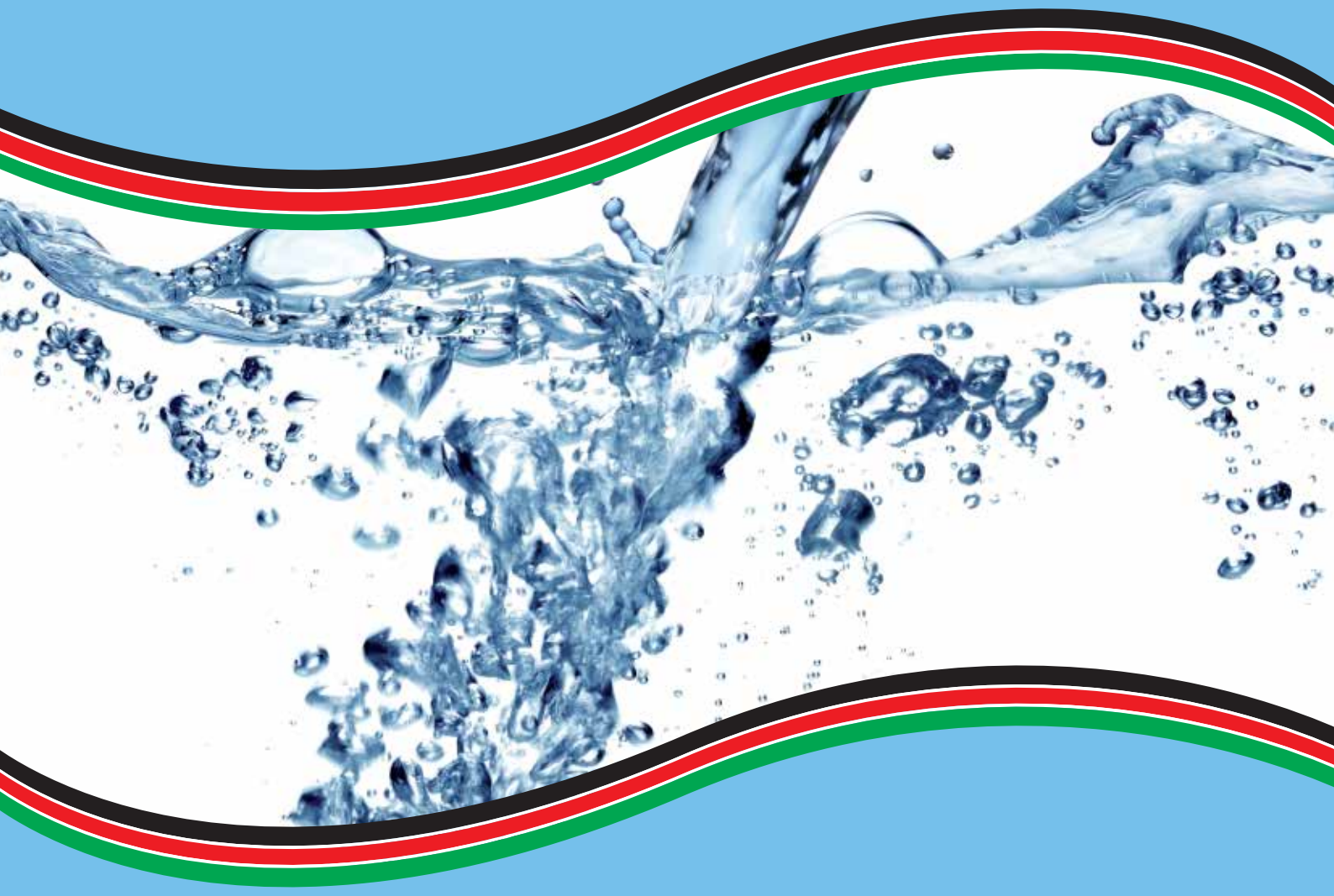
Standards for Non-Revenue Water Management in Kenya



Handbook

WATER SERVICES REGULATORY BOARD
WASREB

KENYA VISION 2030

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Foreword

Water is an important natural resource to all forms of life and for mankind. It is the backbone of economic growth and a nation's prosperity. Kenya as the rest of the world is becoming more and more water scarce due to deterioration of water sources resulting mainly from global warming and population explosion. Construction of new water schemes to meet the growing demand for water services is expensive, requires more time to develop and comes with new challenges. Alternative sources of water are water re-use, desalination and rain water harvesting. However, reduction of non revenue water is the cheapest way to alleviate the water stress.

The Government of the Republic of Kenya is committed to ensuring sustainability of Water Service delivery in order to realize the aspirations of the Jubilee Coalition of achieving universal access by the year 2020 and to the right to water and sanitation as envisaged under the bill of rights in the constitution. However, among the challenges to achieving the Kenyan dream includes a high level of Non Revenue Water (NRW) which is estimated at an average of 45% of the total water production in the country. The water services provision has been devolved to the County Government and therefore, it is timely to ensure an elaborate mechanism is put in place for the proper management of Non-Revenue Water in the country.

Kenya Vision 2030 recognizes that Kenya is a water scarce country and therefore emphasizes water conservation and prudent use for the limited available portable water. In this regard, the Government of Kenya has instituted specific strategies to raise the standards of the country's overall water supply and resource management among others. The National Water Resources Management Strategy and the National Water Services Strategy aim at ensuring that water resources are conserved and maintained and Non Revenue Water at water supply and Sanitation systems is reduced to acceptable levels. Accordingly, the Ministry of Environment, Water and Natural resources in conjunction with Japanese International Cooperation Agency (JICA) has developed standards for Non Revenue Water management in order to cut down on Operation and Maintenance (O&M) costs and avail more water that could otherwise be lost to consumers.

The Non-Revenue Water (NRW) reduction management standards consisting of manual, guidelines and handbook is meant to provide a practical approach to reduction of NRW in Kenya. The effective utilization of the standards will result in significant reduction of NRW and all the Water Services Boards and Water Service Providers are encouraged to use them.

James Teko Lopoyetum, HSC
Principal Secretary
State Department of Water

Executive Summary

"At current levels of NRW, urban WSPs are losing approximately KSh 9.9 billion annually, slightly less than one third of the sector budget. This not only threatens the financial sustainability of the sector but also wastes funds, which could otherwise be used to increase access and improve service delivery. In short, current under performance on NRW is at the direct expense of the customer and undermines Kenya's aspiration to move towards higher living standards."(IMPACT REPORT NO 6 -2013)

The performance indicator with respect to NRW reduction has improved marginally from 47% in 2008/9, 45% in 2010/11 to 44% in 2011/12. The improvement remains very poor, considering the acceptable sector benchmark of 25% and national target in the national water services Strategy (NWSS 2007-2015) of 30% by 2015.

Out of 66 urban WSPs, 64 or 97% have unacceptably high levels of water losses. With 16 WSPs losing more water on the way than they actually manage to sell. These figures are a clear indication of the lack of professional management and good corporate governance in many WSPs.

High levels of NRW result from poor infrastructure maintenance and, above all, poor commercial practices (corruption). They are detrimental to the commercial viability of the WSP as well as the safety of the water it supplies (where related to leakages). Also, coupled with the overall reduction in water production, they result in less water being available for an increasing number of consumers.

This Non-Revenue Water (NRW) management standard aims to provide a practical approach to reduction of NRW in Kenya. The target group is the Utility Managers, technical personnel and those who are in charge of NRW management in the Water Service Provider (WSP).

The standard is based on experiences in management of NRW from pilot studies in four areas (Meru, Embu, Narok and Kapsabet Nandi) with diverse terrain in Kenya. It aims to provide a basis to address current challenges of NRW management that exist in Kenya and suggest procedures and measures that do not require use of sophisticated equipment, high level of skills and major investments.

The standard is comprised of: **Manual, Guideline, Handbook** and **Case Studies** for NRW reduction. The Manual, Handbook and Case Studies are for use by the WSPs. The Guideline is for use by the WSB in evaluating and guiding the NRW reduction activities implemented by WSPs.

Each WSP should prepare its own NRW Reduction Plan, based on the information and practical guidelines as enumerated in the standards. The WSPs should take into consideration the characteristics and conditions of its service area to ensure that procedures and measures established in the Reduction Plan prepared in this manner will be "custom made" and therefore best suited to reduce NRW most effectively.

The effective utilization of the standards will result in significant reduction of NRW in Kenya. This will further contribute to the progressive realization to the right to water and sanitation as envisaged under the bill of rights in the Constitution of Kenya (CoK-2010)

The standard is structured with a view to creating understanding of the basic concepts of NRW management through a diagnostic approach, quantifying NRW and then developing strategy to address it. The following is a brief outline of the standard.

a) Manual

Chapter 1: This seeks to impart the Basic Concept of NRW Management, the overall picture of NRW reduction is explained, and basic knowledge of NRW reduction is provided.

