BEST PRACTICE

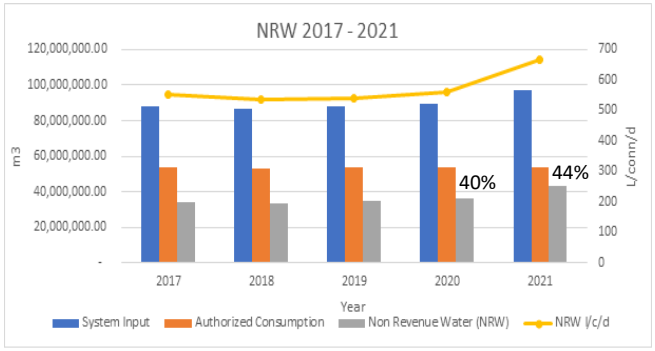
The 'Human Factor' and Role of Telemetry in Scaling-up DMA-based NRW reduction in Kota Semarang

It's a international best practice to apply a District Metered Area (DMA) approach to locate, quantify (total volume and Physical/Commercial loss ratio), and reduce NRW losses. Project interventions, righly so, typically focus on 'piloting' this approach within one or more supply areas. This factsheet concludes that the scale-up of this approach requires a dedicated (full-time), motivated, well trained and -equiped NRW team (the 'human factor') and the use of telemetry (online flow/pressure measurement).

Challenge

With water utility expenditure concentrated on meeting growing water demand (i.e. new connections), network maintenance and 'smart investment' budgets (e.g. PRVs to reduce physical losses, water meters to reduce commercial losses) are often reduced. As a result, Non-Revenue Water (NRW) levels increase, revenues decrease and operational costs gradually increase, the Operating Cost Coverage ratio dwindles and debt financing capacity to finance large-scale investment is compromised.

Serving 1.65 million residents in Kota Semarang (Indonesia), PDAM Semarang is struggling to reduce its NRW levels – particularly since the the production capacity was increased by 15% (with the commissioning of a new WTP) 2 years ago. Considering the significant monetary value of incurred losses (±USD 3M per year) under the existing working procedures and organisational setup (with responsibilities for NRW management scattered across various departments), PDAM Semarang prioritised this activity under the Water Operator Partnership (2018-2025) with VEI.

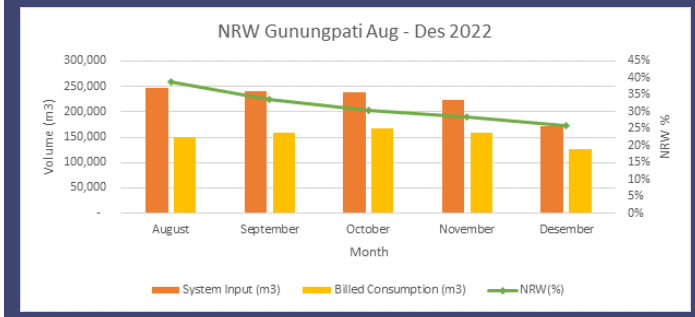


The WOP team members shared one common challenge: how to convince senior managers of the need for a dedicated NRW team to locate, quantify and reduce NRW losses, building on past success in small DMAS (i.e. of less than 1000 connections).

COP6

Water Distribution

Perumda Air Minum Tirta Moedal Kota Semarang



CONTACT INFORMATION:

Ardian Wiedilaksono, Project Consultant PDAM Semarang
Ratna B. K. (Nia), Head Physical Losses Unit PDAM Semarang
Thomas de Jong, Project Manager VEI
Reint-Jan de Blois, Water distribution CoP Coordinator VEI

