Quality Management					1	2	3	4		5				6	7	
	60	Sebit Lado Silvano	Water quality management		○	○	○	○		○				○	○	
	61	Tivo Abowro	Water quality management		○	○	○	○		○				○	○	
	62	Emmanuel Frazer	Water quality management		○	○	○	○		○				○	○	
8.Headquarters (HQ) Management					1	2	3			4	5	6	7		8	
	63	Laam Sophia Pal Gai	Minister								○					
	64	Yar Paul Kuol Awar	MD, SSUWC HQ	○		○				○	○	○	○		○	
	65	Lawrence Busuk Lopula Muludyang	DG of Project and Planning, HQ	○	○	○	○			○	○		○			
	66	Simon Koak Kuay	DG of Admin and Finance, HQ	○		○	○			○	○	○	○		○	
	67	Samuel Taban Longa	DG of Monitoring & Evaluation, HQ				○				○					

Item	No.	Trainee's Name	Position	Term 1(2016/2017)			Term 2 (2017/2018)						Term 3 (2018/2019)			
				Prep	1	2	3	4	5	6	7	8	9	10	11	12
				Oct.	Nov.	Jan.	Jun.-Jul.	Sep.	Nov.	Nov.-Dec.	Feb.-Mar.	Apr	Oct.-Nov.	Dec.	Jan..-Mar.	Apr.
	68	Joseph Ebere Amosa	DG of State Affair,HQ	○						○	○	○	○		○	
	69	Joseph El Nur Sule	Act. Area Manager, Juba Station		○	○										
	70	Osama Mahdi Mohammed	Act. Area Manager, Juba Station							○		○	○			
	71	Aleer Philips Leek	Executive Director, Office of MD, HQ				○				○	○	○		○	
	72	Yenky Santurino Tongun Rubin	Director of Planning & Projects, HQ				○			○	○					
	73	Chrisphine Abugo Paul	Director of Budget, HQ							○	○	○	○		○	
	74	Gabriel Magol Alueth				○										
	75	Wanga Ben Mgbamborigbe			○											
	76	John Duom Warabeck Ayuel													○	
	77	Richard Legge Modi Subek													○	
	78	Natale Albert Dak Deng													○	
	79	Okongo Wilson Daniel											○		○	
	80	Cep Madol Cuot											○			
	81	Ubaa Peter Akulino Ukok										○				
	82	Keneeth Gideon Dayaka (No.1)										○			○	
	83	El-Fateh Rihan (No.57)											○			
	84	William Lokuji (No.7)										○	○		○	
	85	Peter Tabura (No.56)					○					○				

Appendix 2: Training Program

Note: File numbering system

No.	Subject	Numbering
1.	Financial Management/ Management of TFS and PTS	1-1(J) or (N)
2.	Public Awareness	2-1(J) or (N)
3.	Distribution Pipeline Network	3-1(J) or (N)
4.	Non-Revenue Water Management	4-1(J) or (N)
5.	GIS	5-1(J) or (N)
6.	O&M of Purification Plant (Elc&Mech), (Water Treatment)	6-1(J) or (N)
7.	Water Quality Management	7-1(J) or (N)
8.	Headquarters (HQ) Management	8-1(J) or (N)

Prepared by (J): JICA expert or (N): NWSC

(1) Financial Management/ Management of TFS and PTS

Term 1

Training 1 (1-1: Finance)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/22 2016	Lecture on PIs and analysis	Yamada	• Performance Indicators 20161122	1-1 (J)
11/23	Lecture on PIs and analysis	Yamada		1-1 (J)
11/24	Lecture on bill & collection	NWSC	• Billing Management • TQM - Billing Flow chart • Territorial Management	1-2 (N)
11/25	Lecture on bill & collection	NWSC	• Revenue Management Training	1-3 (N)
	Lecture on PIs and analysis	Yamada	• Commercial Strategies TEAM N&NE	1-1 (J)
11/26	Site visit (Kansanga branch office)	NWSC		
11/28	Lecture on PIs and analysis	Yamada	• Sales-PI • Finance_PI	1-1 (J)
	Lecture and practice on Bill & Collection database	Ohno, Yamada		
11/29	Preparation of action plan and strategy for improvement of bill and collection	Yamada	• Strategy Action plan to Improve Billing (draft) 291116	1-4 (J)
11/30	Financial situation and projection, cost recovery	NWSC	• Financial management and related topics-Nwsc	1-5 (N)
	Calculation of water cost and financial projection	Ohno, Yamada	• Financial Projection_Practice	
12/1	Tariff setting policy and guideline	NWSC	• Over view of Tariff Setting and Tariff Structures • Introduction to Practical Exercises in Tariff Modelling	1-6 (N) 1-7 (N)
	Tariff setting policy and guideline	Ohno, Yamada	• Guideline for water tariff setting (first draft)	1-8 (J)

Training 1 (1-1: TFS&PTS)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/29	Sustainable operation and management of PTS&TFS	Ohno	• Sustainable Operation & Management of PTS&TFS (PPT)	1-15(N)
	Case study: Management of PTS & TFS of NWSC	NWSC (Mr.Pelcusonic)		
11/30	Financial situation and projection, cost recovery	NWSC (Mr. Silver	• Financial Management and related topics (PPT)	Same as Finance

		Emudong)		
	Calculation of water cost and financial projection	Ohno, Yamada	• Financial Projection_Practice	Same as Finance
12/1	Tariff setting policy and guideline	NWSC (Mr.Godfrey Katongole)	• Overview of Tariff Setting and Tariff Structures • Introduction to Practical Exercises in Tariff Modelling	Same as Finance
	Tariff setting policy and guideline	Ohno, Yamada	• Guideline for Water Tariff Setting (first draft)(Word)	Same as Finance
12/2	Objective analysis of management of PTS&TFS in Juba Station	Ohno	• Project Analysis and Objective Analysis • (PPT)	1-24(J) 1-25(J)
	Site visit	NWSC (Mr.Pelcusonic)		
12/3	Objective analysis of management of PTS&TFS in Juba Station	Ohno	• Project Analysis and Objective Analysis	1-25(J)

* The training program of 30th Nov. and 1st Dec. is common program as Finance course.

Term 1

Training 2 (1-2)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
1/10 2017	Check of the homework (monthly report and PIs, billing & collection improvement action plan)	Yamada	• Strategy Action plan to Improve Billing_2017	1-4 (J)
	Tariff setting policy and guideline (Theory and practice)	NWSC	• Regulation and Adjustment Mechanisms of Tariffs SS	1-9 (N)
1/11	Tariff setting policy and guideline (Theory and practice)	NWSC	• Introduction to Practical Exercises in Tariff Modelling (2) SS	1-10 (N)
1/12	Tariff setting policy and guideline (Theory and practice)	NWSC	• SS DEL Tariff Training - GROUP PRESENTATIONS	1-11 (N)
1/13	Tariff setting policy and guideline (Theory and practice)	NWSC	• SS DEL_Evaluation -Tariff review and affordability study	1-12 (N)
	Preparation of draft of tariff setting guideline	Ohno, Yamada	• Same as 1-1 No.1-14	1-8(J)

Term 2

Training 3 (2-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
6/15	• Check of Homework • Progress of strategy and action plan for billing & collection improvement)	Ohno	• Strategy and action plan for billing & collection improvement	1-13 (J)
6/16	• Training on Customer Management Database(MS Access) • Identification of large water consumer	Ohno	• Customer ledger (MS ACCESS)	
6/17	• Training on Customer Management Database(MS Access) • Identification of metered customer and large water consumer	Ohno	• Customer ledger (MS ACCESS)	
6/19	• Identification of metered customer and large water consumer • Identification of large outstanding customer • Discussion on Monthly Report	Ohno	• Customer ledger (MS ACCESS)	
6/20	Water meter specification and procurement	Mr.Gilbert Muhwezi	• Water meter specification and procurement	1-14 (N)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
	Water meter on site Water meter test in the laboratory	Mr.Gilbert Muhwezi and meter labo		
6/21	• Identification of metered customer and large water consumer • Identification of large outstanding customer • Rap-up review	Ohno	• Customer ledger (MS ACCESS) • Strategy and action plan for billing & collection improvement	1-13 (J)
6/22	• Confirmation of the action plan • Confirmation on homework up to the next training	Ohno	• Strategy and action plan for billing & collection improvement • Homework	1-13 (J)

Term 2

Training 4 (2-2)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
9/22	• Check of Homework • Progress of strategy and action plan for billing & collection improvement) • Updating Monthly Report	Ohno	• Strategy and action plan for billing & collection improvement • PI datasheet& Monthly Report	1-13 (J)
9/23	• Updating Monthly Report • Identification of target customer for meter installation • Modifying of customer contract, customer application form & notification letter	Ohno	• PI datasheet& Monthly Report • Target customer list for meter installation • Notification letter • Customer contract form • Application form	1-16 (J)
9/25	• Importance of billing & collection • Introduction of metering (customer meter and bulk meter)	(NWSC) Jemmy Owor		
9/26	• Meter reading practice on site • Water meter test in the laboratory	(NWSC) Gilbert Muhwezi	• Meter testing report	
6/27	• Research on meter procurement environment and visiting agent companies for meter • Preparation of meter installation plan • Confirmation on homework up to the next training	Ohno	• Research sheet on procurement environment of water meter	

Term 2

Training 5 (2-3)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/3 2017	Review of the previous training Check of the homework (monthly report and PIs)	Yamada		
	Joint discussion with PR team on cooperation of arrear collection and meter installation	Yamada, Sawazaki		
11/4	Joint discussion with PR team on cooperation of arrear collection and meter installation	Yamada, Sawazaki		
11/6	Updating monthly report	Yamada		
	Check of the homework (progress of strategy and action plan for billing & collection improvement)	Yamada	• 3-1. Strategy Action plan to Improve Billing_2017_171109	1-13 (J)
11/7	Check of draft water meter installation plan and improvement, draft contract form, terms &	Yamada		

	conditions			
	Discussion of billing & collection report format based on the draft idea	Yamada	• Billing & collection Report_format_171109 • 3-3. METER READING SHEET_171109	1-17 (J)
11/8	Analysis of billing ratio by area (MS Access and Excel)	Yamada	• 3-4. Sales-PI_171106 • 3-5. Finance_PI_171106	
	Review of preliminary list of large outstanding customers and discussion of arrears collection	Yamada		
11/9	Review and homework Wrap-up discussion	Yamada		

Term 2

Training 6 (2-4)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
12/11 2017	Working together with GIS team Linkage between customer database and GIS information	Yamada, Thapa		
12/12	Working together with GIS team Linkage between customer database and GIS information	Yamada, Thapa		
12/13	Working together with GIS team Linkage between customer database and GIS information	Yamada, Thapa		
12/14	Working together with GIS team Linkage between customer database and GIS information	Yamada, Thapa		
	Improvement of Access database (customer database)	Yamada		
12/15	Check of the homework	Yamada	• Strategy Action plan to Improve Billing_172119	1-13 (J)
12/16	Updating monthly report	Yamada	• Sales-PI Home Work 3_171219 • Finance_PI_171216-HAKIM	
12/18	Updating monthly report	Yamada	• Monthly report_sales_2017 • Monthly report_finance_2017-upd • Notice For Bill settlement-v	1-16 (J)
	Updating meter installation plan	Yamada	• Ideas of brochure for meter installation	1-15 (J)
12/19	Updating billing & collection report	Yamada	• METER READING SHEET_171219 • Complainers Registration Form	1-17 (J) 1-18 (J)
	Review and homework, wrap-up discussion	Yamada		

Term 2

Training 7 (2-5)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
3/2	Linkage between customer database and GIS information	Ohno/Thapa	• Ledger_ALL(Same as 2-1 No.2&3)	
3/3	Same as above	Ohno/Thapa	• Ledger_ALL(Same as 2-1 No.2&3)	
3/5	Check of the homework	Ohno	• Strategy Action plan to Improve Billing	1-13 (J)
	Updating action plan for billing & collection improvement	Ohno	• Strategy Action plan to Improve Billing	1-13 (J)
	Updating Monthly Report	Ohno	• Monthly report_finance_2017	

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
			• Monthly report_sales_2017	
3/6	Tariff setting principle and guideline	Ohno	• Tariff Setting Guideline_v3 • Tariff Setting Guideline_PPT	
	Estimation of necessary tariff level (practice)	Ohno	• Tariff Setting Guideline_v3 • Tariff Setting Guideline_PPT • Working Sheet_Tariff Setting_Practice_ • .ICRC Tariff Estimate	
3/7	Estimation of necessary tariff level (practice)	Ohno	• Tariff Setting Guideline_v3 • Tariff Setting Guideline_PPT • Working Sheet_Tariff Setting_Practice_ • .ICRC Tariff Estimate	
	Estimation of necessary tariff level (practice)	Ohno	• Tariff Setting Guideline_v3 • Tariff Setting Guideline_PPT • Working Sheet_Tariff Setting_Practice • .ICRC Tariff Estimate	
3/8	Estimation of necessary tariff level (practice)	Ohno	• Tariff Setting Guideline_v3 • Tariff Setting Guideline_PPT • Working Sheet_Tariff Setting_Practice • .ICRC Tariff Estimate	
	Review, Wrap-up and Homework	Ohno	• Strategy Action plan to Improve Billing • HW&data list	1-13 (J)

