

**Federal Capital Territory Administration
Federal Capital Territory Water Board
Federal Republic of Nigeria**

**THE FEDERAL CAPITAL TERRITORY
REDUCTION OF NON-REVENUE WATER
PROJECT
IN
FEDERAL REPUBLIC OF NIGERIA**

**PROJECT FINAL REPORT
(SUPPORTING REPORT, VOL. 2/2)**

January 2019

**Japan International Cooperation Agency
Yachiyo Engineering Co., Ltd
Yokohama Water Co., Ltd**

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ATTACHMENT

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Annex 1	Record of Discussion (R/D)
Annex 2	Minutes of Meetings of JCC (M/M) and PDM Revision
Annex 3	Project Monitoring Sheets (All versions)
Annex 4	Technical Notes
Annex 5	Workshops and Seminar Documents
Annex 6	Public Relations Documents
Annex 7	Report on Capacity Assessment and Capacity Development Plan
Annex 8	Lectures and Training Sessions
Annex 9	Report of GIS Training
Annex 10	Training in Japan and Action Plans prepared by Participants
Annex 11	Shop Drawings for Bulk Meters
Annex 12	Examination Report on Current Condition of Bulk Flow Rate Measurement at LUD
Annex 13	Upgrading of Billing System
Annex 14	Required Power Capacity & Output of Solar Power System and Shop Drawings for Zonal Meters
Annex 15	Manual on NRW Reduction Operations (including GIS and Hydraulic Analysis)
Annex 16	Medium-term Strategic Plan on NRW Reduction (2019-2023)
Annex 17	Annual NRW Reduction Plan for 2019
Annex 18	Planning Manual of NRW Reduction
Annex 19	FCTWB Bill 2017
Annex 20	Official Letters for Approval of Project-related Plans/Manuals
Annex 21	Follow-up Documents for Monitoring from the end of the Project

Annex 5:

Workshops and Seminar Documents

Federal Capital Territory Administration (FCTA)
Federal Capital Territory Water Board (FCTWB)
assisted by
Japan International Cooperation Agency (JICA)

**THE FEDERAL CAPITAL TERRITORY
REDUCTION OF NON-REVENUE WATER PROJECT**

PROGRAMME/AGENDA FOR 1ST WORKSHOP

Venue: Ultimate Hall, Sharon Ultimate Hotel, Area 3, Garki, Abuja
Date: Thursday, 4th December 2014

8:30 - 9:00	Registration of Participants
9:00 - 9:05	Opening Prayer
9:05 - 9:10	Introduction of Members of the High Table
9:10 - 9:20	Welcome Remarks by Project Manager, Mr. Hudu BELLO (Director, FCTWB)
9:20 - 9:30	Address by Chief Representative, Mr. Tetsuo SEKI (JICA Nigeria Office)
9:30 - 9:45	Background of the Project, and NRW situation of FCT (FCTWB)
9:45 - 10:00	Brief Explanation and Principles of the Project Implementation (JICA Expert)
10:00 - 10:30	Tea/Coffee Break
10:30 - 11:00	NRW Video
11:00 - 11:30	Good Practices of NRW Reduction in Yokohama City (JICA Expert)
11:30 - 12:00	Work Plan, Schedule and Progress (JICA Expert)
12:00 - 12:30	Questions, Answers and Discussions
12:30 - 12:45	Way forward
12:45 - 12:55	Closing Remarks by Deputy Project Manager, Mr. S. T. BELLO (HOD, Administration and Supply, FCTWB)
12:55 - 13:00	Closing Prayer
13:00	Lunch Break Adjournment

Supplementary Session

13:30 - 16:00	Group Discussion on Zoning of Pilot Metering Area by Counterparts from Distribution Department and Area Offices
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FEDERAL CAPITAL TERRITORY REDUCTION OF NON-REVENUE WATER PROJECT
DATE: 4TH DECEMBER 2014 VENUE: SHARON ULTIMATE HOTEL ABUJA

WORKSHOP ATTENDANCE LIST

ORGANIZATION: FCTWB

S/N	NAME	TITLE	TELEPHONE	EMAIL ADDRESS
1	Bunmi Olowookere	HOU(P.R.S)		
2	Ottah Chiefinze.E	S.E(KPWSS)		
3	Obeh Vincent M	HOU(MIS)		
4	Mohd. A. S Ramat	AM		
5	Mahmlid Moh'd	Forman		
6	Hudu Bello	Director		
7	Raymond Olowokere	Forman		
8	Segun kayoed	P.R.O		
9	Hasfat Ahmed Lawi	H.O.D(F&A)		
10	Esike Sandra.O	AOII(APD)		
11	Ogbu O. William	AAMC		
12	Yetunde Olaniyan	HOU(monitoring)		
13	Adenuga Adesoji	AM(garki1)		
14	Ibrahim Garba . Y	Forman		
15	Samuel fancisca	HOU(T&W)		
16	Shehu Sulaiman	HOU(G.I.S)		
17	Bello S.T	HOD(A&S)		
18	Ibrahim Umar	AAMC		
19	Hassan Abubakar	Land Resource officer		
20	Mohammed Dauda	Pipeline tech officer		
21	Muhammed Isa k	S/F		
22	Isaac Owolabi	Head of customer care		
23	Engr moh'd D.O	AAMD		
24	Umar Ibrahim	A.T.O		
25	Abdul ismail	HEO/GIS		
26	Salisu Mohammed	Plumber		
27	Engr A.G Adam	PTO(W)		
28	Danjuma Isah	HOU(M/D)		
29	Aliyu Maradun	HOU(major consumer)		
30	Abawonse J.K	P.T.O(AAM)		
31	Abubakar ubale A	Civil engineer		
32	A.U Sanda	AM(gudu)		
33	Mohammed moh'd	Supervisor(jabi)		
34	Jummai ugbodaja	Supervisor(jabi)		
35	Shehu Isa	Craftman(garki)		
36	Rose Akpan	Head Billing		
37	Abbas A Ahmed	Head PR		
38	Engr A A Nahuche	HOD(dist)		
39	Engr douglas oloton	Head Metering		
40	Dikko musa	Head Pipeline		
41	Rose olusegun	S. trade office		
42	Engr Id Akudike	Head facility		
43	Kenneth Azih	Head of ops		
44	Zubairu Raliat	Higher trade officer		
45	Abdulkehi Ibrahim	STA II		
46	Adamu uhama	SA(technical)		

S/N	NAME	TITLE	TELEPHONE	EMAIL ADDRESS
	Hussain			
47	M .K Rabi	Head logistics		
48	Mohammed Gana	Asst Manager G1		
49	Ezeh C Hillary	Surveyor, GIS		
50	Iliya M Galadima	Higher work		
51	Agbawn Suleiman	Billing office		
52	Abubakar Danladi	Foreman		
53	Billy Oboigbe	FIN&ACC		
54	Salihu Sadiq	Distribution		
55	Engr Abdullahi M	Head (PPM)		
56	Aliyu Ibrahim	Supervisor		
57	Hassan A Yelwa	STA		
58	Mohammed S Adis	HOD(commerce)		

ORGANIZATION: FCTA, NPC, FMWR

S/N	NAMES	TITLE	TELEPHONE	EMAIL ADDRESS
1	Ileuma S. A	AD (IC) NPC		
2	Jimoh A Olelekan	FCTA/INFO		
3	Niyi Lawal	FCTA/INFO		
4	Amina Usman	EPRS/FCTA		
5	Usman Ahmed	EPRS/FCTA		

ORGANIZATION: JICA

S/N	NAMES	TITLE	TELEPHONE	EMAIL ADDRESS
1	Tetsuo Seki	JICA(CR)		
2	Chie Shimodaira	JICA (Rep)		
3	Dele Olatunji	PRG officer		
4	Akinori Miyoshi	JICA Expert (CA)		
5	Taketoshi Fujiyama	JICA Expert		
6	Toru Toyoda	JICA Expert		
7	Kiyoshi Kiyama	JICA Expert		
8	Takuji Okubo	JICA Expert		
9	Shinta Segawa	JICA Expert		
10	Kazuhiro Ishiura	JICA Expert		
11	Deborah Ehinomen	Secretary		

ORGANIZATION: IDPs

S/N	NAMES	TITLE	TELEPHONE	EMAIL ADDRESS
1	Hassan Kida	Lead (World Bank)		
2	Michee Duret	WSP/WB(coordinator)		
3	Safiya Abdulrahman	Correspondent		
4	Jeanne Nillelini	AFD(project manager)		
5	Nene Sobande	USAID(Wash programme manager)		
6	Dr Martin Mbonu	EU(programme manager)		

PROJECT BACKGROUND AND NON-REVENUE WATER SITUATION IN FCT

Presentation
By
Engr. A. A. Nahuiche
Technical Manager, Distribution

Annex5-4

OUTLINE

- ▶ Introduction
- ▶ Master Plan for Water Supply in the FCC
 - Raw Water Sources
 - Water Treatment Plants
 - Water Transmission and Storage Tanks

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OUTLINE CONT.

- ▶ Infrastructures at the Disposal of the Board
- ▶ Water Supply Coverage and Sources
- ▶ Non-Revenue Water Situation in the FCT
- ▶ Conclusion
- ▶ Comments, Observations & Questions

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INTRODUCTION

- ▶ The Board is charged with the responsibility of producing, distributing and revenue collection for the potable water being distributed to the residents of Federal Capital City (FCC), Airport community, Gwagwalada, Karu, Nyanya, Bwari & Kubwa satellite towns from its water works located at Lower Usuma Dam along Bwari Road via the various water storage tanks.

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Master Plan for Water Supply in the FCC

- ▶ The Abuja Water Master Plan provides for water frameworks for Federal Capital City. To ensure adequate supply of potable water in the FCC, the Abuja Water Master Plan provides for the construction of the following facilities in phases:



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Annex5-5

- ▶ Raw Water Source
- ▶ Initial Phase
 - LUD (100mcm)
- ▶ Final Phase
- ▶ Gurara Water Transfer Scheme (850mcm)



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Water Treatment Plants

- ▶ 12 WTP of 5,000m³ capacity each
 - 1-Nr to provide for Phases I of FCC
 - 2-Nr to provide for Phase II
 - 3-Nr to provide for Phase III
 - 6-Nr to provide for Final Phases (Phase IV)



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Water Transmission and Storage

- ▶ About 29km 1500mm – 1000mm DI pipe to Tanks 3 & 4 (24,000m³ each), for Phase I
- ▶ About 39km 1500mm – 1000mm DI pipe to Tanks 2 & 5(45,000m³ and 40,000m³ respectively), for Phase II
- ▶ 2 lines of Combined lengths of 62km to Tanks 1 & 6 (40,000m³ each, originally 30,000m³ and 40,000m³), for Phase III
- ▶ 3 lines to feed Tanks 7, 8, 9 and 10 (40,000m³, 45,000m³, 45,000m³ and 24,000m³), for the Fourth and Final Phases

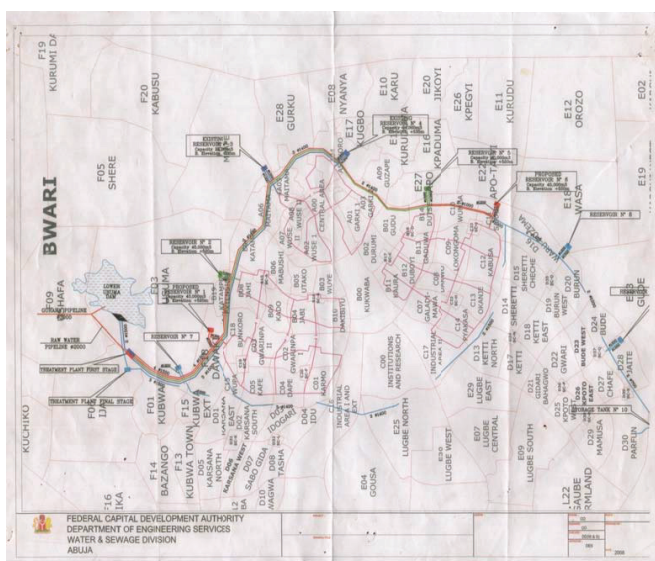


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► **Infrastructures at the disposal of the Board**

The development of water Infrastructures in the Federal Capital Territory is in line with the Abuja water master plan.

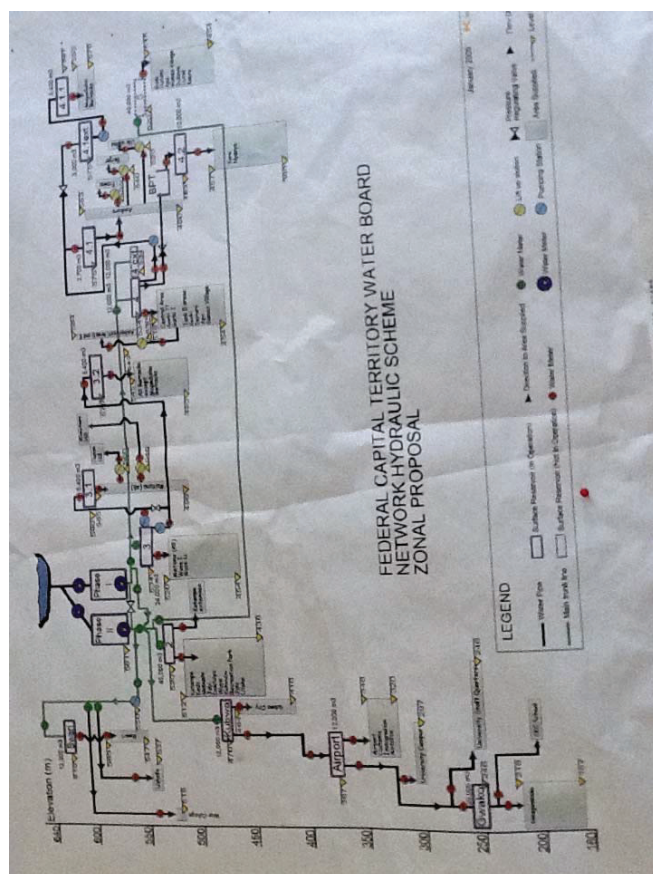
The main source of water supply to the Federal Capital City is from the Lower Usuma Dam Reservoir with a capacity of 100 million cubic meters being augmented through a 3mø Pipeline by inter-basin raw water transfer from Gurara Dam with combined reservoir capacity of 850 million cubic meters.



Infrastructures at the disposal of the Board Cont.

The water treatment plants (Phases 1 & 2) have a combined design capacity of 240,000 cubic meters per day treated water. while water treatment plants (phases 3 & 4) have a combine design capacity of 480,000 cubic meters treated water.

The treated water is conveyed to the city by two trunk mains ranging from 1,400 -1,500mmØ D.I pipes into various tanks i.e (2, 3, 4, and 5) located in Katampe, Maitama, Asokoro and Apo areas respectively.



■ Infrastructures at the disposal of the Board Cont.

In addition to the above, another trunk line of 1000mmØ GRP (Glass Reinforced pipe) pipeline was constructed from Lower Usuma dam waterworks to a storage tank in Kubwa with a capacity of 10,000 cubic meters.

The trunk line was further extended to Airport and Gwagwalada tanks to serve those settlement and govt. agencies around.

Similarly, Bwari Area Council is also being fed by a 600mmØ GRP trunk line by pumping from LUD pumping station and connected to a storage tank in Bwari with a capacity of 12,500 cubic meters.

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Annex5-7

Booster pump stations

- ▶ Berger Booster Pump Station Located in Asokoro District.
- ▶ Dantata Booster Pump Station Located in Asokoro District.
- ▶ Hamza Hill Booster Pump Station Located in Maitama District.
- ▶ Ministers Hill Booster pump Station Located in Mitama District.

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■ Infrastructures at the disposal of the Board Cont.

■ *Water Storage Tanks.*

- ▶ Tank 2 with 45,000m³ Capacity is in use
- ▶ Tank 3 with 24,000m³ Capacity is in use
- ▶ Tank 4 with 24,000m³ Capacity is in use
- ▶ Tank 5 with 40,000m³ Capacity is in use
- ▶ Tank 1 with 40,000m³ Capacity is under Construction
- ▶ Tank 6 with 40,000m³ Capacity is Under Construction

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Water Supply Coverage and Sources

Phases	District	Area Office	Source of Water Supply
Phase I	Garki	Garki I	Tank 4
		Garki II	Tank 4
	Asokoro	Asokoro	Tank 4
	Maitama	Maitama	Tank 3
	Wuse	Wuse I	Tank 4
Phase II		Wuse II	Tank 3
	Gudu	Gudu	Tank 5
	Utako	Utako	Tank 2
	Gwarimpa	Gwarimpa	Tank 2
	Wuye	Wuye	Tank 4
Phase III	Jabi	Jabi	Tank 2
	Kubwa	Kubwa I	Kubwa Tank
		Kubwa II	Kubwa Tank
	Satellite Towns		
	Gwagwalada	Gwagwalada	Gwako Tank
Karu/Nyanya		Karu/Nyanya	Tank 4
Bwari		Bwari	Bwari Tank
Airport & Env.			Airport Tank

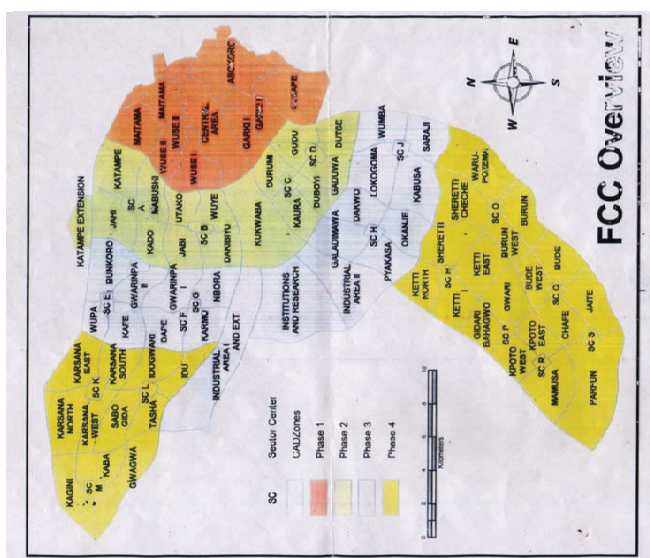
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Non-Revenue Situation in the FCT Water Board, Cont.

- ▶ Design capacities of the water treatment plants 1& 2 are assumed to be operating at 70% (5,040,000m³/month) optimally and the board's tariff of N80/m³ for domestic metered rate. A Gross sum of not less than N403,200,000.00 is the expected revenue every month from the aforementioned production. Currently, water treatment plant phases 3 & 4 are augmenting between 30–40% (5,760,000 m³/month) to plants 1 & 2 for the city demand of about 12,000– 13,000m³/hr or 8,640,000 – 9,360,000 m³/month.
- ▶ The revenue generated on monthly basis from information available is approximately N200,000,000.00 or less, it's obvious that the revenue collected on monthly basis is only about 50% of the total production.
- ▶ In the year 2013 the total revenue generated by the board was N2,179,423,824.15 i.e an average of N181,618,52.01/month, While in the current year 2014 the revenue generated from January to October is N1,647,479,967.01 this also gives an average of N164,747,996.70 /month.
- ▶ Plants 3 & 4 production is only augmenting to meet the city demand of about 12,000m³/hr, which translates to 8,640,000m³/month as combine production of plants 1, 2, 3 & 4 is Non–Revenue Water (NRW).

Non-Revenue Situation in the FCT, Cont.

- In view of the high rate of Non-Revenue Water in the System, the Government of the Federal Republic of Nigeria through the Honourable Minister, FCT requested for technical cooperation to the Government of Japan to strengthen capacity of the FCTWB to reduce NRW. The request was eventually approved by the Government of Japan in order to overcome horrible situation of Non-Revenue Water in FCT.



Non-Revenue Situation in FCT

- ▶ The major challenge being faced by the Board is the issue of high rate of Non-Revenue Water due to aged GI pipes, inadequate capacity and equipment to detect invisible leakages and monitor flow of water to the final consumers
- ▶ The actual water produced and distributed could not be accounted for, due to one or all of the following reasons:
 - Absences of districts or zonal water meters
 - Individual water meters were not full installed to all properties
 - Malfunctioning of water meters
 - Data handling errors
 - Inability to determine volume of water wastages through visible and invisible water leakages
 - Illegal water connection
 - Water theft
- ▶ Unbilled metered and unmetered consumption etc

Conclusion

- ▶ The Government of Japan is highly commended for its kind consideration and approval of this laudable Technical Cooperation Project (Reduction of Non-Revenue Water in FCT) to strengthen capacity of the Board for reducing Non-Revenue Water in FCT.

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Annex5-9

Thank You



Japan International Cooperation Agency
Federal Capital Territory Administration
Federal Capital Territory Water Board



The Federal Capital Territory Reduction of Non-Revenue Water Project

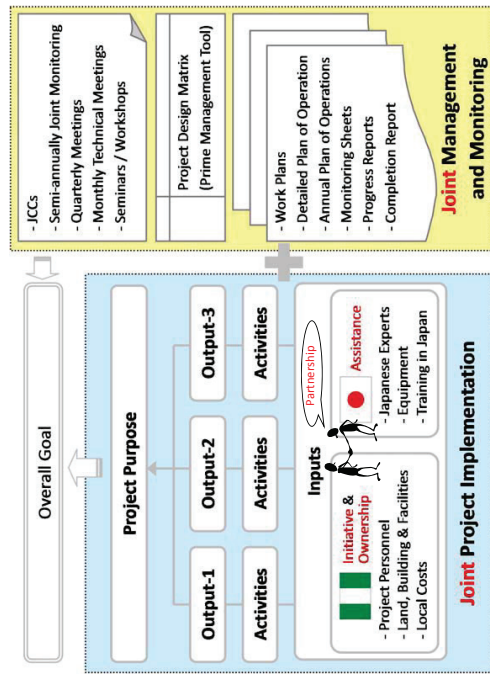
Principles and Outline of the Project

December 2014

JICA Expert Team

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1. Principle of the Project



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Contents

1. Principle of the Project
2. Outline of the Project
3. Current Status & Issues of Water Supply in Federal Capital City
4. Expected Impact by NRW Reduction
5. Principles of the Project Implementation
6. Members of the JICA Expert Team

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2. Outline of the Project

Project Period

Phase-1: October 2014 to December 2016

Phase-2: January 2017 to March 2018

Overall Goal, Project Purpose and three Outputs

See the page 5&6

Project Areas

Federal Capital Territory (FCT)

Pilot Areas: Garki I, Gudu and Jabi

Organizations concerned (Counterparts) in Nigeria Side

Federal Capital Territory Administration (FCTA)

Federal Capital Territory Water Board (FCTWB)

Project Implementing Structure

See the page 7

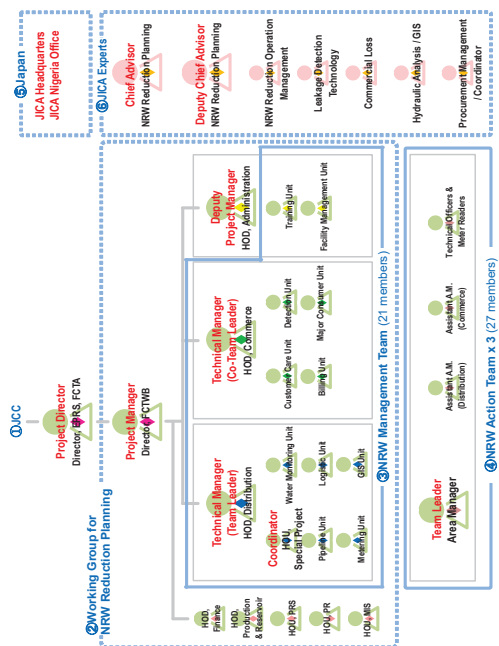
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Overall Goal, Project Purpose and Three Outputs

Overall Goal	Level of Non-Revenue Water (NRW) is reduced at the service area of FCTWB.
Indicator	a. Annual NRW ratio is reduced to X% at the end of the year 2021
Project Purpose	Capacity of FCTWB for NRW reduction is strengthened.
Indicator	a. The medium-term strategic plan (2018-2022) is approved by FCTA.
	b. NRW reduction operations of the first quarter of 2018 are carried out.
	c. Relevant staff become equipped with skills and knowledge necessary for NRW reduction.
	d. NRW ratio of each PMA in the last quarter of the Project reaches its respective target.

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Project Implementing Structure



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Overall Goal, Project Purpose and Three Outputs (Continued)

Output-1	Level of NRW of the service area of FCTWB is monitored regularly.
Indicator	1a: Record of monthly NRW ratio is kept.
	1b: Monthly NRW ratio is reported.
	1c: Quarterly NRW ratio is reported.
Output-2	Methods/operational procedures for effective NRW reduction are established though pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.
Indicator	2a: Decrease rate of NRW ratio for each Sub Metering Area reaches at least 80% of its target.
	2b: Technical manuals are approved.
Output-3	A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.
Indicator	3a: Draft medium-term strategic plan (2018-2022) is submitted by FCTWB to FCTA
	3b: An annual NRW reduction plan (2018) is incorporated in FCTWB's annual recurrent and capital plan (2018).
	3c: A planning manual for NRW reduction is approved.

