


Addis Ababa Water and Sewerage Authority





Vitens Evides
international

Leak detection

ADDIS ABABA WATER SERVICES

Leak detection
Operations & Maintenance Manual


- The Caretaker is responsible for their DMA's O&M Manuals
- Documents the DMA's operational, maintenance and performance data
- If the Caretaker becomes unavailable, then another Caretaker can use the Manual to efficiently take over their duties
- The starting point is the DMA's Detailed Design Notebook


Leak detection
Operations & Maintenance Manual

•Suggested DMA Manual Contents:

- 1.Asset data and location drawings
- 2.Schematic of the pipe network
- 3.Operation and maintenance schedule
- 4.Flow and pressure graphs
- 5.Baseline NRW and pressure, and latest NRW
- 6.Leakage step test procedures and results
- 7.Leak locations and leak reports
- 8.Health, safety and environmental risks




Leak detection Step testing



Leak detection
Leak detection Step test


- to locate leaks
- narrow the location
- successively isolating parts of the DMA Network
- first step furthest away from the DMA water meter
- one step takes around 20 minutes to see the impact
- check flow and pressure
- big drop in flow = increasing pressure means LEAK
- during night times (00.00 – 04.00 am)
 - water supply is shut-off
 - no disturbing measurements by fluctuations in water demand



Leak detection
With leak detection Step Test

- Narrow down Location
- Know location at street level →

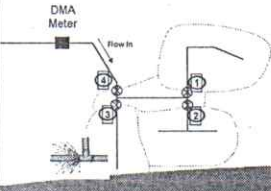
LEAK DETECTION



Leak Reduction using Step-Testing

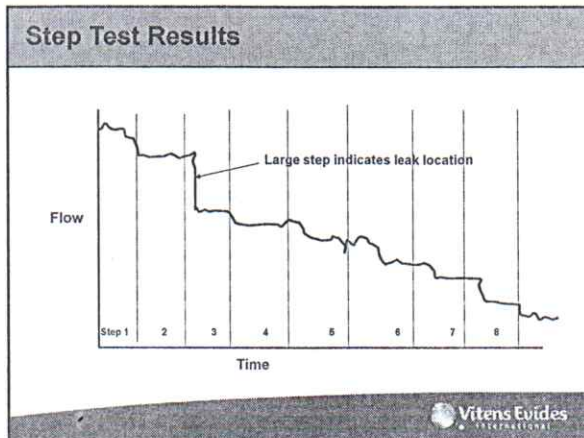
Simple example of a 4-stage step test:

- Predict how much theoretical demand there is in each step area
- First close valve 1 and see the effect on DMA supply at the Bulk meter
- Repeat with valve 2, then 3 and finally 4
- The closed valve that results in a large unexpected drop in flow indicates the DMA area with the most leakage



Flow	Step 1	Step 2	Step 3	Step 4
10	10	8	6	4
8				
6				
4				
2				
0				

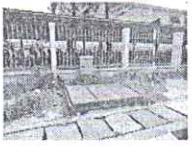


Most leakage in Step Area 3



- ### Methodology
1. Identify the DMA to be step-tested
 2. Mark on the DMA Plan the Inlet Meter and the Boundary Valves (BV)
 3. Draw a simple schematic of the DMA
 4. Identify step areas (maximum of 9 steps)
 5. Identify Step Valves (SVs) and mark on the schematic
 6. Colour code the steps
 7. If correct, then transfer the step-test design onto the GIS
 8. Identify large customers and number of properties in each step
 9. Calculate the Night Flow Consumption table
 10. Produce a valve checking table
 11. Visit the DMA and check the valves fully close; inspect the DMA meter; warn large customers of the step-test date and time
 12. Step-test the DMA

District Meter Areas


DMA = small isolated Network area
500 – 1,500 Service Connections
Input controlled by Flow meter

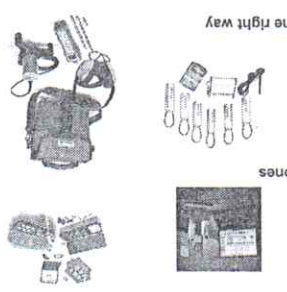
Leak detection

Equipment

- Types of equipment
- Noise detection
- The Leak searching Strategy
- The equipment



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- What do we have:
 - Noise loggers
 - Correlator
 - Leak pens / ground microphones
- Mission:
 - Find more leaks
- How:
 - By using the equipment on the right way

The equipment

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Why leak searching !!!!!!!