Chapter 2: Before embarking on any NRW reduction measures, it is necessary to determine the **volume of water that is being lost**. In Kenya, many utilities lack necessary data or necessary devices such as flow meters. This chapter explains how such utilities could begin to estimate the volume of water being lost.

Chapter 3: The chapter explains the causes of Physical Losses, methods of measuring volume of leakages, methods for detecting underground leakages, and the methods of reducing leakages etc.

Chapter 4: The Chapter explains the significance of Commercial Losses in NRW. Explanations are given on the causes and methods for reducing commercial losses. It is possible to bring the NRW ratio down to approximately 30% by just reducing Commercial Losses.

Chapter 5: This chapter explains what need to be done to manage effectively NRW reduction. NRW reduction activities implemented in a Pilot Area are explained. Thereafter, the most suitable measures for the entire service area are determined.

Chapter 6: It explains the mechanism of meters and the importance of maintaining customer meters in order to maintain accuracy and efficiency of meters.

Chapter 7: This chapter explains the importance of good quality construction work and supervision of construction work. Unless good quality construction is assured, replacing pipes will be pointless, as new leakages from poor construction will occur.

Chapter 8: It explains the importance of zoning in order to closely manage NRW. However, zoning requires significant funds, and therefore many utilities may not manage to implement zoning all at once.

Chapter 9: Managing water pressure is one of the most effective methods of NRW management. Water pressure is a common problem seen in utilities located around the Mt. Kenya region. This chapter provides explanation on how to manage water pressure. In the Pilot Project implemented in Embu WSP, positive results were obtained through managing water pressure.

Chapter 10: GIS: This chapter is provided as the next step forward to those utilities that are already implementing some level of NRW reduction measures. It is not necessary to immediately implement activities in these Chapter, but to improve effects of NRW reduction; these will be necessary activities to implement in the future.

Chapter 11: Cost-Benefit Analysis : It is important for water utilities to consider conducting Cost-Benefit Analysis when they are trying to determine the scope of the NRW reduction measures that should be implemented. Cost-Benefit Analysis will show the effects of the invested cost by comparing the benefit obtained with the cost invested.

Chapter 12: Provides the procedures necessary to make a Plan. The purpose of a NRW Reduction Plan is to determine the most suitable measures to reduce NRW and to use the available budget effectively.

b) Guideline

This Guideline is intended for use by WSB in assessing and evaluating the WSP and giving direction and guidance in the utilities' implementation of Non-Revenue Water (NRW) reduction activities. This Guideline is structured as follows:

Chapter 1: The Self-Assessment Matrix proposed in this Guideline will help each utility to understand its current situation of NRW, and assist the WSB prioritize NRW activities to implement in order to reduce and manage NRW. The focus of the WSB should be on policy direction, leadership and providing necessary materials, equipment and funding for selected activities.
Therefore to use this guideline effectively, the first requirement of the WSB is to request all WSP under its jurisdiction, to conduct a Self-Assessment

Chapter 2: The basic information will be used in calculating the Performance Indicators (PI). This involves the collection, correlation, analysis and summarizing of the basic information of each WSP. This collected data is vital as it will form the basis on which important decisions will be based, including those related to capacity building.

Chapter 3: The Performance Indicators (PI) are indicators that evaluate NRW reduction activities. Using the "Process Benchmarking Method", which is the continuous monitoring of the PI, the importance of each indicator, the relationship between the indicators can be understood and it will also help to clarify problems and issues.
The Performance Indicators will also allow comparisons of WSP, eventually leading to the improvement of the water service, increasing efficiency and strengthening operational fundamentals and providing a basis for better planning for the future.

c) Handbook

This is a simplified NRW reduction manual with many illustrations in the form of diagrams and photographs. The handbook is intended for all staff contributing to NRW management in the WSPs and specifically, the technicians and field personnel for use in their daily activities.

d) Case Studies

The Case Studies involve the activities of NRW management project in Meru Embu , and Narok WSP. The Case studies represent actual work done on a pilot scale by the WSPs working with the JICA Experts in developing and implementing NRW Plans. Using the water balance, site activities and review of practices, issues are identified and interventions categorised into technical, financial, social and institutional. These interventions were then prioritized and activity plans developed for immediate, midterm and long term implementation.

The case studies show that it is possible to identify a pilot area in which all or most of the interventions can be applied and impact monitored. The results of this particular area can then be scaled up to cover the whole operational areas of the water utility.

The philosophies, concepts, and recommendations contained in this standard reflect international best practice. It is recommended that all Water utilities in Kenya apply the approach in order to rapidly benefit from a greater understanding of their networks' performance, and knowledge of the tools available to identify and reduce their levels of NRW.

Abbreviations

/c/d	per capita per day
DMA	District Meter Area
DMAs	District Meter Areas
EWASCO	Embu Water and Sewerage Services Company Ltd.
GIS	Geographic Information System
IWA	International Water Association
JICA	Japan International Cooperation Agency
KEWI	Kenya Water Institute
Km	Kilometer
KNWSC	Kapsabet Nandi Water Sanitation Company Ltd
Kshs	Kenya Shillings
Ksh/m	Kenya shillings per month
l/c/d	litre per capita per day
M³	Cubic Meter
MEWASS	Meru Water and Sewerage Services
Mio	Million
MNF	Minimum Night Flow
Mpa	Mega Pascal
No.	Number
NARWASCO	Narok Water and Sewerage Services Company Ltd
NRW	Non-Revenue Water
MWI	Ministry of Water and Irrigation
O&M	Operation and Maintenance
PI	Performance Indicators
RVWSB	Rift Valley Water Service Board
WARIS	Water Regulation Information System
WASREB	Water Services Regulatory Board
WSB	Water Services Board
WSP	Water Service Provider

Contents

Chapter 1
What is Non-Revenue Water - NRW?

1.1 Definition of NRW

NRW is defined as amount of water which is not billed and does not earn revenue.

NRW = System Input Volume – Billed Authorized Consumption Volume

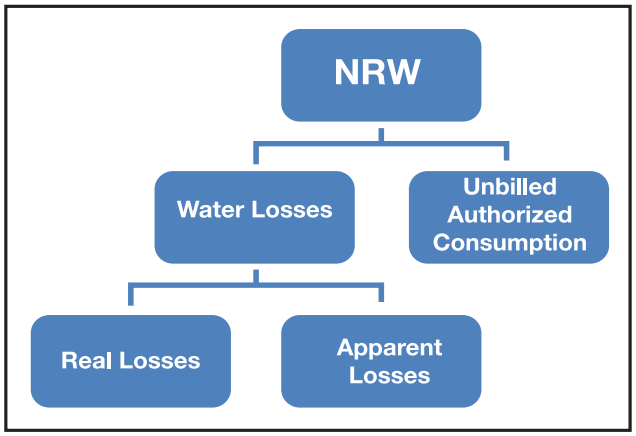
Where:
System input volume is the volume of distributed water

Billed Authorized Consumption Volume is the volume of water billed.

NRW ratio is percentage of amount of water not billed against the total amount of water produced for distribution

$$NRW(\%) = \frac{\text{Non-Revenue Water Volume}}{\text{System Input Volume}} \times 100\%$$

1.2 Components of NRW



Components of NRW are described below.

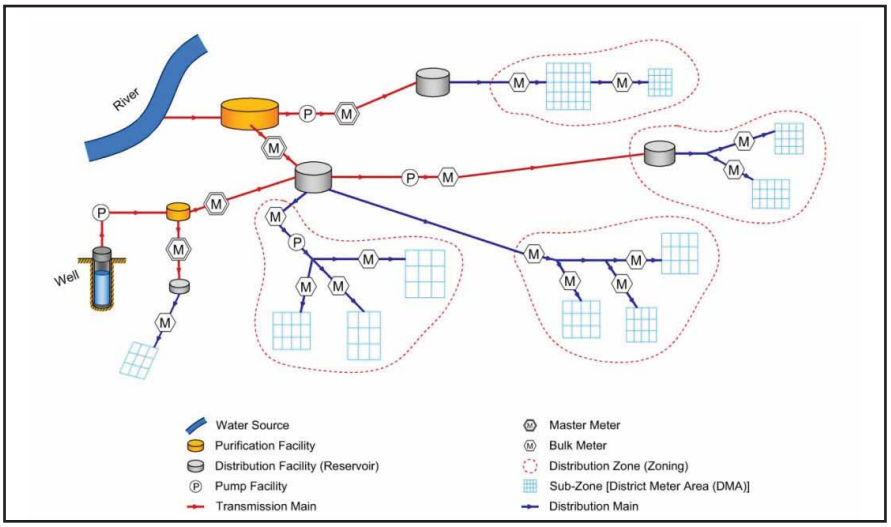
Real Losses: these are Physical Losses of water through leakages in distribution pipes, services pipes and / or water reservoirs

Apparent Losses: these are non-physical losses or Commercial Losses of water due to illegal connections (or water theft), metering errors and unmetered connections

Unbilled authorized consumption: this is water consumption for public and institutional uses e.g. water for fire hydrants, water for pipeline flushing, water fountains, e.t.c.