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Relationship Matrix between Nigerian Counterparts and JICA Experts in terms of their major roles in the Project Implementation

Nigerian Counterparts	Working Group for NRW Reduction Planning																										
	NRW Management Team												NRW Action Team														
JICA Experts	Project Director / Director, EP&S, FCTA																										
	Project Manager / Director, FCTWB																										
	Deputy P.M. / Director, FCTWB																										
	HOD, Administration																										
	HOD, Finance																										
	HOD, Production																										
	HOU, PRS																										
	HOU, PR																										
	HOU, MIS																										
	Technical Manager / HOD, Distribution																										
JICA Experts	Technical Manager / HOD, Commerce																										
	Coordinator / HOU, Special Project Unit																										
	Logistics Unit																										
	Pipeline Unit																										
	GIS Unit																										
	Meeting Unit																										
	W. Monitoring Unit																										
	Cust. Care Unit																										
	Billing Unit																										
	Monitor, & Detect Unit																										
JICA Experts	Major Consumer Unit																										
	Training Unit																										
	Facility Mngmt Unit																										
	Area Manager																										
	Assistant A.M. (Dist.)																										
	Assistant A.M. (Com.)																										
	Technical Officers																										
	Master Readers																										
	JICA Experts																										

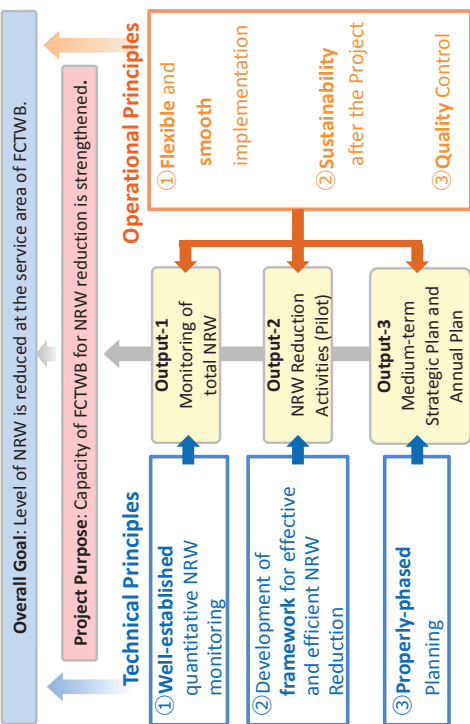
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3. Current Status & Issues of Water Supply in Federal Capital City

- 
1. Strengthening of Management and Organization
 Future independence, inefficient personnel
- 
2. Improvement in Financial Situation
 Depression in tariff collection ratio, weak financial management, etc.
- 
3. Increase in Water Service Coverage
 Delay in development and construction, facility deterioration, etc.
- 
4. NRW Reduction
 Absence of planning, shortage of skilled manpower, absence of quantitative monitoring system by bulk flow meters, passive leakage detection, etc.

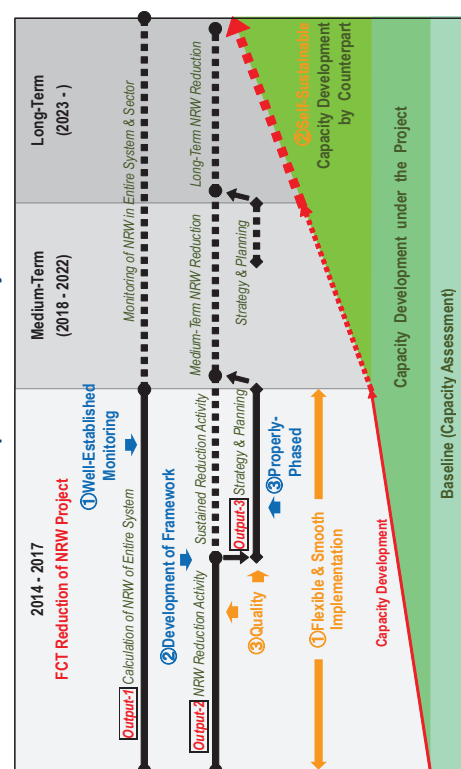
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5. Principles of the Project Implementation



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Relationship in Timeframe between Principles and the Project Flow



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4. Expected Impact of NRW Reduction

Items	NRW/38% (currently estimated)	NRW/20% (Tentative Target)	Impact	Calculation Conditions
Population to be served	1.96 mill	2.53 mill	Additional 0.57 mill	Supply Capacity: estimated 624,000m ³ /day, Per-Capita Consumption: 197LCD
Demand exceeds Supply (When new WTP is needed.)	2017	2024	7 years postponed	Population projection until 2050 by FCTWB
Daily Water Consumption (Billed water)	162,400m ³	209,600m ³	47,000m ³	Actual daily supply: 262,000m ³
Annual Revenue	N4,74bln	N6.12bln	N1.38bln	Water tariff (domestic): N80/m ³
Cost saving of WTP (Rough estimate)	-	-	N16.8bln	47,000m ³ /day x N3,600/m ³ /day

Source: JICA Detailed Planning Survey, 2014

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6. Members of the JICA Expert Team



Akinori MIYOSHI (Mr.)
Chief Advisor /
NRW Reduction Planning



Takuji OKUBO (Mr.)
Commercial Loss



Taketoshi FUJIYAMA (Mr.)
Deputy Chief Advisor /
NRW Reduction Planning



Shinta SEGAWA (Mr.)
Hydraulic Analysis / GIS



Toru TOYODA (Mr.)
NRW Reduction Operations
Management



Kazuhiro ISHIURA (Mr.)
Procurement Management /
Coordinator



Kiyoshi KIYAMA (Mr.)
Leakage Detection Technology

History on Leakage Prevention Work of Yokohama

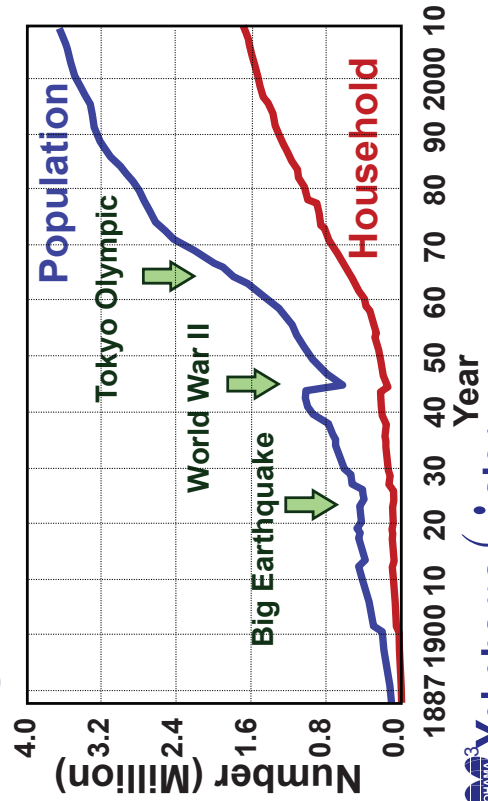


Data of Y.W.W.

1. Start to service : 17/Oct/1887 (127Ys ago) 
2. Served Pop. : 3,687,225 (31/Mar/2011) 
3. Connections : 1,753,184 (31/Mar/2011)
4. Service rate : 100.00% (Since 1988) 
5. Pipelines length : 9,094km (31/Mar/2011) 
6. Revenue rate : 91.7% (FY.2010) 
7. Leakage rate : 5.4% (FY.2010)
8. Daily supply : 1,192,101m³ (FY.2010) 
9. Dist. Manage. : 23 DR, 26 BLK, 250 DMA 

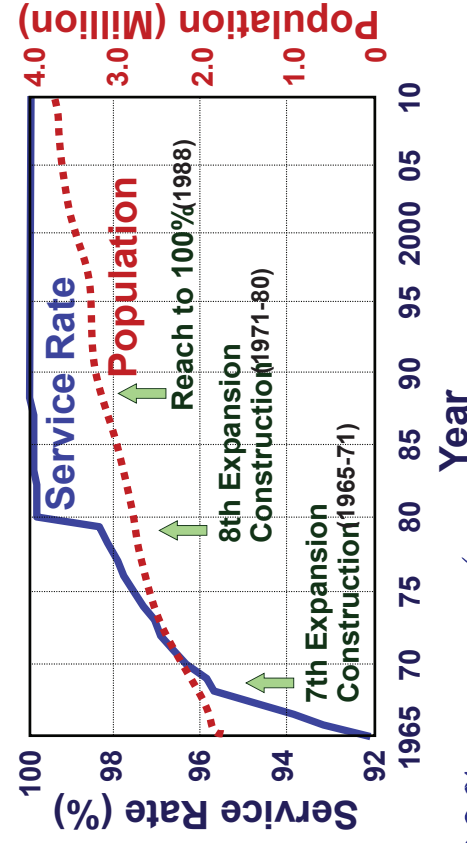
Population & Households

Change of Population & Households



Service Rate

History of Service Rate



Pipelines Length

Kinds of Pipeline's Material

9,094km of Distribution Pipes

[Under 50mm Pipes]

Kind of Steel (VLGP, PLGP): 1,373km

Kind of Resin (PVC, PEP): 760km

Lead: 0km

[Over 75mm Pipes]

Ductile Iron: 6,658km

Steel: 300km

Concrete: 4km

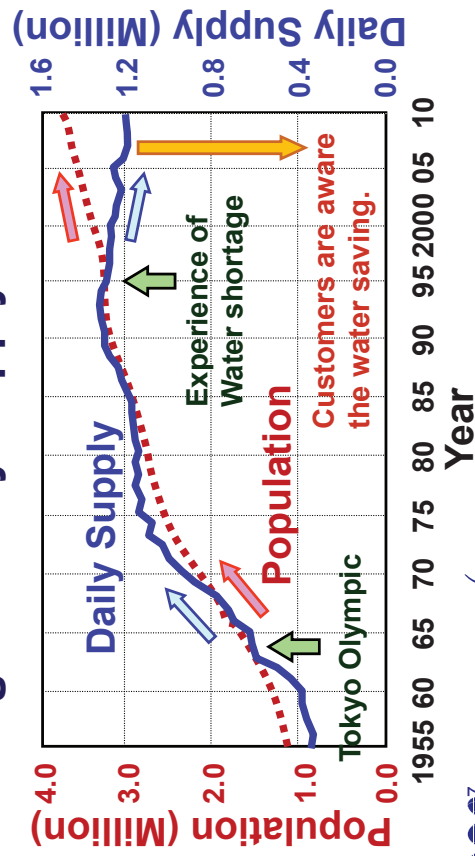
(Conveyance

Aqueduct: 105km)



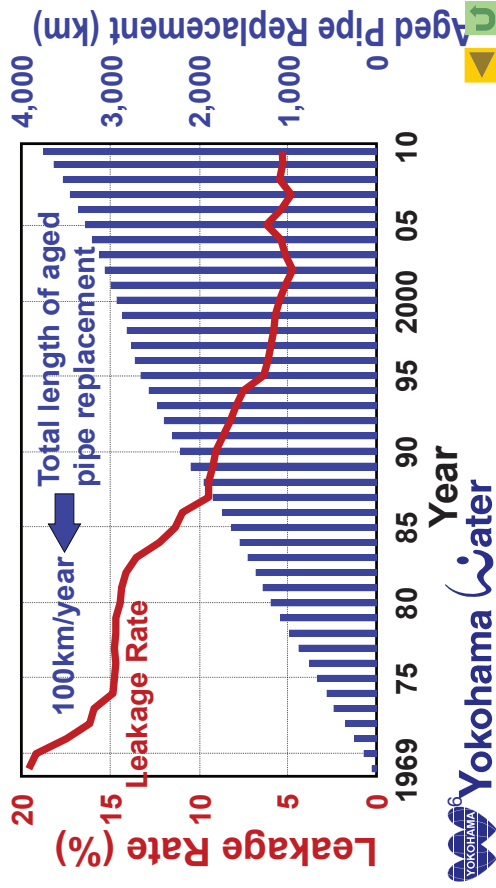
Daily Supply

Change of Daily Supply Volume

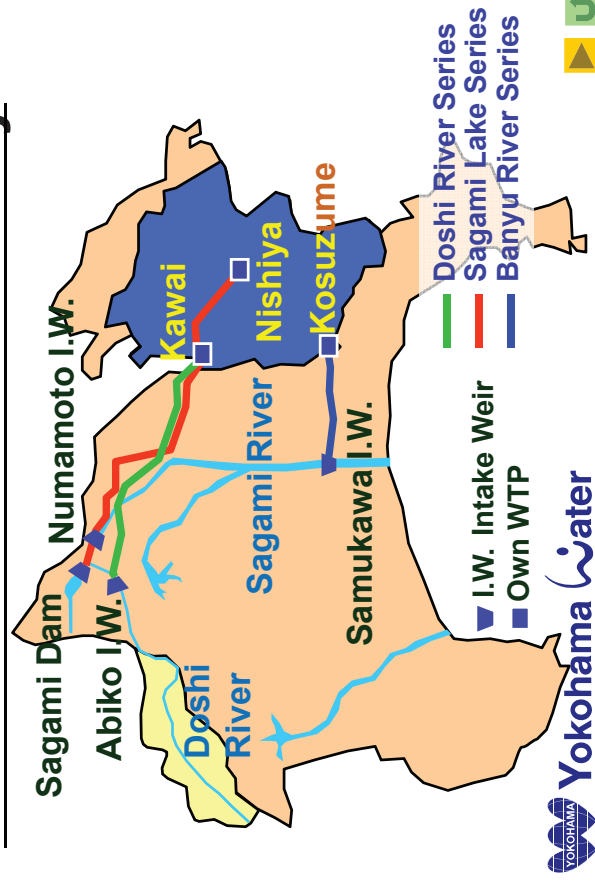


Plan of Pipe Renewal

Pipe replacement & Leakage rate

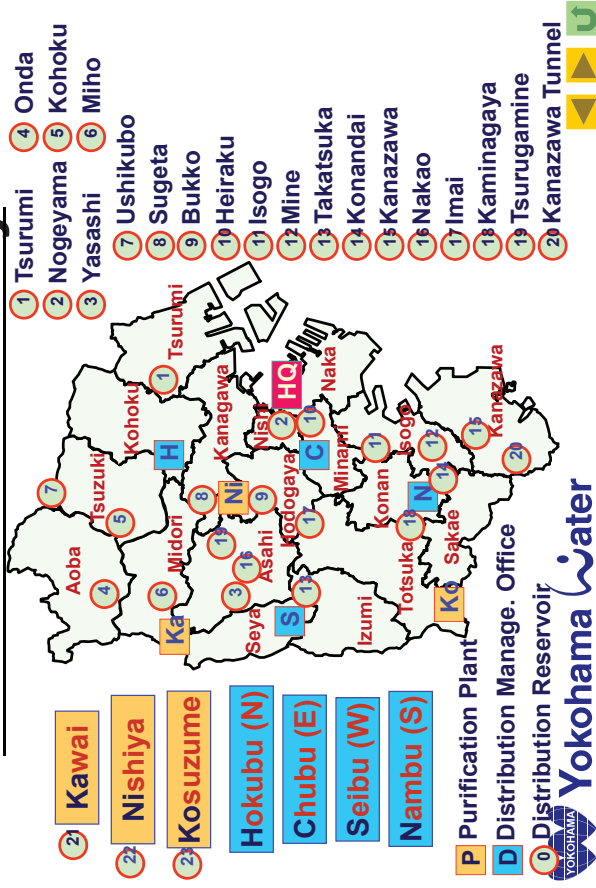


Intake & Treatment Facility



Distribution Facility

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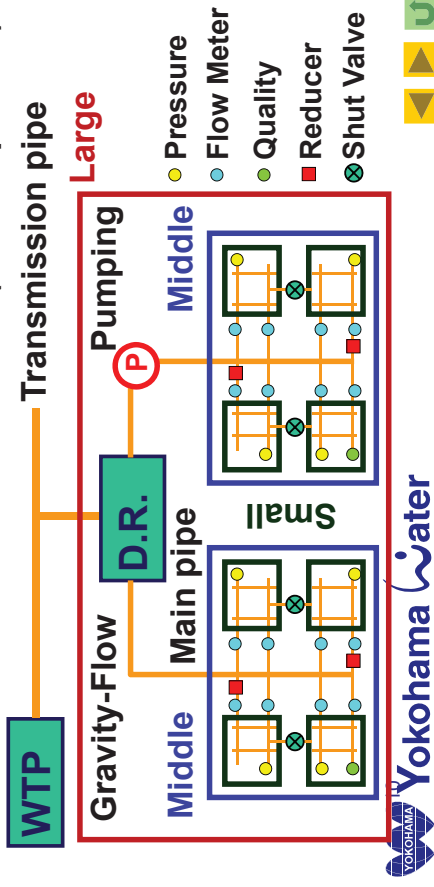
Annex5-16

Block System Concept

Large block: Distribution Reservoir Area (26)

Middle block: Gravity-Flow and Pumping Area (52)

Small block: District Metered Area (250 → Aprx.500)



YWWB Leakage History

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Fighting with Leakage

In 1887, YWW started water supply by cast iron pipe. (126 years ago)

The those days, YWW thought that caulk joint by hemp and lead had strong watertight. YWW did not have the concept of leakage.

After several years, leakage appeared to surface.



YWWB Leakage History

12

Fighting with Leakage

In May 1945, Yokohama city was attacked by aerial bombing. Most waterworks facilities were completely destroyed.

In September 1948, YWW established the leakage repair section. In 1950, revenue water rate was only 20 – 30%.



YWWB Leakage History

Fighting with Leakage

1950 – 60s, YWWB investigated by direct measurement method.

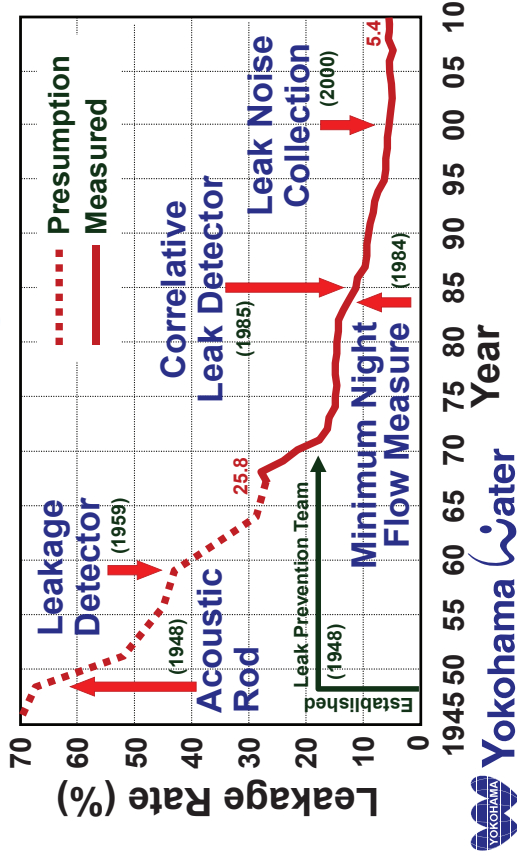
All house's valves were closed. It took much human power and time. And during investigation, 3 - 4 hours long, water supply suspended.

It canceled soon. After that, present system started.



Prevention Work History

Equipment of Leakage Inspection



Analysis of Dist. Table

Distributed Water Volume Analysis

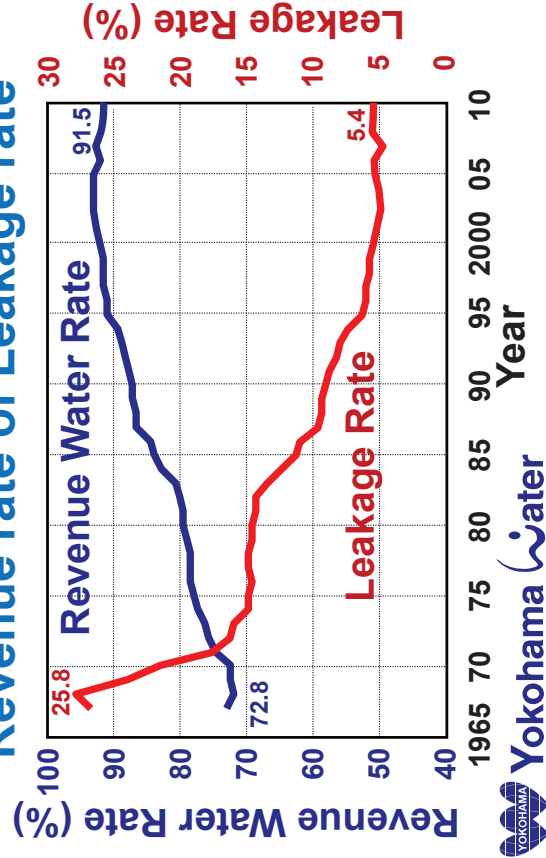
Distributed Water 100%	Effective 94.3%	Revenue 91.5%	Charged Water	91.5
			Fire Control/Work	+0.0
			Break Compensation	+0.0
	Non-Effective 5.7%	Non-Revenue 2.8%	Unmeasured Water	1.9
			Used by YWWB work	0.9
			Leakage Water	5.4
			Etc.	0.3



Number is percentage in 2009.

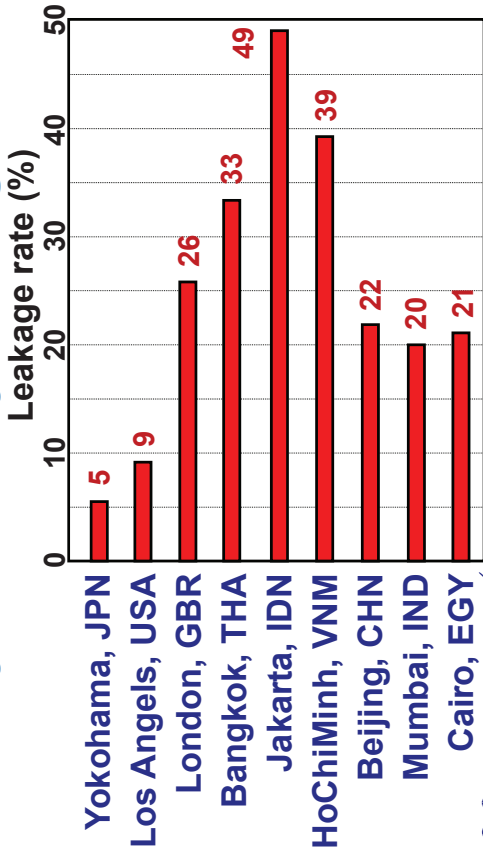
Leakage Rate

Revenue rate of Leakage rate



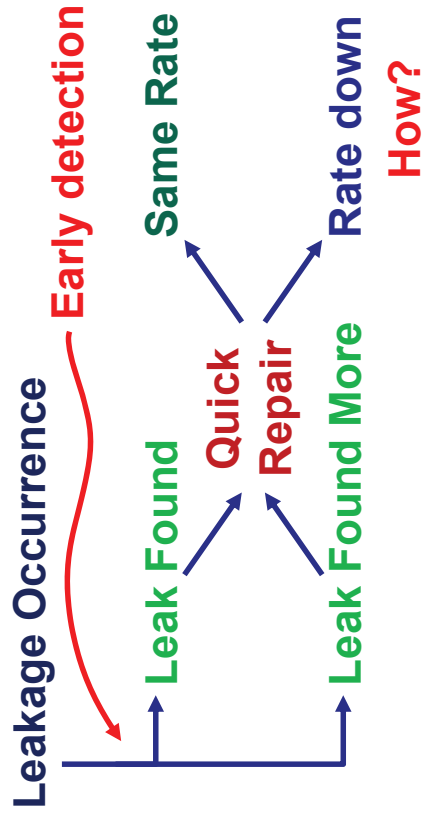
Leakage Competition

How is your country's leakage rate?



How to decrease NRW

(Research → Find → Repair) X Many



Leakage induced

Second Disaster Outbreak

Economic Loss
Reparations Problem

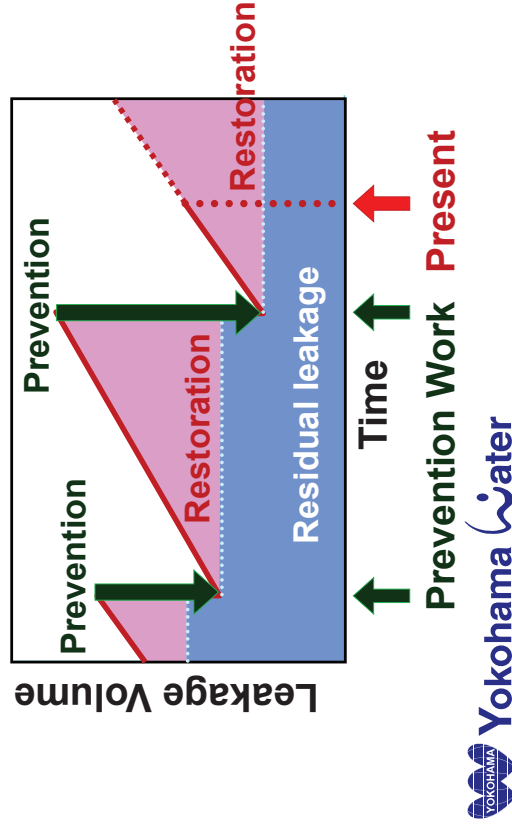


Traffic Trouble
Accident Handling



Leakage Battle

Prevention Work VS Restoration



Outbreak Source of Leakage²¹

Where leakage comes from

- From corroded pipe
- From electric corroded steel pipe
- From bolts that have slacked around pipe joint
- From packing of valve packing and fire hydrant
- From gapped valve pedestal



Mechanism of Leakage²²

Cause of Leakage Outbreak

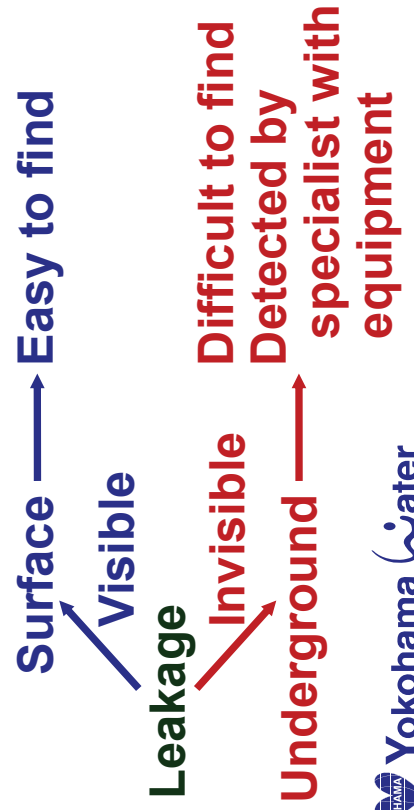
- Traffic of heavy weight vehicles
- Earthquake force
- Road subsidence
- Damage by other pipe laying
- Corrosion (Soil, Electrolytic, Etc)
- Poor pipe material using
- Poor pipe laying technique



Cause of Leakage²³

Specialty of Water Pipelines

Where is leakage point?