Term 3

Training 8 (3-2)

(for plumber)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
12/10 2018	Lecture - Theoretical background on metering including customer meters and bulk meters. Introduction to types of customer meters and explanation on function, parts and functioning of mechanical type meters	NWSC		
	Practical demonstration and exercise of customer meter installation	NWSC		
12/11	Practical demonstration of meter maintenance	NWSC		
	Site visit to meter lab	NWSC		
12/12	OJT on meter installation, site visit to see meter installation and replacement	NWSC		
12/13	OJT on meter installation, site visit to see meter installation and replacement	NWSC		

(for finance)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
12/11 2018	Check of homework	Yamada	• Action Plan_Revenue_181211	
	Updating monthly report	Yamada	• Commercial&Sales-PI_2018 • Finance_PI_181211	
12/12	Updating monthly report	Yamada	• Monthly report_finance_2018_Oct • Monthly report_sales_2018_Oct	
12/13	Preparation of yearly report	Yamada	• Annual Report of 2018_sales • Annual Report of 2018_account	1-19(J)
12/14	Discussion on target value of PDM	Yamada	• 20180213_PDM_ver1_fin_indicatros	
	Review of last training	Yamada		

12/15	Review and homework, wrap-up discussion	Yamada		

Term 3

Training 9 (3-3)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
2/11 2019	Check of the homework (Progress of strategy and action plan for billing & collection improvement)	Yamada	• Action Plan_Revenue_181211	
	Updating monthly report	Yamada	• Commercial&Sales-PI_2018 • Finance_PI_190212	
2/12	Updating monthly report	Yamada	• Monthly report_finance_2018_nov • Monthly report_finance_2018_dec	
	Preparation of annual report		• Annual Report of 2018_sales • Annual Report of 2018_account	1-19(J)
2/13	Preparation of annual report	Yamada	•	
	Joint discussion with HQ team (presentation of progress of strategy and action plan for billing & collection improvement, and annual report of 2019)	Yamada, Sato	• Action Plan_Revenue_181211	
2/14	Estimation and calculation of financial plan for Juba Station	Yamada	• 24h_Simplified Tariff Setting Estimation_Practice_190215 •	1-20 (J)
2/15	Review and homework, wrap-up discussion	Yamada	•	
	Joint discussion with HQ team Wrap-up discussion	Yamada, Sato	• 24h_Simplified Tariff Setting Estimation_Practice_190215 • Annual Report of 2018_sales • Annual Report of 2018_account_190213	1-20 (J) 1-19(J)

Term 3

Training 10 (3-4)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
4/9	Introduction of Finance Training in Term3	Ohno	• Training Program (Finance)	
	Check of the homework (Progress of strategy and action plan for billing & collection improvement)	Ohno	• Action Plan for billing and collection	
4/10	Updating monthly report	Ohno	• Commercial&Sales PI • Finance PI • Monthly report	
	Preparation of 3rd JCC		• JCC Presentation (Seles, Finance)	
	Revision of Water Meter Installation Plan		• Water Meter Installation Plan	1-21(J)
4/11	Lecture on Asset Management	Mr.Charles Kato	• NWSC_Netbook value report details	1-22(N) 1-23(N)
4/12	Site Visit	Mr.Charles Kato	• NWSC_Netbook value report details	1-22(N) 1-23(N)
4/13	Preparation of 3rd JCC	Ohno	• JCC Presentation (Seles, Finance)	
	Review of the training and Homework	Ohno	• JCC Presentation (Seles, Finance) • Commercial&Sales PI • Finance PI	

(2) Public Awareness

Term 1

Training 1 (1-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/22	Orientation	Sawazaki	• Day1 Oientation	
	Teller office and PA:Thinking on meaning and necessity of customer section which is the window for keeping good relationship with customers.	Sawazaki	• Day1 Customer Section Division	
	PA by NWSC :Lecture on practice on PA by NWSC and visiting on call center	Kasule NWSC	• SSUWC benchmarking	
11/23	TOR of teller office	Sawazaki		
	Establishment of teller office Simulation after above discussion.	Sawazaki	• Day2_Draft Customer Service Division	
	About PA :Brainstorming on meaning, importance of PA and why it is required.	Sawazaki		
11/24	Impact assessment of PA activities: Assessment on the impact of public awareness activities and drafting	Sawazaki	• Day2_Awareness Activities	
	Preparation of PA activity plan: Preparation of detail PA activity plan and finalizing a proposal.	Sawazaki	• Day3_Awareness Concept	
11/25	Preparation of evaluation sheet	Sawazaki	• Assessment tool draft	2-3 (J)
	PA pamphlet: Confirmation of contents of PA pamphlet.	Sawazaki	• PA pamphlet	2-1 (J)
	Presentation of PA activity plan	Sawazaki	• Proposal of Public Awareness	2-2 (J)
11/26	Review of PA activity plan	Sato /Sawazaki		
	Presentation of PA activity plan	Sawazaki		

Term 1

Training 2 (1-2)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
1/18	Introduction, Orientation: Recheck promotion activities of Outcome 2	Sawazaki	• Day1-1 Orientation	
	Workshop on Customer Service: Reconfirm the significance and necessity of the Customer Service Section	Sawazaki	• Day1-3 Customer Care Office	
	Situation and Challenge: Discuss the reports and topics of the approaches taken until now, and future policies	Sawazaki	• Day1-2 Customer Service Division	
	Workshop with NWSC for Customer Section: Debate and feedback on topics of the Customer Section together with the person in charge of NWSC customer	Kasule NWSC		
1/19	Workshop: Brainstorming on the significance, importance and the reasons for implementing PA activities	Sawazaki	• Day2-1_Awareness Activities	
	Situation and Challenge: Discuss the reports and topics of the approaches taken until now, and future policies related to PA activities	Sawazaki	• Day2-2_Awareness Week Concept	
	Assessment and activity report: Check the assessment sheet for baseline studies and discuss the report related to PA activities	Sawazaki	• Revised Assessment sheet, Report form	
1/20	Planning and Budgeting: Discuss the program schedule and budget related to detailed contents of the PA activities	Sawazaki	• Day3_Awareness Concept	
	Way forward: Discuss and confirm the paths to establishing the Customer Section and future PA activities	Sawazaki	• Day3 Proposal PA Activities	
	Wrap up and Closing: Summary and confirmation of discussions until now	Sawasaki		

Term 2

Training 3 (2-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
9/11 2017	• Introduction and Ice Breaking Session: • to report the establishing a customer section at Juba Station (JICA E)" • Workshop: to report and reviewing the Public Awareness Activities " • Workshop on the establishment of the customer section in Juba with staff in charge of customers section in NWSC	Sawazaki NWSC	• Day1-1 Orientation • Day1-2 Customer Service Division • Day1-3 Customer Care Office • Proposal of Customer Section • The establishment of customers section-A case of NWSC	2-11 (J) 2-13 (N)
9/12	• Workshop: reviewing the Public Awareness Activities " • Workshop: to report the situation and challenges of Public Awareness Activities " • Filed Observation : Uganda example for Pubic Awareness (1) Reporting system"	Sawazaki	• Day2-1 Awareness Activities • Day2-2 Awareness week concept • Day2-3 Proposal of PA Activities • Proposal of Public Awareness in Juba	2-2 (J)
9/13	• Workshop: Discuss the Public awareness for the clean water provision to citizens" • Workshop: Discuss the Public awareness for Bill Payment" • Feld Observation in Entebbe: Uganda example :Bill collection"	Sawazaki NWSC Entebbe	• Day3-1 Clean Water provision • Day3-2 Reporting System • Day3-3 bill payment	
9/14	• Workshop: Way forward for the next stage • Discussion: Way forward for the next stage for the Public Awareness " • Wrap up session, Feed back of the session " • Closing: Confirming the Wrap up session,	Sawazaki	• Day 4-1 Way forward for PA Activities	

Term 2

Training 4 (2-2)

Visit to Jinja Station and combined meeting with Finance team

PR banner, T-shirts, caps were provided to the CP.

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/1 2017	Introduction and Ice Breaking Session: Workshop: to review the public awareness program we have panned and discuss the aim, and method " Workshop: to practice the evaluation and feedback them of the Public Awareness activities	Sawazaki	• Day1 SSUW Nov 1 2017	
	Workshop of Uganda example for Pubic Awareness: SWOT Analysis	NWSC		
11/2	Field Observation of NWAC in Jinha: Uganda example for Customer Service	NWSC JINJA	• Day2 Presentation on Commercial and Customer Service Directorate	2-14 (N)
11/3	Discussion :how to make use of the PA materials for Public Awareness Activities " Workshop : to leran the inventory system and management method for Public Awareness Activities " Workshop : to reviewing the Monitoring and Evaluation for Public Awareness Activities "	Sawazaki	• Day-3 SSUWC-PA nov 3 2017 • Banner • T-shirts • Caps	2-6 (J)
	Joint discussion with PR Team on cooperation of arrear collection and meter installation	Sawazaki Yamada		
11/4	Joint discussion with PR Team on cooperation of arrear collection and meter installation"	Sawazaki Yamada		

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
	Closing and Wrap up session			

Term 2

Training 5 (2-3)

Compilation of questionnaire survey results

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
2/1	Introduction and Ice Breaking Session: to review the previosn workshop and set up the goal " Workshop: to review the public awareness program we have planned and discuss the aim, and method " Workshop : to reviewing the Monitoring and Evaluation for Public Awareness Activities "	Sawazaki	• Day1-1 introduction • Day1-2 Awareness Activities • Day1-3 PA Activities	
	Workshop of Uganda example for Public Awareness (1) Reporting system" (2) Bill Collection"	NWSC Deogratius Sserumaga	• Key Pillars of Customer Care Service & Customer Centeredness	2-15 (N)
2/2	Workshop: to practice the analysis of the data of the evaluation (data Analysis)" the evaluation and feedback them of the Public Awareness activities (Report writing) (Part 1)"		• Day-2 Data Analysis (1) • Assessment of Data Analysis	2-9 (J)
	Field Observation of front line for the customer care services in Kampala town NWSC"	NWSC		
2/3	Workshop: Discuss the Public awareness for the clean water provision to citizens" Workshop: Discuss the Public awareness for reporting system such as leaking" Workshop: Discuss the Public awareness for Bill Payment"	Sawazaki	• Day-3 Data Analysis (2)	
2/5	Workshop: to practice the evaluation and feedback them of the Public Awareness activities (Report writing) " Workshop: to practice the evaluation and feedback them of the Public Awareness activities (Report Presentation")	Sawazaki	• Day- 4 Report Writing • Report on Assessment on Knowledge, Attitude on Water Life, SSUWC of Juba Citizen	2-10 (J)
2/6	Review and Way forward: Evaluation and Way forward: Review the program Closing:	Sawazaki	• Review and Way forward	

Term 3

Training 6 (3-1)

Introduction of customer service in Tokyo and Yokohama and visit to teller office in Kampala

Preparation of Customer Service Manuals.