1,5 bar	8 mm	27 l / Min	38,8 m3 / PD	13,968 m3/Py	34,920 Birr
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Pressure	Diameters	L/min	M3/day	M3 / year	BIRR
1,5 bar	2	1,8	2,5	900	2.250 Birr
	4	7	10	3500	9.000 Birr
	6	27	38,8	13968	34.920 Birr

Why leak searching !!!!!!!

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Water loss	Diameters	L/min	M3/day	M3 / year	Price Birr a year
10 Bar	2	1,8	2,5	900	9.120 Birr
	4	7	10	3500	35.975 Birr
	6	27	38,8	13968	133.950 Birr
5 bar	2	1,8	2,5	900	8.375 Birr
	4	7	10	3500	23.725 Birr
	6	27	38,8	13968	92.200 Birr
3 bar	2	1,8	2,5	900	4.125 Birr
	4	7	10	3500	12.475 Birr
	6	27	38,8	13968	62.175 Birr
1,5 bar	2	1,8	2,5	900	2.250 Birr
	4	7	10	3500	6.000 Birr
	6	27	38,8	13968	34.920 Birr

Why leak searching !!!!!!!


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- General we loss 35% to 55 % of our water
- We call this NRW (Non Revenue Water)
- Also small leaks are important
- The Price of 1m3 water 1,75 Birr
- 1m3 water cost 2,5 Birr average

Why leak searching !!!!!!!

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- Learn to work with the equipment on the most simple way.
- Learn the possible things from the equipment
- Also learn the limitation of the equipment
- Awareness of possibilities among everyone
- That everybody can and will use it!

Types of equipment

Stethophon® 04



- Compact listening device for detecting water leaks
- New internal oscillation sensor
- Display: illuminated, segmented
- Digital indication of minimum value
- Filter function
- Hearing protection function
- External microphone can be connected
- Power supply: 2 AA batteries

Stethophon® 04



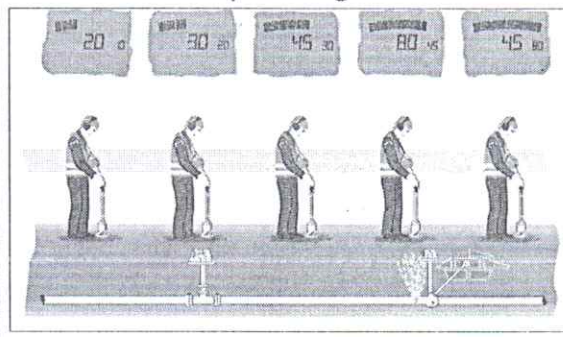
- Bag S4
- Headphone
- Test rod extension
- Ground microphone BM4

AQUAPHON® A100



- Rechargeable batteries (Ni-MH)
- New DSP technology
- Improved filtering

AQUAPHON® A100 - pin pointing



The equipment

The Equipment:

- It is a tool, It is an extra, It makes things more easy with better results!
- Never lose your logical sense; analyse the results and the location and than make conclusions

The basics of different brands are al the same, the keyword is:

- NOISE catching up Noise and convert this to Data



Noise detection

Leakpens, noise loggers, Correlators, Groundmikes

- They all work by catching up Noise and convert this to Data

Noise distribution

- Structure noise; through pipesystem!
 - Depends on pipematerial and pressure
- Groundborne noise; Through grond
 - Depens on Soil type, pressure and depth of pipe




Noise detection

Noise loggers have there advantage and some disadvantage.