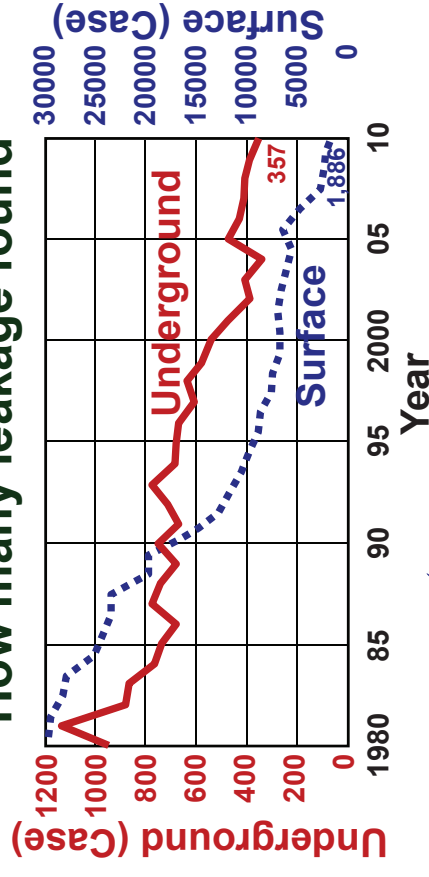


24

Present Situation

Specialty of Water Pipelines

How many leakage found



25

Present Situation

Yokohama Leakage Condition (2010)

DN50mm (2in.) and Under

Surface: 1,781 (79.4%)

Underground: 351 (15.7%)

Total: 2,132 (____%)



50mm VP

DN75mm (3in.) and Over

Surface: 105 (4.7%)

Underground: 6 (0.2%)

Total: 111 (____%)



800mm SP

Total number of leakage: 2,243



26

Outbreak Source of Leakage

Leakage from Service Pipe (2004)

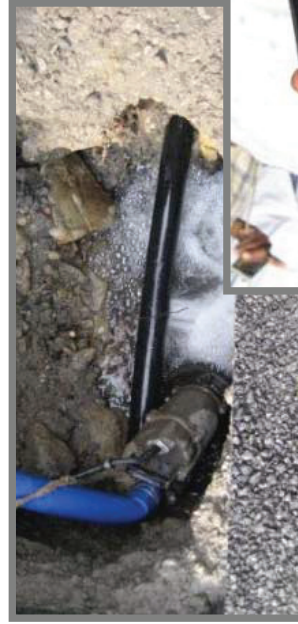
Kind of pipe	Discovery rate
Lead pipe (LP)	50%
Galvanized steel pipe (GP)	23%
Polyvinyl chloride lining steel pipe (VLP)	18%
Polyvinyl chloride pipe (VPC)	6%
Polyethylene pipe (PEP)	2%
High impact polyvinyl chloride pipe (HIVP)	1%
Stainless steel pipe (SUS)	0%



27

Burst Pipe

PEP DN50mm laid in 1970



28

Burst Pipe

SP DN450mm



29

Holed Pipe
CIP DN150mm laid in 1975



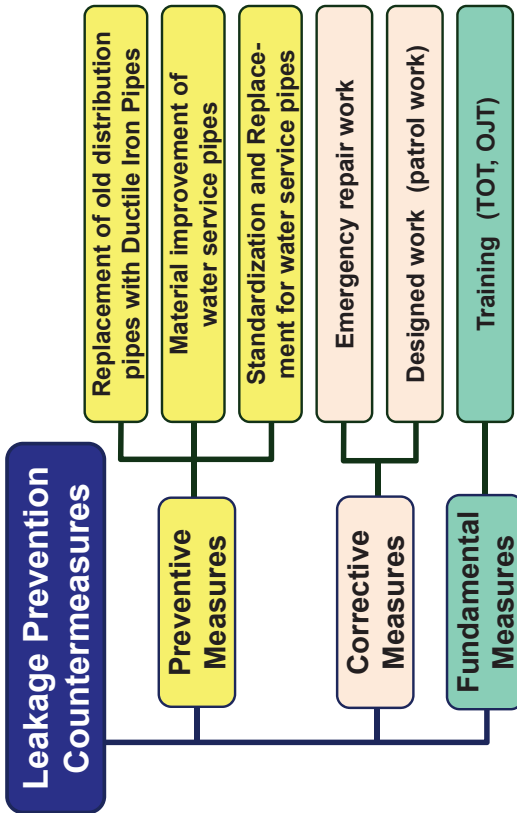
30

Holed Pipe
DIP DN800mm



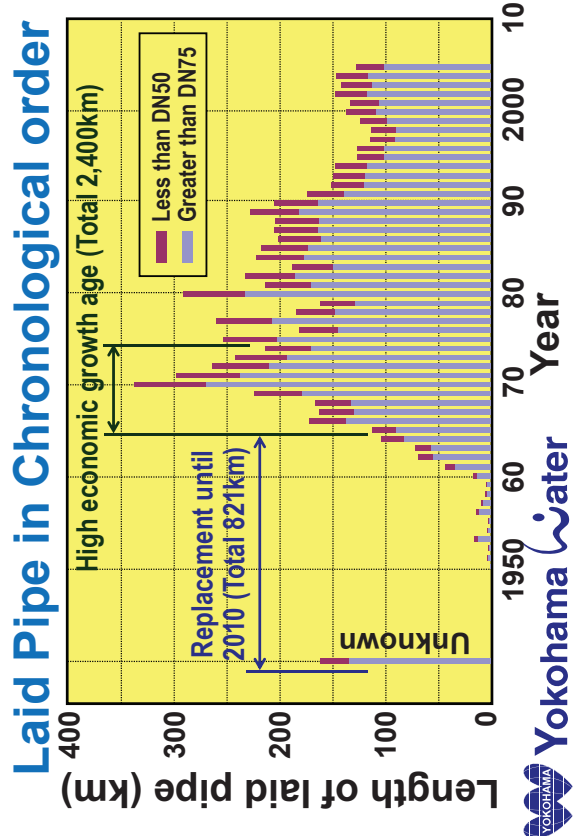
31

Leakage Prevention



32

Plan of Pipe Renewal



Renewal Pipe

Replacement of Aged Pipe

Target of Aged Pipe

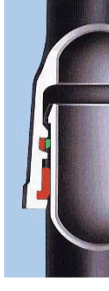
Cast Iron Pipe (Non-Mortar Lining) (CIP)
Asbestos Cement Pipe (ACP)
Lead Pipe (LP)
Polyethylene Pipe (PEP)
Hard Type PVC Pipe (VP)
Galvanized Steel Pipe (GP)
Tar Epoxy Galvanized Steel Pipe (TEGP)



Renewal Pipe

Pipe Material

Ductile Iron Pipe (DIP)
NS joint (DN75-450mm)



Vinyl Lining Galvanized Steel Pipe (VLGP) (DN20-50mm)

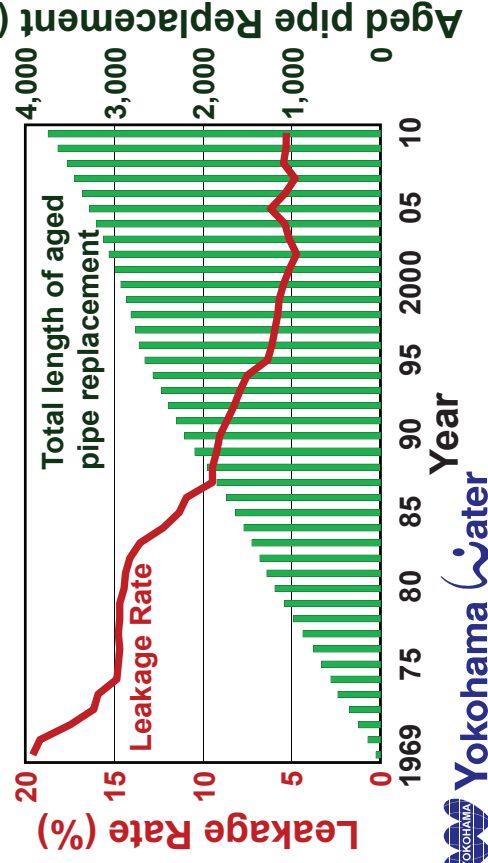


Polyethylene Lining Galvanized Pipe (PLGP) (DN20-50mm)



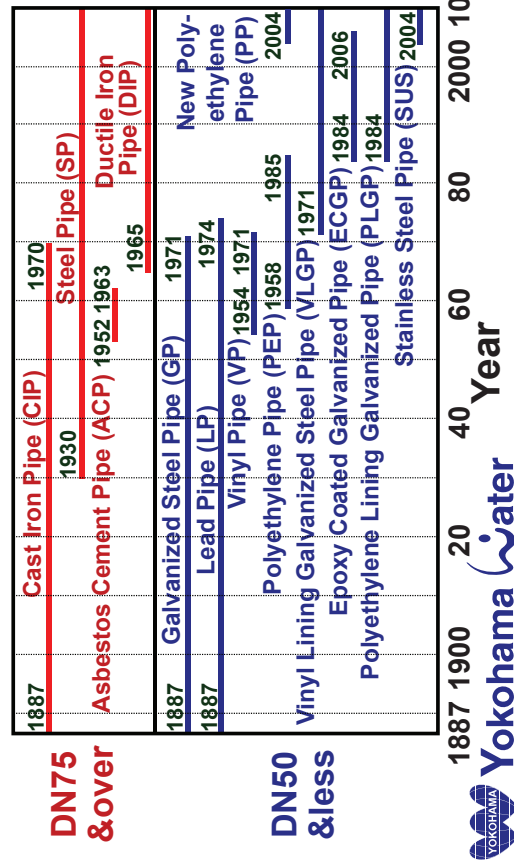
Plan of Pipe Renewal

Pipe replacement & Leakage rate



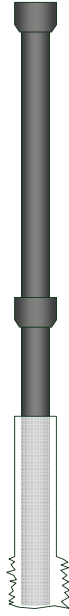
Pipe Material Improving

Pipe Material History



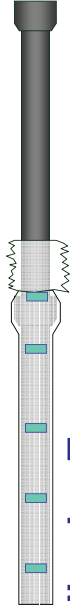
Anti Corrosion

Polyethylene Sleeve Method



Polyethylene Sleeve

Polyethylene Sleeve

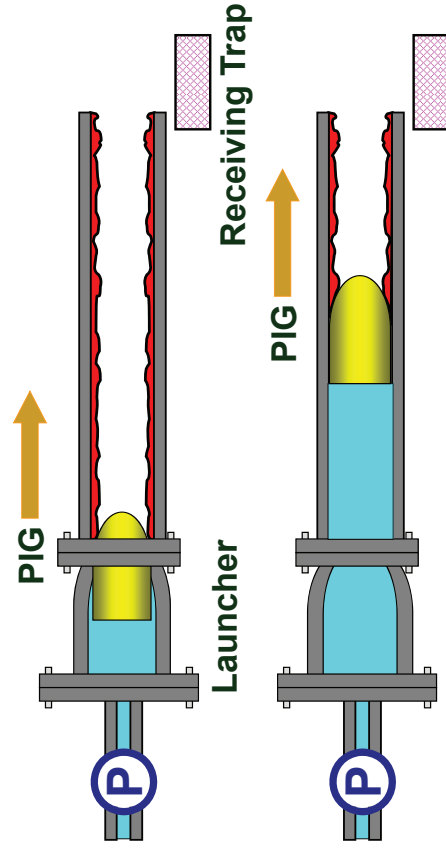


Adhesive Tape



Pipeline Cleaning

PIG Pipe Cleaning Method



Pipelines Location

Manifestation (ID) Tape & Sheet

Manifestation (ID) Tape



Manifestation (ID) Sheet

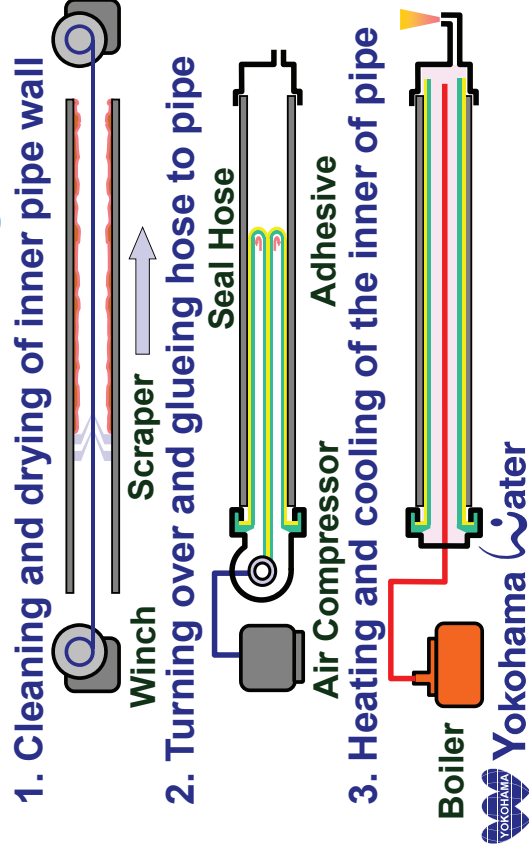


Attention Water Pipe
edId uoituæjY



Renovation of Old Pipes

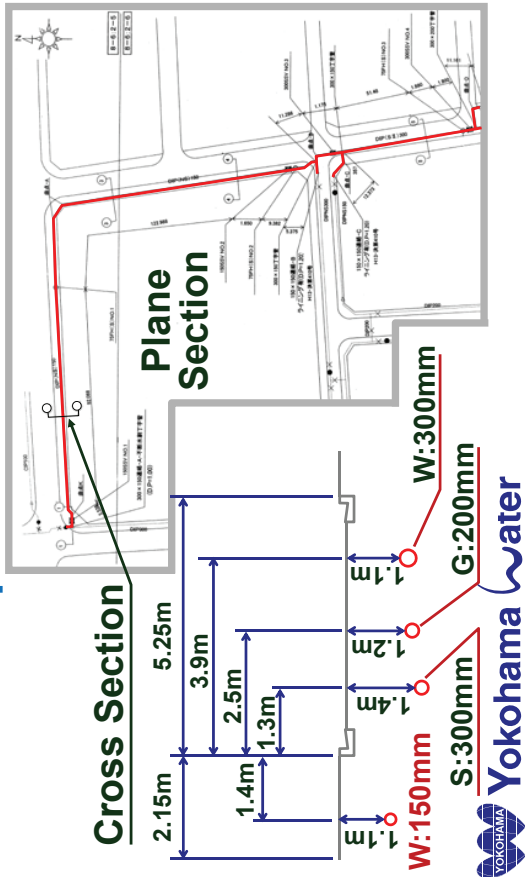
Seal Hose Lining



Pipelines Cross Section

41

Pipeline Location



Repair / Leakage Training

43

Pipeline Training Yard



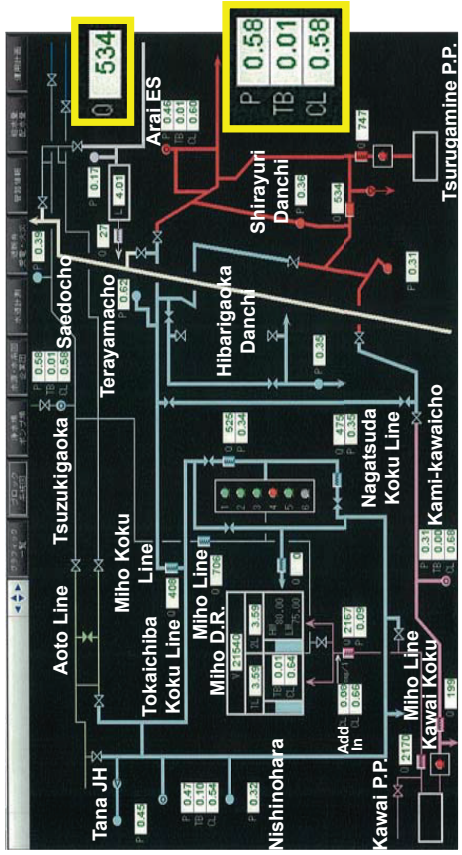
Number of Staff of Leakage Repairable: 95
(Include of 15 Leakage Specialists)



Leakage Discovery

42

Pressure/Volume Monitor: SCADA



Quick Repair

44

Training of Urgent Repair





Japan International Cooperation Agency
Federal Capital Territory Administration
Federal Capital Territory Water Board



The Federal Capital Territory Reduction of Non-Revenue Water Project

Work Plan

December 2014

JICA Expert Team

1

1. Water Balance (or Audit) and Components

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
Water Losses	Unbilled Authorized Consumption	Unbilled Authorized Consumption	Unbilled Metered Consumption	Non- Revenue Water (NRW)
	Commercial (Apparent) Losses	Unbilled Unmetered Consumption	Unbilled Unmetered Consumption	
	Physical (Real) Losses	Unauthorized Consumption	Unauthorized Consumption	
		Customer Metering Inaccuracies and Data Handling Errors	Customer Metering Inaccuracies and Data Handling Errors	
		Leakage on Transmission and/or Distribution Mains	Leakage on Transmission and/or Distribution Mains	
Water Losses	Physical (Real) Losses	Leakage and Overflows at Utility's Storage Tanks	Leakage and Overflows at Utility's Storage Tanks	Non- Revenue Water (NRW)
		Leakage on Service Connections up to Point of Customer Use	Leakage on Service Connections up to Point of Customer Use	

3

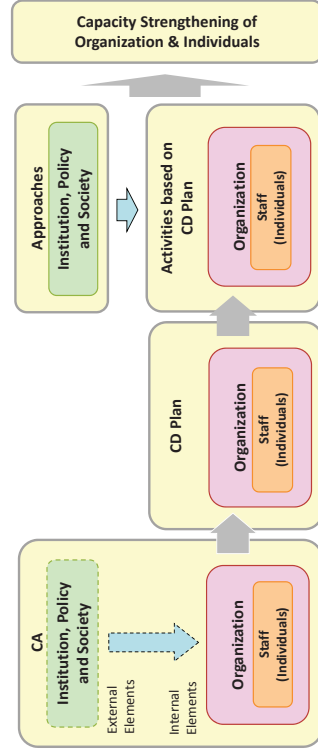
Contents

1. Water Balance (or Audit) and Components
2. Capacity Assessment and Capacity Development Plan
3. Capacity Development for Individuals
4. Activities for Output-1
5. Activities for Output-2
6. Activities for Output-3
7. Project Schedule

2

2. Capacity Assessment and Capacity Development Plan

CA and CP plan are for both **Organization** and **Individuals** with approaches to **Institution, Policy and Society**, as a triadic component.



* CA and CD Planning by **jointly** the JICA Expert Team and the Management of FCTWB.

* **Interim assessments** of organization and individuals will be conducted **annually**.

4

3. Capacity Development for Individuals

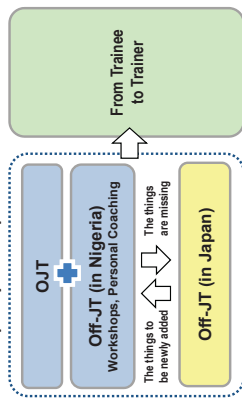
- **Expansion** of transferred skills and knowledge into the **whole** FCC water supply services and other Area Offices after the Project. (Trainee to Trainer)
- Technical meetings and workshops organized under **the initiative of FCTWB staff** with support of the JICA Expert Team.

Trainings in Japan

- 1st Training for the NRW Management Team in charge of Output-1 to 3 (in 2015)
- 2nd Training for the NRW Action Team in charge of Output-2 (in 2016)
- 3rd Training for the Working Group for NRW Reduction Planning in charge of Output-3 (in 2017)

*Supposedly in Yokohama City.

Capacity Development for Individuals



4. Activities for Output-1

1-1	Install bulk meters to water treatment plants 1 and 2. <i>* Four ultrasonic flow meters, chamber and monitoring room if needed (to be constructed by FCTWB).</i>
1-2	Measure monthly water production of water treatment plants 1, 2, 3, and 4.
1-3	Tally the above water production data monthly.
1-4	Calculate the monthly water consumption based on the billing data. <i>*Modification of programme of billing and collection system.</i>
1-5	Calculate monthly NRW ratio of the service area of FCTWB using the data obtained from Activity 1-3 and 1-4.

6

5. Activities for Output-2

2-1	Review existing NRW reduction operations at each pilot Area Office.
2-2	Conduct capacity assessment of the relevant staff of each pilot Area Office.
2-3	Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA.
2-4	Prepare/update distribution network drawings for each PMA. <i>* GIS software, Mesh management, comprehensive mapping system, GIS & database training</i>
2-5	Install water flow meters to each PMA and measure in/outflows monthly.
2-6	Zone each PMA into Sub Metering Areas (SMA).
2-7	Isolate a SMA by installing valves.
2-8	Update the distribution network drawings for each SMA.
2-9	Measure an initial level of NRW of each SMA. <i>* Water balance analysis (IWA)</i>
2-10	Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA. <i>* Minimum Night Flow survey, step test, leakage detector, correlator, etc</i>

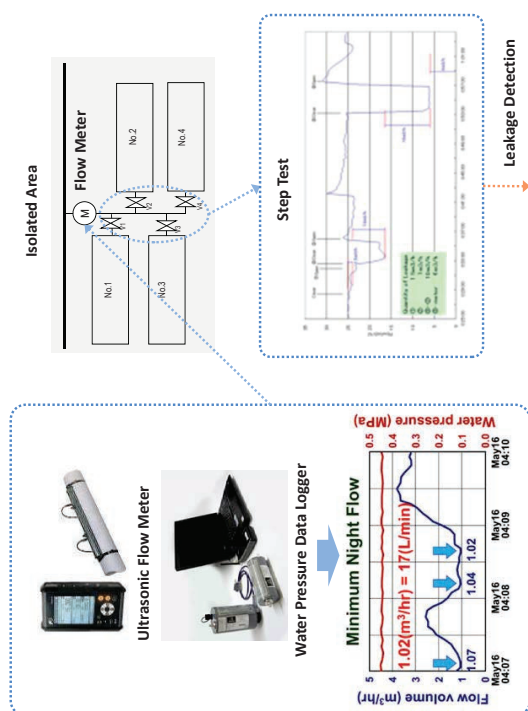
7

5. Activities for Output-2 (Continued)

2-11	Develop a NRW reduction operation plan of each SMA, including reduction target, for review by Head of Distribution Department.
2-12	Review and approve NRW reduction operation plan of each SMA.
2-13	Implement the NRW reduction operations at each SMA. <i>* Leakage repair, legalization/disconnection of illegal connections, replacement/ installation of water meters</i>
2-14	Monitor the progress of the NRW reduction operations of each SMA.
2-15	Measure level of NRW of each SMA at the end of the respective operations. <i>* Minimum Night Flow survey and Water balance analysis (IWA)</i>
2-16	Prepare a report on pilot projects, covering Activity 2-1 to 2-15. <i>* Leakage density by mesh coloring</i>
2-17	Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials. <i>* To be developed by jointly the JICA Expert Team and FCTWB. Audio visual materials by using widely-used software for continuous revision and creation by FCTWB.</i>

8

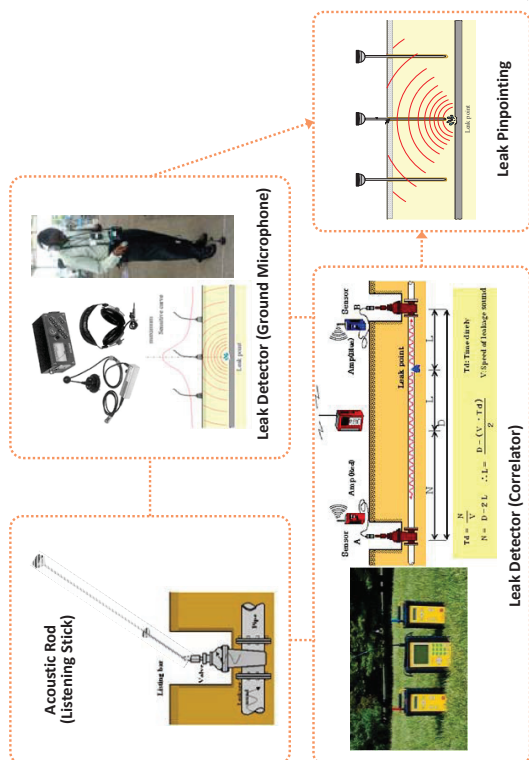
Basic Flow of Detection of Invisible Leakage (Prioritization)



6. Activities for Output-3

3-1	Establish a Working Group for NRW planning.	
3-2	Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB. <i>*Future establishment of specialized unit or task force</i>	
3-3	Conduct hydraulic and water pressure distribution analyses of the pipeline networks. <i>* EPANET supposedly</i>	
3-4	Develop outlines of the medium-term strategic plan and its annual NRW reduction plan. <i>* See the page 12</i>	
3-5	Develop the first medium-term strategic plan (2018-2022) for approval by FCTA. <i>* See the page 13</i>	
3-6	Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA. <i>* See the page 12</i>	
3-7	Develop a planning manual for NRW reduction.	

Basic Flow of Detection of Invisible Leakage

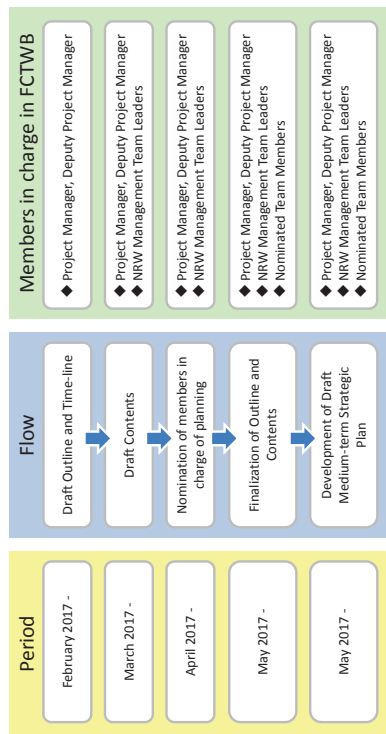


Outlines of the Medium-term Strategic Plan and Annual NRW Reduction Plan (Tentative)

Medium-term Strategic Plan for NRW Reduction (5-year plan)		Annual NRW Reduction Plan
A.	Introduction to NRW and approaches (e.g., PDCA)	a.
B.	Target and Indicator	b.
C.	Staffing plan and their responsibilities	c.
D.	HRD plan	d.
E.	Summary of results of pilot projects	e.
F.	Causes of NRW and their patterns by features of areas	f.
G.	Flow of NRW reduction	g.
H.	NRW reduction operation plan - Network drawings and data - Design and creation of DNA or equivalent (such as PMA and SMA) - Prioritization in NRW reduction - Replacement plan of existing pipelines - Field examination of existing valves, etc - Installation of flow meter - Leakage detection of Minimum Night Flow - Leakage detection - Repair of leaks and recording - Customer listing - Identification of illegal connections and meter inaccuracy - Data collection of billed consumption before/after NRW reduction - Measures against illegal connections and meter inaccuracy - Water balance analysis after NRW reduction operations - Safety measures	h.
		i.
I.	Implementation schedule	
J.	Estimation of total and annual costs	
K.	Estimation of total and annual benefits	
L.	Recommendations	
M.	Manual for equipment	

Flow from Preparation of Outline to Development of The Medium-term Strategic Plan

Technical Managers with support of the JICA Expert Team should take on **leading roles** to develop the first medium-term strategic plan and make it **feasible** in consideration of **cost and budget allocation**, based on the **results of pilot projects** in the Phase-1.