Chapter 2
Understanding The Water Flow

2.1 Volume of Distributed Water



Volume of distributed water must be measured using Flow Meter installed at most suitable locations.

It is important to record the daily volume of distributed water at the same time everyday

Date	Time	Water Volume m^3/day
7/1	07:00	123
7/2	07:00	153
. . .	. . .	. . .
7/30	07:00	141
Total per month		4124 m^3/month

Daily

At the same time

2.2 Volume of Consumption Water

Volume of consumption water can be estimated through customer water meters.



Actual Installation of Customer Water Meters

In order to measure the exact volume of water consumption, Customer meters should be installed to all customers.

Billing	List						
Village	: 008		JUL	AUG	SEP	OCT	NOV
Serial							
Number	Com No.	Status	Consumption	Consumption	Consumption	Consumption	Consumption
00570	0099	ON	55	32	30	47	35
00571	0100	AVG/ON	10	10	10	10	10
00584	0113	AVG/ON	7	7	7	7	7
00615	0144	ON					
00624	0153	AVG/ON	5	5	5	5	5
00628	0157	ON	9	16	14	13	8
00634	0163	AVG/ON	10	10	10	10	10
00635	0164	AVG/ON	5	5	5	5	5
00636	0165	ON	17	17	13	17	7
00638	0168	AVG/ON	10	10	10	10	10
00639	0168	AVG	10	10	10	10	10
00640	0169	ON/AVG/ON	3	8	8	8	8
00662	0191	AVG	10	62	20	19	20
00875	0404	ON/ AVG/ON	25	21	21	21	21
00877	0406	ON	77	43	34	76	50
00879	0410	ON		23	5	9	3
00881	0411	AVG/ON	27	27	27	27	27
00882	0412	ON	3	10	11	16	9
00883	0413	AVG/ON	10	10	10	10	10
00884	0414	ON	34	35	2	35	35
00885	0416	ON	36	39	29	61	72
00887	0420	ON	222	267	125	252	135
00891	0421	ON	66	17		3	9
00892	0422	ON	52	51	26	27	24
00893	0422	AVG/ON	10	10	10	10	10
Grand Total			4782	5769	3714	5011	3787

Source NARWASSCO (NAROK WSP)

WSP should summarize consumption water volume and meter data (account number, status, etc.) in a table for easy understanding.
Analyze customer's water consumption volume every month.

2.3 Water Balance Analysis

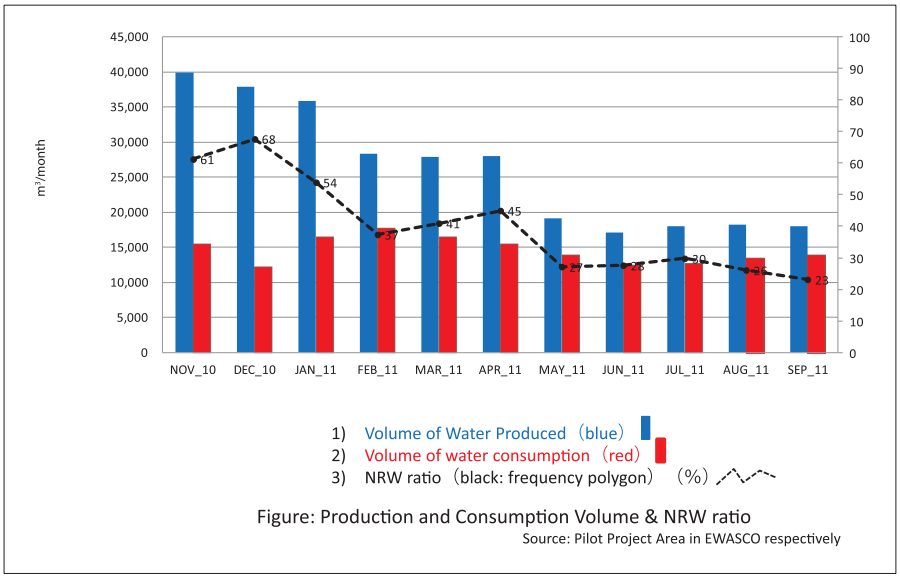


Figure: Production and Consumption Volume & NRW ratio
Source: Pilot Project Area in EWASCO respectively

NRW ratio is calculated based on data obtained on volume of water produced and volume of water consumption as shown by the bar graphs.
NRW ratio (%) is shown by line graph.

2.4 Template for Data Capture for Computation of NRW Ratio

WATER BALANCE ANALYSIS TEMPLATE FOR DATA CAPTURE FOR COMPUTATION OF NRW RATIO

Name of WSP:

Year:

	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Volume of Water Produced (m^3)												
Volume of Water Consumed (m^3)												
NRW Volume												
NRW Ratio												

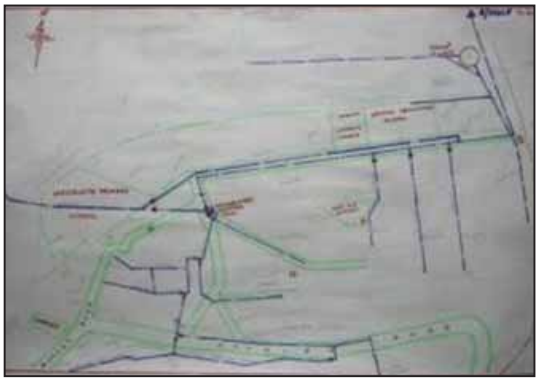
Chapter 3
Mapping

Mapping of the pipeline network is absolutely necessary for WSPs to implement efficient NRW reduction measures.

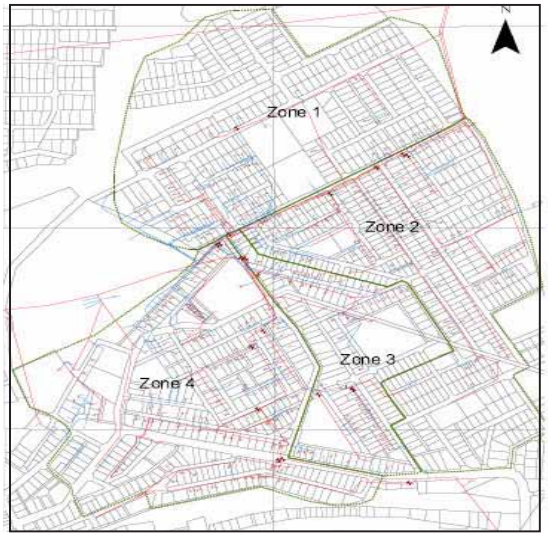
In case of WSP without any map of its pipeline network, the first step is to prepare a hand drawn map by carrying out a site survey of the supply area. It is recommended that this hand drawn sketches be to converted to digital files (CAD, etc.)

The first step to the preparation of the pipeline network map is to conduct a survey of the supply area on foot.

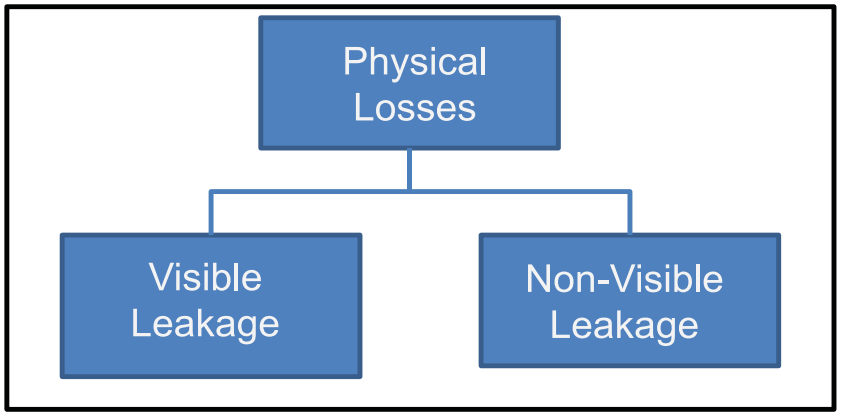
A hand-drawn map must be sketched at the time of the foot survey. All sketched maps must be organized to produce a sketch of the pipeline network of the supply area.



More information such as location of valves and information on water meters, can be added onto this map.
The hand-drawn maps should eventually be converted to digital files using CAD and/or GIS.



