HYDRAULIC MODELLING AND WATER LOSS MANAGEMENT

VEOLIA

Summary

1. Water Balance
2. Water Loss Evolution 2000 - present
3. Actual Water Losses in Veolia – CEE
4. Management of water losses
5. Hydraulic modelling
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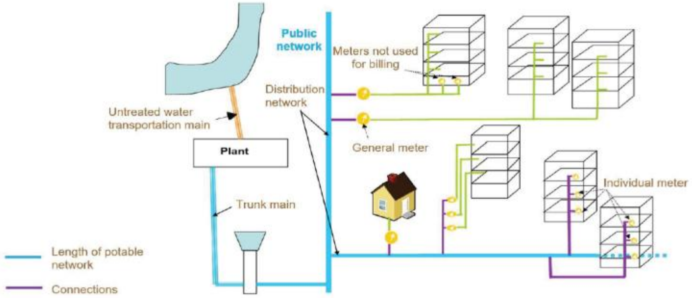
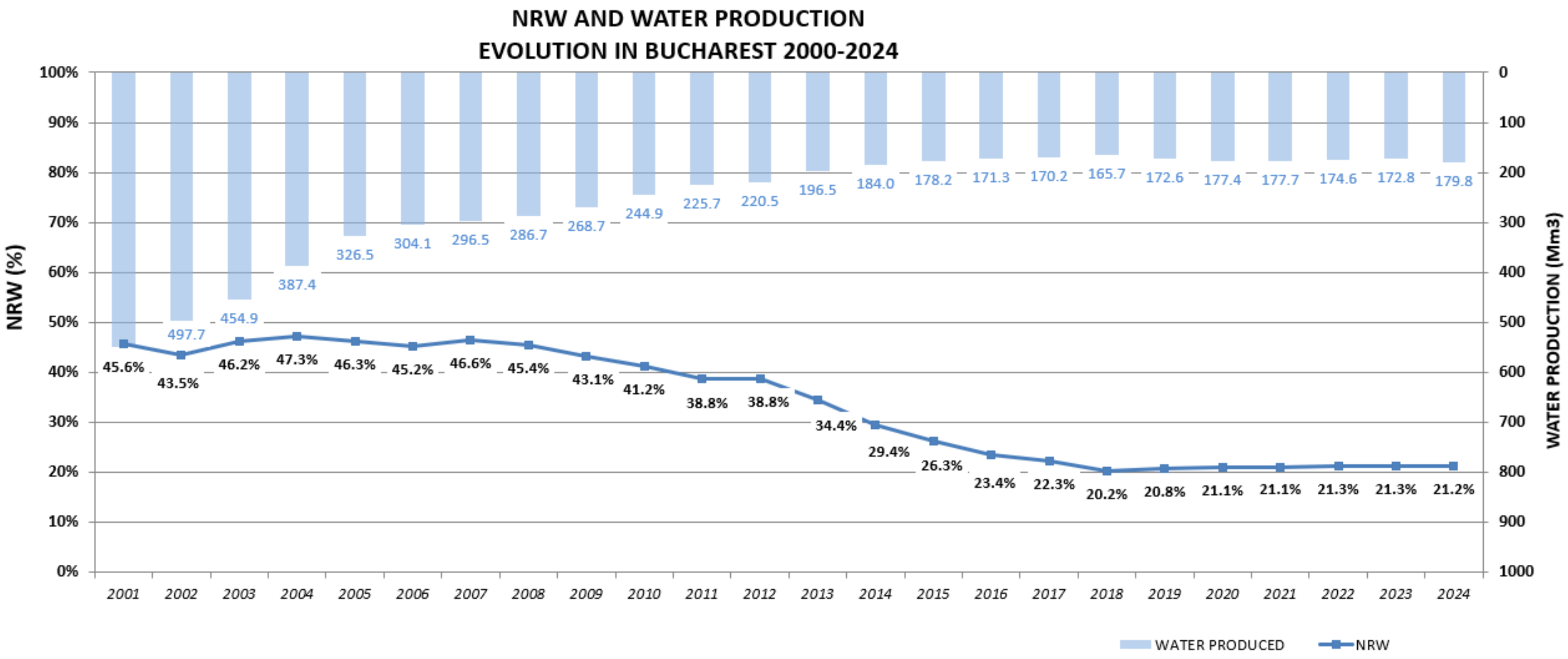
Water Balance

System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered Consumption	Non Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorised Consumption	
			Customer Meter Inaccuracies	
		Real Losses	Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Storage Tanks	
			Leakage on Service Connections up to point of Customer Meter	