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/12 2018	Introduction and Ice Breaking Session: to review the previous workshop and set up the goal " Workshop: to review the public awareness program Workshop : to reviewing the Monitoring and Evaluation for Public Awareness Activities "	Sawazaki	• Day1-1 introduction • Day1-2 Awareness Activities • Day1-3 PA Activities	
11/13	Workshop: to plan Customer section Planning: Aim and method" Workshop: to plan Customer section learn the experience and examples in Japan (Tokyo metropolitan government)"	Sawazaki	• Day2-1 Draft Customer Service Division • Day2-3 Customer Care Office ・Tokyo metropolitan	2-7 (J)

			government (Water Supply in Tokyo)	
	Field Observation of front line for the customer care services in Kampala town NWSC"	NWSC		
11/14	Workshop: to drafting the manual for plan Customer section Workshop: to plan Customer section learn the experience and examples in Japan (Yokohama city)" Workshop: to drafting the manual for plan Customer section :Drafting at computer room	Sawazaki	• Day3 Customer Section Manual Drafting ・Yokohama city (Public relation of Yokohama Waterworks Bureau	2-8 (J)
11/15	Workshop: to drafting the manual for plan Customer section Workshop: to Revise the manual for plan Customer section :Drafting at computer room"	Sawazaki	• Proposal of Customer Section	2-11 (J)
11/16	Presentation for the Customer Section manual and discussion " Review and Way forward: Closing: Fill in the evaluation sheet and talk about the expectation"	Sawazaki	• Customer Section Operational Manual	2-12 (J)

(3) Distribution Pipeline Network

Term 1

Training 1 (1-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/22 2016	Training on basic mathematics (addition, subtraction, multiplication, division, and common fraction)	Y. Sato	• Text 1 made by Y. Sato	3-1(J)
	Unit conversion	Y. Sato	• Text 2 made by Y. Sato	3-2(J)
	Calculation of square and cubic	Y. Sato	• Text 3 made by Y. Sato	3-3(J)
11/23	Maintenance of pipeline network (Pipe material, corroding, corrosion protect, pipe washing and durable years	Y. Sato	• Text 7 made by Y. Sato	3-7(J),
			• Text 8 made by Y. Sato	3-8(J)
11/24	Information of distribution pipe	Y. Sato	• Text 9 made by Y. Sato	3-9(J)
	Inspection of pipe material			
11/25	Water meters, valves and gauges	Kikomeco Samuel of NWSC	• PPT(Water Meter, Valves and Gauges)	3-16(N)
11/26	Hydraulics-1 (Kind of flow, supply amount and current velocity, water pressure, principle of Archimedes and friction loss)	Y. Sato	• Text 4 made by Y. Sato • Text 5 made by Y. Sato	3-4(J) 3-5(J)
11/27	Holiday			
11/28	Management method of water distribution network (How to control pipe network)	Gilbert Muhwezi of NWSC	• PPT(Pilot Operated Control Valve)	3-15(N)
11/29	Hydraulics-2 (Supply amount, current velocity, cross section and supply amount formula)	Y. Sato	• Text 6 made by Y. Sato	3-6(J)
	Running management (Customer satisfaction, water tariff, NRW and asset management)	Y. Sato	• Text 10 made by Y. Sato	3-10(J)
11/30	Lecture on PIs (Necessity and meaning of PI)	Y. Sato	• PPT (Transmission and Distribution Facilities)	3-13(J)
	Review and homework (Basic mathematics, hydraulics and Cross section)	Y. Sato	• Text 11 made by Y. Sato •	3-11(J)
	Procurement of pipe material (Water leakage detection equipment, flow meter, pipe, valve, PE and PVC)	Mukesh Kanji of NWSC	• Gentex Enterprises	
12/1	Service pipe connection (Meaning, method	Denis	• PPT (Customer service	3-17(N)

	and procedure, type of service connection)	Batwaranireki of NWSC	connection)	

Training 2 (1-2)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
1/10	Safety Course	NWSC		
2017	Stock Management			
	Leakage repairing work and recording			
1/11	Homework review of the last training	Thapa Y. Sato	• Preliminary Test made by Y. Sato	3-13(J)
	NRW (Predict leakage, protect leakage, calculation and monitoring)	Thapa		
1/12	Review of basic mathematics (%, average, hydraulics	Y. Sato	• Text 12 made by Y. Sato	3-12(J)
	Learning PC (word and excel for Monthly Report)	Y. Sato		
	Review of PIs (meaning and calculation)	Y. Sato	• PI Distribution Sheet • PI Essential Sheet	3-13(J) 3-14(J)
	Review on Monthly Report (Try to make Monthly Report)	Y. Sato	CP IREC	3-18(N)
1/13	On site training (Leakage repair, service pipe connection, pressure gauge, pipe disinfection)	NWSC		

Term 2

Training 3 (2-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
6/19 2017	• Practical training how to select plumbing tools and equipment. • Practical training on how to select pipe fittings, saddle snap tap and jointing	NWSC	At training laboratory	
6/20	• Practical training how to connect house connection	NWSC	At training laboratory	
6/21	• Practical training how to maintain valves, change parts and stopping leakage	NWSC	At training laboratory	
	• Practical training how to maintain mechanical flow meters			3-19(N)
6/22	• Discuss what kind of plumbing tools and fitting parts required in Juba Station	Y. Sato	• Requiring sheet of Plumbing work in Juba Station	3-24
	• Visit 5 pipe material companies and collect specification and price data	NWSC	At material companies	
6/23	• Discuss what kind to pipe material/fitting parts required in Juba Station	Y. Sato	• Requiring sheet of Plumbing work in Juba Station	3-24
	• Training to write plumbing work report by themselves		• Format of Plumbing Record • Format of Pipe Installation Record	3-26 3-27
6/24	• Discuss action plan on leakage repairing, house connection and the list of tools and equipment	Y. Sato	• Format of O&M Plan	3-28

Training 5 (2-3)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
12/11	Report the current operation situation of Juba Station by C/P	Y. Sato	PPT made by C/Ps	3-29

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
2017	Discuss challenges and issues of current distribution network in Juba Station	Y. Sato	PPT made by C/Ps	3-30
12/12	Discuss with WTP team how to increase water volume in Juba Station	N. Matsumoto Y. Sato		
	Make plan for supplying water equally in Juba Station	Y. Sato		
12/13	Practice how to make the leakage report and the service connection report at IREC	Y. Sato	• Format of Plumbing Record • Format of Pipe Installation Record	3-26 3-27
	Discussion on O&M plan of distribution system in Juba Station	Y. Sato	• Format of O&M Plan in Juba	3-28
12/14	Practical training how to weld steel pipe and fittings	NWSC	At training laboratory	
12/15	Practical training for making Monthly Report	NWSC		
	Practical training for calculating PIs	NWSC		3-18(N)
12/16	Make plan for O&M at Juba Station with WTP team	N. Matsumoto Y. SATO		3-15(J)
12/17	Holiday			
12/18	Overview and summary of all training	Y. Sato		

Term 3

Training 7 (3-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
10/30 2018	Demonstration/using of leak detection equipment Lecture of leak repairing process	NWSC Gilbert Muhwezi		3-21(N) 3-22(N)
10/31	OJT at actual water leakage site where NWSC worked for pipe leakage.	NWSC	At site	
	JICA reported JICA officials regarding activities in UGanda	NWSC		
11/01	OJT at actual water leakage site. C/P collaborated with NWSC staffs.	NWSC	At site	
11/02	Lecture on dismantling/assembling large bulk flow meters	NWSC	Field Training	
	Practical training on connecting different kind of material pipe/parts in the demonstration field	NWSC	Field Training	
11/03	Discuss to order pipe plumbing tool, fitting parts and made the order formats	Y. Sato	• Format of Tool & Fitting & Spare Parts for Plumbing work	3-24 3-25 3-26
	Presentation on the situation of O&M in Juba Station by C/P	Y. Sato	• PPT made by C/P (Current Situation of Distribution Dpt.)	3-30

Training 8 (3-2)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
2/12 2019	OJT on actual water leakage repairing site and watched NWSC working.	NWSC, at Buziga in Kampala	On site	
2/13	Lecture on equipment and materials for maintenance of distribution pipe	NWSC Gilbert Muhwezi	Network Training SSUWC	3-20(N) 3-23(N)
	Observation of actual equipment and pipe materials at the NWSC warehouse		Ware House of NWSC	
2/14	OJT on actual water leakage site and learned their repairing procedure	NWSC, at near Parliament Kampala	At site	

2/15	Practical training on dismantling/assembling large bulk flow meters	NWSC, at 6th Street Office On site	At site	
	Practical training on connecting different kind of material pipe/parts in the demonstration field	NWSC, at VSDF	Field Training	
2/16	Discuss to order pipe plumbing tool, fitting parts and made the order formats	Y. Sato	・Needed material table	
	Presentation on the situation of O&M in Juba Station by C/P	Y. Sato	• PPT made by C/P (Current Situation of Distribution Dpt.)	3-29 (J)

(4) Non-Revenue Water Management

Term 1

Training 1 (1-1)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2016 /11/21	Orientation and opening ceremony	Introduction of participants, briefing on the program and schedule			
11/22	Initial assessment test	Written test of 1 hour duration covering basics on NRW and some mathematical calculations		• Evaluation Test Questions Test (1)	4-1 (J) (8)
	NRW and its composition	Lesson on IWA standard water balance NRW components, exercise	Thapa Phatta	• Introduction to NRW and its Composition	4-1 (J) (1)
11/23	NRW reduction measures	Lesson on commercial and physical loss reduction measures. Group discussion on potential NRW measures in Juba.	Thapa Phatta	• NRW Reduction Measures	4-1 (J) (7)
11/24	DMA formation and management	Concept of DMA, how to design and manage DMAs	Thapa Phatta	• DMA Formation and Management	4-1 (J) (5)
	Pipe location, flow measurement and leak detection equipment	Introduction to pipe location, flow and pressure measurement tools and methods	Thapa Phatta	• Pipe Location and Flow Measurement	4-1 (J) (4)
11/25	Workshop - DMA demarcation in Juba	Marking approximate boundary of DMAs on GIS map together with the participants	Thapa Phatta	• * Practical work on GIS, no PP slides	
	Leak theory and detection methods	Lesson on how and why leak happens, how to detect, and what tools are used to detect	Thapa Phatta	• Leak Detection Tools & Methods	4-1 (J) (3)
11/26	Review of lessons, test to check progress	All the lessons completed by then were summarized. Oral tests were taken to understand if they were understanding the lessons or not.	Thapa Phatta		
11/28	Workshop - DMA demarcation in Juba	Marking approximate boundary of DMAs on GIS map together with the participants	Thapa Phatta	* Practical work on GIS, no PP slides	
11/29	Class on NWSC's NRW reduction measures	Lecture on NWSC's NRW status and steps taken to reduce NRW	(NWSC) Timothy Mubbala	• Basic Knowledge on NRW • NRW presentation • NRW SAM (self-assessment matrix)	4-1 (N) (1), (2), (3)
11/30	Site visit	Visited NWSC Kampala city	(NWSC)	• Gentex Brochure; no PP	

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
	(observation of tools & equip, pipe fittings manufacturers and suppliers)	branch to observe pipe location, leak detection, flow and pressure measurement equipment and tools Visited Gentex (plastic pipe manufacturer) for learning about pipe and fittings.	Timothy Mubbala	slides	
12/01	Customer metering	Lessons about the type and accuracy of customer meters according to latest international standard.	Thapa Phatta	• Metering	4-1 (J) (6)
	Performance indicators	Explained briefly about the types, importance, and method of calculating performance indicators	Thapa Phatta	• Performance indicator	4-1 (J) (2)
	Monthly report preparation	Explained the main data to be collected for preparing monthly report	Thapa Phatta	• Did not use PP	
	Final evaluation test	Written test of 1 hour duration covering the subjects taught and some mathematical calculations	Thapa Phatta	• Evaluation Test Questions_Test (2)	4-1 (J) (9)
	Home work	Individual and group home work involving data collection and NRW related lessons	Thapa Phatta	• Group Homework for NRW Team	4-1 (J) (10)
12/02	Feedback of the final test result		Thapa Phatta		

Training 2 (1-2)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2017/1/9	Orientation and opening ceremony	Distribution of training materials, briefing of program			
1/10	Safety management	Occupational health and safety (Together with O&M of purification group)	(NWSC) Dr. Martin Kalibbala	Occupational, Environmental Health & Safety	6-2 (N)
	Store management	How to manage materials flow and keep their record	(NWSC) Ntanzi John Baptist	INVENTORY MANGEMENT JICA	6-7a (N)
	Leak repair methods and record keeping	How to repair various types of leaks and various pipe materials, and how to keep proper record of the repair	(NWSC) Timothy Mubbala	• Leakage monthly report • NRW Management_ Leakage_ Management • Record keeping • Leak Form-NWSC	4-1 (N) (7), (8), (9), (10)
1/11	Joint review of the 1st training home work	Review of the homework given during 1st training, discussion and explanation of the answers	Thapa Phatta		
	Methods to identify leak-prone area	Criteria and discussion on methods to identify areas with higher leak potentials	Thapa Phatta	• Leakage prevention	4-1 (J) (11)
	Measures to protect against the occurrence of leak	Measures to protect against the occurrence of leak during planning and design stages	Thapa Phatta	• Leakage prevention	4-1 (J) (11)
	NRW measurement and monitoring plan	Updating zoning plan of Juba together with the	Thapa Phatta	• Practical work on GIS, no PP slides	

	for Juba	participants			
	NRW management manual	Discussion on the content of draft manual.	Thapa Phatta		
1/12	O&M of distribution pipe network	Simple calculation of percentage, average, MS Word, Excel, Performance Indicators, monthly report	Yarai Sato	• Practice on computer	
1/13	Site visit	Observation of leak repair, tapping of branch from distribution main, and house connection works at site	(NWSC) Timothy Mubbala, Danis	• Customer service Connection-NWSC, • Water meter, Valve and Gauge presentation-NWSC,	4-1 (N) (4) 4-1 (N) (5)
1/14	Wrap-up discussion and awarding ceremony	Feedback and evaluation of 2nd training by the participants; awarding of certificate to the participants			