Chapter 4
Reduction of Physical Losses



Physical Losses are classified into Visible Leakage (Surface Leakage) and Non-Visible Leakage (Underground Leakage).

Visible Leakage occurs on pipes with high water pressure, and appears on the ground surface. It can be found by visual observation.

Non-visible Leakage occurs on pipes with low water pressure and seeps into the ground. It can be found by leak detection survey.

Generally, more leakage occur on service pipes than on distribution pipes.

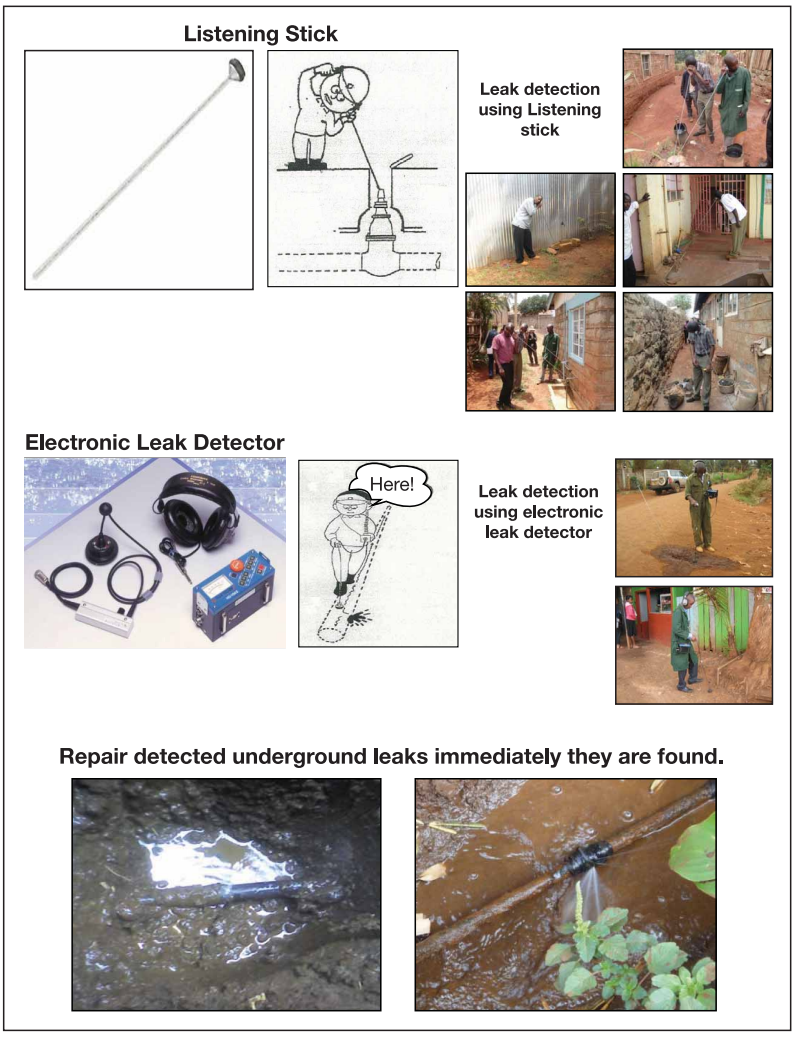
4.1 Visible Leakage (Surface Leakage)

Surface leakage can be found through a report from customers or through line patrolling. The leaks should be repaired promptly.

4.2 Non-Visible Leakage (Underground Leakage)

Underground leakages can be found using different types of leak detectors. The choice of leak detection equipment depends on the level at which the WSP is in reducing NRW. The more sophisticated equipment is used when the NRW ratio has been reduced.

4.3 Detection of Underground Leakage

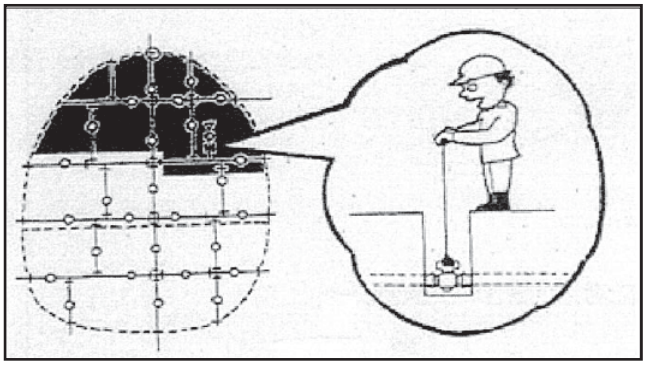


Chapter 5
Quantifying Physical Losses

This section explains how to measure Physical Losses.

5.1 Direct Measurement

(1)
Isolate the measurement area by closing the all peripheral valves.



(2)
Close all customer valves of the measurement area temporarily

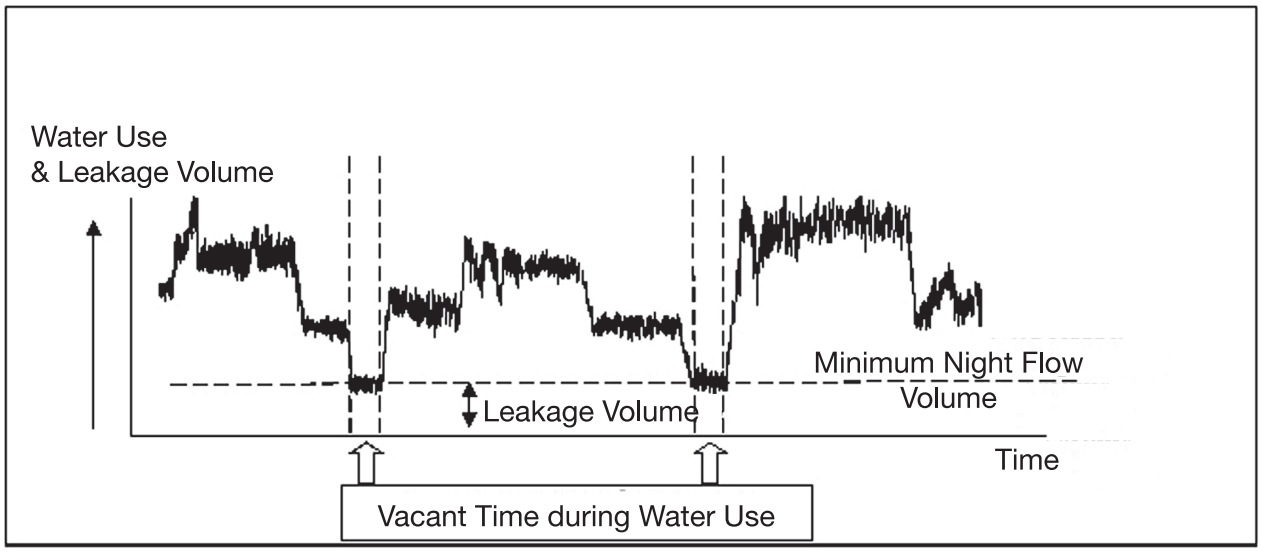
(3)
Measure the flow volume into the area at inflow point

The measured volume can be considered as existing leakage

5.2 Minimum Night Flow Measurement - MNF

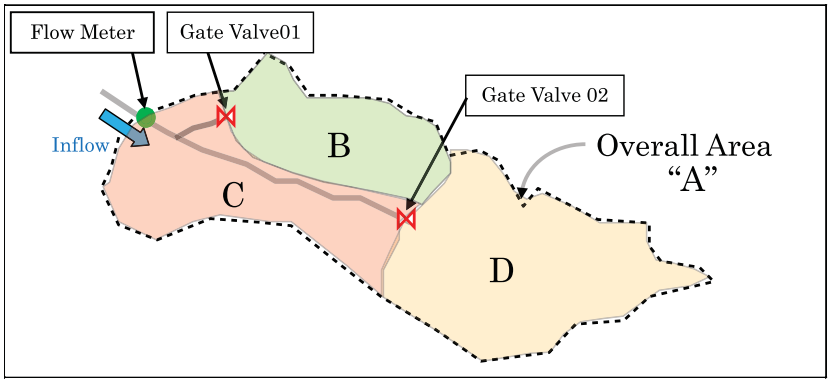
The leakage volume can be estimated by measuring Minimum Night Flow (MNF) in the target area. The target area should be perfectly isolated from the adjoining area. MNF is measured continuously through the night by using electromagnetic flow meter or ultrasonic flow meter.
MNF is considered as the flow volume when there is no water use and hence the indication of leakage or illegal consumption.

Measurement of MNF



MNF is measured without cutting off supply to all customer meters. It therefore does not inconvenience customers. However MNF includes a certain level of water consumption such as water use, water theft, unmetered consumption, meter errors, etc. MNF does not always show the true leakage volume.