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7. Schedule

	Phase-1												Phase-2												
	2014	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Activities for Output-1: Level of NRW of the service area of FCTWB is monitored regularly.																									
1-1																									
1-2																									
1-3																									
1-4																									
1-5																									
Activities for Output-2: Methods/operational procedures for effective NRW reduction are established through pilot projects at PMAs under pilot Area Offices.																									
2-1																									
2-2																									
2-3																									
2-4																									
2-5																									
2-6																									
2-7																									
2-8																									
2-9																									
2-10																									
2-11																									
2-12																									
2-13																									
2-14																									
2-15																									
2-16																									
2-17																									
Activities for Output-3: A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output-1&2.																									
3-1																									
3-2																									
3-3																									
3-4																									
3-5																									
3-6																									
3-7																									

14

Federal Capital Territory Administration (FCTA)
Federal Capital Territory Water Board (FCTWB)
assisted by
Japan International Cooperation Agency (JICA)

THE FEDERAL CAPITAL TERRITORY
REDUCTION OF NON-REVENUE WATER PROJECT
PROGRAMME/AGENDA FOR 2ND WORKSHOP

Venue: Savannah Suites Hotel, 8 Faskari Street, Area 3, Garki, Abuja
Date: Wednesday, 17th February 2016
MC: Ms. Bunmi Olowoolere, (Head PRS, FCTWB)

- 8:30 - 9:00 Registration of Participants
- 9:00 - 9:05 Opening Prayer
- 9:05 - 9:10 Welcome Remarks (Project Manager, Mr. Hudu Bello)
- 9:10 - 9:25 Project Progress and Introduction (Technical Manager, Engr. A. A. Nahuche)

Session 1: Water Distribution Management

- 9:25 - 9:40 Concept and Ideal of Water Distribution Management (Engr. A. R. Lawal)
- 9:40 - 9:55 Installation of Bulk & Zonal Meters and Pilot Remote Monitoring (Engr. A. R. Lawal)
- 9:55 - 10:10 Hydraulic Analysis for Diagnosis of Distribution Network (Engr. M. Kabir)
- 10:10 - 10:25 Drawing and GIS in FCTWB (Mr. Shehu S.)
- 10:25 - 10:40 Current Situation of Billing (Mrs. Rose A.)
- 10:40 - 10:55 Contribution and Discussion (Facilitated by Engr. A. R. Lawal)
- 10:55 - 11:25 Tea/Coffee Break

Session 2: NRW Reduction Pilot Project

- 11:25 - 11:40 NRW and Procedures of Pilot Project (Engr. Douglas)
- 11:40 - 11:55 Concept and Creation of PMA/SMA (Mr. M. Dikko)
- 11:55 - 12:15 Findings in Gudu before NRW Reduction Operations (Mr. Ozumi & Mr. Williams)
- 12:15 - 12:30 Findings in Jabi before NRW Reduction Operations (Mr. Ramat)
- 12:30 - 12:40 Meter Error Test (Engr. Masaud)
- 12:40 - 13:00 Contribution and Discussion (Facilitated by Engr. A. R. Lawal)
- 13:00 – 14:00 Lunch Break

Session 3: Wrap-up

- 14:00 - 14:30 Practice of Water Balance Analysis (Mr. Toyoda)
- 14:30 - 15:00 Action Plan by Trainees in Japan (Technical Manager, Mr. Adis S. Muhammad)
- 15:00 - 15:50 Clarification of Problems and Way Forward (Facilitated by Engr. A. R. Lawal)
- 15:50 - 15:55 Closing Remarks (Deputy Project Manager, Mr. S.T. Bello)
- 15:55 - 16:00 Closing Prayer

**FEDERAL CAPITAL TERRITORY REDUCTION OF NON- REVENUE WATER
PROJECT**

2ND WORKSHOP ATTENDANCE LIST

DATE: 17th, February 2016

S/N	NAME	POSITION	TELEPHONE	EMAIL
1	Hudu Bello	Dir FCTWB		
2	S.T Bello	H.O.D Admin & supply		
3	A.A Nahuche	H.O.D Distribution		
4	S.M Adis	H.O.D Commerce		
5	Hasfat Ahmed Lawi	H.O.D Finance & Account		
6	Agbotan O.S	H.O.D Reservoir and production		
7	Bunmi Olowookere	H.O.U P.R.S		
8	Abbas A. Ahmed	Head of PR		
9	Abolade R.Lawal	Head of Special Project Unit		
10	Moh.Kabir Rabi	Head of Logisitics Unit		
11	Musa Dikko	Head of Pipeline		
12	Shehu Suleiman	Head of G.I.S		
13	Douglas E.Oloto	Head of Metering		
14	Iliya Galadima	Senior works Garki 1		
15	Aliyu N. Maradun	C.C.O		
16	Wasin Olajide	P.A		
17	Mumini Raifu	AAM gwarinpa		
18	Okobi .O.Y	H.O.D Quality Control		
19	Umar Farouk Abdullahi	S.T.A Pre-paid		
20	Nweke Francisca	AAMC Kubwa 1		
21	Mohammed Ozumi	AAM(dist) Gudu		
22	Tuta John	AAM		
23	Solomon O Oladoja	AAM Bwari		
24	Ogebide Uche	H.O.D facility		
24	Isah Mohammed	AAM(C) Karu/Nyayan		
25	Umar U Abdullahi	AAM Maitama		
26	Hamzat R.T	Head Audit		
27	Samuel Francisca	H.O.U (T/W)		
28	Olufemi Oyekanu	Coord JICA Solar		
29	Salihu O. Sadiq	AAM(dist) Jabi		
30	Usman A. Dakingari	Area manager		
31	Mustapha A. Abdullahi	AAM(dist) kubwa II		
32	Nma Yahaya	AAM(dist) Kubwa III		
33	Ibrahim Murtala	AAM(C) kubwa		
34	A.U Sanda	Area Manager Asokoro		
35	Sulaiman A.Mulid	AAM(C)		
36	Haraya B. Koti	AAM(C) Jahi/katan		

37	Amos Bulus	PEE(M&E)		
38	Esike Sandra Ogechi	SAO Admin&Supply		
39	Fasinkun Kehinde	Head MIS Unit		
40	Aluko Tope	ACE		
41	Bello. A. Tata	Area manager Kubwa III		
42	Adaobi Iloduba Nwaike	AAM Wuse II		
43	Idris Mohammed	AAM(dist) Gwagwalada		
44	Mohammed Basir	AAM(C) Kubwa II		
45	Sulaiman Abdul-A	AD/AM (Jahi/katampe)		
46	Okoli Martin	AD/AM Wuse II		
47	Ibrahim Saidu	AM Gwagwalada		
48	Maimuna Adamu	AAM(C) Garki II		
49	Sani U.Bunza	Area Manager Bwari		
50	Ogbu Onuaha Williams	AAM Gudu		
51	Ibrahim M. Umar	AAM		
52	Alhassan L. Mohammed	AAM Kubwa		
53	Mijinyana Yahaya	Area Manager Garki II		
54	Igbinsola Courage	AAM Asokoro		
55	Aminu Umar	Head Ops& WM		
56	Ohamma Amaka	Snr Exec. Officer Garki I		
57	Abubakar Ubale A.	Snr Engr.		
58	Edafe Mary O.	Area manager Wuse I		
60	Gwani John	AAM		
61	Isah Danjuma	HOU Monitor		
62	Abdullahi Masaud	Head PPM		
63	Abizimi A. Joseph	Supervisor Gudu		
64	Owolabi Isaac Olusola	AD Com. Customer Care		
65	Umar A.B	Area Manager Gwarinpa		
66	John O. Olanrewaju	Area Manager Wuye		
67	Abdulrahman Shehu	APM (VW)		
68	Yusuf Yelwa	Area Manager Utako		
69	Obrike C.M	AD(RWSS)		
70	Mohd Dauda	Pipeline Unit		
71	Jibrin Moh'd Y.	AAM Wuse II		
72	Adesole Olufemi	AAM Maitama		
73	Abawonse J.K	AAM Jabi		
74	Moh'd A.S Ramat	Area Manager Jabi		
75	Choji Pam O.	AAM(C) Garki I		
76	Habib Ahmed Kiru	Area Manager Gudu		
77	Dada James O.	AAM(Dist) Kubwa II		
78	Abdulrahman Mohammed	Snr Engr.		
79	Mohammed Shehu	AD A/M Maitama		
80	Alhamdu J.Nqafono	AAM(Tech) Garki II		
81	Hussain Dauda	AAM(C) Asokoro		
82	Ezeh C. Hillary	GIS/Logistics		

83	Akor Japhet A.	AAM Utako		
84	Simon I. Eku	AAM Wuse I		
85	Mohammed Mohamd	Supervisor		
86	Ottah C.E	S.E		
87	Adenuga A.O	Area Manager Garki I		
88	Aliyu B. Zakari	AAM Kubwa I		
89	Abdul Yusuf	Sup. P&P Gudu		
90	Azih Kenneth	Area Manager Karu/Nyanya		
91	Mogbo Stella. N	Information Officer		
92	Segun Kayode	Principal Info. Manager		
93	Adamu U.Hussain	S.A(Technical)		
94	Abdullahi Y A	AAM(C)		
95	Mohammed E. Gana	AAM(Dist) Garki I		
96	Rose Akpan	Head Billing		
97	Takayaki Ohira	JICA P.F.A		
98	Chie Shimodaira	JICA Rep		
99	Joachim Ezeji	Advisor JICA		
100	Akinori Miyoshi	JICA Expert		
101	Taketoshi Fujiyama	JICA Expert		
102	Toru Toyoda	JICA Expert		
103	Kiyoshi Kiyama	JICA Expert		
104	Hiroyuki Morita	JICA Expert		
105	Shinta Segawa	JICA Expert		
106	Takashi Mori	JICA Expert		



Federal Capital Territory Administration
Federal Capital Territory Water Board
Japan International Cooperation Agency



The Federal Capital Territory Reduction of Non-Revenue Water Project

Introduction

17 February 2016

Engr. A. A. Nahuche
Technical Manager, HOD Distribution, FCTWB

2. Project Outline and Progress

Overall Goal	Level of Non-Revenue Water (NRW) is reduced at the service area of FCTWB.
Project Purpose	Capacity of FCTWB for NRW reduction is strengthened.
Output-1	Level of NRW of both the service area of FCWTB and water distribution areas are monitored regularly.
Output-2	Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.
Output-3	A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

1. What is Non-Revenue Water?

NRW is an indicator of water supply management and O&M for actions to be taken, and also is supposed to be kept lower to improve efficiency of water supply services.

Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption		Revenue Water
		Billed Unmetered Consumption	Unbilled Metered Consumption	
System Input Volume	Unbilled Authorized Consumption	Unbilled Unmetered Consumption	Unauthorized Consumption	Non-Revenue Water (NRW)
	Commercial (Apparent) Losses	Customer Metering Inaccuracies and Data Handling Errors		
	Physical (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 Use		

* "Un-accounted for Water (UfW)" is no longer common term.

2. Project Outline and Progress (continued)

Project Areas

Federal Capital Territory (FCT)

Pilot Areas: Garki I, Gudu and Jabi

** Since water distribution management was introduced as additional concept into the Project in Nov. 2015, involvement of all Area Offices has been important.*

Project Period

Phase-1: October 2014 to December 2016

Phase-2: January 2017 to March 2018

Project Progress

See a separate paper "Project Progress (as of mid-Feb. 2016)"

4. Purpose and Sessions in Workshop

Purpose of Workshop

- Formation of shared awareness of project orientation and updated progress, problems and challenges

Session 1: Water Distribution Management

(Related activities: 1-1 to 1-7, 3-8 and 3-9)

Session 2: NRW Reduction Pilot Project

(Related activities: 2-1 to 2-17)

Session 3: Wrap-Up

5

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Session 2: NRW Reduction Pilot Project

- 2-1. NRW and Procedures of Pilot Project
- 2-2. Concept and Creation of PMA/SMA
- 2-3. Findings in Gudu before NRW Reduction Operations
- 2-4. Findings in Jabi before NRW Reduction Operations
- 2-5. Contribution and Discussion

Session 1: Water Distribution Management

- 1-1. Concept of Water Distribution Management
- 1-2. Bulk & Zonal Meters and Pilot Remote Monitoring
- 1-3. Drawings and GIS in FCTWB
- 1-4. Hydraulic Analysis
- 1-5. Reading and Billing in FCTWB
- 1-6. Contribution and Discussion

6

Session 3: Wrap-Up

- 3-1. Practice of Water Balance Analysis
- 3-2. Action Plan by Project Members participated in Training in Japan
- 3-3. Clarification of Problems, Challenges and Way Forward

8

Thank you for your attention.

Your productive contributions for success of the Project and development of FCTWB would be highly welcome.

9



Concept and Ideal of Water Distribution Management

Engr. Abolade R. Lawal

1

Concept of Water Distribution Management

Water supply utilities have to control **Water Volume, Water Pressure, Water Quality**.

Water Volume

Water supply utilities have to supply **necessary and sufficient water** even at peak and in future.

Water Pressure

Water supply utilities have to supply water **at proper water pressure** at each service point.

Water Quality

Water supply utilities have to supply **safety water** (Ensuring residual chlorine at each service point).

Quantitative & scientific comprehensive control



**Do you think
FCTWB is able to do so?**

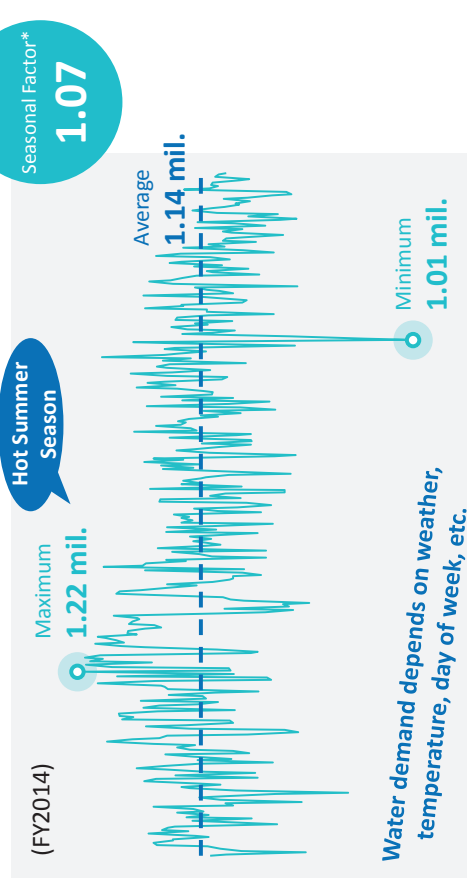
Discuss for a while



Water demand varies with the seasons

*Seasonal Factor = Max. / Ave.

Daily Water Supply [m^3/day]



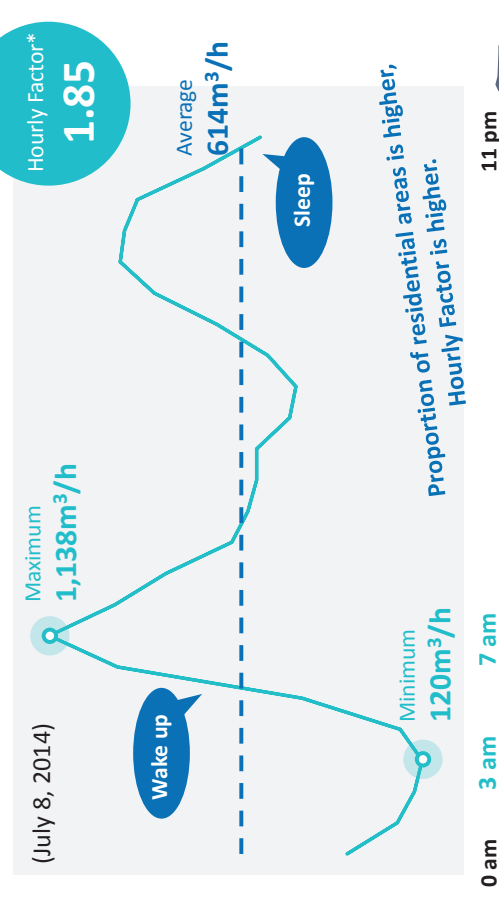
Source: Yokohama Waterworks Bureau



Water demand also varies with time

*Hourly Factor = Max. / Ave.

Water Supply in Miho Pumping Area [m^3/h]

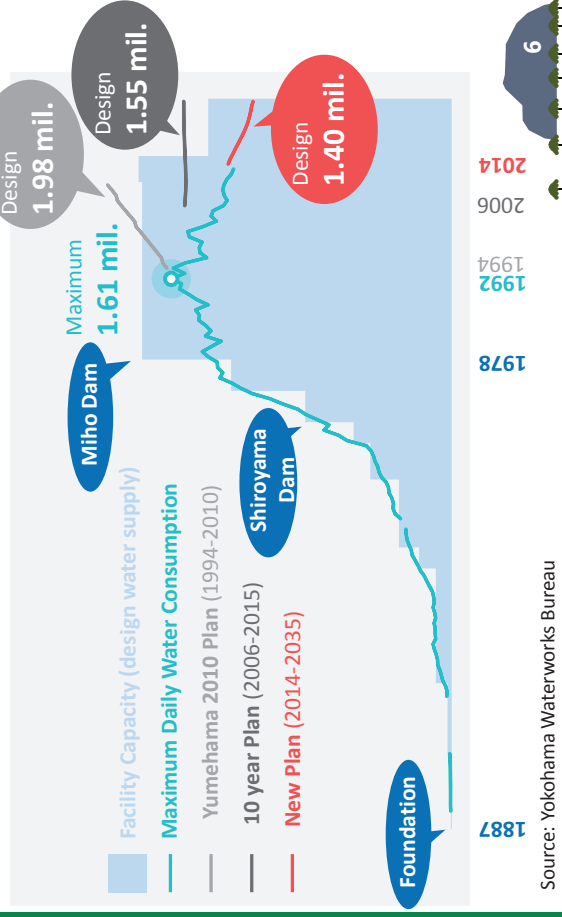


Source: Yokohama Waterworks Bureau



Water Demand Forecasting

Water Supply & Facility Capacity [m^3/day]



Proper Water Pressure in Japan

7.5.3 Water Pressure

The water pressure of a distribution pipeline shall conform to the following conditions:

- [1] The minimum hydrodynamic pressure shall be ensured **more than 0.15MPa** in principle.
- [2] The maximum hydrostatic pressure shall **not exceed 0.74MPa** in principle.

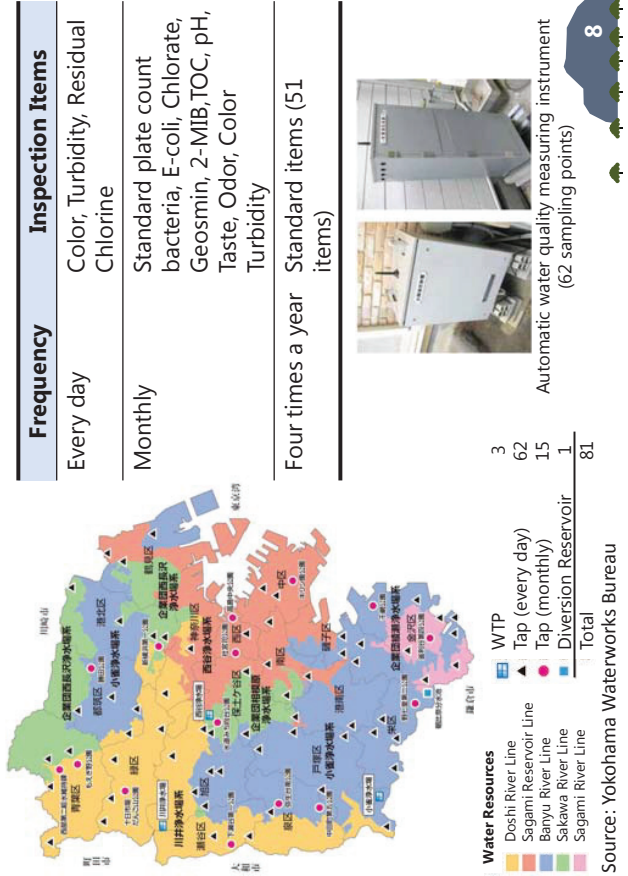
"Design criteria for waterworks Facilities" of JWWA

Water pressure of 0.15MPa can secure the direct water supply for two-storied building.

YWWB ensures the minimum hydrodynamic pressure more than 0.20MPa for the three-storied building.



Water Quality Management in Yokohama



Committee for distribution management

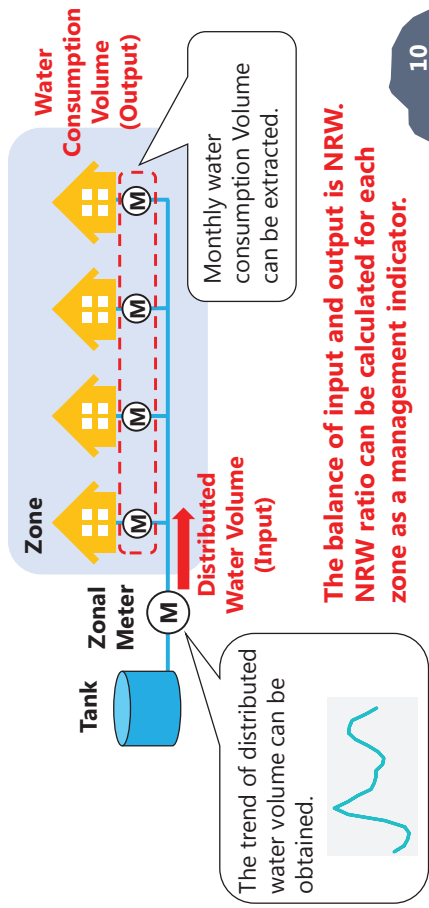
FCTWB establishes the cross-organizational Committee for distribution management, and Kick-off meeting was held on February 4, 2016.



3 Departments (Distribution, Commerce and Quality Control) solve the problems of water distribution management as a team.

Water volume control

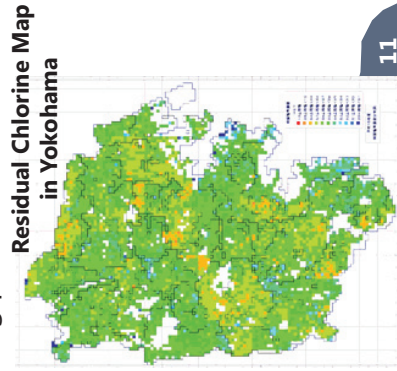
- In this project, JICA installs zonal meters (ultrasonic flow meters) to each outlet pipe from Tank.
- On the other hand, JICA modifies the tariff system with enhanced aggregate function.



Water Pressure & Quality Control

- In this project, JICA brought portable water pressure loggers and water pressure can be measured at each fire hydrant using them.
- It is necessary to measure the concentration of residual chlorine at several sampling points.

Based on these measurements, Water Pressure Map and Residual Chlorine Concentration Map can be created on the GIS.



These information can be visually and scientifically monitored.

Platform for distribution management

Platform in considering problems and measures

- Calculation of NRW ratio for each zone
- Creation of Water Pressure Map
- Creation of Residual Chlorine Concentration Map



- Gap between the plan and the actual situation can be understood.
- Taking budgetary steps, the necessary for project is explained standing in scientific knowledge.