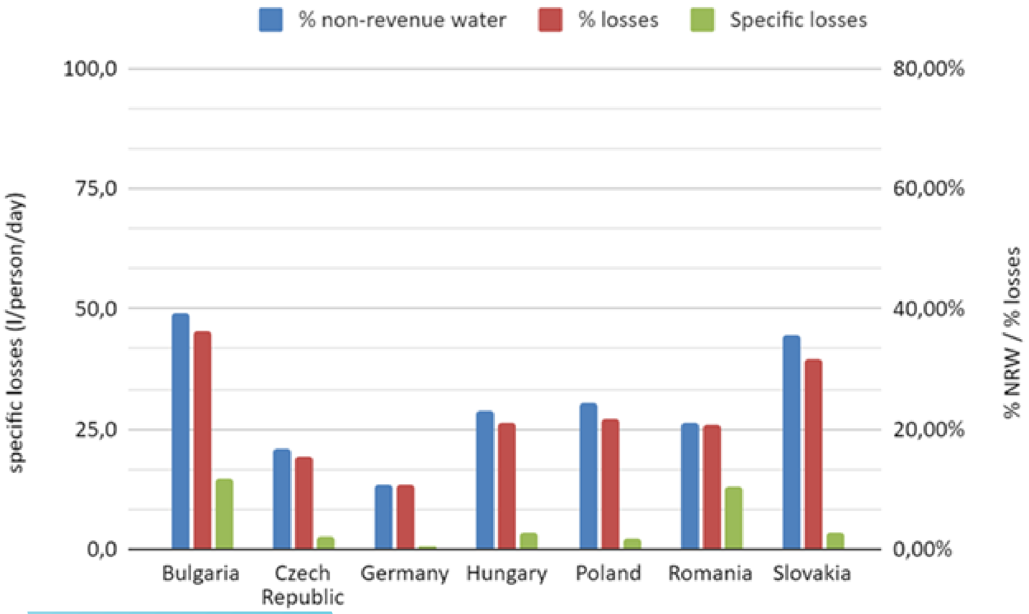
Standard water balance from IWA (International Water Association)

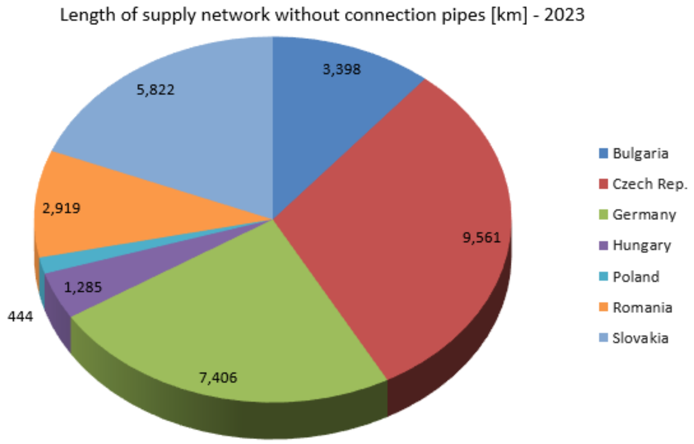


Bucharest Water Loss Evolution 2000 - present



Actual water losses in Veolia – Central and Eastern Europe





Management of water losses

Based on NRW assessment, different stages of development related tot to NRW for water utility companies could be distinguished, based on NRW percentage or NRW magnitude (volume) or both of them:

- **Beginner (NRW > 50%);**
- **Medium (NRW= 30-50%);**
- **Advanced (NRW= 20-30%);**
- **Top class (NRW < 20%).**

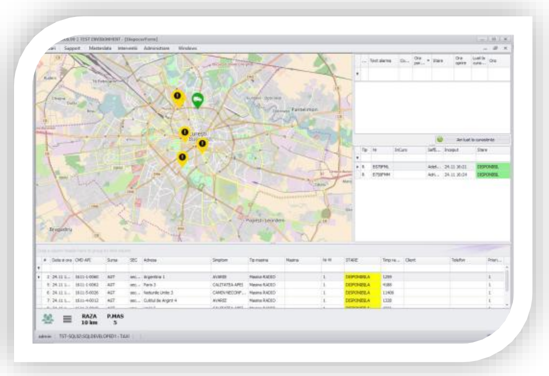
It is obvious that the specific actions for different stages are different from both technical and investment perspectives.

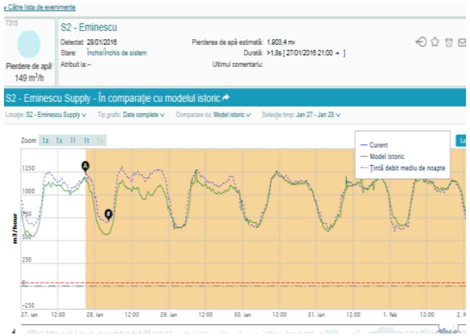
A successful NRW reduction programme takes into consideration the current stage of development, legal/contractual obligations, investment plan and prioritization of cost-effective solutions. It should be based on best available technologies and work organization measures .

Management of water losses

Work force management

- SCADA system for the Distribution Zone (45k signals);
- Real time monitoring of the system's efficiency (flow / pressure);
- Early pipe failure / bursts detections with statistical analysis;
- Dedicated software for hydraulic modeling;
- Reduce intervention time for leak repairs.