5.3 Step Test Measurement



Schematic Diagram of Leakage Monitoring Block (Step Test)

Flow Meter Reading

Closing Gate Valve

By measuring the MNF of a sub - block and comparing the obtained readings to previous MNF records of the same sub - block; any abnormal flow can be detected and can be a pointer to possible leakage.

5.4 Determination of Volume of Leakage at the Actual Leakage Point

When a leak is detected, it is important to measure the exact leakage volume before repairing it in order to understand the benefits of leakage control works.

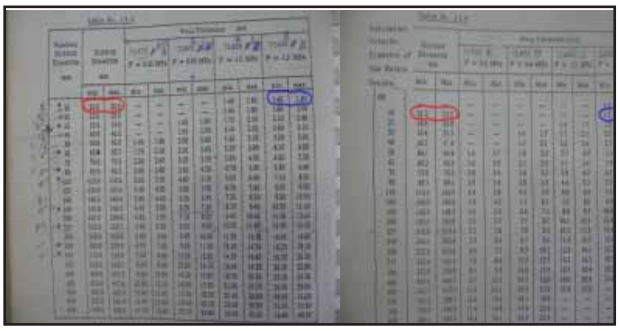
Leakage volume per minute can be measured by measuring the actual leakage at the leakage point. By multiplying this value by the number of leakage points, the leakage volume of the target area can be estimated.

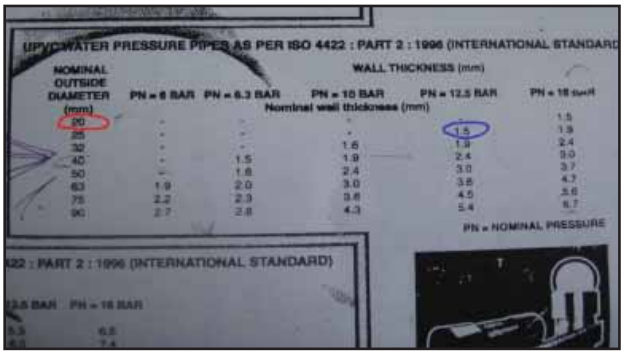
Measurement at actual leakage point

Chapter 6
Construction Method

Leakages may still occur even if distribution and service pipes are all replaced, if the quality of construction work is poor. In Kenya, the quality of construction work is an important factor.

6.1 Standardizing of Pipe and Joint Materials





Kenya uses both inches and meters, and in addition the ISO standards are being used.

Also, the couplings that come from the manufactures are not uniform.

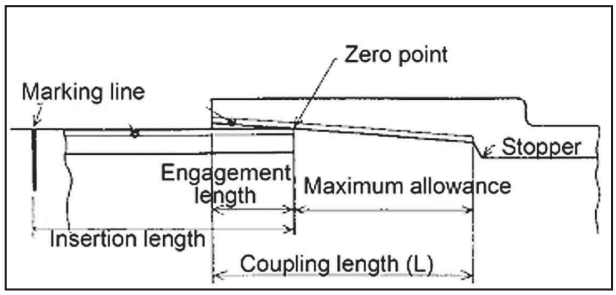
This results in variations in pipe thickness and internal diameter therefore requiring adjustments at site.

Measurement using gauge

Check the external and internal diameters before connecting

6.2 Construction Works

Upon connecting, carefully check each length



Fire Coupling

X

Plastic Paper Bends

X

Fire coupling and plastic paper bends can often be seen in pipe repair works in Kenya. Regardless of the construction quality, problems of water tightness would remain. This is not only due to poor workmanship, but also due to mixed use of pipe standards.

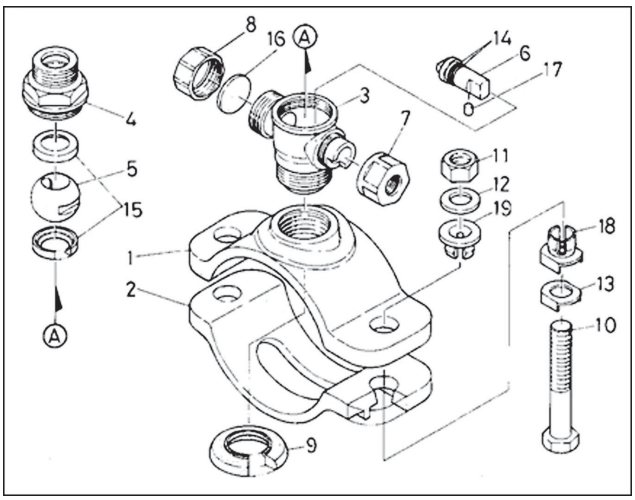
Pipe Fittings Parts

WSPs should adopt pipe fittings which meet Kenya Standard KS06 – 149 for plastic pipes and ISO 65 for steel pipes, in accordance with the Practice Manual for Water Supply Services in Kenya, 2005

6.3 Under Pressure Tapping

Under pressure tapping is the facilitation of a service connection, from a main distribution pipe, without stopping water supply in the existing pipe. This is advantageous as water losses are reduced, and water supply is not interrupted.

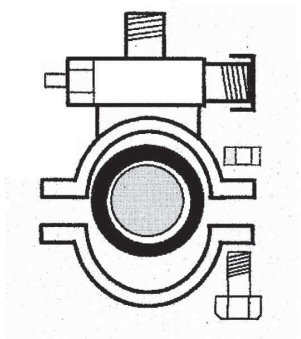
(1) Saddle Ferule



1 Saddle
2 Band
3 Body
4 Ball retainer
5 Ball valve
6 Spindle
7 Protective nut
8 Cap
9 Saddle packing
10 Bolt
11 Nut
12 Washer
13 Stop washer
14 O-ring
15 Ball seat
16 Cap packing
17 Stop spin
18 Insulator A
19 Insulator B
20 Core
21 Anti-corrosion film

Typical use of Saddle Ferule

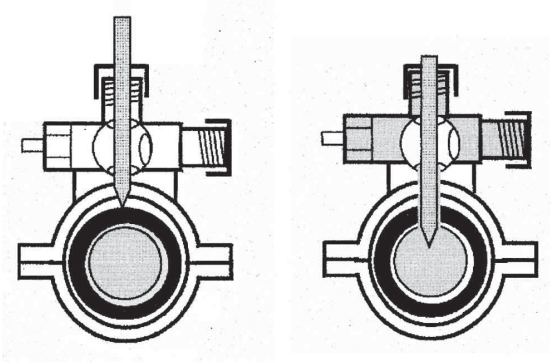
(2) Under Pressure Tapping Procedures



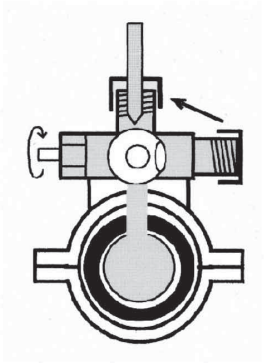
i Pipe and saddle ferrule should be cleaned and installed it with bolts and nuts to an extent that the polyethylene pipe slightly flexes.

ii Attach a cap to a service pipe take-out port on the side so that water does not come out from it when a hole is bored.

iii Looking into the port from above, confirm that the ball valve is open and the hole can be bored. If the hole is bored with the ball valve closed, the ball valve body will be damaged.

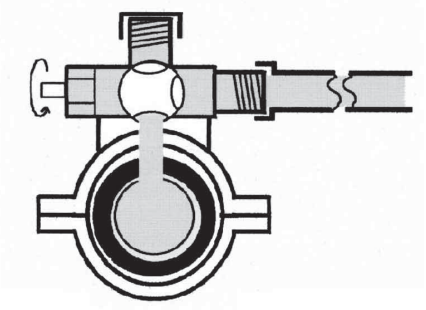


iv Set a boring machine to the port at the top, and bore a hole. Be careful not to bore the opposite pipe surface.



v After the hole is bored, lift the drill to the top, and turn the ball valve 90° to stop water.

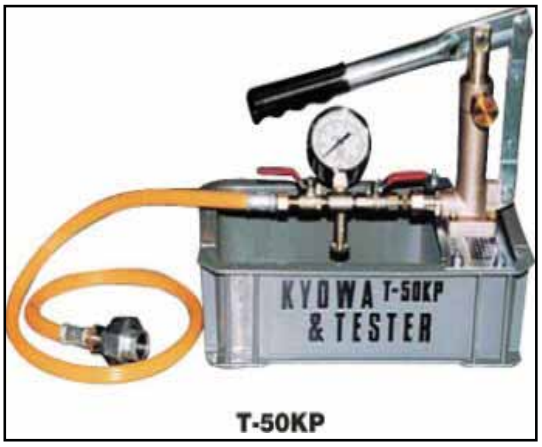
vi Remove the boring machine. Remove the cap attached to the screw on the side, and set it to the port at the top.



vii After jointing to the service connection which is already connected to taps or a stop valve, open the ball valve to supply water.