Term 2

Training 3 (2-1)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2017/ 6/12	Review of earlier training result	- Causes of leakage, methods to reduce leakage, method of leak repair	(NWSC) Timothy Mubbala	• Lecture, no material provided	
	Practical training at site for leak repair and recording (Bombo Road, Namogogo area)	- Leak repair on 200 mm uPVC main damaged due to backfilling with sharp concrete lump during road expansion	(NWSC) Timothy Mubbala (JICA E) Thapa Phatta		
6/13	Format and method of reporting leak repair	- Explanation of leak repair / burst recording format	Thapa Phatta	• Leak repair - burst recording format	4-2 (J) (2)
		- Practical demonstration of data input for reporting of leak repair in computerized reporting system of NWSC	(NWSC) Timothy Mubbala	• Demonstration only, no material	
	Practical training at site for leak repair and recording (Kololo area)	- Re-routing of old CI distribution main by cutting and joining with new PVC pipe (150 mm)	(NWSC) Timothy Mubbala (JICA E) Thapa Phatta		
6/14	Method of material issue	- The process and steps of issuing repair materials from store	(NWSC) Kampala Branch Store Manager	• None	
	Process of house connection application and approval	- Formats and methods of new application - Process of approval - Process of connection	(NWSC) Kampala Branch Manager	• Hard copy filled files (given to head of distribution, Mr. Mading)	
	Practical training at site for house connection (Wabigalo area)	- New house connection from HDPE distribution line with HDPE pipe	(NWSC) Timothy Mubbala (JICA E) Thapa Phatta		
	Estimating tools and fittings for leak repair	- Discussion and making a listing of tools and fittings required for leak repair in Juba	Thapa Phatta	• Leak repair methods and tools	4-2 (J) (1)
6/15	Store management	- Observation of how materials	(NWSC)	-	

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
		are stored - Process of purchase, record keeping, and issuing the materials	Kampala Branch Store Manager		
	Practical training at site for pipe connection (….area)	- Connection and extension of 200 mm dia uPVC pipe to improve supply situation in outer area	(NWSC) Timothy Mubbala (JICA E) Thapa Phatta	-	

Training 4 (2-2)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2017/ 9/4	Review and summary of previous training	- Summarized the topics covered from the beginning of training for refreshing their mind	Thapa Phatta	• Used the materials prepared during previous trainings	
	Discussion and confirmation of pipe fittings required for demonstration of leak repair	- Quantity of most essential pipe fittings and tools sufficient to repair leaks at 10 locations were identified listed by discussion.	Thapa Phatta	-	
	Review of causes and countermeasures of NRW	- Causes of real losses and their countermeasures - Causes of apparent losses and their countermeasures	Thapa Phatta	• Used materials prepared during previous trainings	
9/5	Theoretical background on metering including customer meters and bulk meters.	- Lecture on meter types, operating principle, installation position, accuracy, maintenance	(NWSC) Eng. Gilbert	• Water meters and metering SSUWC	4-2 (N) (1)
	Practical demonstration and practice of meter maintenance	- Disassembling, repairing, and assembling customer meters	(NWSC) Senoga Umaru	-	
	Practical demonstration of meter accuracy check using test bench	- Checking repaired Class B and C meters for accuracy - Demonstration of minimum flow at which these meters started working	(NWSC) Senoga Umaru	-	
9/6	Updating Juba DMA plan and estimating valves and bulk meter requirement	- Since the pipe network was updated last time, the DMA plan prepared earlier was revised based on the updated pipe network map - Required number of bulk meters was estimated starting from Munuki area. The available time was not sufficient to finish all the Juba area.	Thapa Phatta	• Worked on GIS	
	Theory on water pressure measurement	- Lecture on methods, tools, and importance of measuring water pressure - Interpretation of water pressure data	(NWSC) Eng. Gilbert	• Verbal lecture	
	Practical demonstration of water pressure measurement and interpretation of result	- Practical demonstration of measuring water pressure - Practical demonstration how water pressure measurement along the pipeline can be used to identify causes of pipe blockage and water leak problems	(NWSC) Technician Thapa Phatta		

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
	Practical demonstration and practice of mechanical bulk meter maintenance	- How to open and change parts - How to reassemble - Main problems related to mechanical bulk meters	(NWSC) Meter workshop technicians		
9/7	Customer meter installation and reading	- Best practices for customer meter installation - How to read meters accurately	Thapa Phatta	• Best practices for customer meter installation and reading	4-2 (J) (4)
	Basic performance indicators - collection of data and monthly report preparation	- Explanation of basic PIs - Explanation of methods to collect data for the PIs - Methods of calculating PIs with collected data - Main points for preparing report - Important PIs to be included in the monthly report	Thapa Phatta	• Performance indicators	4-2 (J) (5)
	Review of the training, evaluation by the C/Ps and homework	- Preparation of monthly report using the PIs has been given as a homework for next training	Thapa Phatta	• Homework	4-2 (J) (9)

Training 5 (2-3)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2017/ 12/18	Review and summary of previous training	- Summarized the topics covered from the beginning of training for refreshing their mind: causes of real losses and their countermeasures, causes of apparent losses and their countermeasures, metering	Thapa Phatta	• Used the materials prepared during previous trainings	
	Performance indicators	- Repeated lecture on NRW basic performance indicators and methods for their calculation			
12/19	Study visit of NWSC Greater Entebbe area	- Lecture by NWSC on NRW management - Discussion and question answer on subjects related to NRW and distribution management - Briefing by Area Manager - Site visit of wastewater and water treatment plants and DMAs	NWSC Eng. Timothy Lwarnusayi Eng. Herbert Sentaba	• Entebbe Area Operations Presentation_for SSUWC	4-2 (N) (2)
12/20	Lessons learned from the Entebbe visit, operational problems in Juba and potential solution	- Discussion and elaboration on important lessons learned from the Entebbe visit - Listing of operational problems in Juba - Discussion on potential solution of the operational problems in the present situation (financial and security situation) of Juba	Thapa Phatta	• Lessons from Entebbe site visit	4-2 (J) (7)
12/21	Simplified action plan for reducing visible leakage	- Preparing and discussing simplified draft action plan for reducing visible leakage in Juba - Discussion on self-evaluation matrix of NRW situation in Juba	Thapa Phatta		
12/22	Training evaluation, progress test, homework	- Evaluation of the training by the C/Ps - Achievement test - Homework		• Evaluation test questions • Homework	4-2 (J) (8), (9)

Training 6 (2-4)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2018/ 3/5	Homework checking, explanation and feedback	- Homework - checking, discussing, and providing feedback on monthly reports of distribution (Dec 17, Jan – Feb 18) - Homework - checking and analyzing supply amount to Tanker Filling Station (TFS) at Hamza Inn	Thapa Phatta		
	Refresher of previous lessons	- Repeated lessons on; NRW components, causes of NRW, and measures to reduce NRW		• Used the materials prepared during previous trainings	
3/6	Explanation and review of zoning system in Juba	- The zoning plan prepared before was explained and discussed to secure their full understanding	Thapa Phatta	• Presented directly from GIS	
	Formats and method of monitoring of water sales by tanker	- They brought the bulk meter flow data of Hamza Inn TFS for Jan and Feb 2018. This work was given as a homework - It was taught how to put those data in MS Excel, format, calculate total and daily average values and monitor water sale volumes		• Equitable water distribution plan for Juba-training Mar 2018	4-2 (J) (13)
	Exercise on equitable supply	- An exercise was done on how much water needed to be supplied to each planned distribution zone assuming the current production of water by WTP = 4,500 m^3/day - By using MS Excel program, calculated how many hours each day or each week the pumps at WTP and Hospital Tank needed to operate to supply water equitably. The MS Excel program can be easily modified in future if any change happens to WTP production capacity or volume of water sold from TFS and so on		• Equitable water distribution plan for Juba-training Mar 2018	4-2 (J) (13)
3/7	Preparation of draft manual on leakage reduction and equitable water distribution	- Prepared a simplified and practical step-by-step manual on various activities related to leakage reduction and equitable distribution	Thapa Phatta	• Leak reduction and equitable distribution manual Draft 201803 • NRW Reduction Guideline - Draft Feb 2018	4-2 (J) (11) (12)
3/8	Same as above	- Same as above			
3/9	Exercise on correct meter reading,	- Exercise on how to read customer meters and bulk meters of various sizes correctly by showing pictures and asking them to tell the correct values	Thapa Phatta		
	Self-evaluation matrix on NRW	- Self-evaluation matrix on NRW was quickly discussed - Juba area's position for each indicator was tentatively identified		• Self-evaluation matrix of Juba	4-2 (J) (10)
	Practice for correctly filling Leak Record and Leak Repair Record	- Latest formats for Leak Record and Leak Repair Record was prepared and explained - Practiced several times on how to fill these forms correctly		• Leak Report and Leak Repair Report format 201803	4-2 (J) (14)
3/10	Compilation of prepared materials, achievement test, and feedback	- Compilation of all materials prepared from the beginning of training - Quick review of the materials and subjects covered in each material - A written test consisting of 19 questions		• NRW Achievement test questions with answers • Homework	4-2 (J) (15)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
		and 1-hour duration was taken - Test papers of all were checked quickly and correct answers of each question were explained - Homework			

Term 3

Training 7 (3-1)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2018/ 10/30	Orientation	Orientation to new trainees	Thapa Phatta		
	Overall maintenance procedure of distribution	Maintenance process Leak detection process Leak repair process	Gilbert (NWSC)	• Network Training SSUWC • Leak Detection Training SSUWC • Hands on Training-SSUWC • Hidden leak detection work instruction SSUWC • Plumbers work instruction SSUWC	4-3 (N) (1), (2), (3), (4), (5)
	Equipment and materials of leak detection and distribution management in NWSC	Showed and demonstrated various pipe locating and leak detecting equipment available in NWSC Kampala branch office (6th Street) Showed and explained about various types of pipe and leak repair materials available in NWSC store			
10/31	OJT on leak repair	At Muyanga site: leak on 250 mm uPVC distribution pipe was repaired At Nakawa site: leak was on smaller CI pipe	Gilbert (NWSC)		
11/01	OJT on leak repair	At Salaama road: leak on 300 mm DI transmission main was repaired	Gilbert (NWSC)		
11/02	Practical on maintenance of bulk meters	At Ggaba VSDF the participants practiced how to open, clean, repair, and close 150 mm diameter bulk meters	Gilbert (NWSC)		
	Practical on connecting various types of pipe materials	At Ggaba VSDF training site, the participants practiced how to connect HDPE, uPVC, and steel pipes and various fittings	Robert Makoba (NWSC)		
11/03	Making the format for ordering plumbing tools	Exercise on estimating plumbing tools and fittings	Sato Yarai		
	Presentation about Juba operation	A Power Point presentation was made by C/Ps covering various aspects of water system operation in Juba	SSUWC C/Ps	• Presentation of South Sudan Urban water Corporation Juba Station • Hamza Inn TFS record Sep 2018	4-3 (S) (1) 4-3 (S) (2)
	Exercise on preparation of leak repair report	The trainees practiced on how to prepare report of two leak repair works done as OJT on 10/31 and 11/01.	Thapa Phatta	• Leak repair record format-updated	4-3 (J) (4)
	Review of monthly report of distribution	The C/Ps prepared and brought monthly reports of distribution for July, August, and September 2018. These reports were studied and discussed. The September report	Thapa Phatta	• Monthly reports of SSUWC distribution for July, August, and September 2018	4-3 (S) (3), (4), (5)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
		was improved as a reference for future.			
11/05	OJT on installation of house connection	New house connection work on Markandya area from 63 mm HDPE pipe New branching of 20 mm HDPE pipe in Bunga are	James (NWSC)		
11/06	Lessons learned from site work, test, and feedback	Listing of key observations of leak repair OJT conducted on 10/31 and 11/01 Progress evaluation test lasting 45 minutes Scoring of test result, explanation of correct answers of each question Homework	Thapa Phatta	• Lessons learned from site visits • Test questions • Homework	4-3(J) (1), (2), (3)
11/07	Evaluation	Evaluation of the training by the participants			

Training 8 (3-2)

The schedule and contents of the training are as shown under Training 8 (3-2) of Distribution Pipeline Network).