FCTA/FCTWB-JICA

The Federal Capital Territory
Reduction of Non-Revenue Water Project

Installation of Bulk & Zonal Meters and Pilot Remote Monitoring

17 February 2016

Engr. Abolade R. Lawal
Coordinator, HOU Special Projects, Distribution, FCTWB

Contents

1. Bulk Meters

- 1.1 Roles of Bulk Meters
- 1.2 Location of Bulk Meters
- 1.3 Procurement
- 1.4 Work Progress

2. Zonal Meters

- 2.1 Roles of Zonal Meters
- 2.2 Location of Zonal Meters
- 2.3 Procurement
- 2.4 Work Progress

1. Bulk Meters

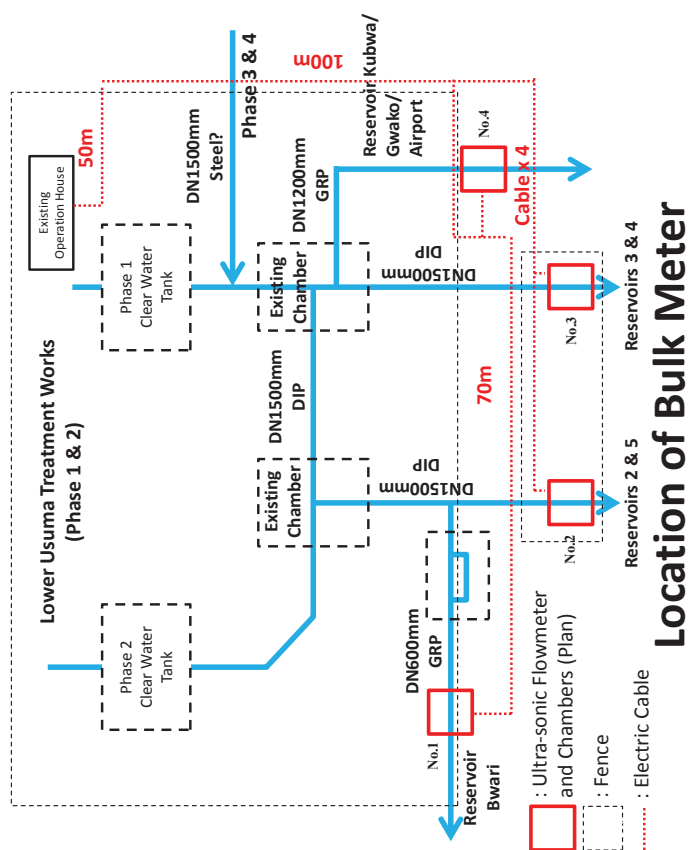
1.1 Roles of Bulk Meters

- Measure flow rate transmitted from Lower Usama Water Treatment Plant (WTP) to learn water production and daily maximum factor
- Measure flow rate transmitted from WTP to learn water loss in transmission mains

1.2 Location of Bulk Meters

- See Next Page

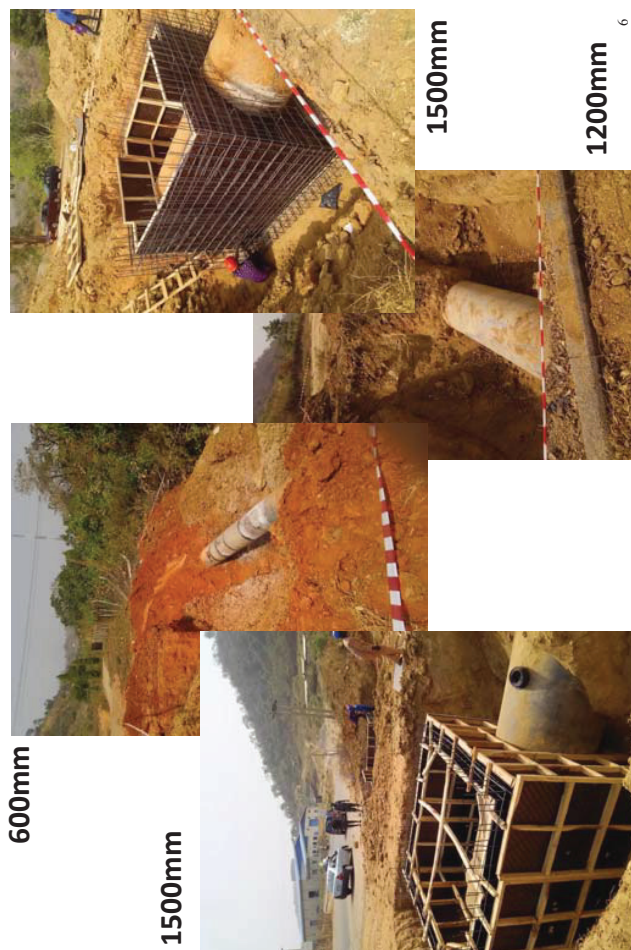
1.4 Progress of Works



1.3 Procurement

Item	Diameter	Nr.	Remarks
Ultra-sonic Flowmeters	600mm	1	To Reservoir Bwari
Ditto	1200mm	1	To Reservoir Kubwa, Gwako and Airport
Ditto	1500mm	2	To Reservoir 2&5 To Reservoir 3&4
Data Logger		1	Four channels for four ultrasonic-flowmeters
Chamber Construction		4	Four types of chamber

1.4 Progress of Works



1.4 Progress of Works (Cont.)

Pipe Diameter	February		March		
	15	25	5	15	25
600mm					
1200mm					
1500mm					
Res. 2&5					
1500mm					
Res. 3&4					

■ : Chamber Construction ■ : Bulk Meter Installation

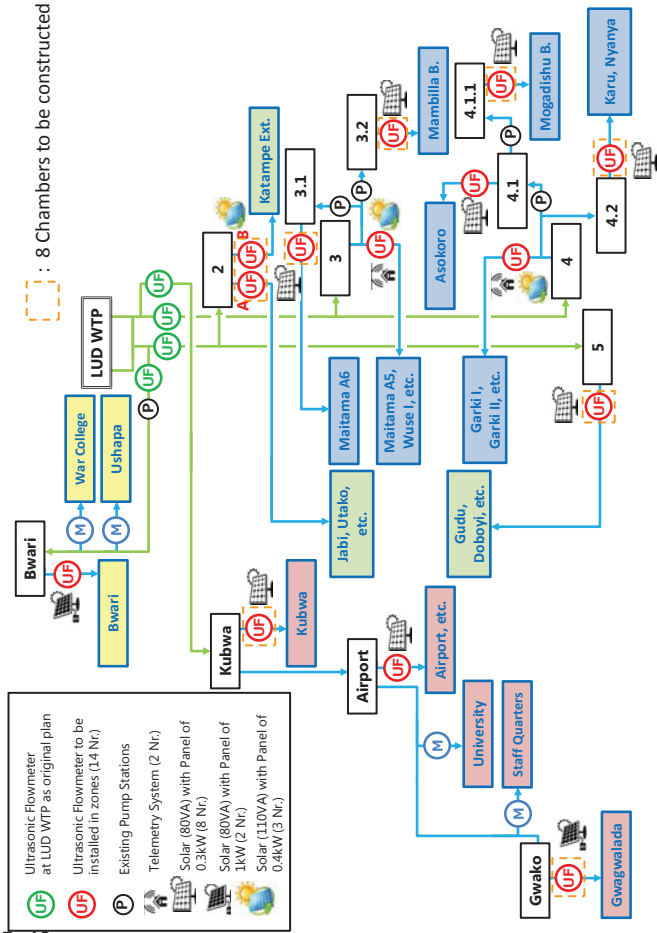
2. Zonal Meters

2.1 Roles of Zonal Meters

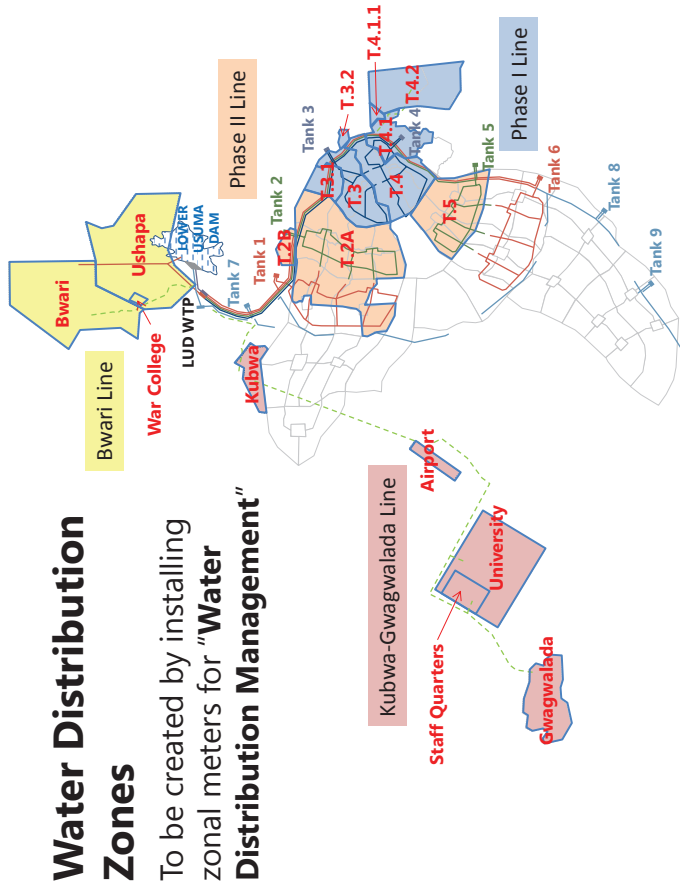
- Learn distributed water flow rate and analyze IWA water balance by zone
- Prioritize NRW reduction activities by zone in FCT

2.2 Location of Zonal Meters, Water Distribution Zones and Multi-Boundary

- See next pages



Location of Zonal Meters, Telemetry & Solar System ,



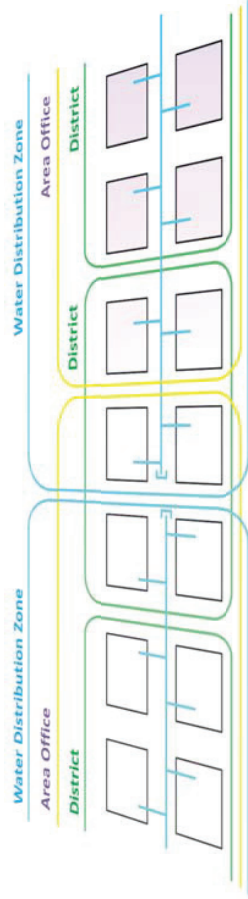
Water Distribution Zones

To be created by installing zonal meters for “**Water Distribution Management**”

Multi-Boundary in Water Distribution

There are **three** boundaries:

- (1) **Administrative District**
- (2) **Area Office’s managing area**
- (3) **Water Distribution Zone** defined by configuration of distribution network and its isolation



FCTWB should find **optimum** distribution management.

2.3 Procurement

Main Component	Purpose
Zonal Meters + Data Logger	See 2.1
Chambers of Zonal Meters (Ultra-sonic Flowmeters)	Maintain flowmeters regularly
Telemetry System to monitor Flow Rate of Zonal distributed Water	- Monitor water flow rate to maintain NRW at low level - Verify relevance on introduction of SCADA system in future
Solar System	- Back-up power source for ultra-sonic flowmeters and telemetry - Permanent power source for Gwako and Bwari for the time being
Water Pressure Logger (Portable)	Monitor water pressure of network to maintain an optimum water pressure

Annex5-41

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2.3 Procurement (Cont.)

Ultra-sonic Flowmeters		
Diameter of the Existing Pipes (mm)	No.	Site of Tank
1500	2	2 & 5
1200	2	3 & 4
600	3	Bwari, Kubwa & Gwako
500	2	3.1 & 4.2
400	1	4.1
300	3	2, 3.2 & Airport
250	1	4.1.1
Total	14	

Note: **Data loggers** will be installed in each site of tank. Total data loggers are **13** sets.

13

2.3 Procurement (Cont.)

Chambers for Zonal Meters			
Diameter of the Existing Pipes (mm)	No.	Type of Chambers	Site of Tank
1500	1	Type- D	5
1500 +300	1	Type- A	2
600	2	Type- B and - G	Kubwa & Gwako
500	2	Type- B and - C	3.1 & 4.2
300	1	Type- E	3.2
250	1	Type- F	4.1.1
Total	8		

2.3 Procurement (Cont.)

Specification	No.	Site of Tank
Solar System of 80VA (1.0kW)	2	Bwari & Gwako
Solar System of 80VA (0.3kW)	8	3.1, 3.2, 4.1, 4.1.1, 4.2, 5, Kubwa & Airport
Solar System of 110VA (0.4kW)	1	2
Solar System of 110VA (0.4kW) with Telemetry System	2	3 & 4
Total	13	

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2.3 Procurement (Cont.)

Portable Water Pressure Logger	
Specification	No.
Portable Water Pressure Logger	2

2.4 Work Progress (Cont.)

Item	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
Zonal Meters & Data Logger										
Chamber Construct.										
Telemetry										
Solar System										
Water Pressure Logger										

2.4 Work Progress

Equipment	Progress
Zonal Meters & Data Logger	Preparing specification and BQ
Chambers	Bid Tender on 11 Feb. 2016
Telemetry	Preparing specification and BQ
Solar System	Preparing specification and BQ
Water Pressure Logger	Preparing specification and BQ



Bid Tender



Drawing and GIS in FCTWB

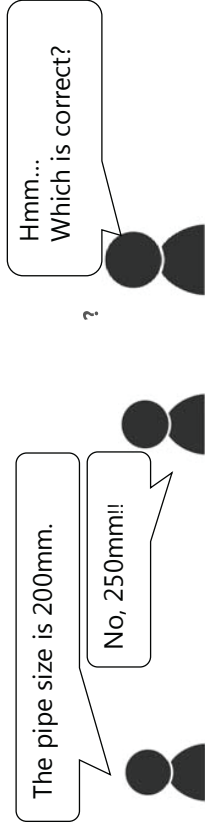
Shehu Suleiman

1

Why GIS?

GIS in FCTWB is aimed at addressing the following challenges:

- Non availability of comprehensive drawing in FCTWB.
- pipeline information is based on the memory and experience of the staff.
- Each area office maintains their facility without the drawings.



→ **Gather the memory and experience of staff and existing drawings and develop a unified drawings on GIS.**



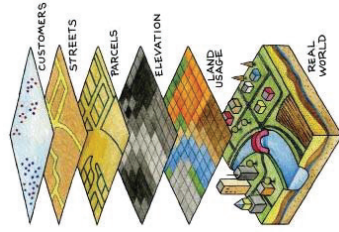
Basic concept of GIS

GIS is an abbreviation for Geographic Information System.

Topography (Elevation), Boundary, Land Usage, Street, Plot, House/Building, etc.

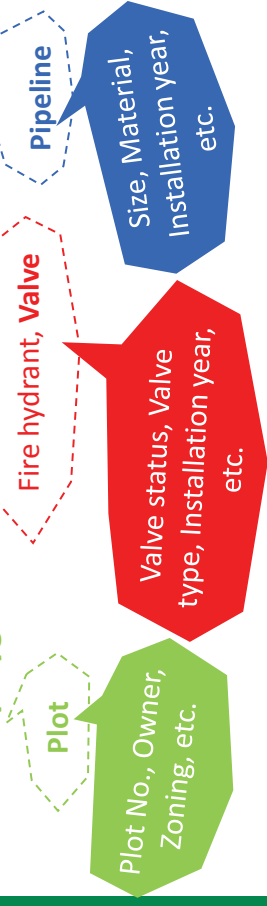
For Water supply and distribution:

Facilities (WTP, Tank), Pipeline (Primary, Secondary, Tertiary), Fire Hydrant, Valve, Water Meter, etc.



Basic concept of GIS

We can input geographic information into two or three-dimensional space of GIS as **a point**, **a line** and **a polygon**.



We can also input a lot of **attributes** to geographic information.



Uses of GIS for day to day operation

- We can make the facility maps.
- We can share the waterworks facility information by accessing GIS or referring map book based on GIS.
- We can store the information in GIS.
- We can analyze information using GIS.
- We can make a plan for pipe replacement using GIS information.



GIS in FCTWB

- Input from AGIS

Satellite Image, Street data and Plot data of whole of FCT

...in some estates developed by private company, no street and plot is inputted.

- Input from FCT Water Board

Pipeline, Valve and Fire hydrant for Phase I pipe size only. Only pipe size was captured as attribute.



Brief History of GIS in FCTWB

- | | |
|-----------|---|
| 1999-2000 | At least 75% of waterline information in Phase I was converted from analogue to digital form (i.e. transferred from paper as-built drawings to computer). |
| 2003-2004 | Digitized waterline information was migrated from AutoCAD to GeoMedia. |
| 2007-2009 | 20% of additional waterline information was added to the 75% existing data, making the pipeline data captured to be 95% in Phase I. |
| 2014- | JICA NRW Reduction Project was started.
Captured additional pipeline information for 3 PMAs created. |



Procedure for GIS development

General

- Digitization of pipeline information (pipe location, size, material) with valve, fire hydrant on the plot and the road information without satellite image.



GIS Map

- Set the basic scale of GIS of 1/2,000
- Print the GIS map in the 1,000m x 1,000m on A1 paper.

Distribution Map Book (BLUE BOOK)

- Set the blue book scale of 1/10,000
- Print the map in the 2,000m x 3,000m on A3 paper and bind them



Procedure for creation of GIS map

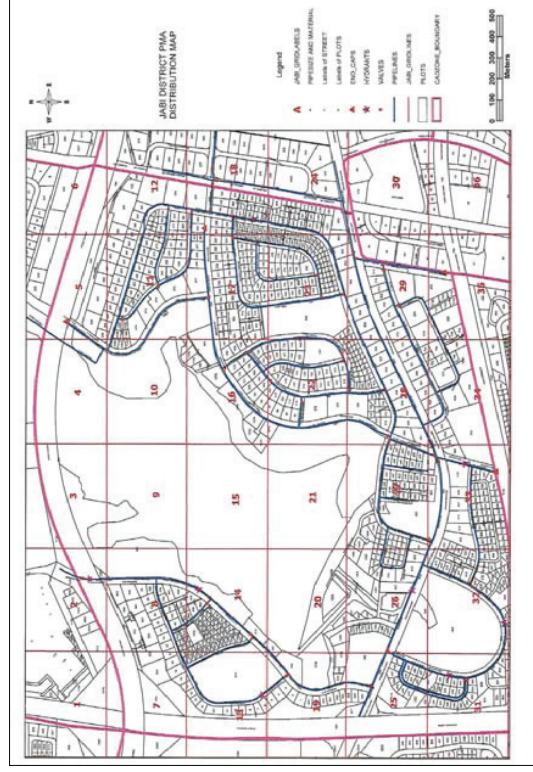


- (1) GIS unit prepares the satellite image map.
- (2) 3 pilot area offices make a sketch of pipeline network.
- (3) GIS unit inputs the pipeline information into the GIS based on the sketch.

- (4) GIS unit prints the drawing and confirm the inputted information with each area offices and pipeline unit.
- (5) GIS unit update and print the drawing and share it with each area offices.



One output of this project



Distribution Map of Jabi District (sample)

10

One output of this project



Distribution Map of Jabi District (sample)

11

Challenges for GIS work

- FCTWB is already supplying water without receiving as built drawings from construction companies.
→ Management should ensure that As-built drawings are submitted by the contractor before handing over the facilities
- Lack of procedure for the integration of latest pipeline information into the GIS Database.
→ A well defined structure should be put in place that will ensure the submission of updated pipeline information by each Area Office to the GIS Unit as appropriate.
- Slow pace of GIS development as well continuous update across the entire service areas of FCT due lack of adequate manpower.
→ Dedicated unit and staff for GIS work is required.

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For the future

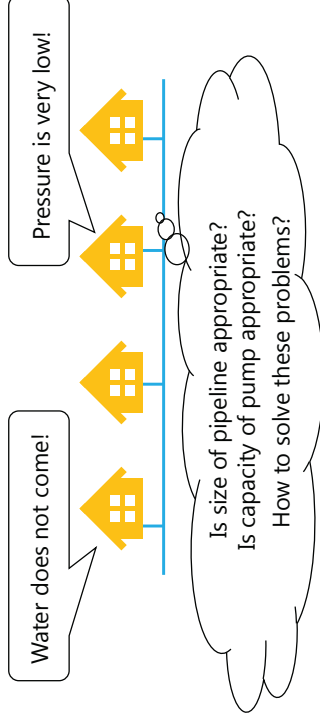
- ◆ **Development of drawings for each area office**
 - At the moment, we are developing distribution drawings for 3 pilot areas.
 - This initiative will be extended to the entire FCT and GIS maps will be distributed to each area office.
 - At that time, pipeline and conduit information will be shared among the staff, and the drawings will be utilized for day-to-day operation and maintenance.
- ◆ **Visualization of a lot of information**
 - In this pilot project, a leakage repair map will be developed.
 - For water distribution management, water pressure map and residual chlorine map will also be developed.
 - With these, problems can easily be identified for immediate solution.

13

Thank you for listening

How to solve a lot of problems?

The primary functions of water distribution system is to meet the water demand for users while maintaining acceptable pressure in the system and also supply water for fire protection at specific locations within the system while maintaining acceptable pressure. There are a lot of problems in attaining the stated demands.

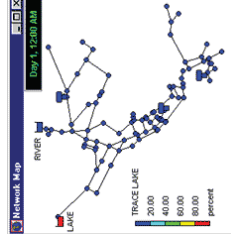


Hydraulic analysis is one of the methods that give the answers.

What is the hydraulic analysis?

Hydraulic analysis is one of the methods used for modeling water pipe network and simulating the flow of water in the pipe.

- EPANET: A computer programme that perform extended period simulation of hydraulics and water quality behavior within pressurized pipe network
- Others: WaterCad, EpaCad , Mike Urban etc.



Source: EPANET Website

Input

- Pipe information (location, size, material)
- Elevation
- Water demand (water consumption volume)

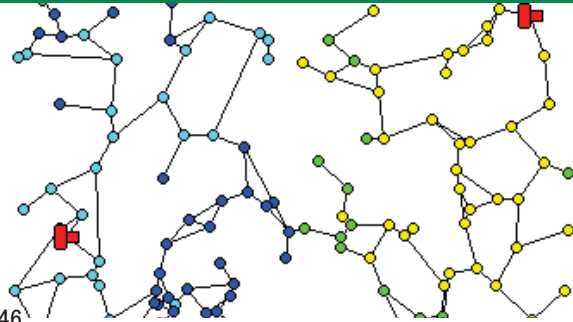
Analysis

Output

- Flow volume
- Flow direction
- Flow rate (velocity)
- Water pressure, etc.

Hydraulic Analysis for Diagnosis of Distribution Network

Engr. Moh. Kabir Rabiul

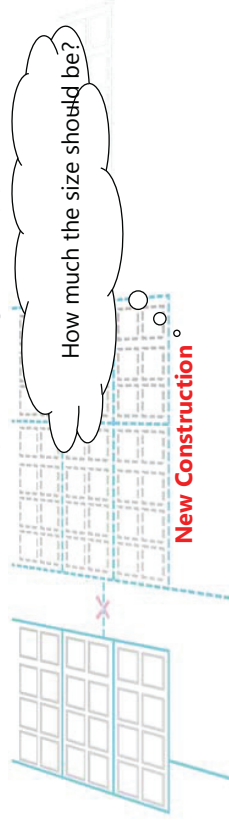


Example use of hydraulic analysis

(1) Consideration of new pipeline installation

When constructing new pipeline network, we can simulate the proper pipe sizes by carrying out the hydraulic analysis before construction.

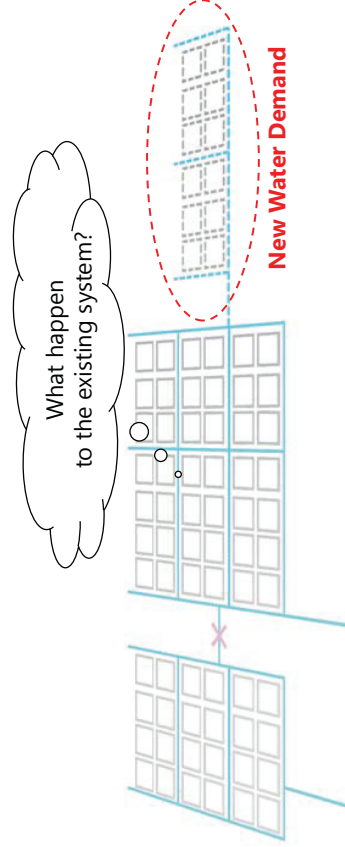
- A Network consist of pipes, nodes (pipe junctions), pumps, valves and storage tanks.
- The beauty of using EPANET software is that it tracks flow of water in each pipe, pressure at nodes, height of water in storage tanks and concentration of chemical species throughout the pipe network.



Example use of hydraulic analysis

(2) Consideration of the impact of new water demand

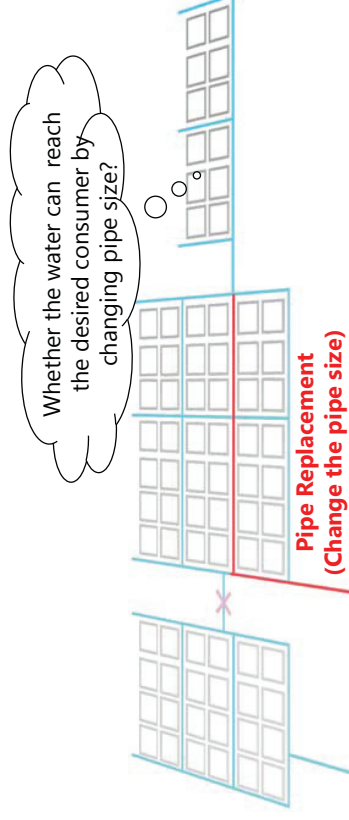
If the new water demand is added to the existing system, we can simulate the impact on it by carrying out the hydraulic analysis.



Example use of hydraulic analysis

(3) Consideration of the changing of pipe size

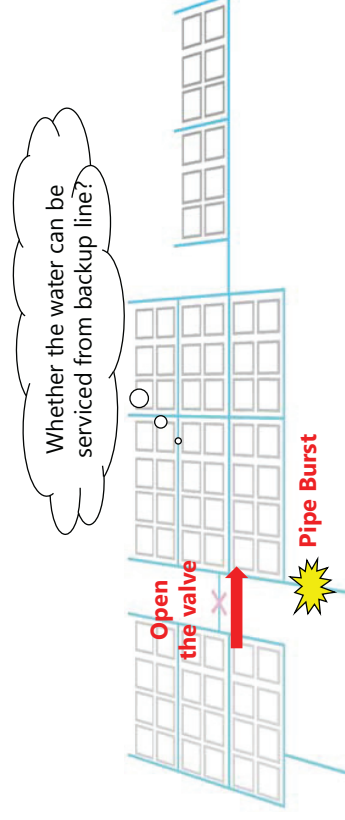
If the size of the pipe is changed, we can simulate whether or not the needed water volume can be distributed by carrying out the hydraulic analysis.



Example use of hydraulic analysis

(4) Consideration of water operation of emergency

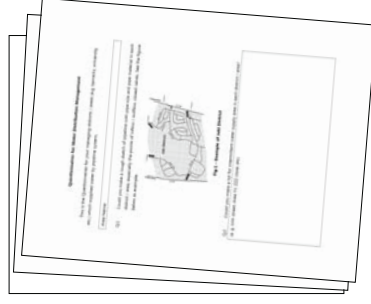
In the event of an emergency, such as a pipe burst, we can simulate whether or not water is distributed from the backup line by carrying out the hydraulic analysis.



Questionnaire to each area office

In order to collect basic data of water distribution management, GIS and hydraulic analysis, now, JICA team is visiting area offices and requesting to administer the questionnaire.

- Sketch of pipeline network
- Intermittent water supply area
- High/Low water pressure area
- Water Consumption of each area



8

Sketch of pipeline network

Make a sketch of the pipeline network information in your domain using the satellite image provided. (pipeline, valve, fire hydrant etc. and pipe location, pipe size, pipe material, etc.)



9

Intermittent water supply and water pressure

- Identify the intermittent water supply areas in your domain (location and frequency)
 - Identify high and low water pressure areas in your domain.
- Information of water pressure is used for calibration of hydraulic analysis, in comparison with the results of the simulation.

10

Water Consumption Volume

Provide water demand data (customer number, current billed amount, water consumption volume) of the past one month for each tariff structure and for each meter reading area as simplified in the table below:

	No. of Customers	Water Rates	Total Current Billed Amount (2015.12)	Total Water Consumption (m ³ /mo.)
Domestic				
Flat rate		N\$ 500/mo.		
Mechanical Meter		N\$0/m ³		
Estimate		N\$0/m ³		
AMR Meter				
Commercial				
Flat rate		N\$5,000/mo.		
Mechanical Meter		N\$150/m ³		
Estimate		N\$150/m ³		
AMR Meter				

*Except for prepaid meter. We ask to Meter Unit (Prepaid) for prepaid meter customers.
*Except for major consumers. We also ask to Commerce Department for major consumers.