Advantage

- You can program them at all time and place them all times
- Recording 24 hours with out taking care
- Accurate reading
- Low HR power needed
- Use under water
- Easy to use

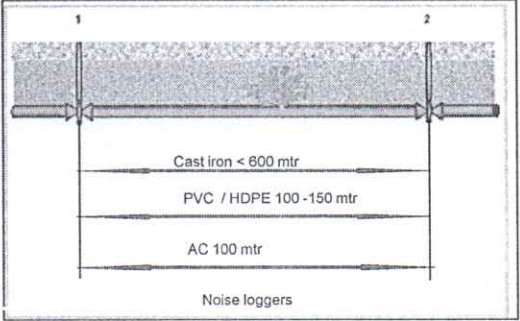


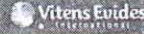
Disadvantage

- Limited distance between to valves
- Expensive



Noise detection






Noise detection

Correlators have there advance and some disadvantage.


Advantage

- Accurate readings
- Easy to use
- No interference by the weather

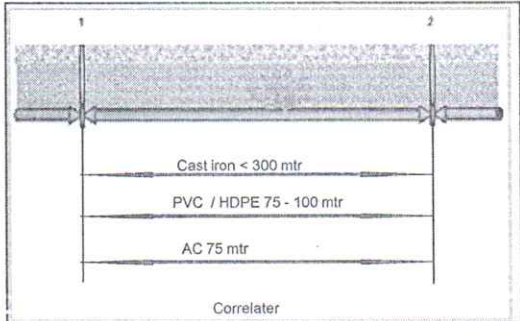



Disadvantage

- Limited distance between to valves
- Expensive



Noise detection







The strategy for leak searching

When we selected a area for leak searching we first checked all the data, is this data correct data.

- Maps
- Valve locations
- Are the valves we need uncoverd
- Are the valves top clean and free from dirt
- Are the valves fully open / close





Valves, valves, valves, valves, valves, valve, valves!!!!!!!!!!!!



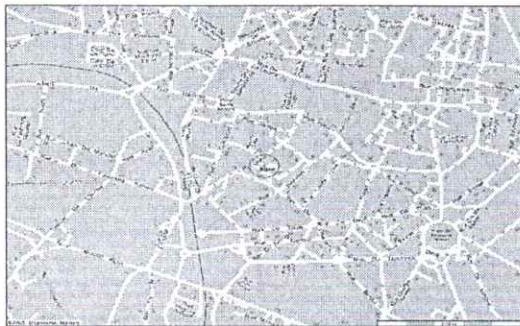
The strategy for leak searching

- FROM BIG TO SMALL, THE STEPS:
 - Big area: Noiseloggers
 - Medium section: Correlator
 - Small: GroundMike (for pinpointing if possible)
- USE MAPS OF THE INVESTIGATED AREA
 - For location of noiseloggers
 - For analysing results
 - For making plan for Correlator!





The strategy for leak searching



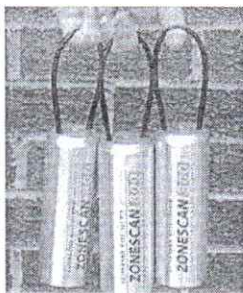
The strategy for leak searching



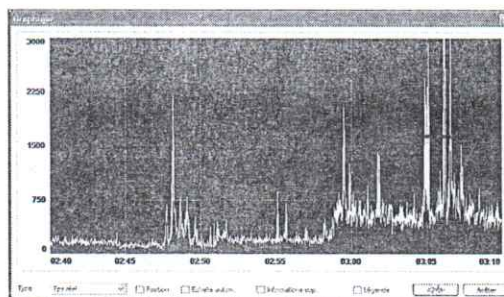
The strategy for leak searching

Example
On the valves we going to install the loggers.
We program them that they will read between 02:00 and 05:00 AM

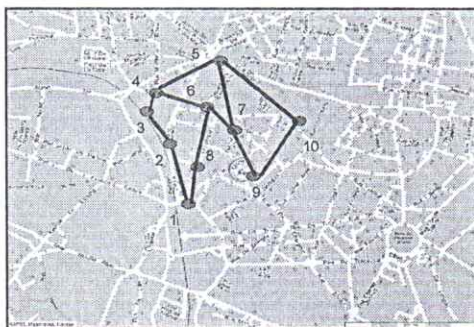
The next morning at 09:00 AM we going to pick them up. And read the results