Source: JICA NRW Training Text (made by NAGOYA Waterworks Bureau)

6.4 Water Pressure Test



Hand Pump for Water Pressure Test

Leakage from bad connection point

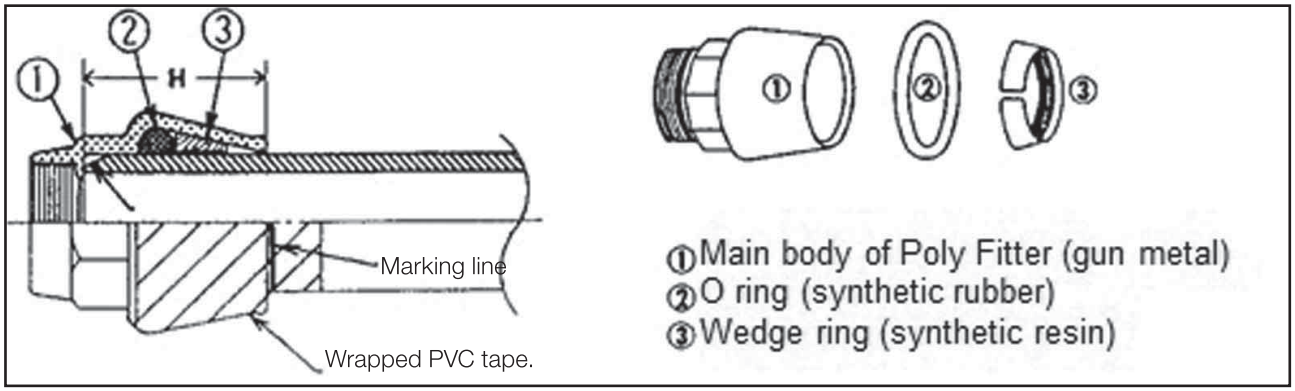
Connect pump with pipe and place water pressure gauge

Water Pressure Test must always be conducted soon after replacement of pipes to confirm that there are no leakages.

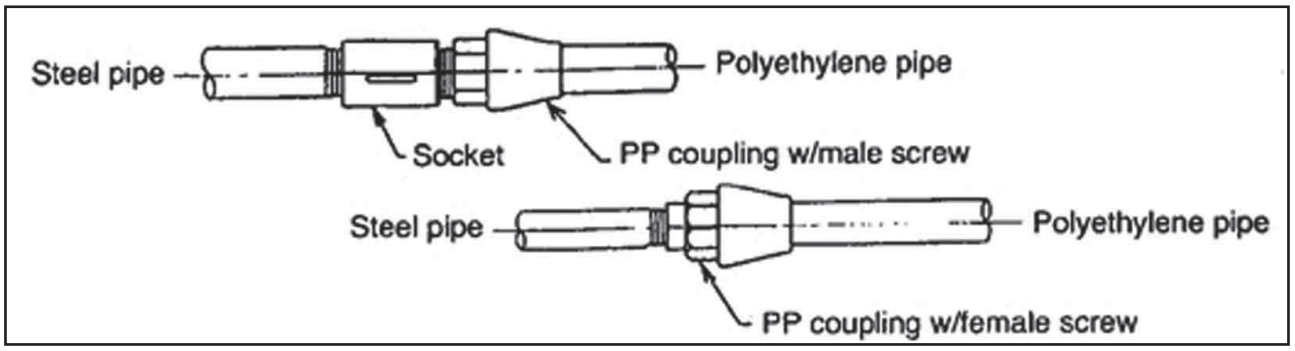
6.5 Joint of Pipes

Pipe jointing work is very important in the leakage prevention. The supervisor of jointing work should have enough knowledge, experience and understanding of principle of various types of joints.

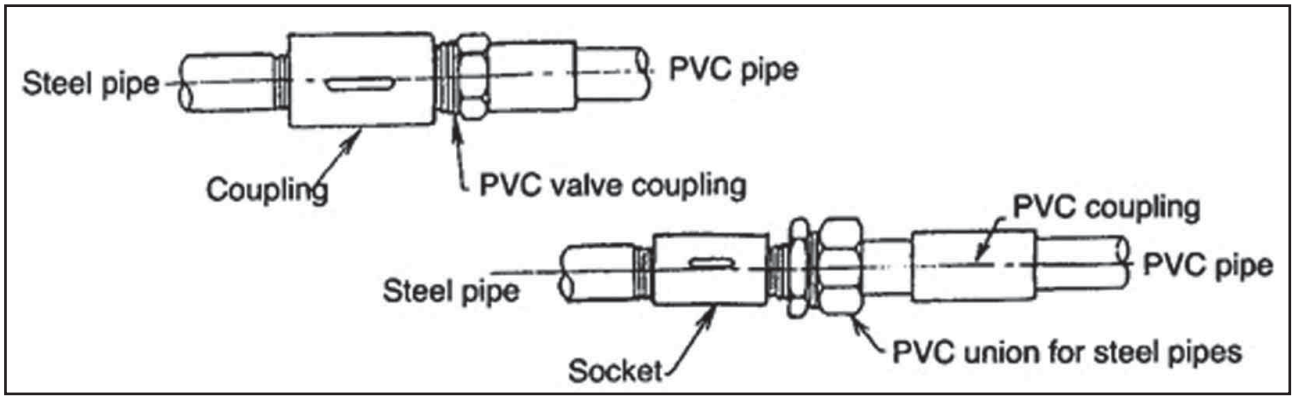
(1) Polyethylene (PE) pipe



(2) Steel pipe and Polyethylene pipe

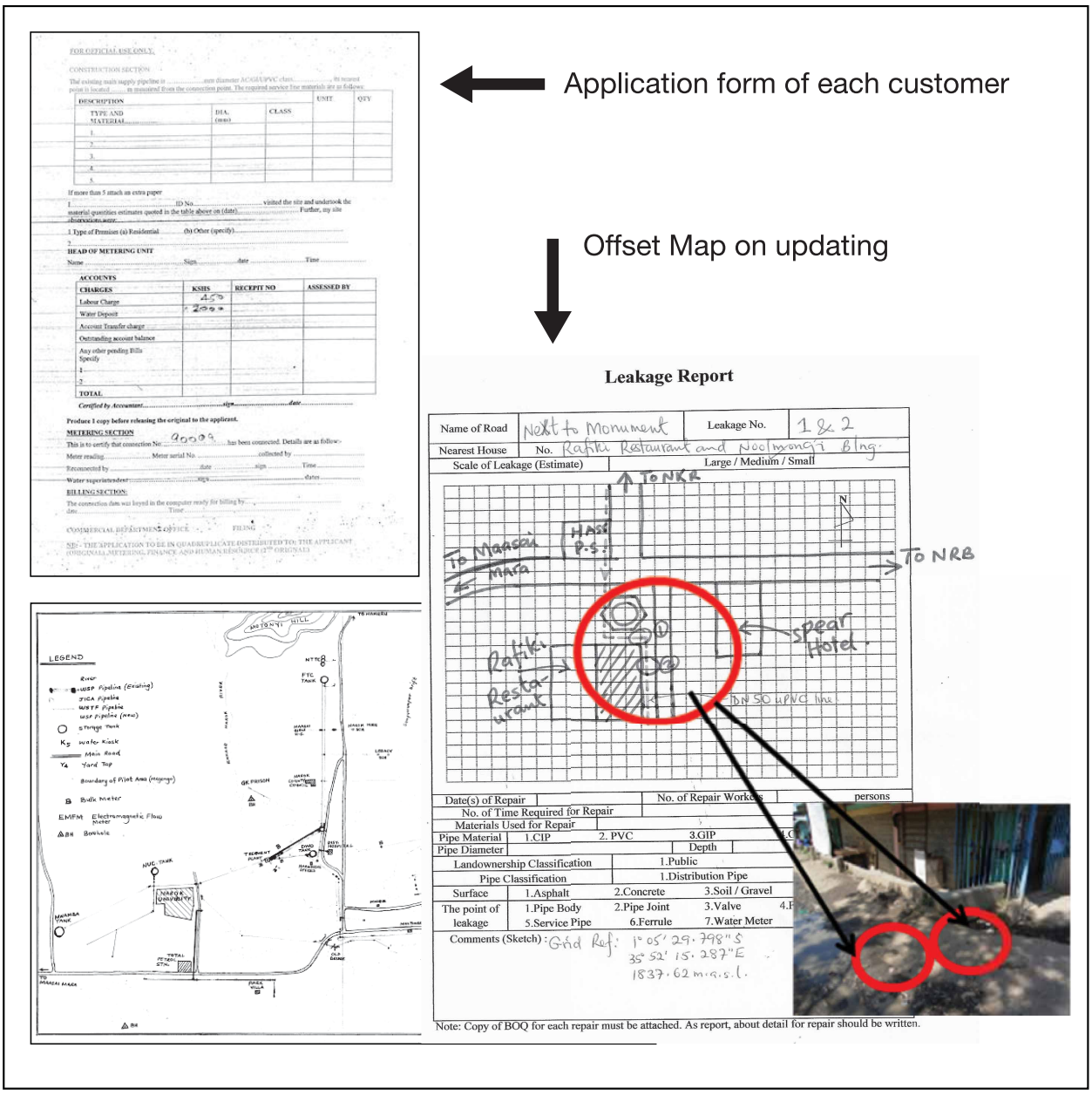


(3) PVC and Steel pipe



6.6 Updating of Map

When repair works are undertaken, the hand sketch map of the pipeline network must be updated.