11

Diagnosis of Distribution Network

- By calculating the hydraulic analysis, facilities (water distribution system) can be diagnosed.
- It is also possible to simulate the countermeasures to improve the facilities.
- Based on the results of simulation, facility improvement may be achieved.



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The Federal Capital Territory Reduction of Non-Revenue Water Project

Meter Reading and Billing in FCTWB

17 February 2016

Mrs. Rose Akpan
HOU Billing, Commerce, FCTWB

Content

1. Customer Category
2. Customer Meter
3. FCTWB's Divisions for Meter Reading
4. Billing Measures
5. Billing Systems
6. FCTWB's Divisions for Billing
7. Water Tariff
8. Other Facts

2

1. Customer Category

- **Domestic**
- **Commercial**
- **Commercial (un-coded)**
- **Major Consumers** (Co-operate Body, Mini Hotel/ Restaurant, Major Consumer, Petrol Station/Plaza, Private School/Clinic)
- **Institutions** (Embassy, High Commission, Ministry/ Parastatals, Liaison Office, Religion)
- Public Tap/Convenience & Kiosk
- Lifting Point (Bulk Selling)

In Japan, only a few categories such as "Domestic and Business/Industrial users", "Small and Large in customer meter diameter".

3

1. Customer Category (continued)

Customer Category	No. of Bill (Nos.)	Percentage (%)
Domestic	46,900	96.7
Commercial(un-coded)	(30,700+11,100+5,100)	
Major Consumers	1,600	3.3
Institutions	(1,000+600+0)	
Total	48,500	100.0

Customer Category	Billed Charge (Mil. N)	Percentage (%)
Domestic	356.6	76.4
Commercial(un-coded)	(293.1+56.1+7.4)	
Major Consumers	110.2	23.6
Institutions	(104.0+6.2+0)	
Total	466.8	100.0

2. Customer Meter (continued)

Meter Type	No. of Bill (Nos.)	Percentage (%)
Conventional	24,600	50.7
AMR	11,700	24.1
Prepaid	5,100	10.5
Flat-rate	7,100	14.6
Total	48,500	100.0

Meter Type	Billed Charge (Mil. N)	Percentage (%)
Conventional	313.2	67.1
AMR	62.3	13.3
Prepaid	7.4	1.6
Flat-rate	83.9	18.0
Total	466.8	100.0

2. Customer Meter

- Conventional (Mechanical)
- Automatic Meter Reading (AMR)
- Prepaid
- Flat-rate (non-metered)

In Japan, conventional type is mostly popular.

3. FCTWB's Divisions for Meter Reading

- Domestic: Area Offices, AMR Unit, Prepaid Unit (Distribution)
- Commercial(un-coded): Area Offices, AMR Unit
- Major Consumers: 5 Units, AMR Unit
- Institutions: 3 Units, AMR Unit
- Public Tap & Kiosk: 1 Unit
- Lifting Point (Bulk Selling): Area Offices

In case of a large scale of water supply agency in Japan, branch offices with outsourcing are in charge of all meter reading regardless of customer category.

4. Billing Measures

- Conventional: Reading or **Estimate** (automated if inaccessible)
- AMR: Reading or **Estimate** (automated if unobtainable)
- Prepaid: Prepaid or **ad hoc Flat-rate** or temporarily-installed conventional meter reading (if malfunctioning)
- Flat-rate: Fixed Charge

In Japan, billing measure is nothing but reading in principle.

5. Billing Systems

- Conventional: Puma I
- AMR: Puma III
- Prepaid: Stand-alone system (unlinked to Commerce)
- Flat-rate: Puma I

In Japan, several billing systems do not exist in a water supply agency.

4. Billing Measures (continued)

Meter Type	No. of Bill (Nos.)	Percentage (%)
Conventional_Reading	11,100	35.0
Conventional_Estimate	13,500	42.6
Conventional_Flat-rate	7,100	22.4
Sub-Total	31,700	100.0
AMR_Reading	5,900	50.4
AMR_Estimate	5,800	49.6
Sub-Total	11,700	100.0
Prepaid	N/A	N/A
Prepaid_Flat-rate	N/A	N/A
Sub-Total	5,100	100.0
Total	48,500	-

5. Billing Systems (continued)

Puma I

- FCTWB has simply entered reading data and printed out bills.
- Puma I has been **outdated**.
- Puma I does **not** have function or automated programme to **extract, tally or sort data** as for regular monitoring or analysis of billing cycle.
- But, FCTWB can obtain tallied/sorted data only if FCTWB pays extra to private programmer.
- Puma I has created **estimate bills automatically**.
- Puma I should be **upgraded** for FCTWB to monitor and analyze data by FCTWB itself in terms of sustainability.

5. Billing Systems (continued)

Modification of Billing System (Puma II)

- Update to advanced and user-friendly system
- Flagging to identify questionable or abnormal value
- Addition of new entering items such as distribution zone
- Tallying and sorting function by any entering items without relying on programmer
- Prevention of automated estimate billing even if zero consumption
- Both automated or manual billing and choice function for each customer to deactivate bills easily

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7. Water Tariff

Domestic

- Conventional_Reading&Estimate: N80/m³
- Conventional_Flat-rate: N5,500/month
- AMR_Reading_Reading&Estimate: N80/m³
- AMR_Reading_Flat-rate: N4,000/month
- Prepaid: N80/m³
- Prepaid: N3,000/month (if malfunctioning)

Commercial (un-coded)

- Conventional_Reading&Estimate: N150/m³
- Conventional_Flat-rate: N45,000/month
- AMR_Reading&Estimate: N150/m³
- AMR_Flat-rate: N30,000/month

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6. FCTWB's Divisions for Billing

- Conventional: Billing Unit
- AMR: AMR Unit
- Prepaid: Prepaid Unit (Distribution)

In Japan, several billing units do not exist in a water supply agency.

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7. Water Tariff (continued)

- Prepaid: N150/m³
 - Prepaid: N3,000/month (if malfunctioning)
- ### Major Consumers
- Conventional_Reading&Estimate: N150/m³
 - Conventional_Flat-rate: N45,000/month or more
 - AMR_Reading&Estimate: N150/m³
 - AMR_Flat-rate: N30,000/month

Institutions

- Conventional_Reading&Estimate: N80orN100/m³
- Conventional_Flat-rate: N45,000/month or more
- AMR_Reading&Estimate: N150/m³
- AMR_Flat-rate: N30,000/month

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7. Water Tariff (continued)

Public Tap/Convenience & Kiosk

- Conventional_Flat-rate: N15,000-30,000/month

Lifting Point (Bulk Selling)

- Subject to size of Water Truck

In Japan, common tariff is basic charge plus progressive (step-up) rate block system according to water consumption, which varies per-m³ price by customer category. At least, water tariff of Japan is much simpler than one of FCTWB.

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8. Other Facts (continued)

Cases generating NRW in Commerce

- **Excess** or **more-than-assumed** water consumption in all Flat-rate billings
- **Ungaugeable** water at **less-accurate** meters, e.g. stagnant faulty meters
- **Data handling errors** such as incorrect reading and entering
- **Illegal** water use (direct or bypass connection)
- Water use by customers **escaping from billing** regardless of any reasons or background, e.g. fire hydrant, staff

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THE FEDERAL CAPITAL TERRITORY REDUCTION OF NON-REVENUE WATER PROJECT

NRW and Procedure

17 February 2016

Douglas E. Oloton
Head of Metering General, FCTWB

8. Other Facts

Return Bills

- Approximately **4,800** nos. of return bills (**10%** of total bills) exist widely across service areas, and amount to **75 million Naira** (**16%** of total billed charge).
- Existence of return bills in billing system causes **wastefulness** and **unreliable financial analysis**.
- Causes of return bills are: disconnected, demolished, non-existing, vacant/abandoned, own water source (borehole), duplication generated from meter conversion, etc.
- **Lack of proper addressing** on the bills

17

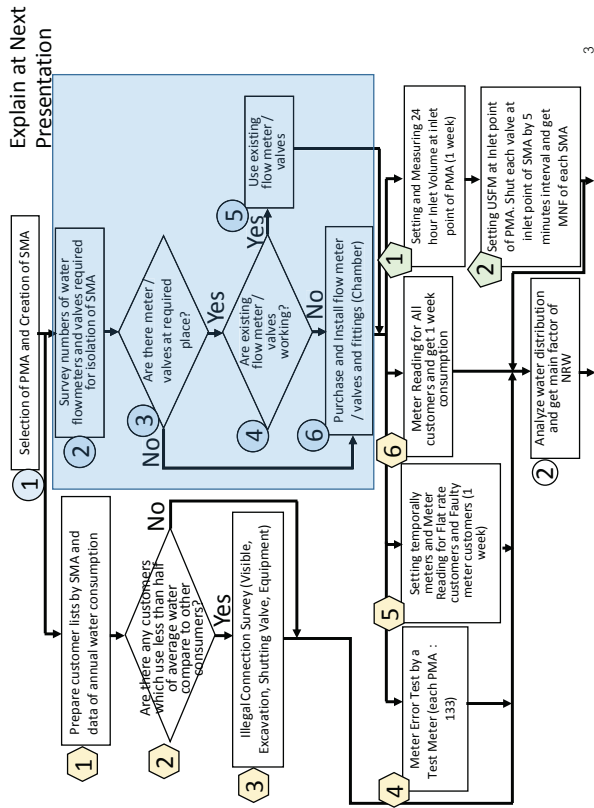
Procedure of NRW Reduction

- **Baseline Survey** (Before NRW Reduction Operations)
 - Workflow of Baseline Survey
 - Measure Commercial Loss
 - Measure Minimum Night Flow (MNF)
 - IWA Water Balance Analysis
 - Features of SMA
- **NRW Reduction Plan**
 - Workflow of NRW Reduction Operations by SMA
 - NRW Reduction Operations on Commercial Loss
 - NRW Reduction Operations on Leakage
 - Overview of SMA
 - IWA Water Balance Analysis
 - Noticeable Points on NRW Reduction Operations
 - Schedule of Activities
 - Cost estimated for NRW Reduction Activities

① Selection of PMA and Creation of SMA

- At the first, it has to be done the selection of areas which can be isolated from 2 to 4 in the PMA. A SMA has to have one inlet point and zero or one outlet point.
- When there are multiple inlet points in the SMA, inlet water volume has to be considered for selection of the only one inlet point and other inlet points have to be closed by installed valves.

Workflow of Baseline Survey



Measure Commercial Loss

- 1 Prepare customer lists by SMA and data of annual water consumption
- 2 Are there any customers which use less than half of average water compare to other consumers
- 3 Illegal Connection Survey (Visible, Excavation, Shutting Valve, Equipment)
- 4 Meter Error Test by a Test Meter (each PMA : 133)
- 5 Setting temporally meters and Meter Reading for Flat rate customers and Faulty meter customers (1 week)
- 6 Meter Reading for All customers and get 1 week consumption

Measure Minimum Night Flow (MNF)

- 1 Setting and Measuring 24 hour Inlet Volume at inlet point of PMA (1 week)
- 2 Setting USFM at Inlet point of PMA. Shut each valve at inlet point of SMA by 5 minutes interval and get MNF of each SMA

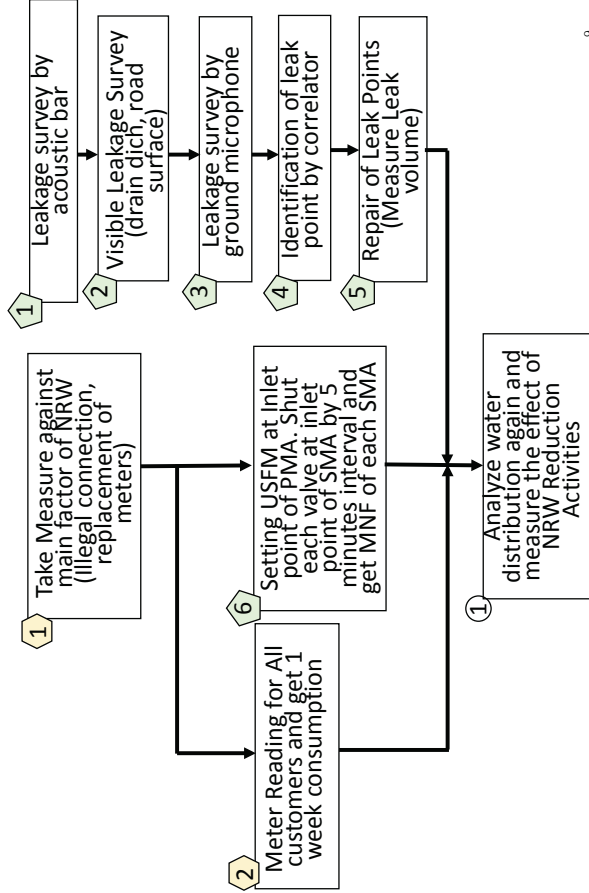
IWA Water Balance sheet

System Input Volume	Authorized Consumption	Billed Authorized consumption	Billed Metered Use	Revenue Water
		Billed Un-Metered Use	Billed Un-Metered Use	
		Water Losses	Unbilled Authorized consumption	Unbilled Metered Use
	Apparent Losses		Unbilled Un-Metered Use	
			Unauthorized Use	
	Metering Inaccuracies			
	Leaks on Transmission and/or Distribution Pipelines			
Real Losses	Leakage Service Connection up to Customer Meter			
		Storage tank Leaks & Overflows		
				7

Features of SMA

- Percentage of Commercial Use
- Percentage of Domestic Use
- Percentage of Measure Consumer
- Percentage of Illegal Connection
- Percentage of Borehole User
- Percentage of Flat Rate
- Percentage of Conventional Meter
- Percentage of Other Meter

NRW Reduction Plan



NRW Reduction Operations on Commercial Loss

- 1 Take Measure against main factor of NRW (Illegal connection, replacement of meters)
- 2 Meter Reading for All customers and get 1 week consumption

NRW Reduction Operations on Leakage

- 1 Leakage survey by acoustic bar
- 2 Visible Leakage Survey (drain ditch, road surface)
- 3 Leakage survey by ground microphone
- 4 Identification of leak point by correlator
- 5 Repair of Leak Points (Measure Leak volume)
- 6 Setting USFM at Inlet point of PMA. Shut each valve at inlet point of SMA by 5 minutes interval and get MNF of each SMA

Overview of SMA

Items	Before Operation	After Operation
Number of House Hold	house	house
Number of Contract house hold	house	house
Number of Non-contract house hold	house	house
Number of Flat Rate customer	house	house
Number of Illegal Connection	house	house
Pipeline Length	km	Km
Minimum Night flow (amount)	m3/h	m3/h
Minimum Night flow (time)	h:m	h:m

IWA Water Balance Analysis

- Analyze water distribution again and measure the effect of NRW Reduction Activities
- Input each Value which measured after NRW Reduction Operation into each Column of Water Balance Sheet
- Compare the Deference of Sheets before and after of NRW Reduction Operation

Water Balance Analysis Table

Items			Before Operation	After Operation
Revenue Water	Billed Authorized Consumption (m3/d)	Billed Metered Consumption		
		Billed Unmetered Consumption		
Non-Revenue Water	Unbilled Authorized Consumption (m3/d)	Unbilled Metered Consumption		
		Unbilled Unmetered Consumption		
	Commercial Loss (m3/d)	Unauthorized Consumption		
		Customer Metering Inaccuracies		
	Real Losses (m3/d)	Leakage		
System Input Volume (SIV)				
Non-Revenue Water Rate (NRW) (%)				14

Noticeable Points on NRW Reduction Operations (cont.)

- It is necessary to make an illegal connection survey team, because there might be many illegal connections.
- The most of leak are pipe joint leakages because of defective workmanship. Therefore, it is necessary to improve the quality of contractors.

Noticeable Points on NRW Reduction Operations

- There is possibility of dosing water to private tank in night and Illegal water usage by potable water factory in SMA 1, because there is little difference between Minimum Night Flow Rate and daytime water consumption.
- It is difficult to narrow down target consumers for illegal connection survey in Prince and Princess Estate, because it is insufficient the information of prepaid meter customers.

Continue to Next Page

Schedule of Activities

PMA		Overall Activates Schedule											
		SMA	Activities	12	1	2	3	4	5	6	7	8	9
Gudu	SMA 1	Making Customer List											
		Meter Reading											
		Leakage Survey											
		NRW Reduction Operation											
	SMA 2	Meter Reading											
		Leakage Survey											
		NRW Reduction Operation											
		Meter Reading											

Cost estimated for NRW Reduction Activities

- Total Manpower Input (Man X Days)
- Estimated Cost of NRW Reduction Activities (Personnel, Transportation & Materials)

FCTA/FCTWB-JICA

THE FEDERAL CAPITAL TERRITORY REDUCTION OF NON-REVENUE WATER PROJECT

Concept and Creation of PMA/SMA

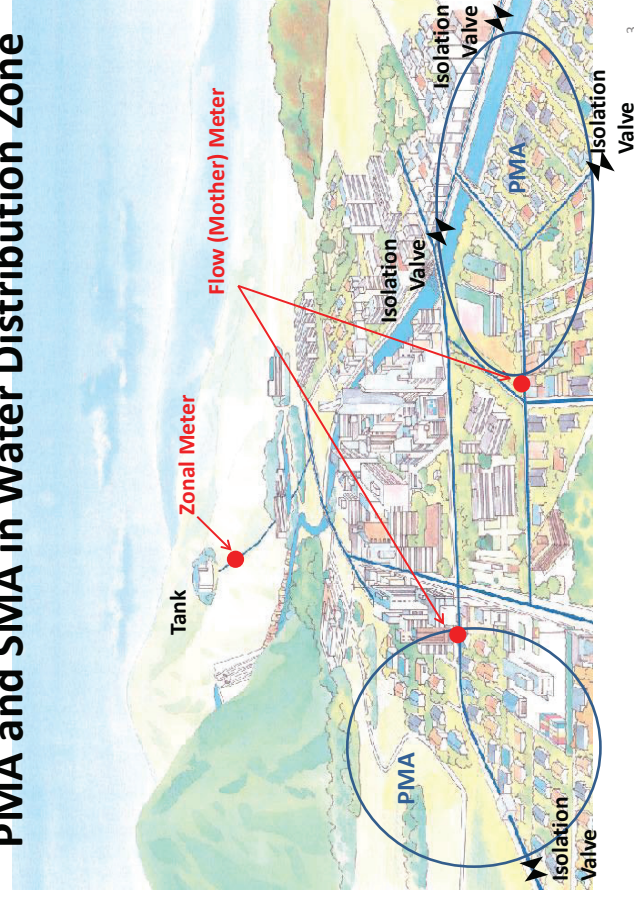
17 February 2016

Engr. Musa Dikko
HOU Pipeline, Distribution, FCTWB

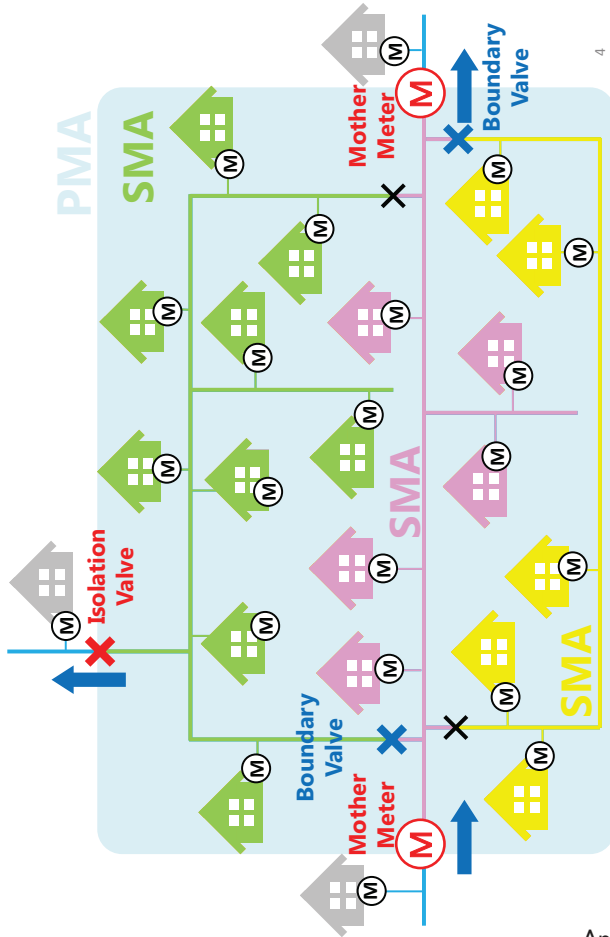
Definition of PMA/SMA

- **PMA** is defined as **Pilot Metering Areas (PMA)**, a pilot case of **District Metered Area (DMA)**, internationally-used term, which is discrete area of water distribution network and.
- **SMA** is defined as **Sub-Metering Area (SMA)**, which is a segment of PMA.
- PMAs and SMAs were created to implement Pilot Project in the Project.
- A PMA was selected in each pilot Area Office namely Garki I, Gudu and Jabi.

PMA and SMA in Water Distribution Zone

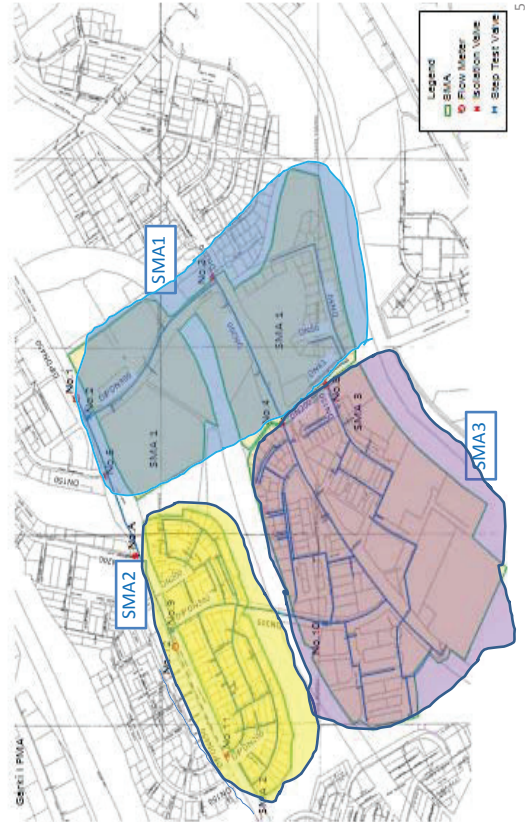


Concept of PMA/SMA Creation



4

Example of PMA/SMA in Garki I



5

PMAs in Three Pilot Area Offices

Area Office	Number of PMA	PMAs
Garki I	3	1. Area 1& 2-1 2. Area 2-2& 3 & 7 3. Area 8 & 10 & 11
Gudu	4	1. Hot FM 2. Adis Estate & Legislator 3. Prince & Princess 4. Games Village
Jabi	1	1. Jabi

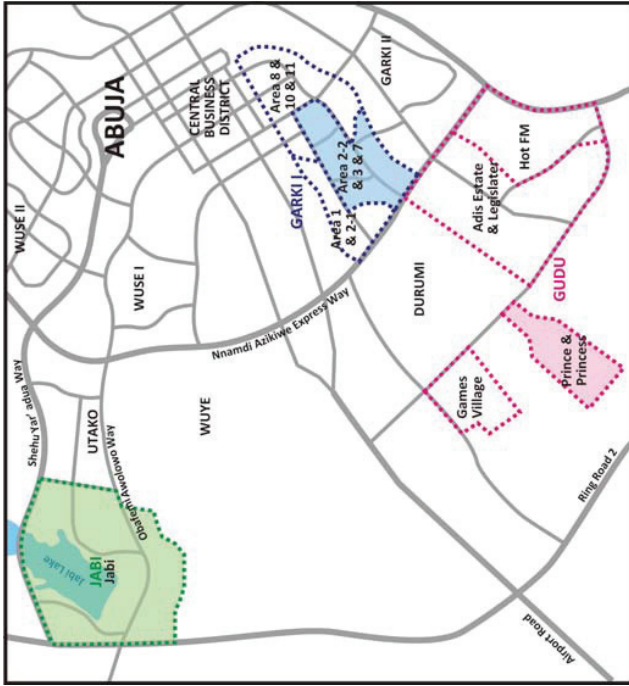
6

Criteria of PMA Selection

Criteria to select PMAs	Reasons that Criterion were selected	Weighting Factor (%)
1. Security Condition	Secure safe condition	35
2. Leakage Condition	Impact of NRW reduction operation	30
3. Condition of Network Drawing and Data	Work efficiency and an accuracy of measurement	15
4. Number of Customers	Impact of NRW reduction operation	10
5. Easily Measurement of Flow Rate	PMA where cascading water flowmeters is less	5
6. Type of Water Meter (Mechanical for Jabi, AMR for Garki I and Pre-paid for Gudu)	Learn characteristics of PMA by types of water meters	5
Total		100

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Selected PMAs



SMA Isolation

In principle:

- Each other's number of households is nearly equal.
- Each other's pipe distance is nearly equal.

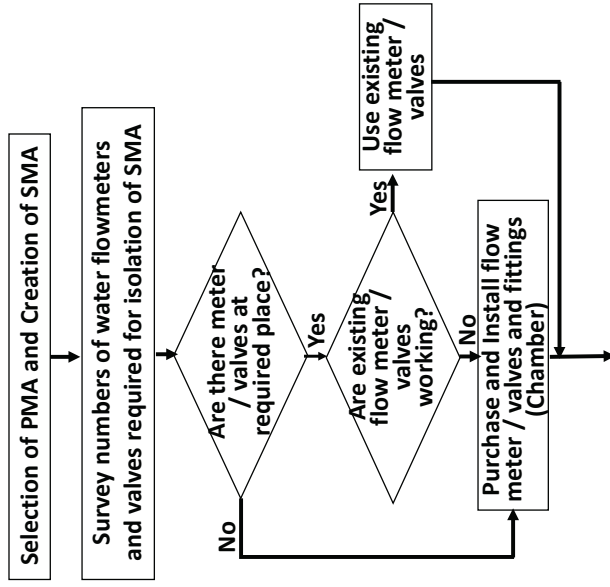
However:

- The above concepts are NOT practical, unless the valves are located in appropriate places or water supply is operated properly.