(5) GIS

Term 1

Training 1 (1-1)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2016/ 11/22	Introduction to GIS and Quantum GIS (QGIS) Software	- Introduction to GIS and functions - Introduction of QGIS software	Alokkumar Katayama	• GIS and QGIS Intro	5-1 (J) (1)
11/23	Importing/Adding Raster and Vector Data in Map in QGIS	- Addition of raster data - Addition of vector data - Creation of new Point, Line, and Polygon shape files	Alokkumar Katayama	• Add Vec and Raster Data QGIS	5-1 (J) (2)
11/24	Editing of Shape files NWSC GIS Implementation	- To edit a Point, Line, and Polygon shape files - Introduction, procedure, resources, challenges and remedies, outcomes and way forward related to NWSC GIS database	(JICA E) Alokkumar Katayama (NWSC) Gilbert Akol Echelai	• Editing of Shape Files • • Gilbert_ SSUWC_JICA	5-1 (J) (3) 5-1 (N) (1)
11/25	Symbolizing Features and Querying Data	- Symbolizing features using single symbol and to change the color and style of point shape files - Use of categorized symbols and changing color and style of line shape files - Use of graduated symbols - Querying data using table	Alokkumar Katayama	• Symbolizing features n Data Query	5-1 (J) (4)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
11/26	Creation of a Map for Printing	- Addition of Map, Title, North arrow, Legend, and Scale to a Map Canvas - Printing a map or exporting as Image or pdf file	Alokkumar Katayama	• Creation of Map for Printing	5-1 (J) (5)
11/28	Recording of Location Data in GPS and Importing Data from GPS to QGIS Map	- Marking of location using GPS - Importing of GPX data to QGIS - Converting of GPX file to shape file	Alokkumar Katayama	• GPS Operation marking and data import	5-1 (J) (6)
11/29	Update of Data on Existing Water Supply Facilities	- Update of WTP, reservoir, customer data - Update of pipelines data - Update of buildings, roads	Alokkumar Katayama	• Update of Existing data WS Facilities	5-1 (J) (7)
11/30	Input of Data on New Customers Visualization of Customer Data	- Combining new customer locations to existing database - Marking new customer locations in GIS (without merging) - Input of data on newly recorded customers in shapefile - To show area covered by water supply and potential customers - To find out customers that are not receiving water - To find out customer with a particular name - To find out customers that are not paying bills	Alokkumar Katayama	• Input of Data on New Customers • Visualization of customer data	5-1 (J) (8) 5-1 (J) (9)
12/1	Checking of Customer Data and Joining Data GIS Data of Wau Water Supply Facilities	- To check if customer data of GIS and revenue are matching and to correct data if required - To add a column in the customer table containing data on Customer Reference Number - To join data from revenue to table of customer shape file in GIS using common column of CRNum - Introduction, procedure, resources, challenges and remedies, and outcomes related to Wau GIS database	Alokkumar Katayama	• Checking of customer data in GIS n Revenue Database	5-1 (J) (10)

Training 2 (1-2)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2017/ 1/16	Checking of customer data	Checking details of customer data already input in GIS	Thapa Phatta	• Explained directly on GIS system, no separate power point file prepared	
	Hands on practice GIS	- Updating software - Adding vector and raster layers - Grouping layers	Thapa Phatta		

		- Preparing maps (composing prints)			
1/17	Hands on practice GIS	- Preparing maps - Labelling - Searching (querry)	Thapa Phatta		
1/18	Joining customer data	- Joining customer data updated by two separate teams (merging vector layers) - Splitting vector layer	Thapa Phatta	• Explained directly on GIS system, no separate power point file prepared	
	Hands on practice GIS	Creating new shape files (lines and points)	Thapa Phatta		
	Visit to NWSC GIS centre	- Explanation of NWSC mapping system - Process of map preparation - Attributes of different water system components - Customer mapping - Generation of unique customer identification number and its use for linking GIS and revenue data - Use of GIS for maintenance management	(NWSC) Allan Mujja	• Explained directly on GIS system, no separate PP file prepared	
1/19	Hands on practice GIS	- Creating new shape files (polygons) - Stack labelling - Snapping - Editing District Metered Areas in Juba (editing polygons)	Thapa Phatta		
	Wrap-up discussion & awarding of certificate	- Summarizing the important points required for practical use of QGIS and presenting the certificates to each participant			

Term 2

Training 3 (2-1)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2017/ 6/16	OJT on updating of pipe network and water facilities map, and practice on basic GIS skills taught in earlier trainings	(Both GIS and Distribution teams worked together on 16th, 17th, 23rd, and 24th. Other days only 3 persons of GIS team.) - Explanation of proposed Grid system of Juba - Checking pipe material, size, year of installation, alignment on the road one by one starting from the Juba WTP - Adding missing pipes, deleting non-existing pipes - Doing the same for valves, bulk meters, tanks, and public stand-posts	Thapa Phatta	• GIS layers and database structure • Updating pipe network and water facilities	5-2 (J) (1) 5-2 (J) (2)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
6/17	Same as above	Same as above	Thapa Phatta		
6/19	Same as above	- Practice on symbology - Practice on labelling - Continuation of updating work on pipe network and water facilities as above	Thapa Phatta		
6/20	Same as above	- Practice on Georeferencing - Practice on choosing and applying correct coordinate system - Practice on preparing map for printing (Print composer) - Continuation of updating work on pipe network and water facilities as above	Thapa Phatta	• Tutorials files already provided during earlier training.	
6/21	Same as above	- Practice on Symbology - Practice on creating new GIS files from scratch when internet is available (practice of Wau town) - Continuation of updating work on pipe network and water facilities as above	Thapa Phatta	• Handouts already provided during earlier training.	
6/22	Same as above	- Practice on Quering - Practice on creating and managing Bookmark - Practice on 'Selection by location' function - Practice on 'Join attributes by location' function - Continuation of updating work on pipe network and water facilities as above	Thapa Phatta	• Handouts already provided during earlier training.	
6/23	Same as above	- Same work as on 16th, both GIS and Distribution teams worked together	Thapa Phatta		
6/24	Same as above	- Same work as on 16th, both GIS and Distribution teams worked together	Thapa Phatta		
6/26	OJT on updating of pipe network and customer map, and practice on basic GIS skills taught in earlier trainings	- More practice on 'Selection by expression' function - Practice on using Field calculator - Practice on rotating point symbols such as valves and flow meter - Continued updating work of pipe network and customer map	Thapa Phatta		
6/27	Same as above	- Topological correction of pipe network map - Adding fittings on pipe network map - Checking of customer map layer and preparing for field survey for updating customer information - More practice on symbology, querying, map preparation for printing.	Thapa Phatta		

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
6/28	Same as above	- Practice on how to join customer information in MS Excel file to GIS layer - Saving GIS data in Excel and practice on data analysis in Excel - More practice on map preparation for printing	Thapa Phatta		
6/29	Achievement test and feedback	- Achievement test - Feedback on test result	Thapa Phatta	• Initial assessment and final achievement test questions	5-2 (J) (3)
6/30	Overall review and homework	- Review of entire lessons based on the result of achievement test - Explanation of Homework • to complete topological check and correction of the remaining portion as a homework • to collect missing customer information (name, population) by a field survey and prepare Excel database as a homework. This will be used for next on-the-job training.	Thapa Phatta	• Homework	5-2 (J) (4)

Training 4 (2-2)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
12/4	Preparation of computer, software, review of homework, initial test to new trainee, review of basic GIS skills	- Homework was given to find and write names of about 700 customers which were missing in GIS points of customers. They did not do the given work but had brought all the survey forms to Uganda. - In order to understand the level of new trainee, a simple test was conducted lasting about 1 hour. The Excel and Word test was also taken by two other trainees. - Basic GIS skills were review for the new trainee and as a. refresher for the other two.	Thapa Phatta	• Initial assessment test questions	5-2 (J) (6)
12/5	Refresher lessons of basic and medium level GIS	- Refresher lessons of basic and medium level GIS using QGIS (adding layers, creating new layers, coordinate reference system, symbolizing, labelling, querying). - Importing GPS data to GIS. - Practice of the above.	Thapa Phatta		
12/6	Cleaning customer data in GIS	- Map and map book preparation. - Practice of the above. - Correcting names of customers	Thapa Phatta		

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
		and verifying locations of customers in GIS map.			
12/7	Same as above	- Same as above	Thapa Phatta		
12/8	Same as above	- Same as above	Thapa Phatta		
12/9	Same as above	- Same as above	Thapa Phatta		
12/11	Same as above	- Working together with Finance team to correct names and verify locations of customers	Thapa Phatta		
12/12	Preparing unique IDs of customer	- Working together with Finance team to give each customer a unique ID. - Finding the customers in billing database and matching with the customer points in GIS map.	Thapa Phatta		
12/13	Same as above	- Same as above	Thapa Phatta		
12/14	Same as above	- Same as above	Thapa Phatta		
12/15	Joining of customers in GIS to billing database	- Joining of customer location in GIS (about 540 customers) with customer data in billing database. - Practice of the above.	Thapa Phatta	• How to link customer accounts to points in GIS map	5-2 (J) (5)
12/16	Achievement test, homework, and feedback	- Practical test lasting 45 minutes was taken - Homework was given which they should do and bring for the next training	Thapa Phatta	• Achievement test questions • Homework	5-2 (J) (7) 5-2 (J) (8)

Training 5 (2-3)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2018/ 2/26	Preparation of computer, software, review of homework, review of basic GIS skills, and practice	- Homework was given correct names and address of the customers but they did not do anything - Basic GIS skills were reviewed as a refresher course	Thapa Phatta		
2/27	Refresher lessons on medium level GIS skills, and practice	- Rule based symbology, rule-based labelling, querying, etc. - Lesson on joining of customer data with GIS points - Practice of the above	Thapa Phatta	• Steps for rule-based symbology and labelling • How to link customer accounts to points in GIS map	5-2 (J) (9)
2/28	Lessons on advance level GIS skills, and practice.	- Creating new symbols using Inkscape program - Customer database cleaning (correcting addresses, names etc.) - Practice of the above	Thapa Phatta	• Steps for using Inkscape for preparing new symbols	5-2 (J) (10)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
3/1	Compilation and explanation of prepared materials, achievement test, and feedback	- Compilation of all materials prepared from the beginning - Quick review of the materials and subjects covered in each material - Practical test consisting of 9 questions and 90 minutes duration - Feedback on the test result and answers	Thapa Phatta	• Achievement test questions • Homework	5-2 (J) (11) 5-2 (J) (12)
3/2	Working together with Finance team to clean customer data for linking customer database with GIS	- Checking customer name and address in customer ledger (billing database) and finding that customer in GIS - Correcting minor spelling errors to match perfectly those two sources of data (customer ledger and GIS)	Thapa Phatta		
3/3	Same as above	- Same as above	Thapa Phatta		

Term 3

Training 6 (3-1)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2019/ 1/29	Update of QGIS software and folder/ file system management	- Installed QGIS version 3.2, the earlier version was 2.18, - Taught them how to prepare new folder and filing system	Thapa Phatta		
	Review of homework and activities of GIS team	- Enquired what GIS work the participants did during the gap between previous and this training period			
	Introduction to new version of QGIS	- Introduced and explained the changes between version 2.18 and 3.2			
1/30	GIS basics (1): Refresher of basic tools and operation; lecture and practice	- Explained the basic tools and menu items and their functions. - Explained basic functions such as creating new shape files and symbolizing features. - In the afternoon, the trainees practiced the items taught in the morning.	Thapa Phatta	• Tutorials 1 (Symbolizing), • Tutorial 2 (Creating new shape files) (Screen Recording of Microsoft Power Point + Media file)	5-3 (J) (1) 5-3 (J) (2)
1/31	GIS basics (2): Refresher of basic operations; lecture and practice	- Lecture and demonstration on basic functions such as adding features, selecting suitable data type, snapping options, and so on in the morning. - They practiced the same items in the afternoon.	Thapa Phatta	• Tutorials 3 (Adding features and selecting suitable data type), • Tutorial 4 (Snapping options), • Tutorial 7 (Arranging field and using filtering function)	5-3 (J) (3) 5-3 (J) (4) 5-3 (J) (7)

Date	Title	Contents	Lecturer	File name of the presentation and materials	File No.
2/1	GIS basics (3) lecture and practice	- Lecture and demonstration on basic functions such as editing shapefile, exporting, viewing statics, labelling, querying, filtering and so on in the morning. - They practiced the same items in the afternoon.	Thapa Phatta	• Tutorials 5 (Quarrying), • Tutorial 6 (Labelling), • Tutorial 8 (Calculating pipe length according to diameter and material)	5-3 (J) (5) 5-3 (J) (6) 5-3 (J) (8)
2/2	GIS basics (4) lecture and practice	- Lecture and demonstration on composing print layout, inserting map elements, scaling, exporting maps, georeferencing images, and so on in the morning. - They practiced the same items in the afternoon.	Thapa Phatta	• Tutorial 9 (Composing print layout and Atlas)	5-3 (J) (9)
2/4	Advance topics in GIS (1): lecture and practice	- Installing and using various plugins, Atlas preparation, joining tables, and so on in the morning. - They practiced the same items in the afternoon.	Thapa Phatta	• Tutorial 9 (Composing print layout and Atlas), • Tutorial 10 (Joining tables)	5-3 (J) (9) 5-3 (J) (10)
2/5	Advance topics in GIS (2): lecture and practice	- Use of GeoPackage and important vector tools (buffering, clipping, line to polygon conversion, polygon to line conversion)	Thapa Phatta	• Tutorial 11 (GeoPackage) • Tutorial 12_1 (Buffering and clipping)	5-3 (J) (11) 5-3 (J) (12_1)
2/6	Using vector tools, and Preparation of image basemap	- Other vector tools (joining attributes by location, merging vector layers, splitting vector layers, selection by location, and creating grids) - Demonstration on how to prepare an image basemap - Preparation of an image basemap of Wau city by the participants	Thapa Phatta	• Tutorial 12_2 (Splitting, joining, and attribute extraction)	5-3 (J) (12_2)
2/7	Use of vector tools, evaluation test	- Practice of vector tools - Evaluation test (3 hour-long) - Feedback on evaluation test	Thapa Phatta	• Achievement test questions	5-2 (J) (3)
2/8	GIS network update of Juba, homework	- GIS network update of Juba including newly installed bulk meters - Homework	Thapa Phatta	• Homework	5-2 (J) (4)

Note: Refer to CD3 for 5-3.