It is important to record the type, diameter, location of pipes, valves, etc. on site by hand sketching and using the sketch to update the pipeline network maps, back in the office.

6.7 Inspection of Service Piping Work

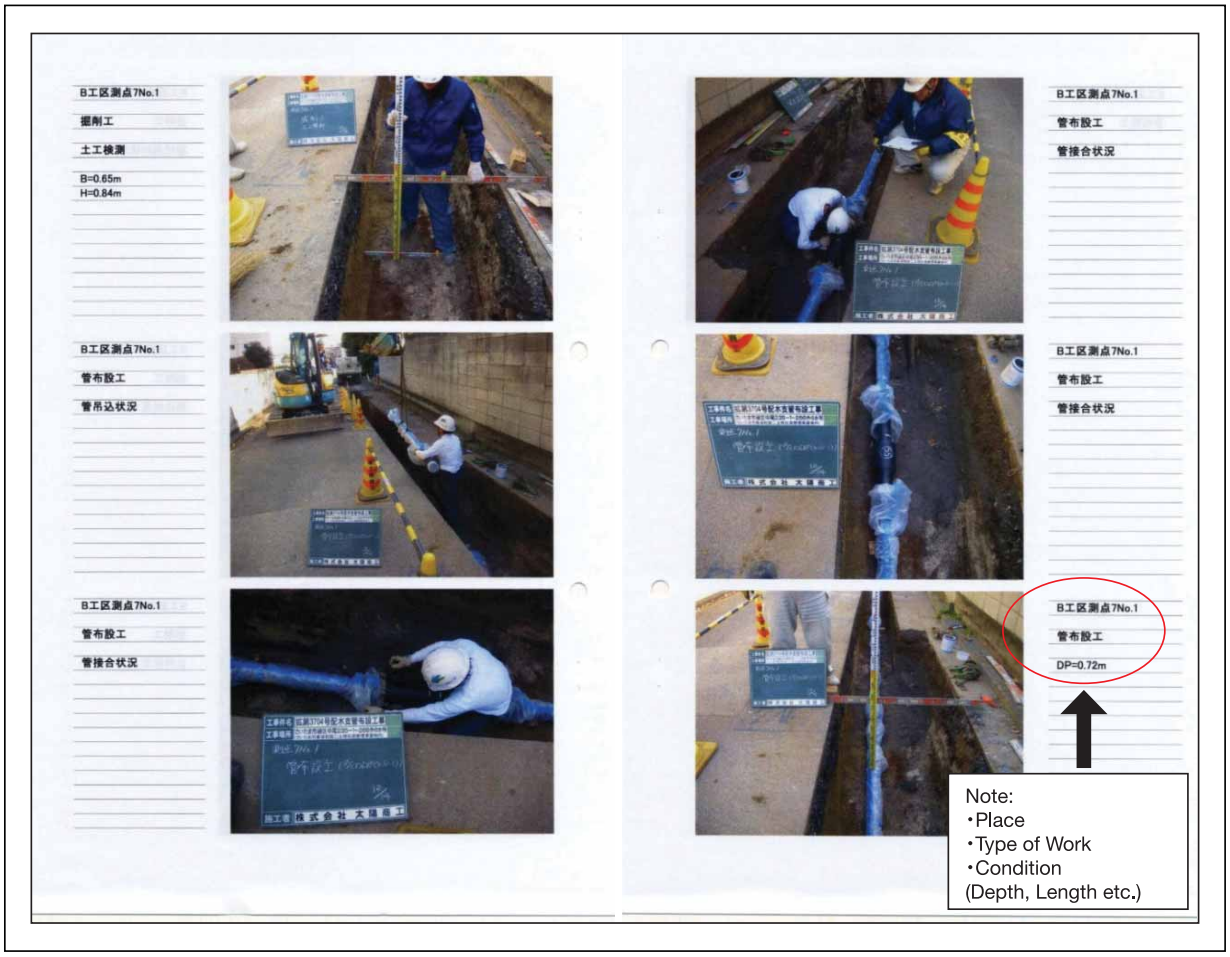
The figures below show examples of jointing of pipes of NAGOYA Waterworks Bureau, Japan. The following standards should be adhered to during piping work.

(1) Excavation Depth should be sufficient, as per the Practice Manual for Water Supply Services in Kenya, 2005

(2) Connections (Joints) should be done as per the Standard

(3) Backfilling should be done as per the Standard

(4) Record keeping with Photograph (Japanese case)



Chapter 7
Reduction of Commercial Losses

Focusing on reducing commercial losses can reduce NRW ratio to as low as about 30%.

7.1 Meter Errors

- Inspect of Customer Water Meter its operation, registration, location, etc.

- Install customer water meters to all customers (Gradually move towards 100% installation).

- Replace all aged and non-functioning meters with new ones

7.2 Update Water Meter Register

It is important to keep the water meters register constantly updated, as customer water consumption bills are based on information in the water meter register.

The best method for identifying billing system errors is by conducting a complete customer survey in the supply area.

7.3 Elimination of Illegal Connections

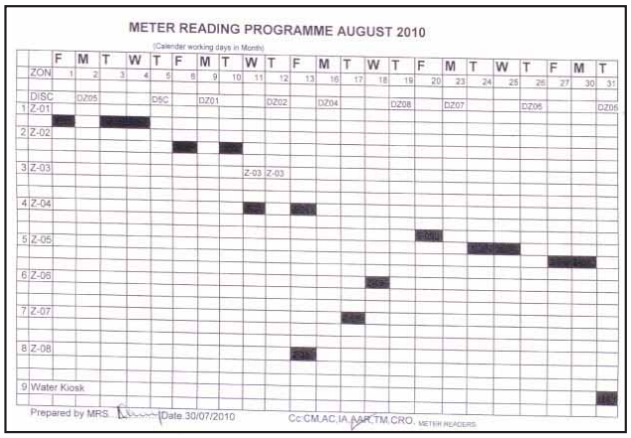
Detect illegal connections by line patrolling of distribution and service lines and inspection of water meters.

Take action against illegal connections by either disconnecting the service followed by legal action or legalizing the connection.

7.4 Water Accounting Errors

(1) Misreading by Meter Readers

Training meter readers



Typical Schedule of meter reading

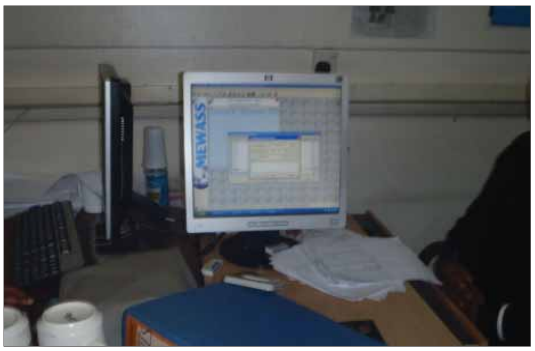
Check list of previous meter readings and compare with current actual readings to eliminate error due to misreading

- Enhance training to reduce misreading.
- Routinely alternate meter readers to prevent fraud
- To prevent misreading, carry a list of previous meter readings.

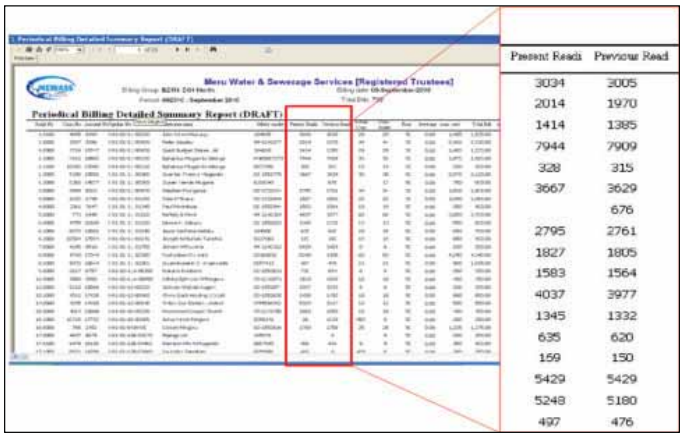
(2) Improve Billing System

Data logger

Take in Data



PC installed with processing software



Present Reads	Previous Read
3034	3005
2014	1970
1414	1385
7944	7909
328	315
3667	3629
	676
2795	2761
1827	1805
1583	1564
4037	3977
1345	1332
635	620
159	150
5429	5429
5248	5180
497	476

Processing software of MEWASS
「MAJICS」

Read meter using data logger and manage gathered data using a computer system or software
Review the produced bills for errors, abnormality and authenticity of the output.