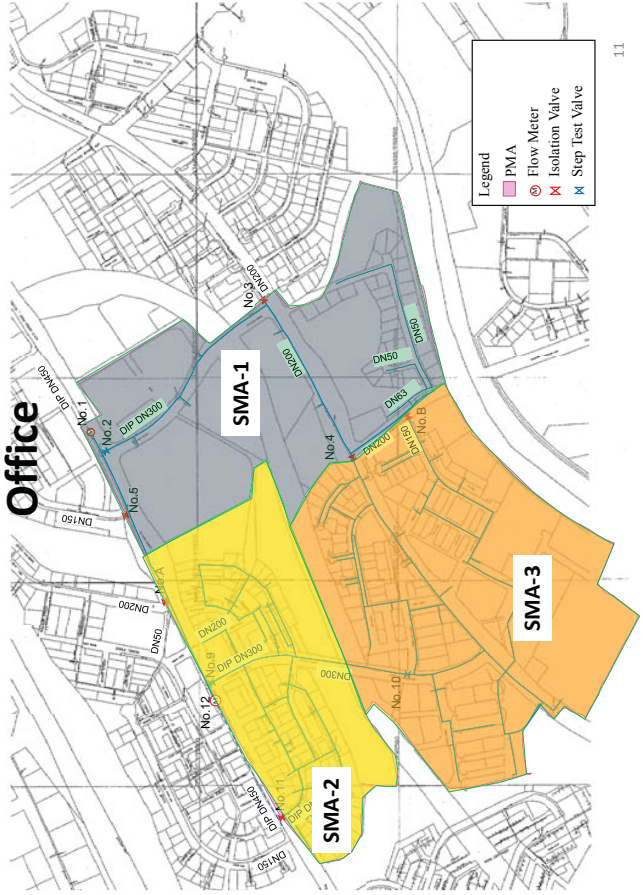
Prioritized as follows:

1. Location of the existing Valves
2. Functionality of the existing Valves
3. Current status of water supply operation
4. Ease of valve installation (covering depth of the existing pipelines, etc.)
5. Number of Households

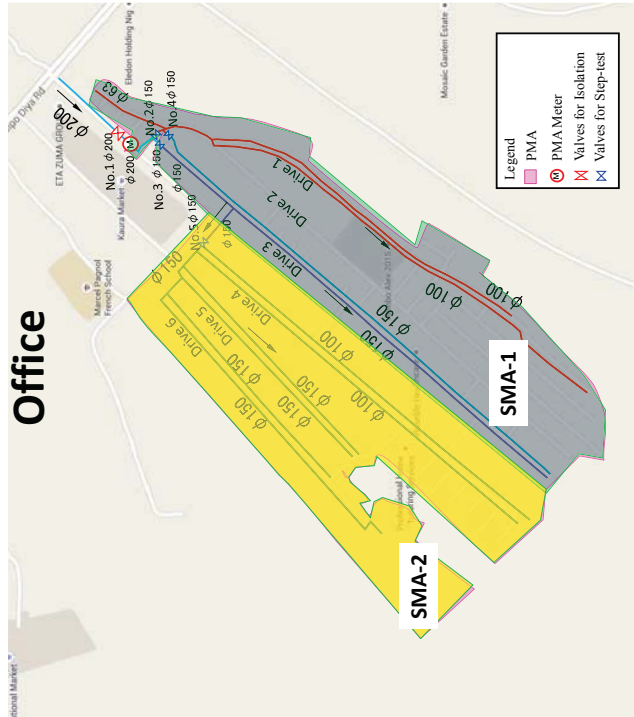
Workflow of PMA/SMA Creation



Selected PMA in Service Area of Garki-I Area Office

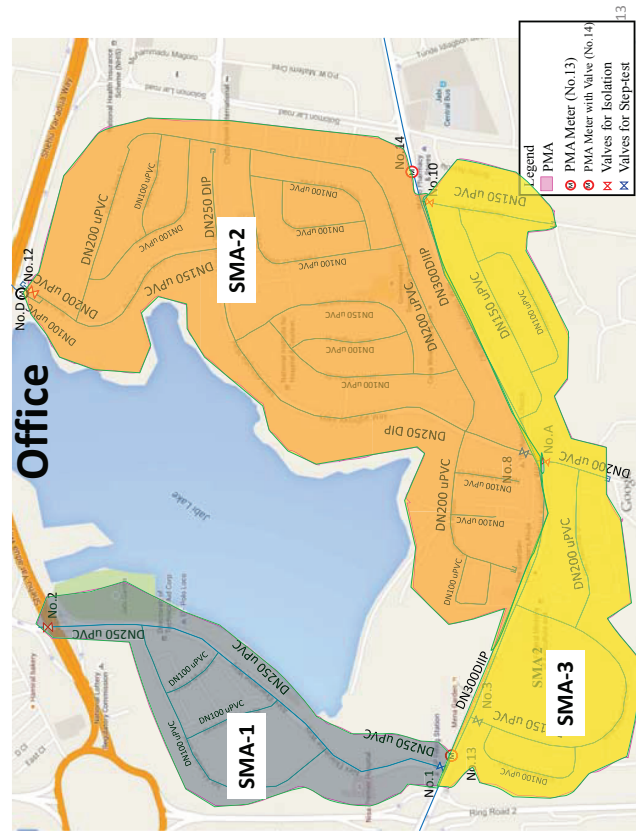


Selected PMA in Service Area of Gudu Area



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Selected PMA in Service Area of Jabi Area



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Overview of PMA

Area Office	SMA	Number of Households*	Pipe Distance** (km)	Isolation Valves (No.)	Step Test Valve (No.)	Flow-meter (No.)
Garki-I	3	640	N.A.	6	3	2
Gudu	2	1,035	N.A.	0	4	1
Jabi	3	651	N.A.	4	3	3

Note:

* Provisional Data

** Developing database

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Problems of PMA/SMA Creation

- No comprehensive drawings
- No space to install Flow/Mother Meter (Jabi)
- Pipe size is different from given information (Jabi, Garki-I)
- Depth of pipeline is very deep (Jabi)
- Water is supplied from PMA Gaki-I to Area 8 of Garki
- Isolation is difficult because of water supply to other areas (Jabi)
- Some important information appeared after creation of PMA (Garki-I, Jabi)

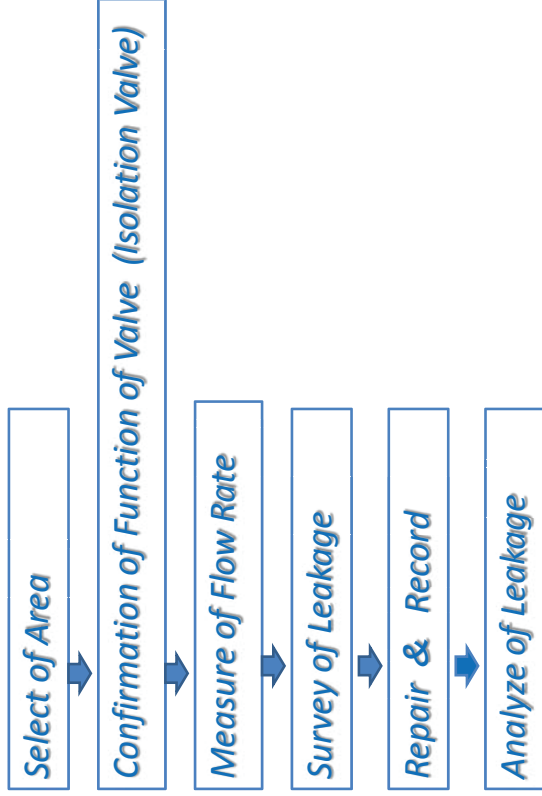
Reduction of Non-Revenue Water Project

Survey of Leakage (Real Loss)

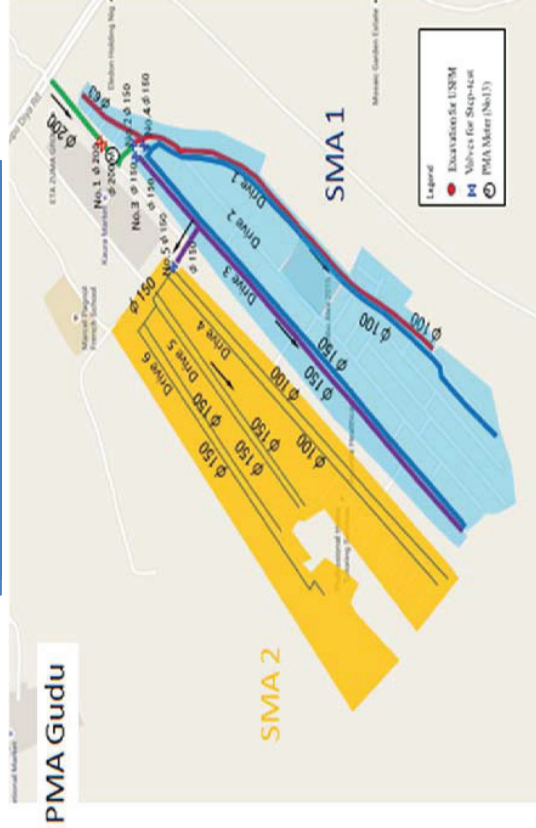


Gudu Area office

Flow of Leakage Survey



Select of Area



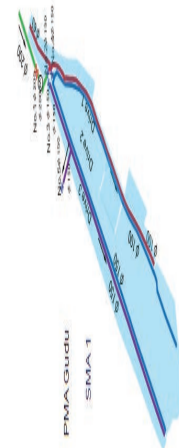
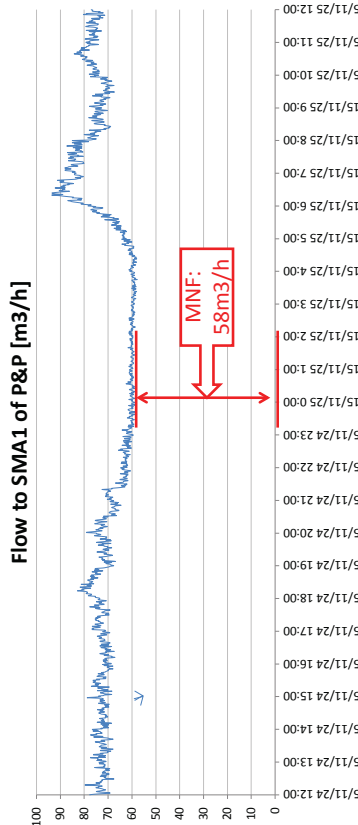
Confirm of Function of Valve

Confirm of Existing Valve

Exchange to New Valve

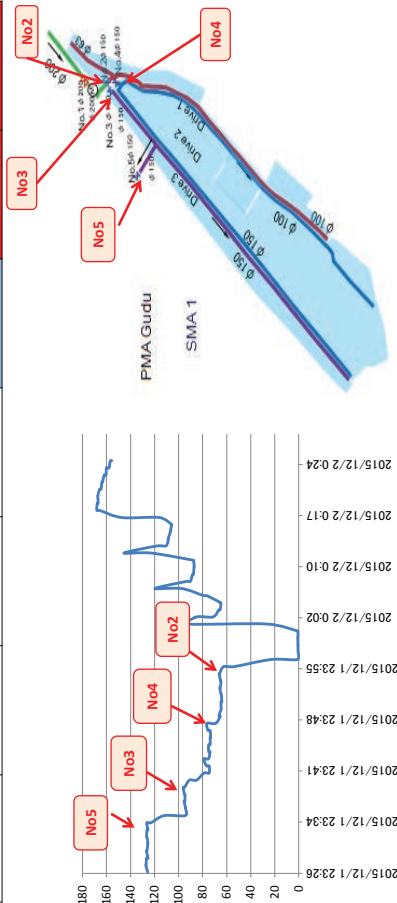


Measure of Flow Rate (SMA1)



Measure of Flow Rate (Step Test SMA1)

Minimum Night Flow Survey (Gudu) 01/12/2015					
Close of Valve	Flow Rate at Before Valve Operation	Current Flow Rate	Flow Rate Difference	Area	Line
—	126.3m3/H	126.3m3/H	— m3/H	SMA1	ALL
No5	126.3m3/H	94.9m3/H	31.4m3/H	SMA2	Drive 1,2,3
No3	94.9m3/H	75.1m3/H	19.8m3/H	SMA1	Drive 4,5,6
No4	75.1m3/H	65.1m3/H	10.0m3/H	SMA1	Drive 3
No2	65.1m3/H	0.7m3/H	64.4m3/H	SMA1	Drive 3 + Drive 2
				SMA1	Drive 1 + Drive 2

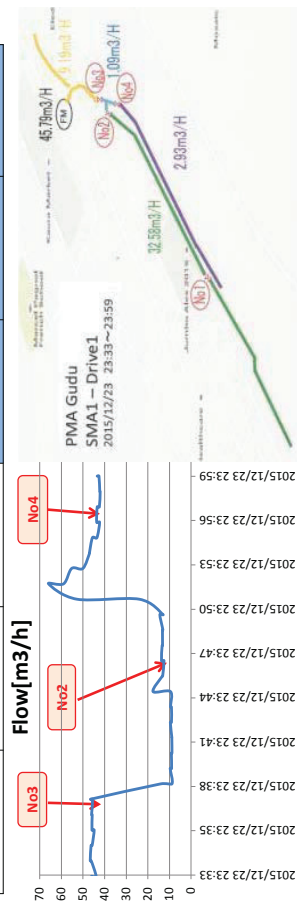


Result of Step Test (SMA1)

Minimum Night Flow Survey (Gudu) 01/12/2015					
Close of Valve	Flow Rate at Before Valve Operation	Current Flow Rate	Flow Rate Difference	Area	Line
—	126.3m3/H	126.3m3/H	— m3/H	ALL	
No5	126.3m3/H	94.9m3/H	31.4m3/H	SMA1	Drive 1,2,3
No3	94.9m3/H	75.1m3/H	19.8m3/H	SMA2	Drive 4,5,6
No4	75.1m3/H	65.1m3/H	10.0m3/H	SMA1	Drive 3
No2	65.1m3/H	0.7m3/H	64.4m3/H	SMA1	Drive 3 + Drive 2
				SMA1	Drive 1 + Drive 2

Measure of Flow Rate (Step Test SMA1 Drive1)

Step Test Flow Survey (P&P Drive1) 23/12/2015					16/12/2015
Close of Valve	Flow Rate at Before Valve Operation	Current Flow Rate	Line	Flow Rate of Line (Night Time)	Flow Rate of Line (Day Time)
—		45.79m ³ /H	ALL	45.79m ³ /H	58.55m ³ /H
No3	45.79m ³ /H	9.19m ³ /H	Yellow	9.19m ³ /H	8.38m ³ /H
No2		13.21m ³ /H	Green	32.58m ³ /H	39.37m ³ /H
No4		42.86m ³ /H	Purple	2.93m ³ /H	3.34m ³ /H
			Blue	1.09m ³ /H	7.46m ³ /H



Result of Step Test (SMA1 Drive1)

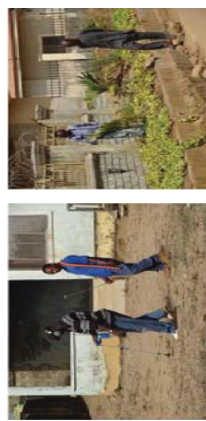
Step Test Flow Survey (P&P Drive1) 23/12/2015					16/12/2015
Close of Valve	Flow Rate at Before Valve Operation	Current Flow Rate	Line	Flow Rate of Line (Night Time)	Flow Rate of Line (Day Time)
—		45.79m ³ /H	ALL	45.79m ³ /H	58.55m ³ /H
No3	45.79m ³ /H	9.19m ³ /H	Yellow	9.19m ³ /H	8.38m ³ /H
No2		13.21m ³ /H	Green	32.58m ³ /H	39.37m ³ /H
No4		42.86m ³ /H	Purple	2.93m ³ /H	3.34m ³ /H
			Blue	1.09m ³ /H	7.46m ³ /H

Survey of Leakage

Acoustic Survey at House



Acoustic Survey on the Ground



We Detected the Leakage at 24 points

Repair & Record

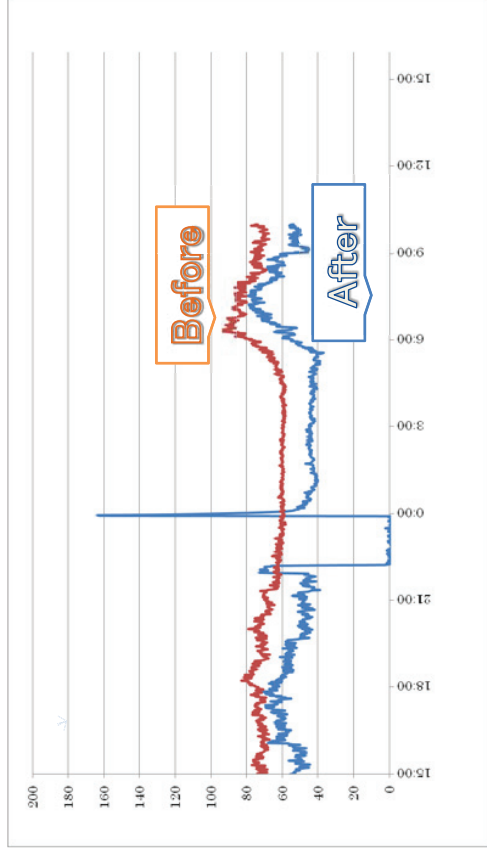


Leakage Record Sheet		Leak Point	
Line No.	Leak Point No.	Leak Point	Leak Point
1. C/P	2. C/P	3. C/P	4. C/P
5. C/P	6. C/P	7. C/P	8. C/P
9. C/P	10. C/P	11. C/P	12. C/P
13. C/P	14. C/P	15. C/P	16. C/P
17. C/P	18. C/P	19. C/P	20. C/P
21. C/P	22. C/P	23. C/P	24. C/P
25. C/P	26. C/P	27. C/P	28. C/P
29. C/P	30. C/P	31. C/P	32. C/P
33. C/P	34. C/P	35. C/P	36. C/P
37. C/P	38. C/P	39. C/P	40. C/P
41. C/P	42. C/P	43. C/P	44. C/P
45. C/P	46. C/P	47. C/P	48. C/P
49. C/P	50. C/P	51. C/P	52. C/P
53. C/P	54. C/P	55. C/P	56. C/P
57. C/P	58. C/P	59. C/P	60. C/P
61. C/P	62. C/P	63. C/P	64. C/P
65. C/P	66. C/P	67. C/P	68. C/P
69. C/P	70. C/P	71. C/P	72. C/P
73. C/P	74. C/P	75. C/P	76. C/P
77. C/P	78. C/P	79. C/P	80. C/P
81. C/P	82. C/P	83. C/P	84. C/P
85. C/P	86. C/P	87. C/P	88. C/P
89. C/P	90. C/P	91. C/P	92. C/P
93. C/P	94. C/P	95. C/P	96. C/P
97. C/P	98. C/P	99. C/P	100. C/P



Measure of Flow Rate (SMA1 after repair)

Reduce of About 20m³/h



Reduce of Minimum Night Flow

Reduce of Loss money

20m³/h x 80N=1,600N/h

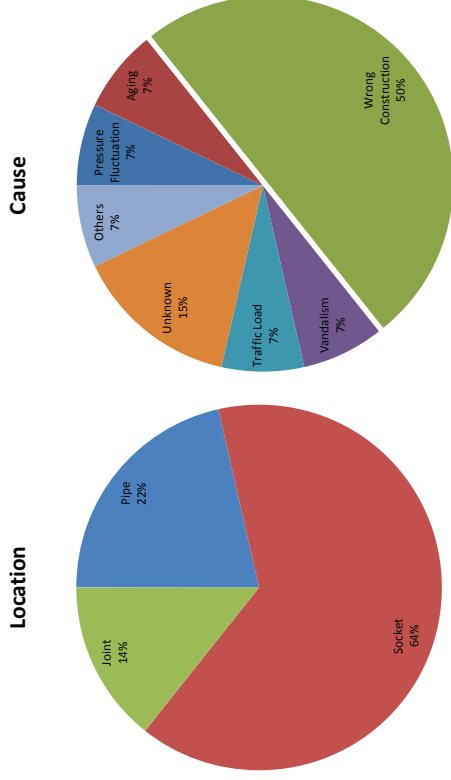
1,600N X 24h=38,400N/D

38,400N x 30Days=1,152,000N/M

38,400N x 365Days=14,016,000N/Y

Analyze of Leakage

Main Pipe



Issues

- Meter Installation into the Premises
- Main pipe and Serves pipe Buried into the Premises
- Undevelopment of Drawings
- Water Leakage Caused by Construction Defects

Thank you
for your
attention!

THE FEDERAL CAPITAL TERRITORY REDUCTION OF
NON-REVENUE WATER PROJECT

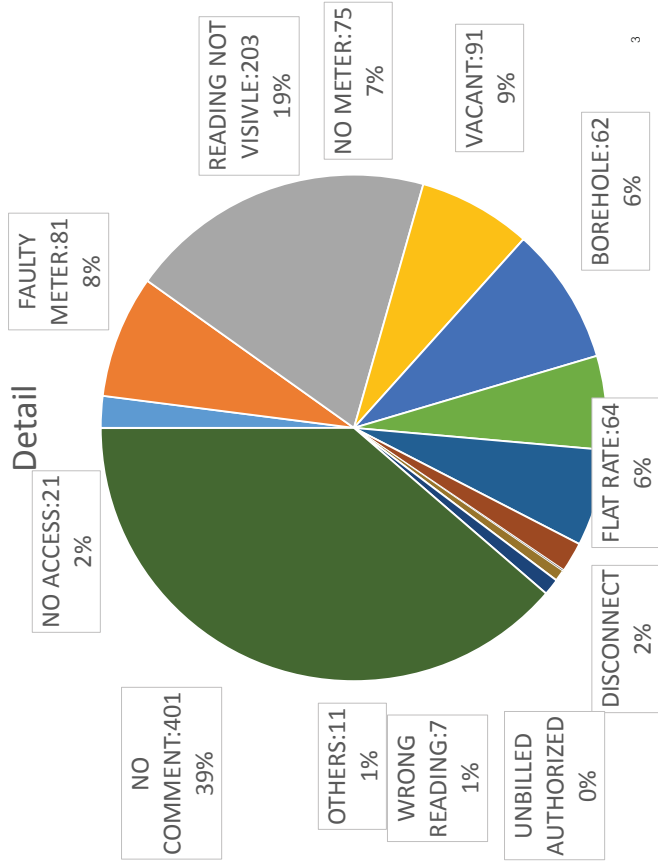
Result of Meter Reading (Gudu)

17 February 2016

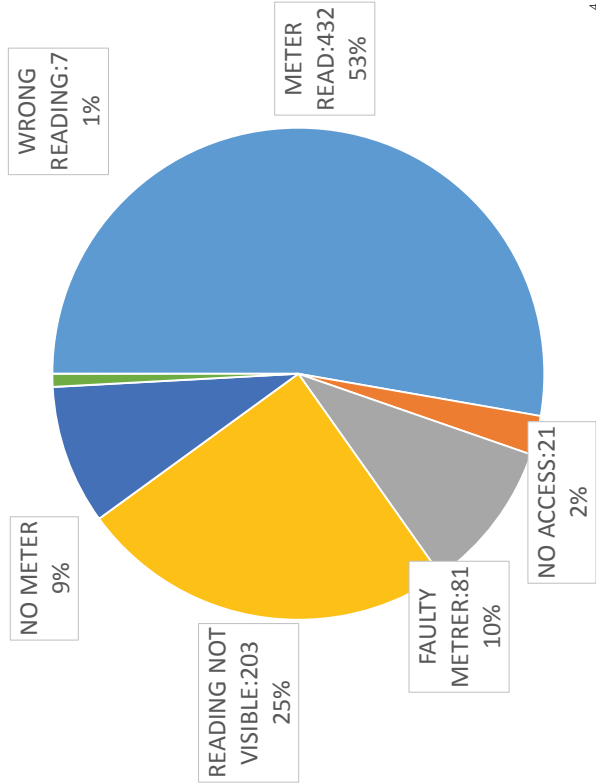
Ogbu O. Williams
Assistant Area Manager (Commerce), Gudu, FCTAWB

Detail of Meter Reading Result

S/No	ITEM	DRIVES						TOTAL
		1	2	3	4	5	6	
1	NO ACCESS	5	8	6	1	1	0	21
2	FAULTY METER	20	9	17	27	6	2	81
3	READING NOT VISIBLE	20	47	45	41	31	19	203
4	NO METER	11	28	15	9	7	5	75
5	VACANT	24	23	17	18	3	6	91
6	BOREHOLE	10	15	6	11	10	10	62
7	FLAT RATE	8	9	3	21	12	11	64
8	DISCONNECTED	2	7	3	5	2	1	20
9	UNBILLED AUTHORIZED	0	1	0	0	0	0	1
10	ILLEGAL (CONNECTION, REVERSE)	Under Investigation						
11	WRONG READING	1	2	1	0	3	0	7
12	OTHERS	1	3	0	6	0	1	11
13	NO COMMENT	65	93	102	45	64	32	401
TOTAL		167	245	215	183	138	87	1035



Meter Read Rate



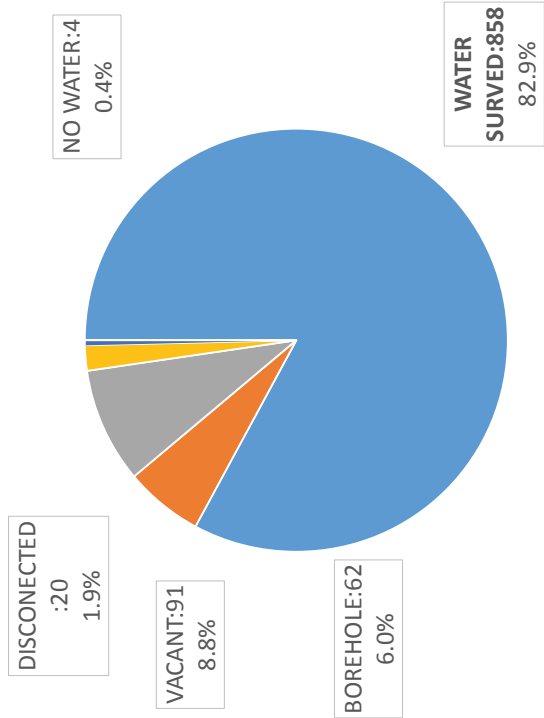
4

Water Supply Condition

ITEM	DRIVES						TOTAL	Percentage
	1	2	3	4	5	6		
1 WATER SURVED	131	200	189	148	120	70	858	82.9
2 BOREHOLE	10	15	6	11	10	10	62	6.0
3 VACANT, Under const.	24	23	17	18	3	6	91	8.8
4 DISCONNECTED, by pass	2	7	3	5	2	1	20	1.9
5 NO WATER	0	0	0	1	3	0	4	0.4
Total	167	245	215	183	138	87	1035	100.0