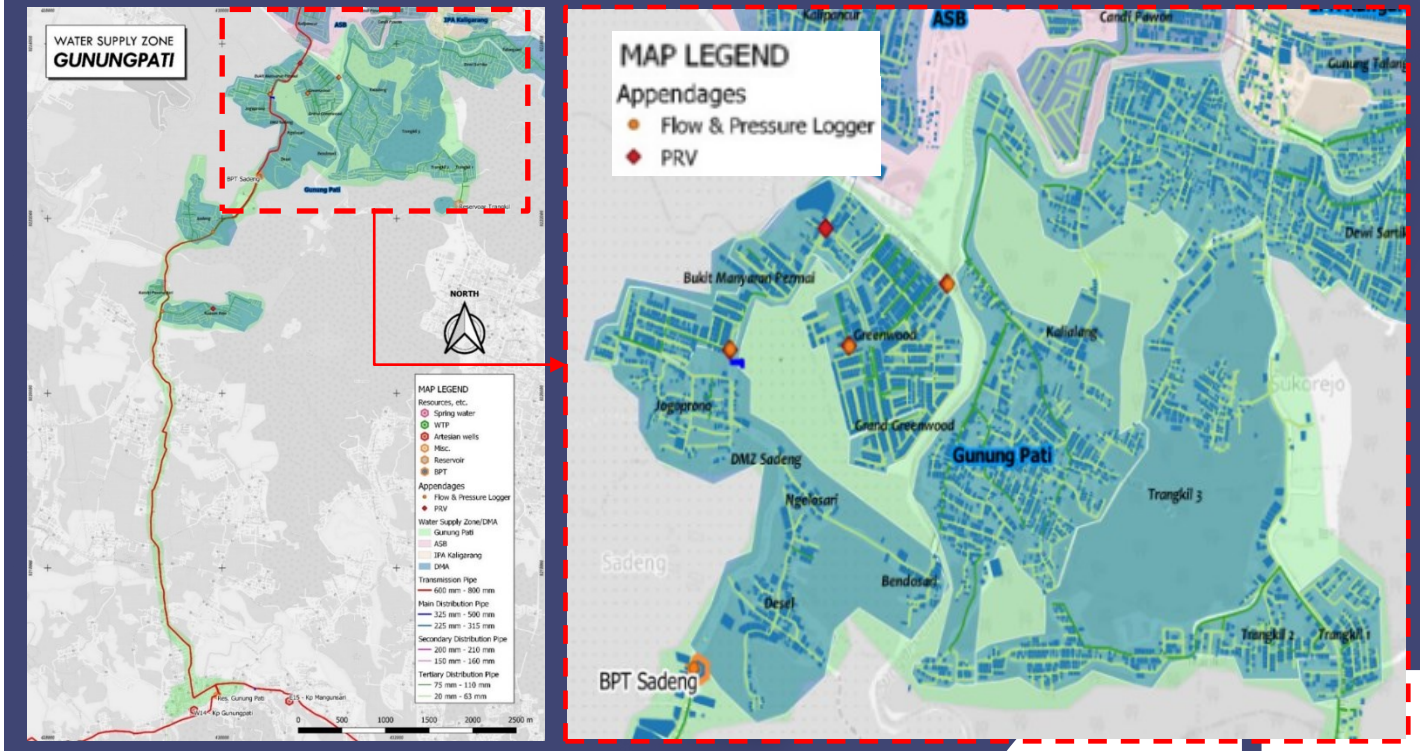
Approach

The saying *'if you cannot measure it, you cannot improve it'* holds true to NRW reduction efforts as well. While monthly water balance calculations can be effectively done using permanently installed bulk (system-input) and consumer meters, Minimum Night Flow (MNF) measurements (to quantify the Physical/ Commercial losses ratio) requires portable equipment (ultrasonic flow meter and pressure logger) to implement; this can be done effectively at a DMA level (in a 'one-off' pilot setting) but NOT at supply zone or utility-level.

This requires the **installation of telemetry (permanent flow/ pressure sensors and data loggers)** that can be used to monitor the DAILY distribution of water (i.e. from a Control Centre where the data can be visualised and analysed), estimate the water losses volume (using MNF/pressure measurement data) and monitor progress by a dedicated Active Leak Detection (ALD) team in reducing these losses to an acceptable level. To convince senior management that a **dedicated NRW Department (with three newly established ALD - Commercial Loss Reduction - Instrument Control & SCADA units)** could generate the desired return on investment, this approach was 'piloted' in the one of the 11 supply zones.

A top-down assessment (IWA water balance) of the NRW losses (using EasyCalc) estimated the Physical losses at 90% (with an Infrastructure Leakage Index of close to 50; higher than all but one PDAM's in Indonesia.

A 'leak component analysis' estimated unavoidable/ reported/searched for/unreported leak volumes at 2.4%/0.6%/17%/80% respectively (storage reservoir overflows 0%). Out of these 28%/37%/19%/16% on service lines/tertiary/secundary/primary mains.