(6) O&M of Purification Plant (Elc&Mech) (Water Treatment)

Term 1

Training 1 (1-1)20161120-1203

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Nov/22	1. Organization of "O &M of Purification Plant in Juba Station" & Relationship of other section	N. Matsumoto	SSUWC organization and role	6-1 (J)
	2. Charge of "O &M of Purification Plant in Juba Station"	N. Matsumoto	Standard Operating Procedure ver4(draft)	6-3 (J)
	3. Sedimentation & Coagulant (Alum)	N. Matsumoto	Coagulation-Sedimentation	6-33 (J)
	"4. Basic Arithmetic Study-1 (Mental Calculation, Common Fraction),	N. Matsumoto	Arithmetic-2 Arithmetic-3	6-9a (J) 6-9b (J)

	"5. Basic Arithmetic Study-2 (Unit Conversion),		Unit Conversion	6-9c (J)
Nov/23	6. Sand Filter	N. Matsumoto	OM Manual for Purification	6-4 (J)
	7. Chlorine			
	8. Review of "Operation and Maintenance Manual"	N. Matsumoto	Checklist of Operation Procedures	6-6 (J)
	9. Monthly Report		Check List of Electric and mechanical Equipment	6-23 (N)
	10. Summary of Maintenance			
Nov/24	11-15. WTP field trip (NWSC)	NWSC	Entebbe WTP	-
Nov/25	16-18. Generator (NWSC)	NWSC	-	-
	19-20. Operation	N. Matsumoto	monthly Report for the Month of November	6-34 (J)
Nov/26	21-22. Monthly Report			
	23. Risk management			
Nov/28	24. Procedure to purchase (chemical, equipment, spare parts, expendables)	N. Matsumoto	Spare Parts List	6-7 (J)
	25-26. Equipment list, Spare parts list, Expendable list			
	27. Identification of problems			
	28. Discuss the problems			
Nov/29	29. Discuss the problems			
	30-31. decide the procedure to resolve			
	32-33. Pump (NWSC)	NWSC	-	-
Nov/30	34-35. Evaluation and diagnosis of sand	N. Matsumoto	Purification Plant Drawings(20120218)	6-32 (J)
	36-38. Procedure to wash sand			
Dec/1	39. Generator review(NWSC)	NWSC	O&M Generators	6-24 (N)
	40. Pump review(NWSC)	NWSC	O & M pumps 2 Final	6-26a (N)
Dec/2	44. Review of this seminar	N. Matsumoto	-	-
	45. Planning of next seminar	N. Matsumoto	-	-

Training 2 (1-2)20170108-0115

(Electric and Generator, Pumps) 4 persons

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Jan/10	1. Safety management: lecture	NWSC	Occupational, Environmental Health & Safety	6-2 (N)
	2. Safety management: practice			
	3. Storage management: lecture		INVENTORY MANGEMENT JICA	6-7a (N)
	4. Pump: lecture		O & M pumps 2 Final	6-26a (N)
	5. Pump: practice			
Jan/11	6. Pump : practice	NWSC	O & M pumps 2 Final	6-26a (N)
	7. Pump : practice			
	8.Pump : practice			
	9. Generator: lecture		O&M Generators	6-24 (N)
	10. Generator: practice			
Jan/12	11. Generator: practice	NWSC	O & M Generators	6-24 (N)
	12. Generator: practice			
	13. Generator: practice			
	14. Electrical equipment: lecture		Perform Service of control panels SSUWC	6-29 (N)
	15. Electrical equipment: practice			
Jan/13	16. Electrical equipment: practice	NWSC	-	-
	17. Electrical equipment: practice			
	18. Electrical equipment: practice			
	19: Visit Kampara Supplier of Generator Pumps Electrical parts	NWSC	-	-
	20: Visit Kampara Supplier of Generator Pumps Electrical parts			
Jan/14	21. Wrap up and Award Ceremony at IREC	N. Matsumoto	-	-
	22. Wrap up and Award Ceremony at IREC			
	Distribution management for Water			

	treatment plant staff			

(Water Purification) 3 persons

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Jan/10	1. Safety management: lecture	NWSC	Occupational, Environmental Health & Safety	6-2 (N)
	2. Safety management: practice			
	3. Storage management: lecture		INVENTORY MANGEMENT JICA	6-7a (N)
	4. Pump: lecture		O & M pumps 2 Final	6-26a (N)
	5. Pump: practice			
Jan/11	6. Hydraulic Calculation : lecture	N. Matsumoto	Basic Hydraulic	6-43 (J)
	7. Hydraulic Calculation : lecture			
	8. Hydraulic Calculation : lecture			
	9. Generator: lecture	NWSC	O&M Generators	6-24 (N)
	10. Generator: practice			
Jan/12	11. WTP O & M : lecture	N. Matsumoto	Check List of Electric and mechanical Equipment	6-23 (J)
	12. WTP O & M : lecture			
	13. WTP O & M : lecture			
	14. Electrical equipment: lecture	NWSC	Electric-mechanical Equipment	6-5 (J)
	15. Electrical equipment: practice			
Jan/13	16. WTP O & M : lecture	N. Matsumoto	Check List of Electric and mechanical Equipment	6-23 (J)
	17. WTP O & M : lecture			
	18. WTP O & M : lecture			
	19: Visit Kampara Supplier of Generator Pumps Electrical parts	NWSC		
	20: Visit Kampara Supplier of Generator Pumps Electrical parts			
Jan/14	21. Wrap up and Award Ceremony at IREC	N. Matsumoto		
	22. Wrap up and Award Ceremony at IREC			
	Distribution management for Water treatment plant staff			

Term 2

Training 3 (2-1)20170702-0717

(Electric and Generator, Pumps)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Jul/4	Orientation : Schedule of this training : lecture	N. Matsumoto	-	
	Review : Last training : lecture		-	
	Generator: practice	NWSC	O&M Generators	6-24 (N)
Jul/5	Practice at Gaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC	SSUWC Training - Gaba WTP	6-40 (N)
Jul/6	Pump : practice	NWSC	O & M pumps 2 Final	6-2 (N)
Jul/7	Water quality monitoring method : lecture	NWSC	Water Quality Data	6-41 (N)
	WTP O & M	N. Matsumoto	OM Manual for Purification	6-4 (J)
Jul/8	Equipment list, Spare parts list, Expendable list		Spare Parts List	6-7 (J)
	WTP O & M		OM Manual for Purification	6-4 (J)
Jul/10	Safety management: lecture	NWSC	Occupational, Environmental Health & Safety	6-2 (N)
	Storage management: lecture		INVENTORY MANGEMENT JICA	6-7a (N)
	Visit at supplier of Generator Pumps Electrical parts		-	

Jul/11	Blower: practice	NWSC	Blowers and Compressors Notes	6-26b (N)
Jul/12	Valve : practice	NWSC	Water meter, Valve and Gauge presentation	6-26c (N)
Jul/13	Chemical feeding equipment : practice	NWSC	SSUWC Training - Gaba WTP	6-40 (N)
	Electorical equipment: practice(Panel, Wiring, Instrument)		Electric-mechanical Equipment	6-5 (J)
Jul/14	Electorical equipment: practice(Panel, Wiring, Instrument)	NWSC	Electric-mechanical Equipment	6-5 (J)
Jul/15	WTP O & M : lecture	N. Matsumoto	O&M Manual for Purification	6-4 (J)

(Water Purification) 3 persons

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Jul/4	Orientation : Schedule of this training : lecture	N. Matsumoto	-	
	Review : Last training : lecture		-	
	Theory of Water Treatment : lecture		Presentation Water Treatment	6-33a (J)
Jul/5	Practice at Gaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC	GABA WTP 1, 2 & 3 LAYOUT AND PROCESSES	6-40 (N)
Jul/6	Practice at Gaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC		
Jul/7	Water quality monitoring method : lecture	NWSC	Water Quality Monitoring Program Daily Water Test Results 16082021	6-38 (N) 6-39 (N)
	WTP O & M	N. Matsumoto	O&M Manual for Purification	6-4 (J)
Jul/8	Equipment list, Spare parts list, Expendable list		Spare Parts List	6-7b (J)
	WTP O & M		O&M Manual for Purification	6-4 (J)
Jul/10	Safety management: lecture	NWSC	Occupational, Environmental Health & Safety	6-2 (N)
	Storage management: lecture		INVENTORY MANGEMENT JICA	6-7a (N)
	Visit at supplier of Generator Pumps Electrical parts		-	-
Jul/11	Practice at Gaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC	GABA WTP 1, 2 & 3 LAYOUT AND PROCESSES	6-40 (N)
Jul/12	Practice at Gaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC		
Jul/13	Practice at Gaba WTP with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC		
Jul/14	WTP Operation and maintenance/Hydrology	N. Matsumoto	O&M Manual for Purification	6-4 (J)
	WTP O & M : lecture			
Jul/15	WTP O & M : lecture	N. Matsumoto	O&M Manual for Purification	6-4 (J)

Training 4 (2-2)20170903-0918

(Electric and Generator, Pumps)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Sep/5	5.3.1 Practice of Electrical equipment, panel wiring, Repair and	NWSC	Electromechanical tools Electric-mechanical Equipment	6-22 (N) 6-5 (J)

	Inspection(wiring, panels, Change over switch, contactor, meter, cable, tool etc.)		Check List of Electric and mechanical Equipment	6-23 (J)
Sep/6	Equipment list, Spare parts list, Expendable list	N. Matsumoto	Equipment List Spare Parts List	6-7c (J) 6-7b (J)
	WTP O & M		OM Manual for Purification	6-4 (J)
Sep/7	5.3.1 Practice of Electrical equipment, panel wiring, Repair and Inspection(wiring, panels, Change over switch, contactor, meter, cable, tool etc.)	NWSC	Electromechanical tools Electric-mechanical Equipment Check List of Electric and mechanical Equipment	6-22 (N) 6-5 (J) 6-23 (J)
Sep/8	5.1.3 Visit at manufacturer of Electric Panel	NWSC	-	
Sep/9	Equipment list, Spare parts list, Expendable list	N. Matsumoto	Equipment List Spare Parts List	6-7c (J) 6-7b (J)
Sep/11	5.1.1 Lecture Maintenance Procedure	NWSC	OM Manual for Purification	6-4 (J)
	5.3.2 Practice of Generator (overhauling, trouble shooting, Generator Panel electrical wiring)	NWSC	O & M Generators Perform Generator service SSUWC	6-24 (N) 6-25 (N)
Sep/12	5.3.2 Practice of Generator (overhauling, trouble shooting, Generator Panel electrical wiring)	NWSC		
Sep/13	5.3.2 Practice of Generator (overhauling, trouble shooting, Generator Panel electrical wiring)	NWSC		
Sep/14	5.3.2 Practice of Generator (overhauling, trouble shooting, Generator Panel electrical wiring)	NWSC		
Sep/15	5.1.4 Site visit: Other WTP	NWSC	JINJA WTP	-
Sep/16	Equipment list, Spare parts list, Expendable list	N. Matsumoto	Equipment List Spare Parts List	6-7c (J) 6-7b (J)

(Water Purification) 3 persons

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Sep/5	5.2.1 Lecture Outline of Gaba WTP I, II, III	NWSC	GABA WTP 1, 2 & 3 LAYOUT AND PROCESSES	6-40 (N)
	5.2.2 Training of Turbidity and Residual chlorine analysis in WTP		Water Quality Monitoring Program Daily Water Test Results 16082021	6-38 (N) 6-39 (N)
Sep/6	Equipment list, Spare parts list, Expendable list	N. Matsumoto	Equipment List Spare Parts List	6-7c (J) 6-7b (J)
	WTP O & M		OM Manual for Purification	6-4 (J)
Sep/7	5.2.3 Lecture of Operation Manual for Gaba WTP (I, II, III) (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC	-	-
Sep/8	5.1.3 Visit at manufacturer of Electric Panel	NWSC	-	-
Sep/9	Equipment list, Spare parts list, Expendable list	N. Matsumoto	Equipment List Spare Parts List	6-7c (J) 6-7b (J)
Sep/11	5.1.1 Lecture Maintenance Procedure	NWSC	OM Manual for Purification	6-4a (J)
	5.2.4 Lecture of How to report Operation and Maintenance	NWSC	Operation and Maintenance of Gaba1	6-4b (N)
Sep/12	5.2.5-1 Practice at Gaba WTP (Gaba I) with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)	NWSC	-	-
Sep/13	5.2.5-2 Practice at Gaba WTP (Gaba I) with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control)			

Sep/14	WTP O & M	N. Matsumoto	OM Manual for Purification	6-4a (J)
Sep/15	5.1.4 Site visit: Other WTP	NWSC	-	-
Sep/16	Equipment list, Spare parts list, Expendable list	N. Matsumoto	Equipment List Spare Parts List	6-7c (J) 6-7b (J)