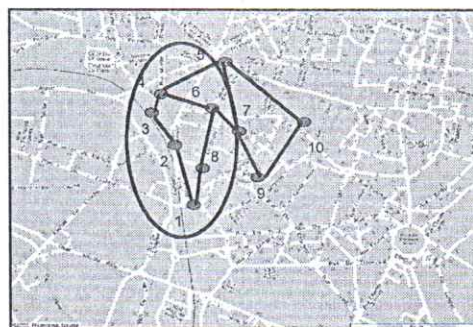
The strategy for leak searching



The strategy for leak searching



The strategy for leak searching



The strategy for leak searching

So we concentrate on this area

The strategy for leak searching

We going to use the correlator now in this Area to pin point the leaks

The strategy for leak searching

We go to correlated in the field

- We need: Data
 - Pipe Material (Cast iron, PVC, HDPE, AC)
 - Pipe Diameter
 - Exact Distance between valves (by measuring wheel)
- Place two microphones on the selected valves
- Connect the microphones to the transmitter
- Start the computer

The strategy for leak searching

The strategy for leak searching

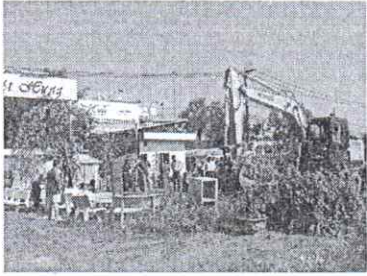

Leak detection

Video



The strategy for leak searching

We found a leak!!!!!!
And what now????

REPAIR





The strategy for leak searching





Wrap up

- The equipment is a tool
- Never lose your logical sense; analyse the results and the location and than make conclusions




Active Leakage Control (ALC)



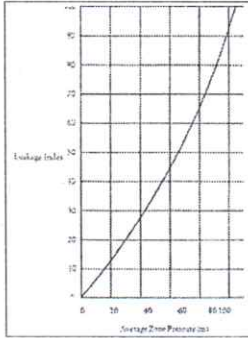
ALC

Active leakage control (ALC) is vital to cost-effective and efficient leakage management.

The concept of monitoring flows into zones, or district meter areas (DMAs), where bursts and leaks are unreported is now an internationally accepted and well-established technique to determine where leak location activities should be undertaken. The quicker the operator can analyse DMA flow data, the quicker bursts or leaks can be located. This, together with speedy repair, limits the total volume of water lost. There are many points in a distribution network where leakages can occur and where they are best monitored.



Pressure and Leakage Relationship




- The relationship between pressure and leakage is almost linear
- A 10% decrease in pressure can produce a 10% decrease in leakage
- Reducing pressure is the most cost effective method for reducing leakage

Operations and Maintenance


O&M Manuals

- Map network
- Locations valves, hydrants etc
- O&M schedule
- Customer data base and service connections
- Flow and Pressure graphs
- Step test procedures
- Leak reports
- Health and safety issues




Failure

In each DMA there are a lot of leaks in household service connections a year



What is the reason that our service connection pipe burst / leak



Do you know?



Preventative maintenance in practice

Before we do preventative maintenance or inspections a number of conditions must be met:

- > The location of all appendages is stored in an electronic database (like GIS)
- > The appendage must be accessible.
- > The appendage must be clearly visible.
- > The appendage must be clean.
- > The nearby surroundings of the appendage must be clean. (no bushes, weeds or litter).
- > The box of the appendage is not broken.
- > The box is covered with a steel or concrete lit.
- > The box is clean (no weeds or litter inside the box).


Activities for Operations & Maintenance

Repair and Maintenance of the network



- > Regular maintenance of the network
- > Maintenance of appendages (Valves, Fire Hydrants, ect..)
- > Maintenance of distribution pumps and booster stations
- > Repair leakages
- > Flush and clean pipelines based on a schedule

Investments

- > Replacement and extensions of the network in including house connections



Questions


For your attention