The 'Gunungpati' Supply Zone (7.500 connections, 13 DMAs) showing the location of a selection of the 13 installed flow/pressure (data) loggers; measurement results of which were used to guide Active Leak Detection Activities and Physical Loss reduction interventions (see overleaf): pipe repair, PRV installation (pressure management), pipe replacement

Prior to the WOP intervention, active leak detection was practically non-existent. Zonal leak repair teams would repair ±25 (by customer) reported VISIBLE leaks per day. Considering that the NRW level was not decreasing with a much larger volume of water lost to unreported INVISIBLE leaks (as per the component analysis), the management team agreed to the proposed establishment of 2 dedicated Active Leak Detection (ALD) teams to scale-up leak detection and repair. ALD team members were recruited from the existing leak repair teams on the basis of interviews and hearing tests using acoustic leak detection equipment. Each team was equipped with a ground microphone and a stick and trained -on leak detection principles (in class) and approaches (in-field)- by VEI's ALD Expert. With leak repair teams on standby, staff could experience the impact of a joint -ALD/leak repair- team effort first hand.

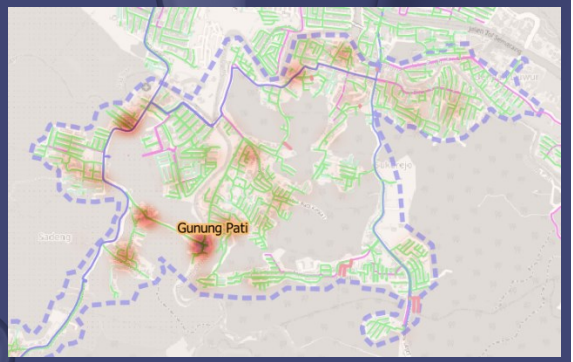
To cost-effectively prioritize (a selection of) the 13 DMAs in the 'Gunungpati' supply zone (with 7.500 connections in total) for the ALD activities (i.e. those with the largest NRW volume), the WOP co-invested in 17 flow and pressure sensors/data loggers. This enabled the Controle Centre staff to monitor the impact of the leak detection and repair activities without having to wait for the results of monthly water balance calculations.

Results

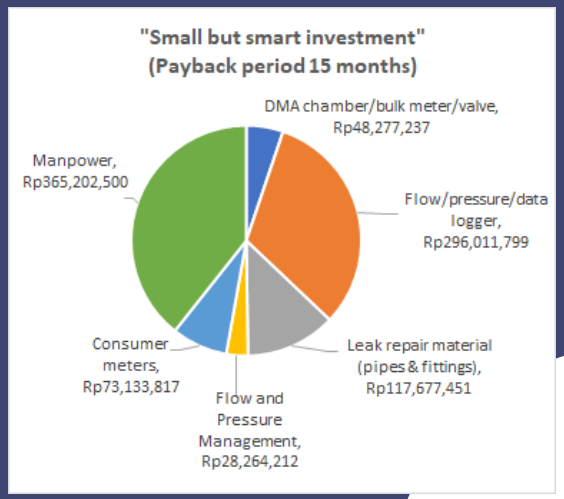
Through the ALD activities, 2 to 4 additional underground (INVISIBLE) leaks were identified and repaired every day. A generated 'leak (recurrence) heatmap' guided the installation of Pressure Reducing Valves and/or pipe replacement. Within 4 months time, NRW was reduced from 39% to 25% (711.000 m^3 yearly ≈ 4/5th of an olympic swimming pool daily!) in 5 months time (Aug-Dec 2022) - with a payback period for hardware and staff costs of ±1,25 years (15 months).

The PDAM Semerang team has been actively involved in Global WOPs - Community of Practice on Water Distribution where numerous NRW/GIS/Hydraulic modelling experts have been sharing results and insights from evaluated and ongoing WOP interventions. Following a presentation of a their planned approach in June 2021, these results -and the underlying story- will be presented to peers in a COP webinar in June 2023.

Training of ALD team members (left) and Training of Trainers (right) targetting best performers - focussed on strengthening PDAM Semarang's capacity to sustain the (transfer of) knowledge in the future.



'Leak (recurrence) heat map'



Documentation

Click here for the full paper (presented at the GWOPA WOPs Congress May 22-25th 2023)

Here you can register -free of charge- on the Global WOPs Community of Practitioners (Workplace) platform hosted by GWOPA.