Training 5 (2-3)20171203-1217

(Electric and Generator, Pumps)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Dec/5	Lecture & Discussion; Equipment Spareparts Consumable List	N. Matsumoto	Equipment List Spare Parts List Spareparts Consumable List	6-7c (J) 6-7b (J) 6-16 (J)
	Discussion of SOP etc.	N. Matsumoto	SOP for Purification	6-42 (J)
Dec/6	Training of Alternator (Generator)	NWSC	O & M Generators	6-24 (N)
Dec/7	5.2.2 (M&E: 4 persons) Training of Electrical (flow meter, motor, panel, wiring, protection system).	NWSC	Electromechanical tools Electric-mechanical Equipment Check List of Electric and mechanical Equipment	6-22a (N) 6-5 (J) 6-23 (J)
Dec/8	Visit to Kampala (Panel manufacturer)	NWSC	-	-
Dec/9	Equipment Spare parts Consumable List, How to Report	N. Matsumoto	Equipment List Spare Parts List Consumable List	6-7c (J) 6-7b (J) 6-16 (J)
Dec/11	5.2.3 (M&E: 4 persons) Training of Pump(>400m3/h, 50m, 100kW, gland & mechanical packing)	NWSC	O & M pumps 2 Final	6-26a (N)
Dec/12	5.2.4 (M&E: 4 persons) Training of Rewinding 3-phase squirrel cage induction motor(>100kW)	NWSC	Perform rewinding electric motor and Welding machine	6-28 (N)
Dec/13	5.2.4 (M&E: 4 persons) Training of Rewinding 3-phase squirrel cage induction motor(>100kW)			
Dec/14	(M&E + Distri + NRW : 11 persons) 7.2 Practical training how to weld pipes and fittings guided	NWSC	Tech specs EM Wshop tools Tech specs for Welding Machine	6-11 (N) 6-12 (N)
	5.2.4 (M&E: 4 persons) Training of Rewinding 3-phase squirrel cage induction motor(>100kW) and Graduation examination	NWSC	Perform rewinding electric motor and Welding machine	6-28 (N)
Dec/15	Visit to WTP Masaka(120km)	NWSC	-	-
Dec/16	Discussion of SOP ; Wrap up"	N. Matsumoto	SOP for Purification	6-42 (J)

(Water Purification) 3 persons

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Dec/5	Lecture & Discussion; Equipment Spareparts Consumable List	N. Matsumoto	Equipment List Spare Parts List Consumable List	6-7c (J) 6-7b (J) 6-16 (J)
	Discussion of SOP etc.	N. Matsumoto	SOP for Purification	6-42 (J)
Dec/6	Practice at Ggaba WTP (Ggaba II) with NWSC Operation team (intake, sedimentation, filter, distribution pump, chemical, Waste water treatment, control)	NWSC	GABA WTP 1, 2 & 3 LAYOUT AND PROCESSES	6-40 (N)
Dec/7	Practice at Ggaba WTP (Ggaba III) with NWSC Operation team (intake, sedimentation, filter, distribution pump, chemical, Waste	NWSC		

	water treatment, control)			
Dec/8	Visit to Kampala (Panel manufacturer)	NWSC	-	-
Dec/9	Equipment Spare parts Consumable List, How to Report	N. Matsumoto	Equipment List Spare Parts List Consumable List	6-7c (J) 6-7b (J) 6-16 (J)
Dec/11	Lecture & Discussion; Monthly Report"	N. Matsumoto	Monthly Report for the Month of November	6-34 (J)
Dec/12	Discussion; Even water supply "	N. Matsumoto		
	Discussion; WQ monitoring report"	N. Matsumoto		
Dec/13	Lecture and practice of WQ monitoring quality control using x-R control chart	NWSC	Water Quality Data	6-41 (N)
Dec/14	Review of training (Part2) and Graduation examination	N. Matsumoto	-	-
Dec/15	Visit to WTP Masaka(120km)	NWSC	-	-
Dec/16	Discussion of SOP ; Wrap up"	N. Matsumoto	SOP for Purification	6-42 (J)

Term 3

Training 6 (3-1)20181202-1215

(Electric and Generator, Pumps)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Dec/4	5.1.Lecture & Discussion; Safety "	NWSC	Occupational, Environmental Health & Safety	6-2 (N)
	5.2. Practice at Gaba WTP (Gaba I & II & III) with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control) "	NWSC	GABA WTP 1, 2 & 3 LAYOUT AND PROCESSES	6-40 (N)
Dec/5	5.3.Training of Generator	NWSC	O&M Generators	6-24 (N)
Dec/6	5.3.1 Training of Generator			
Dec/7	5.3.2 Training of Blower	NWSC	Blowers and Compressors Notes	6-26b (N)
Dec/8	5.3.3 Training of Valve	NWSC	Water meter, Valve and Gauge presentation	6-26c (N)
Dec/10	5.3.4 Training of Pump	NWSC	O & M pumps 2 Final	6-26a (N)
Dec/11	5.3.4 Training of Pump			
Dec/12	5.3.5 Training of Motor	NWSC	Perform rewinding electric motor and Welding machine	6-28 (N)
Dec/13	5.3.6 Training of Electrical panel & Wiring and Instrument	NWSC		
	5.3.7 Wrap up of Practice	N. Matsumoto	-	-
	Discussion of SOP	N. Matsumoto	SOP for Purification	6-42 (J)

(Water Purification) 3 persons

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Dec/10	Lecture & Discussion; Monthly Report	N. Matsumoto	Monthly Report for the Month of November	6-34 (J)
Dec/11	Discussion; Even water supply			
Dec/12	Lecture & Discussion; Rapid Sand Filter	N. Matsumoto	Presentation Water Treatment	6-33a (J)
	Practice; Rapid Sand Filter at Gabba WTP II & III	N. Matsumoto	-	-
Dec/13	Discussion of SOP	N. Matsumoto	SOP for Purification	6-42 (J)

Training 7 (3-2)20190224-0309

(Electric and Generator, Pumps)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Feb/26	Purpose of the Training etc	N. Matsumoto	-	-

	5.1.Lecture & Discussion; Safety "	NWSC	Occupational, Environmental Health & Safety	6-2 (N)
	5.2. Practice at Gaba WTP (Gaba I & II & III) with NWSC operation team (intake, sedimentation, filter, distribution pump, chemical, waste water, control) "	NWSC	GABA WTP 1, 2 & 3 LAYOUT AND PROCESSES	6-40 (N)
Feb/27	Lecture of Running & Operation record	N. Matsumoto	Monthly Report for the Month of November	6-34 (J)
Feb/28	5.3.1 Training of Blower	NWSC	Blowers and Compressors Notes	6-26b (N)
Mar/1	5.3.2 Training of Motor & Panel	NWSC	Perform rewinding electric motor and Welding machine	6-28 (N)
Mar/2	5.3.3 Training of Valve	NWSC	Water meter, Valve and Gauge presentation	6-26c (N)
Mar/4	5.3.4 Training of Generator	NWSC	O&M Generators	6-24 (N)
Mar/5	5.3.5 Training of Pump (small)	NWSC	O & M pumps 2 Final	6-26a (N)
Mar/6	5.3.6 Training of Pump (large)	NWSC		
Mar/7	Discussion of SOP etc	N. Matsumoto	SOP for Purification	6-42 (J)

(Water Purification) 3 persons

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
Mar/4	Lecture & Discussion; Monthly Report	N. Matsumoto	Monthly Report for the Month of November	6-34 (J)
Mar/5	Discussion; Equal water supply	N. Matsumoto		
	Visit to Muyenga Resovoir	NWSC	-	-
Mar/6	Discussion of SOP	N. Matsumoto	Standard Operating Procedure ver4	6-3 (J)
Mar/7	Discussion of SOP etc	N. Matsumoto		

(7) Water Quality Management

Term 1

Training1 (1-1) (at KEWI, Nairobi)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/22 2016	Interview and discussion about SSUWC activity	Y. Morita	• Interview about SSUWC activity 2016 Nov.	7-1(J)-1
	Unit for water quality analysis and unit conversion	Y. Morita	• Unit for water quality monitoring	7-1(J)-2
11/23	Theory and process management of coagulation and sedimentation	Y. Morita	• Coagulation-sedimentation • Calculation of alum injection • Discussion with SSUWC CP coagulation sedimentation	7-1(J)-3
	Theory and process management of sand filtration	Y. Morita	• Sand filtration	7-1(J)-4
	Theory and process management of chlorination	Y. Morita	• Chlorination	7-1(J)-5
11/24	Water quality data assessment	Y. Morita	• Data assessment	7-1(J)-6
	Site visit at National Water Quality Laboratory (Nairobi city)	KEWI		
11/25	Water quality data review and monthly report preparation including water quality data analysis training using Excel	Y. Morita	• SSUWC data review Nov 2016	7-1(J)-7
11/28	Introduction of Biological test	Y. Morita	• Biological test	7-1(J)-8
	Site visit at Kabete WTP and water quality analysis company (Nairobi city)	KEWI		
11/29	Laboratory training of Jar test	KEWI		
11/30	Calculation of coagulant injection ratio using Jar test data	Y. Morita	• Jar test • Jar test data analysis	7-1(J)-9
12/1	Visit to water quality monitoring equipment /	Y. Morita		

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
	reagent distributors in Nairobi			

Term 1

Training 2 (1-2) (at KEWI, Nairobi)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
1/10 2017	Jar test data review and monthly report preparation	Y. Morita	• SSUWC Jar test data review Dec 2016	7-2(J)-1
1/11	Water quality data review and monthly report preparation	Y. Morita	• SSUWC data review Dec 2016 • Presentation SSUWC data	7-2(J)-2
1/12	Laboratory training of chlorine demand test	KEWI Y. Morita	• Lecture Chlorine demand test data	7-2(J)-3
1/13	Calculation of chlorine injection ratio using chlorine demand test data	Y. Morita	• Chlorine demand and consumption test	7-2(J)-4
	Site visit at Ticka water and sewerage company (THIWASCO)	KEWI and THIWASCO		

Term 2

Training 3 (2-1) (at Ggaba WTP, Kampala)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
6/27 2017	Interview and discussion about SSUWC activity (Additional interview: 7/7)	Y. Morita	• Interview about SSUWC activity 2017 Jul	7-3(J)-1
6/28	Site visit at water quality laboratory and water monitoring system in Ggaba WTP 1	NWSC		
	Laboratory training Jar test and chlorine demand test (Day1)	NWSC	• NWSC Chlorine demand test and Jar test SOP • Chlorine demand test data • Jar test data	7-3(J)-2
6/29	Laboratory training Jar test and chlorine demand test (Day2)	NWSC		
6/30	Visit to water quality monitoring equipment / reagent distributors in Kampala	Y. Morita		
7/1	Water quality data review and monthly report preparation	Y. Morita	• Revised monthly report July 2017 • SSUWC data review July 2017	7-3(J)-3
7/3	Water quality data review and monthly report preparation	Y. Morita		
7/4	Water quality data review and monthly report preparation	Y. Morita		
	Joint workshop with SSUWC WTP C/P: Theory of water treatment	Y. Morita	• Training coagulation-Sedimentation • Training Sand filtration • Training Chlorination	7-3(J)-4
7/5	Practical training at Ggaba WTP 2 and 3 (with SSUWC WTP C/P)	NWSC		
7/6	Practical training at Ggaba WTP 2 and 3 (with SSUWC WTP C/P)	NWSC		
7/7	Joint workshop with SSUWC WTP C/P: Water quality test for WTP operation	Y. Morita	• WQ monitoring for treatment process management	7-3(J)-5

Training 4 (2-2) (at Ggaba WTP, Kampala)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
9/4 2017	Review of previous training	Y. Morita	• Review of previous training	7-4(J)-1
	Quality control of water quality monitoring data	NWSC	• Quality control of Water quality monitoring data	7-4(J)-2

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
9/5	Joint workshop with SSUWC WTP C/P: Introduction of Ggaba WTP I, II, III	NWSC	• SSUWC Training - Understanding GABA WTP 1,2 &3 layout and processes	7-4(J)-3
	Practical training of turbidity and residual chlorine monitoring in WTP with SSUWC WTP C/P (Day1)	NWSC		7-4(J)-4
9/6	Practical training of turbidity and residual chlorine monitoring in WTP with SSUWC WTP C/P (Day2)	NWSC		
9/7	Water quality data review and monthly report preparation	Y. Morita	• SSUWC data review Sep 2017 • Comparison turbidity meter SSUWC and NWSC •	7-4(J)-5
9/8	Water quality data review and monthly report preparation	Y. Morita		
9/9	Joint workshop with SSUWC WTP C/P: Improvement water treatment process based on water quality data	Y. Morita N. Matumoto	• Alum tank operation timetable	7-4(J)-6
9/11	Visit to water quality equipment distributor (Kampala city)	Y. Morita		
9/12	Practical training at Ggaba WTP with SSUWC WTP C/P	NWSC		
9/13	Site visit at Lubigi WWTP at Kampala	NWSC		
9/14	Joint workshop with SSUWC WTP C/P: Calculation of coagulant and chlorine injection	Y. Morita N. Matumoto	• Calculation of chemical injection • Chemical calculator for SSUWC	7-4(J)-7
9/15	Site visit at Jinja WTP with SSUWC WTP C/P	NWSC		