(3) Obstacles to Meter Readings

Meters can frequently be covered with mud, garbage or soaked in water. Thus, the readers do not read the meters correctly.

Install the meters in accessible locations where the readers can easily read them

Water Meter covered with mud

(4) Check the Volume of Water Consumption of Large Customers

Public Facilities, Large Factory, etc.

Hotel, e.t.c

Undertake monthly check and confirmation of the volume of water consumed by large consumers such as large factories, hotels, schools, hospitals, prisons, and confirm correctness of measurement of consumption and billing.

7.5 Others

(1) Meter Accuracy Test

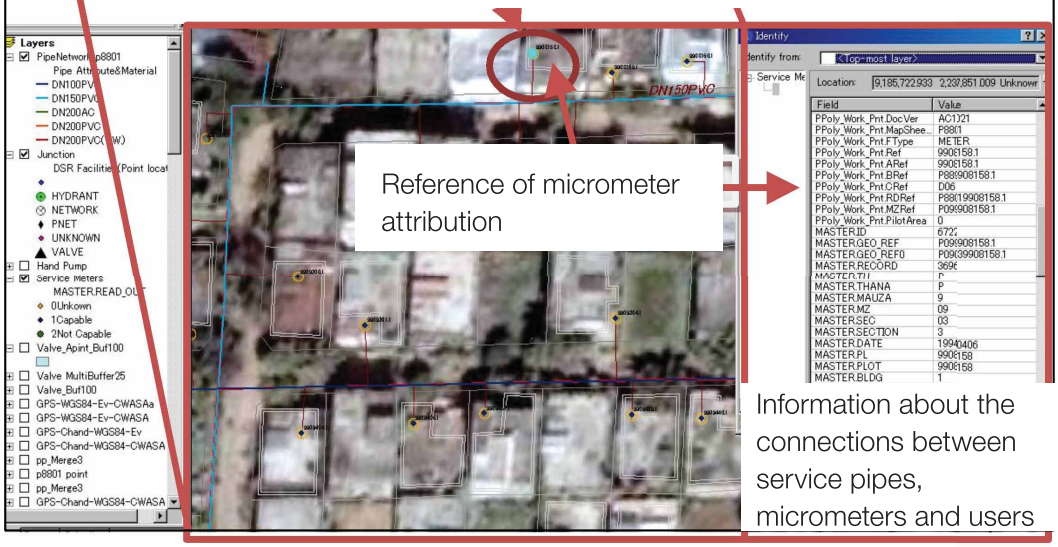
Water Meter Test Bench
(NYEWASCO)

Meter Test

- Test water meters periodically and calibrate for accuracy.
- Testing after categorization based on the year of installation and meter type in order to assess their performance.

(2) Introduction of GIS Database

Figure 1: Example of map of existent service pipe works



GIS has been introduced as a platform for the management of water service system, especially for its characteristic capacity for comprehensive management of maps and databases. GIS is used in areas such as data analysis methods, customer registers, revenue collection, etc.

Chapter 8
Water Pressure Management

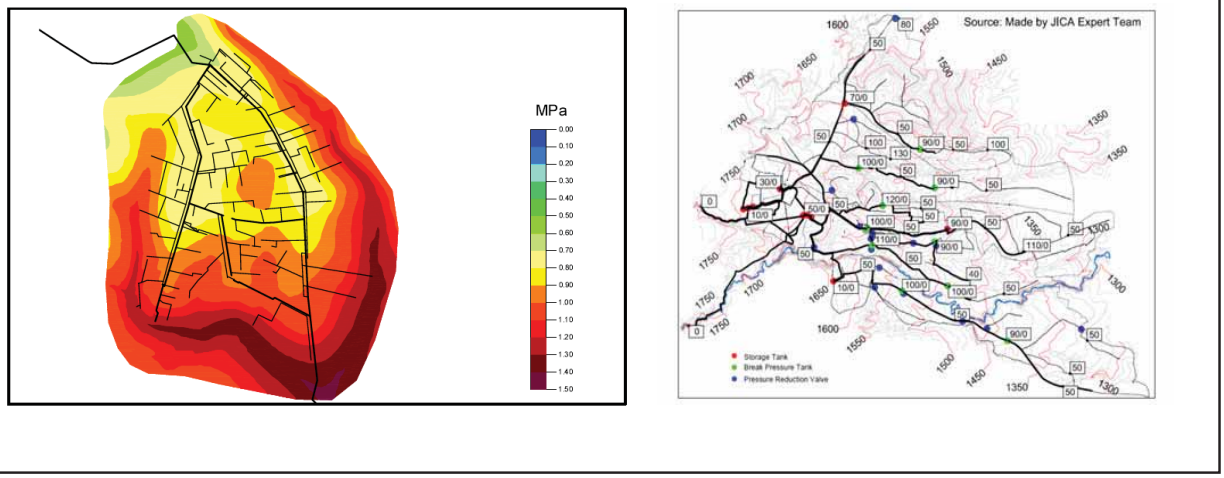
Water pressure management must be made a top priority in WSP located in area with a large difference of elevation.

8.1 Measurement of Water Pressure

Measurement of Water pressure at Domestic Meter

Measure water pressure at the middle of pipes or water taps of houses using water pressure gauge

8.2 Distribution Map of Water Pressure



Plot distribution map of water pressure based on the results of measurement of water pressure

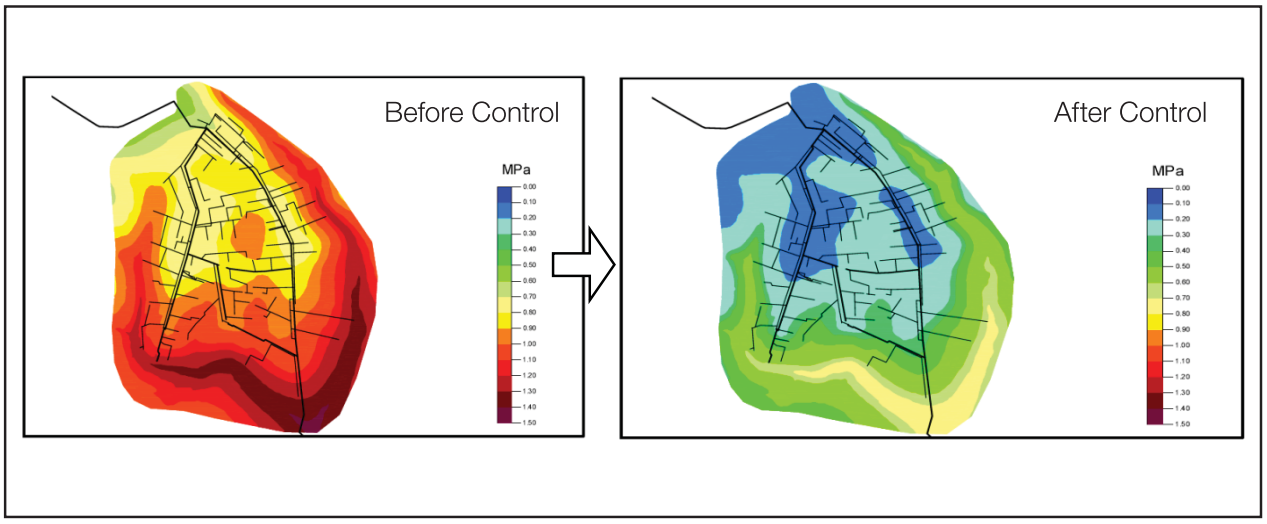
8.3 Introduction of Pressure Reducing Equipment

BPT (Break Pressure Tank)

Pressure Reducing Valve (Automatic adjustment)

Installation of Pressure Reducing Valve (Small)

Based on the distribution map of water pressure, determine suitable locations of pressure reducing equipment such as BPT (Break Pressure Tank) and Pressure Reducing Valve. (PRV)



Success Story

EWASCO succeeded in reducing the number of bursts, leakages and water shortages after controlling pressure by installing Pressure Reducing Valves.
(2010-2011: EWASCO Pilot Project)


Japan
60 years
60 years
Japan's Official Development Assistance