5

Water Supply Condition



6

Customer Survey

- NUMBER OF PERSON INCLUDING EMPLOYEE
- STORAGE TANKS (Capacity, Filling Time, Manual/Automatic)

Under Analysis

7

Problem of Meter Reading

- Some houses are needed to visit several times for meter reading. Even visit several time, 21 No Access houses have still remained.
- There are many faulty meters : 81
- There are many non-readable meters : 203
- There are many no meter : 75
- There are some wrong reading : 7

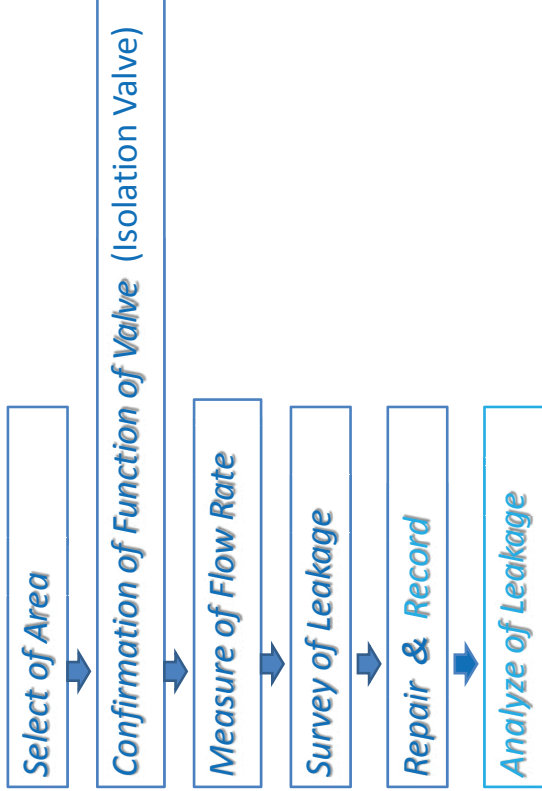
Reduction of Non-Revenue Water Project

Survey of Leakage (Real Loss)

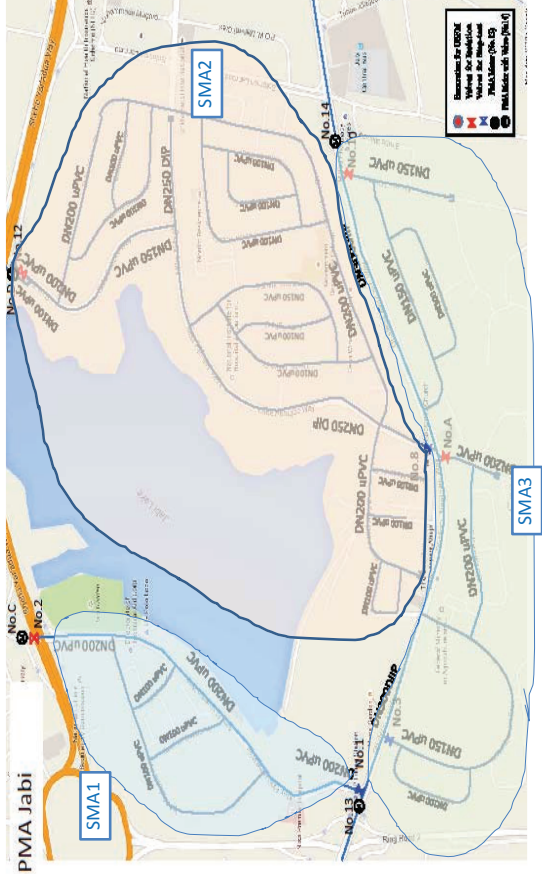


Jabi Area office

Flow of Leakage Survey



Select of Area



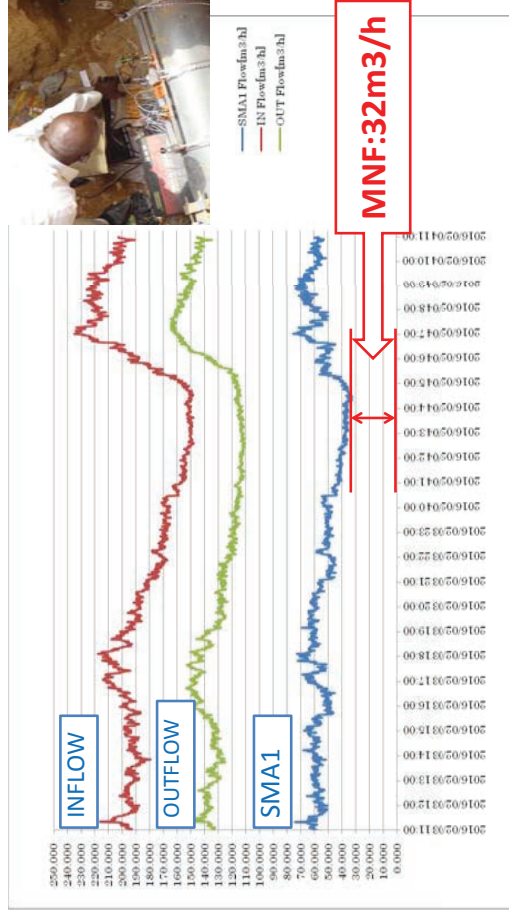
Confirm of Function of Valve

Install of New Valve

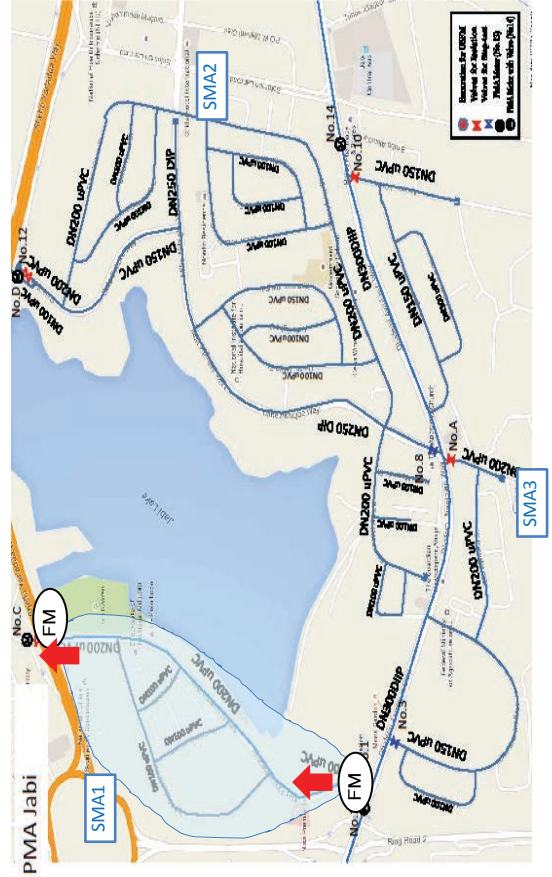


Result of Flow Measurement (SMA1)

JABI SMA1 Flow Measurement (03/02/2016 11:00~04/02/2016 11:00)



Measure of Flow Rate (SMA1)



Survey of Leakage

Acoustic Survey at House



Acoustic Survey on the Ground



Survey of Leakage

Result

NRW	Leakage	↑	4
	Illegal Connection	↑	3
RW	Leakage (after meter)	↑	9

NOT YET

Measure of Flow Rate (SMA1 after repair)

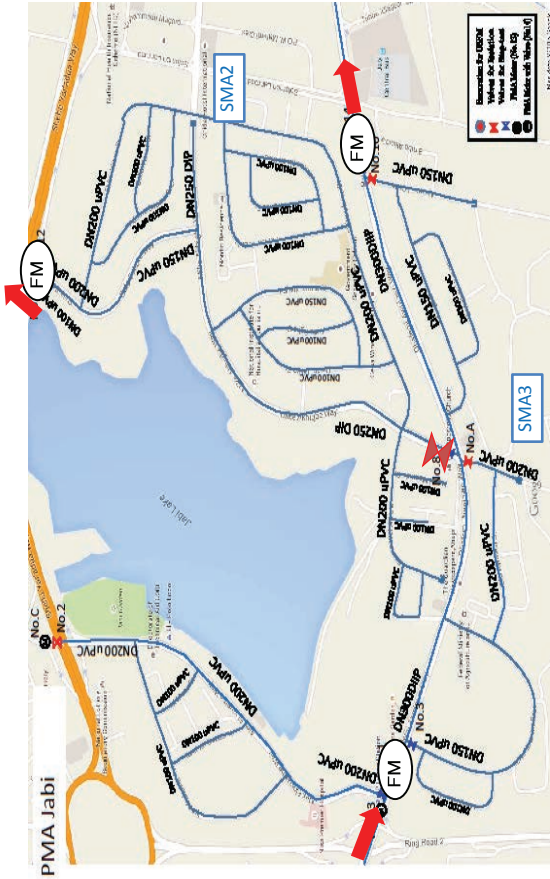
Repair (on-going)

Record of water leakage repair

Analyze of Leakage

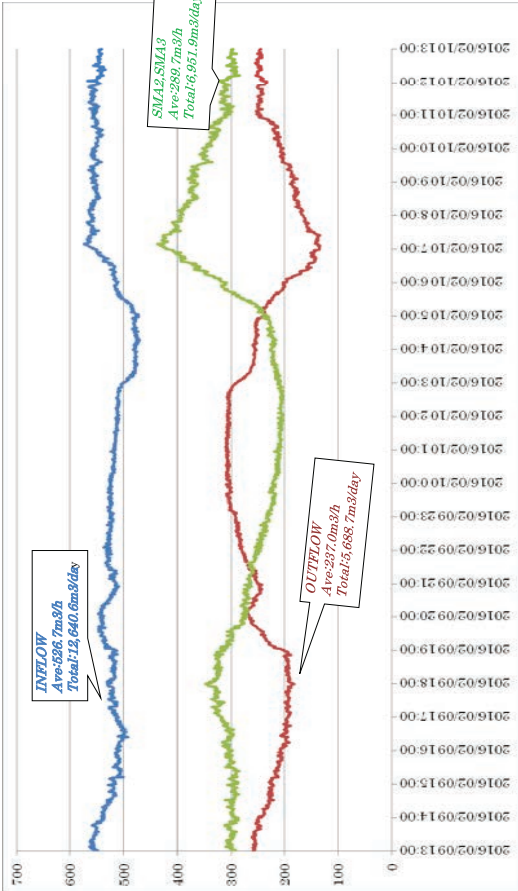
NOT YET

Flow Measurement SMA2 & SMA3



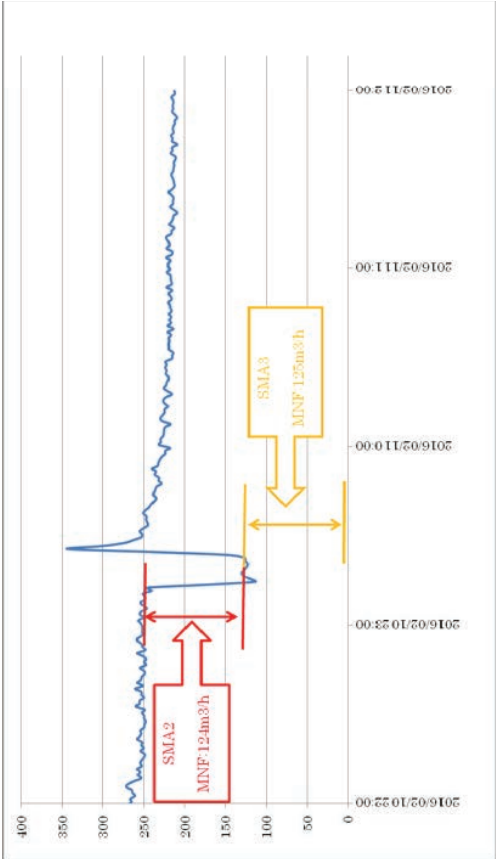
Result of Flow Measurement (SMA2,3)

Jabi SMA2 & 3 Measurement of Flow Rate 24h



Result of Flow Measurement (SMA2,3)

Jabi SMA2 & SMA3 Step Test



Issues

- Meter Installation into the Residential Land
- Undevelopment of Drawings

*Thank you
for your
attention!*

FCTA/FCTWB-JICA

THE FEDERAL CAPITAL TERRITORY
REDUCTION OF NON-REVENUE WATER PROJECT

Meter Error Test

17 February 2016

Engr. Abdullahi Masaud
HOU Metering (Prepaid), Distribution, FCTWB

What is Meter Error Test ?

- To measure **inaccuracy** of meters as a component of “**Non-Revenue Water**”
- Allowance of Standard for Meter before Using
Low Flow: **5%**, Medium/Large Flow: **2%**
- Allowance of Standard for Meter in Use
Low Flow: **10%**, Medium/Large Flow: **4%**

Common Failures of Water Meter

“No advance of meter pointer”

Possible Causes

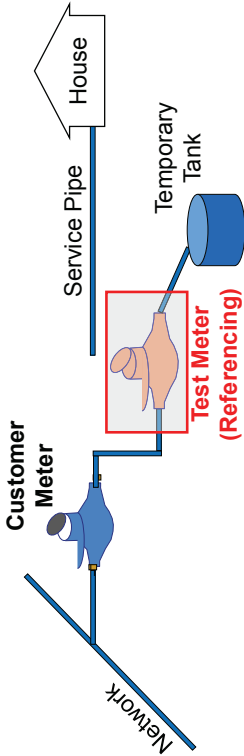
- Foreign bodies (sand, rust, etc.) being trapped
- Damage to a part due to excessive use
- Damage to a part due to water hammer
- Damage to a part due to freezing or partial freezing (not common in Nigeria)

“Excess advance of meter pointer”

Possible Causes

- If the strainer and rectifier, etc., become blocked, there is a generation of contraction, which increases the instrumental error.
- Due to pressure fluctuation (pulsation), the pointer intermittently advances even when no water is used.

Meter Error Test by Test Meter



Customer Meter



Test Meter (Referencing)

Comparison

Sampling for Meter Error Test

Statistical Consideration

Number of customers: approx. 48,300

Probability : 95%

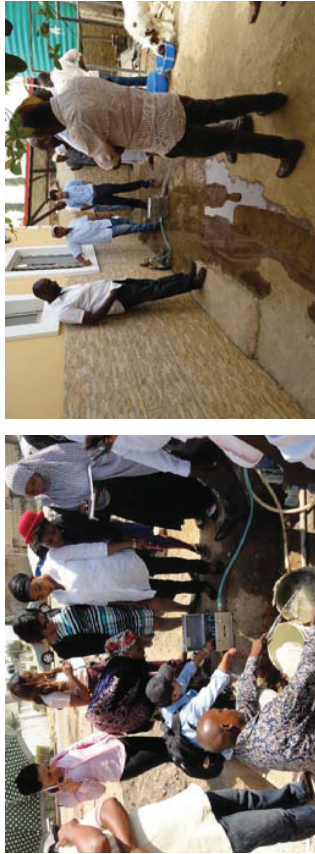
Sampling Error : 5%

Population Rate : 50%

Number of Sample

Required Sample of Test: 397

Samples for each PMA: 133



Record Sheet of Meter Error Test

Date & Time		Person in Charge		
AC / ID No.		Customer Name		
Meter Number		Product Year	Installed Date	
		Customer's Meter	Test Meter	
Meter Reading at Starting				Difference (%) A—B
Meter Reading at Ending				Rate of Error (%) C/B x100
Flow Amount		A	B	C

Problem and Challenges

Gudu (Prince & Princess)

- Some customer meters are located **inside property**, so it is **NOT easy accessible**.
- Mechanical metering part of prepaid meter is **NOT readable** due to **moisture**.

Jabi

- Most of properties have very **deep** chamber for customer meter, so it is **NOT easy to access** the meter.
- Most of customer meters are **NOT detachable** for test.

THE FEDERAL CAPITAL TERRITORY REDUCTION OF
NON-REVENUE WATER PROJECT

Water Balance Analysis

17 February 2016

FCTWB
JICA Expert Team

Water Balance Analysis

Total Distribution 3,222	Revenue Water	Billed Metered Consumption	
		Billed Unmetered Consumption	
	Non Revenue Water	Unbilled Authorized	
		Illegal Connection	
		Customer Meter Inaccuracies	
		Unidentified Consumption	
		Leakage	
		Physical Losses	
		2	

Billed Consumption

Categories		Number	Volume
Domestic	measured	424	709.89
	average		1.67
	unmeasured	352	589.34
Commercial	measured	8	20.26
	average		2.53
	unmeasured	10	25.30
Flat Rate	conventional	10	22.14
	prepaid	54	140.34
Total		858	1,507.27

Total Distribution

- Meter Reading once a month at Inlet Point of PMA
Read one year Value divided by 365: m3/day
- Incase of sample : Measured by Ultra Sonic Flow
Meter at the Inlet Point of P&P: 3,222m3/day

Billed Metered Consumption

- Meter Reading once a month commercial and domestic use
- One year's record of Prepaid
Record of one year Value divided by 365: m3/day
- Actual read consumption: one week meter reading for
conventional and prepaid
Unmeasured consumption: average consumption
domestic: 709.89+589.34 + commercial: 20.26 + 25.30 =
1,344.79m3/day (consumption of church:1.67m3/day
included) so 1,344.79-1.67=**1,343.12m3/day**
- * Consumption of British School (Major Consumer) is not
included.

Billed Unmetered Consumption Flat Rate

- N5500 /month / N80/m3 = 68.75m3/month x 12 / 365
= 2.26m3/day (Conventional)
Excess from 2.26m3/day becomes commercial loss
- N3000 / month / N80/m3 = 37.5m3/month x 12 / 365
= 1.23m3/day (Prepaid)
Excess from 1.23m3/day becomes commercial loss
- Actual read consumption for conventional: **22.14**m3/day
/ 10 = 2.21m3/day is **not excess** from 2.26m3/day
- Average value of prepaid is 2.6m3/day 2.6-1.23=
1.37m3/day x 54 = **68.5m3/day** is commercial loss
- **22.14 +1.23x54 = 88.56m3/day**

Unbilled Authorized

- Church and other unbilled unmetered authorized
consumption
Measure Quantity by Ultra Sonic Meter?
- Assumption : same volume to the average of domestic
because small church **1.67**m3/day

Illegal Connection

- Real consumption of Illegal connection can't be measured
- **Illegal connection is under investigation**

Leakage

- Actual volume of Leakage is difficult to know because leak term and quantity is not measured
- Some volume is fixed by experiences

Leakage: 14 average 20 l/min.

$$14 \times 20 \text{ l/min.} \times 60 \text{ min./hr.} \times 24 \text{ hr./day} / 1000 \text{ l/m}^3 = \mathbf{403.2 \text{ m}^3/\text{day}}$$

Customer Meter Inaccuracies

- Allowable error of using meter is 4%
- Differences between average actual error and allowable error is NRW
- **Meter error test is on going**

Unidentified Consumption

- Unidentified consumption is remaining volume from volume of other factors
- Unidentified Consumption + Illegal connection + Customer Meter Inaccuracies: $3222 - 1,343.12 - 88.56 - 68.5 - 1.67 - 403.2 = \mathbf{669.87 \text{ m}^3/\text{day}}$

Water Balance Analysis

Total Distribution 3,222	Revenue Water	Billed Metered Consumption	1,343.12	
	1431.68	Billed Unmetered Consumption	88.56	
			68.5	
			Unbilled Authorized	1.67
	Non Revenue Water		Commercial Losses	1,316.95
		Illegal Connection		
		Customer Meter Inaccuracies		
	1,790.32	Unidentified Consumption		
55.57%	Physical Losses	Leakage	403.2	
			12	

Annex5-77

14

$$\text{Non Revenue Water rate} = 1790.32 / 3222 \times 100 = 55.57\%$$

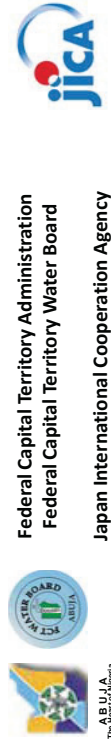
Revenue Water

- Billed Metered Consumption : 1343.12m3/day
- Billed Unmetered Consumption : 88.56m3/day
- Revenue Water : 1,343.12 + 88.56 = 1,431.68m3/day

Non Revenue Water

- Excess of Flat Rate : 68.5m3/day
- Unbilled Authorized : 1.67m3/day
- Illegal Connection : on going
- Meter Inaccuracies : on going
- Unidentified Consumption : on going
- Leakage : 403.2m3/day
- Non Revenue Water : 68.5+1.67+1,316.95+403.2= 1790.32m3/day

13



The Federal Capital Territory Reduction of Non-Revenue Water Project

Action Plan by Trainees

17 February 2016

Mr. Adis S. Muhammad
Technical Manager, HOD Commerce, FCTWB

1

Training Course in Japan

- Water Supply Services Management and NRW Reduction

Training Period

- The second half of August 2015

Trainees

- Engr. A. A. Nahuche, HOD Distribution
- Mr. Adis S. Muhammad, HOD Commerce
- Engr. Aliyu Usman, HOD Production
- Mr. Musa Dikko, HOU Pipeline, Distribution

What we learnt are:

- Water supply system in Japan
- Self-supporting Accounting system
- Rehabilitation of WTP
- New technology of membrane filtration/purification plant
- Water tariff
- Customer service center
- Customer satisfaction
- Mapping system
- Water supply operation & management
- Leakage detection
- Aged pipe replacement
- Water meter maintenance
- Human resource development
- Water supply planning & water demand prediction
- Asset management
- Management plan

At the end of training, we the trainees emphasized:

“Capacity strengthening of FCTWB and service improvement will be achieved by imbibing the practice of being self-sustaining organization as well as applying scientific approaches. Based on knowledge gained from the training, we propose **actions** to be taken or considered by FCTWB”

We propose our Action Plans:

Organization

- **Enabling Law** for FCTWB
- **Restructuring** the organization for more effective & efficient service delivery
- Preparation of short, medium and long-term **planning for training**

Planning

- Forming a committee to review ongoing business plan and discuss **future plan** covering the NRW reduction
- Introduction of **quality management** of works
- Introduction of **information management**

We propose our Action Plans:

Operation and Maintenance

- Creation of the mapping/
GIS unit and procedures
- Establishment of leak
detection unit
- Strengthening of metering
units and establish meter
workshop
- Installation of bulk/zonal
meters to manage and
monitor distribution system
- Introduction of strategic plan
for maintenance



Leakage Detection Training Yard



Meter Workshop for
Accuracy Check

We propose our Action Plans:

Billing

- Review of mode of payment
to be more flexible for
customers
- Review of water tariff based
on volume of water
consumption (progressive water tariff)
- Review of billing papers, elimination of return bills



Meter Reading and Billing

Customer Services

- Enhancement of Customer Service Center and
creation of desk officer of each area office
- Creation of more awareness through PR



Thank you very much.



Federal Capital Territory Administration
Federal Capital Territory Water Board
Japan International Cooperation Agency



The Federal Capital Territory Reduction of Non-Revenue Water Project

Suggestions

(These are still ideas...)

17 February 2016

JICA Expert Team

1. Suggestions (Commerce)

Overviews

- Situations in meter reading and billing are **complicated** and **over-segmented** in all aspects. This has caused **inefficiency** of works.
- So, **streamlining**, **simplification** and **uniform management** are keys.
- A lot of Problems and challenges exist in various area, **wide-ranging approaches** supported by all related staff in the short/medium/long term

2

2. Suggestions (Commerce)

- Reduction/elimination of **flat-rate** bills causing **NRW** by installing meter
- Reduction/elimination of **estimate** bills causing **customer dissatisfaction** by **sure reading**
- Standardization of customer meter (mechanical) for FCTWB, and ensuring **stable supply** of meters.
- **Approval/licensing** of customer meter (mechanical) by FCTWB
- Establishment of **Meter Workshop for accuracy check** of customer meters

4

2. Suggestions (Commerce)

- Prompt countermeasures against **return bills**, such as **deactivation** or **elimination**
- Decision-making at **metering policy** and **strong spearhead** of implementation with budget
- For billing based on **sure reading**, staff's **performance of duties** with **awareness-rising, discipline and training**, **meter installation** and **replacement** of malfunctioning meters, **meter relocation** to outside of property for **accessibility**, **enhancement of logistics**, and **thorough monitoring** of reading regardless of any types of meter

3

2. Suggestions (Commerce)

- Review of water tariff to shift it more **simplified** and **comprehensible** one, such as **basic charge** plus **progressive (step-up)** rate block system, which can deal with unreadable situation for revenue collection
- **Update/improvement of customer database and management** against various type and situation of customers
- Lastly, **review of roles and responsibilities** of all related staff, for example, Area Offices in charge of all meter reading meanwhile HQs in charge of supervision of them by not category but zone.

5

3. Suggestions (Distribution)

- As-built drawings and calculation results if any should be properly corrected from FCDA and other development authorities of private developer, etc.
- All construction works by them should be properly supervised based on guideline.
- Review of design criteria or standard of particularly network, service pipelines, meter installation, etc.
- GIS in FCTWB should be away from **constraint by AGIS policy** for establishing own database.

6

4. Suggestions (Cross-Organization)

- All official documents including as-built drawings should be properly archived and handled as an aspect of information management.
- Preparation of guidelines and manuals for sustaining all kind of works in FCTWB as an aspect of quality management.
- Preparation of comprehensive training programme based on assessment for each level of staff (junior-, mid-, senior-) in accordance with future plan.
- Creation of dedicated unit(?) of NRW monitoring covering both Distribution and Commerce.

8

3. Suggestions (Distribution)

- Focusing on NRW at tanks, along trunk mains and distribution mains, at air valves, wash-out valves, etc.
- Creation of dedicated unit of Water Distribution Management in Distribution together with Quality Control.
- Driving of assembling a GIS database by dedicated unit with manual and workflow.
- Creation of dedicated unit of leakage detection for expansion of activities.
- Preventive maintenance
- Stock of materials for prompt maintenance

7