Training 5 (2-3) (at Ggaba WTP, Kampala)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
12/7 2017	Practical training at Gaba 1 WTP with SSUWC WTP C/P	NWSC		
12/8	Calculation of coagulant and chlorine injection	Y. Morita		
12/9	Proficiency test and follow up Part1	Y. Morita N. Matumoto	• Proficiency test follow up Part1	7-5(J)-1
12/11	Laboratory training of chlorine demand test	NWSC	• Chlorine demand test data sheet Dec.11	7-5(J)-2
12/12	Water quality data review and monthly report preparation	Y. Morita	• Monthly report Jan – Nov 2017	7-5(J)-3
	Proficiency test and follow up Part2	Y. Morita N. Matumoto	• Proficiency test follow up Part2	7-5(J)-4
12/13	Labo training of pH meter and EC meter calibration	NWSC		
12/14	Preparation of SOPs for pH, EC and Turbidity	Y. Morita	• Standard operation procedure pH • Standard operation procedure EC • Standard operation procedure Turbidity	7-5(J)-5
12/15	Site visit at Masaka WTP with SSUWC WTP C/P	NWSC		

Term 3

Training 6 (3-1) (at Ggaba WTP, Kampala)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
12/10 2018	Water quality data review and monthly report preparation	Y. Morita	• Chlorine demand test data • Monthly report Jan. -Dec. 2018	7-6(J)-1
12/11	Quality and accuracy control of water quality	Y. Morita	• Data quality management	7-6(J)-2

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
	monitoring data		• Statistic item S.Sudan	
12/12	Joint workshop with SSUWC WTP C/P: Lecture of rapid sand filtration	Y. Morita N. Matumoto	• Comparison table Type of Filtration	7-6(J)-3
	Occupation health and workplace safety	NWSC	• Module Perform occupational health and safety practices	7-6(J)-4
12/13	Joint workshop with SSUWC WTP C/P: Revision of existing SOP for WTP operation and WQ monitoring	Y. Morita N. Matumoto	• Alum tank operation • Revised SOP, Dec. 12-13 2018	7-6(J)-5

Term 3

Training 7 (3-2) (at Ggaba WTP, Kampala)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
3/4 2019	Water quality data review and monthly report preparation	Y. Morita	• Monthly report Q and A • Turbidity and Treatment process Data sheet • Turbidity and Treatment process Graph	7-7(J)-1
3/5	Visit to water quality equipment distributor (Kampala city)	Y. Morita	• Meeting at Palin test Co.	7-7(J)-2
	Site visit at service reservoir in Kampala city	NWSC	• Photo	7-7(J)-3
3/6	Training of water quality data analysis	Y. Morita	• See File 7-1	7-7(J)-1
3/7	Joint workshop with SSUWC WTP C/P: Revision of existing SOP for WTP operation and WQ monitoring	Y. Morita N. Matumoto	• Revised SOP, Mar.7 2019	7-7(J)-4

(8) Headquarter Management

Term 1

Training 1 (1-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/22	Review of Problem analysis	H. Sato	• 05_Problem and Objective trees	8-1(J)05
	Result of Baseline survey of SSUWC Juba station	H. Sato	• 01_JCC1final presentation	8-1(J)07
	Explanation of capacity assessment for SSUWC Juba station	H. Sato	• Report on Capacity Assessmen 20160629	8-1(J)08
11/23	Manual for Reporting and Planning System for Juba Station	H. Sato	• Manual for Reporting and Planning System for Juba Station	8-1(J)01
	Performance Indicators (PI) of Juba station Record format and database	H. Sato	• Performance Indicators (PI) and Data Sheet Datasheet for SSUWC Headquarter Local Station Management	
	Roles of SSUWC Headquarter Duty and responsibility of HQ staff/department	H. Sato	• Roles of SSUWC Headquarter Reporting and Planning System Database of Stations	8-1(J)02
12/24	Explanation of Corporate plan of SSUWC (performance contract)	B. Lawrence	• SSUWC CP Presentation LLM May 2015	8-2(J)
	Explanation of Corporate plan of NWSC	NWSC	• NWSC CORPORATE PLANNING PROCESS	8-3(N)
12/25	Reform history of NWSC Reform history of NWSC Implementation of improvement program and the result	NWSC	• Reform History NWSC 25.Nov.2016	8-4(N)
12/26	Review of training and preparation of draft improvement plan.	H. Sato	• SSUWC Management Training Daily Report 2016 Nov 26	8-5(S)

Training 2 (1-2)

Date	Training topic	Lecturer	File name of the presentation and	File No.

			materials	
1/10 2017	Check of the homework for reform agenda	H. Sato	-	-
	Explanation and Review of JICA Capacity Development Project	H. Sato	-	-
	Tariff setting policy and guideline (theory)	NWSC	• Regulation and Adjustment Mechanisms of Tariffs SS	1-16 (N)
1/11	Manual for Reporting and Planning System for Juba Station	H. Sato	• Manual for Reporting and Planning System for Juba Station	8-1(J)01
	Performance Indicators (PI) of Juba station, Database	H. Sato		
	Juba Station Annual plan and budget in Phase 1	H. Sato	• Manual for Reporting and Planning System for Juba Station	8-1(J)01
	Roles of SSUWC Headquarters Duty and responsibility of HQ staff/department	H. Sato	• Roles of SSUWC Headquarter Reporting and Planning System Database of Stations	8-1(J)02
1/12	Reform history of NWSC	NWSC	• 8-5(N)_Reform History NWSC 12.Jan.2017	8-6(N)
	How to prepare specific reform programs and implement it (lecture)	NWSC	• Reform History NWSC 13.Jan.2017 Exercise	8-7(N)
1/13	Discussion on Stage 2 activities	H. Sato		
	How to prepare specific reform programs and implement it (lecture)	NWSC		
1/14	Wrap-up discussion Awarding ceremony	H. Sato	• SSUWC Management Training Daily Report 2017 Jan 25 • HQ management memorandum	8-8(S) 8-9(S)

Term 2

Training 3 (2-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
6/6 2017	• Explanation and discussion of Diagnosis and action plan for Wau by SSUWC • Progress Report of Remote Training for Term 1, Achievement, Challenges and proposed Way forward for Term 2 Activities • Explanation and discussion of Work Plan (2nd Term) • Progress of Action plan by SSUWC HQ and issues encountered by SSUWC	H. Sato	• Progress Report (Term 1) • Diagnosis and action plan for Wau • Work Plan (Term 2) • SSUWC HQs Management Reform Agenda	8-13(J) 8-10(S)
6/7	• Operation manuals of NWSC and how to prepare operation manuals • Whole structure of standards, guidelines, manuals, and standard operation procedure (SOPs) of NWSC • How to prepare manuals and SOPs and make staff follow	NWSC Technical manager, Mr. Sonko Kiwanuka	• O & M Manual for Wakiso February 2013 • O&M Manual Oct 09 NWWS • Operations Manual ppt to SSUWC 07062017 • Procedure - M&E NWSC Edited • Procedure - New connections-NWSC Edited	8-11(N)
6/8	• Organization structure of NWSC and functions of sections/departments and Stations / Areas and job description • How to prepare job descriptions and make staff follow them • Exercise of preparation of job description	NWSC Human Resource Developme nt Manager	• Job Description • Human resource management	8-12(N)
6/9	• Review of Reform activities of NWSC by SSUWC • Explanation of training in Japan and Cambodia and Homework assignment for training in Japan and Cambodia	H. Sato	• Reform activities of NWSC • Policy of training in Japan and Cambodia	
6/10	• Visit Jinja Area Water Supply	Jinja station manager	• SSUWC Management Training Daily Report June 2017	8-14(S)

Training 4 (2-2)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
11/28 2017	Progress of Reform Activities in SSUWC HQ	H. Sato	• Day 1-1 Reform Progress HQ-20171128	8-15(S)
	Discussion on PDM/PO	H. Sato	• Modified PDM/PO (draft) • PDMPOMeeting20171128	
11/29	Discussion on PDM/PO	H. Sato	• Memorandum of the Meeting draft20171129b1	
	Governance of Water Utility	H. Sato	• Day 2-1 (JICA E) Governance (Sustainable utility) SSUWC-20171129	8-16(J)
	Governance of Water Utility	NWSC − Joseph − Silver Emudong	• Day 2-2 (NWSC) NWSC at a Glance-20171129 • Day 2-3 (NWSC) Corporate Governance-20171129	8-17(N) 8-18(N)
11/30	Progress Report of Action Plan of Juba Station	H. Sato	• Day 3-1 Progress Report Juba-20171130	8-19(S)
	Operation Manuals of SSUWC HQ	H. Sato	• Materials prepared by SSWUC HQ (not received)	
12/1	Review of Reform Plan of SSUWC HQ	H. Sato	• Materials prepared by SSWUC HQ (not received)	
12/2	Wrap up	H. Sato	• SSUWC Management Training Daily Report 2017 Dec 2	8-20(S)

Training 5 (2-3)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
12/2 2018	2nd Joint Coordination Committee Meeting	H. Sato	• NWSC At a Glance_JICA, SSUWC_12th Feb 2018	8-21(N)
13/2	Meeting in JICA Uganda Office ~TV Conference with JICA South Sudan Office and JICA HQ - Progress of the project, Modification of PDM/PO, Minutes preparation	H. Sato		
14/2	NWSC reform history and Corporate governance	NWSC		
15/2	Progress of reform activities in Juba station and HQ	H. Sato	• Progress of reform activities of Juba station and HQ	8-22(S)
16/2	PDM activities of HQ	H. Sato	• SSUWC Management Training Daily Report 2018 Feb 16	8-23(S)

Training 6 (2-4)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
4/17 2018	Review of remote training activities by JICA Expert	H. Sato		
	Progress of evaluation of Monthly report of Juba station by SSUWC HQ	H. Sato		
	Action plan of Juba station - Technical service department - Commercial management and financial department - Administration and HRM department	H. Sato	• Juba Action Plan Osama Juba Station One Table combined	8-24(S)
4/18	Overall summary of action plan of Juba station	H. Sato		
	Reform Action plan of HQ - Technical service and O&M department - Planning and project department - Information management system department - Finance and HRM department	H. Sato	• SSUWC HQs Action plan (New format_v2)	8-25(S)
4/19	Overall summary of action plan of HQ	H. Sato		
	Overall discussion on action plans and preparation of template for review of plans	H. Sato		

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
4/20	Preparation of revised action plans based on template by group	H. Sato	• SSUWC Management Training Daily Report 2018 Apr 20	8-26(S)

Term 3

Training 7 (3-1)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
10/30 2018	• Explanation and discussion on Work Plan (3rd Term) • Review of Term 2 activities by JICA Expert • Current situation of HQ and Progress of implementation of action plan by HQ and issues encountered and discussion	H. Sato	• SSUWC-TC Term3-1_20181030 • SSUWC HQs Action Plan 2018 • SSUWC Reforms Action Plan Progress Report	8-27(J) 8-32(S) 8-33(S)
10/31	Current situation of Juba Station and Progress of implementation of action plan by Juba Station and issues encountered	H. Sato	• SSUWC CP 2015-18 Performance Review Analysis	8-28(S)
	Preparation of questionnaire for study tour in NWSC	H. Sato	• Questionnaire to NWSC	8-29(J)
11/1	Study tour for management method of NWSC HQ, Kampala WC, Station	NWSC		
11/2	Discussion on issues on implementation of action plans	H. Sato		
	Overall summery of progress of action plan and new targets by Area Manager and by HQ	H. Sato	• Action Plan Juba Station Final.V2	8-30(S)
	Preparation of Study tour report	H. Sato		
11/3	Review of Study tour report Preparation of Minutes and	H. Sato	• Site visit summary and discussion 20181103 • SSUWC Management Training Daily Report 2018 Nov 4	8-31(S) 8-34(S)
	Presentation of water tariff setting by Commercial Division of Juba Station	H. Sato	• Work sheet for estimation of necessary unit tariff rate	

Training 8 (3-2)

Date	Training topic	Lecturer	File name of the presentation and materials	File No.
2/12 2019	• Agenda of JCC in Juba Presentation of homework by SSUWC • Progress of HQ operation manual preparation and implementation • Progress and issues of HQ action plan • Review of lesson learned in previous Study tour • Forecast of revenue and expenditure in case of fuel options	H. Sato	• SSUWC-TC Term3-3_20190211 • Action Plan Presentation Feb 2019	8-35(J) 8-36(S)
2/13	• Progress and issues of Juba station action plan and HQ reform plan • Joint discussion with Finance Team and HQ Team (1)	H. Sato, S. Yamada	• Action Plan Juba Station 2019v	8-37(S)
2/14	• Study tour for management method at Entebbe Area Station in NWSC	NWSC		
2/15	• Preparation of Performance Contract between HQ and Juba • Wrap up discussion on study tour • Joint discussion with Finance Team and HQ Team (2)	H. Sato, S. Yamada	• 24h_Simplified Tariff Setting Estimation_Practice_190215 • Annual report sales • Annual report account	
2/16	• Progress of evaluation of Monthly report of Juba station by SSUWC HQ • Preparation of Minutes and Study tour report • Wrap up and evaluation and homework	H. Sato	• Monthly report Oct～Dec 2018,Jan 2019 • SSUWC Management Training Daily Report 2019 Feb 18	8-38(S)