Impact after implementation			
INDICATOR	PERCENT	IMPROVED	
Number of notifications	8.80%	↘	√
Average intervention response time	30.60%	↘	√
Number of interventions / team	35.00%	↗	√
Operational teams requested	15.70%	↘	√

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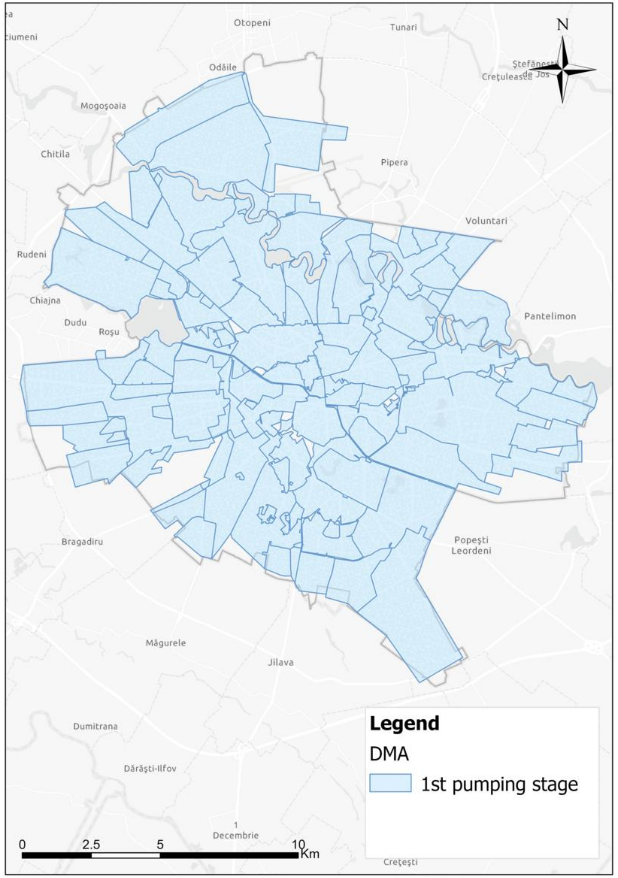
Management of water losses

District Metered Areas (DMAs)

A DMA is defined as a discrete area of a distribution system usually created by the closure of valves or complete disconnection of pipe work in which the quantities of water entering and leaving the area are metered. The flow is analyzed to quantify the level of leakage. (*IWA, Water Loss Task Force*)

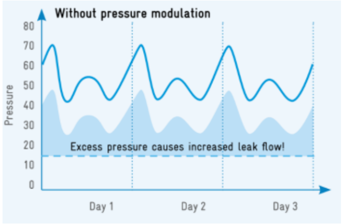
- Over 250 DMAs in Bucharest;
- Average network length is 10 km per DMA;
- Designed for Active Leakage Control;
- Assess Minimum night flow per DMA;
- Determine real and apparent losses at the level of DMA;
- Establish optimal pressure regime in each DMA;

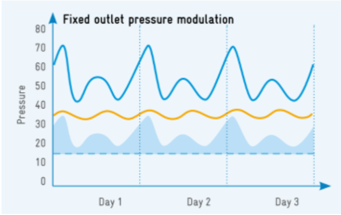


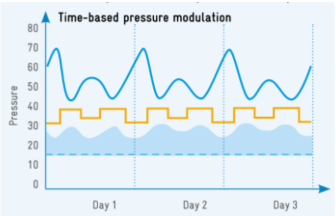
Management of water losses

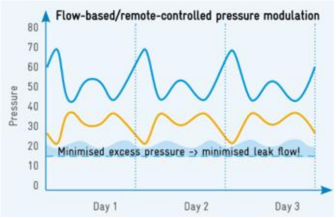
Pressure Management

- **Fixed outlet:** pressure is maintained at a chosen level at all times;
- **Time-based pressure modulation**: pressure is modulated according to the time, usually to reduce pressure during night time when flow rates are low.
- **Flow-based pressure modulation:** different outlet pressures can be set for different flow rates in order to maintain the minimum required pressure in the zone during peak flow
- **Remote-controlled pressure modulation:** using the most advanced type of pressure modulation, outlet pressure is continuously adjusted via telemetry from pressure sensors at one or more critical points in the DMA where the pressure is kept stable at the desired level.





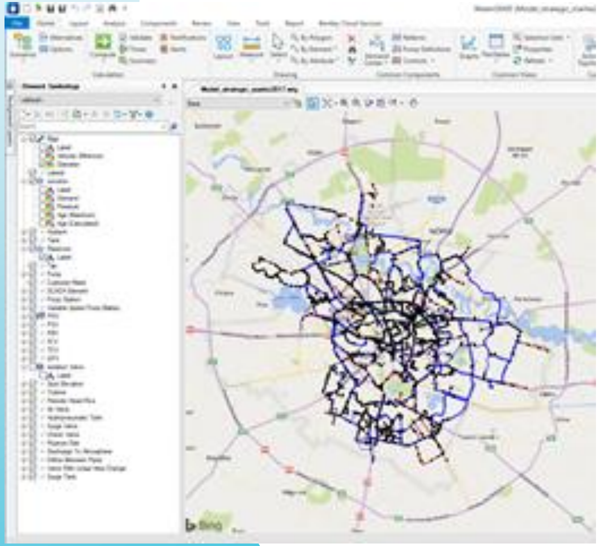




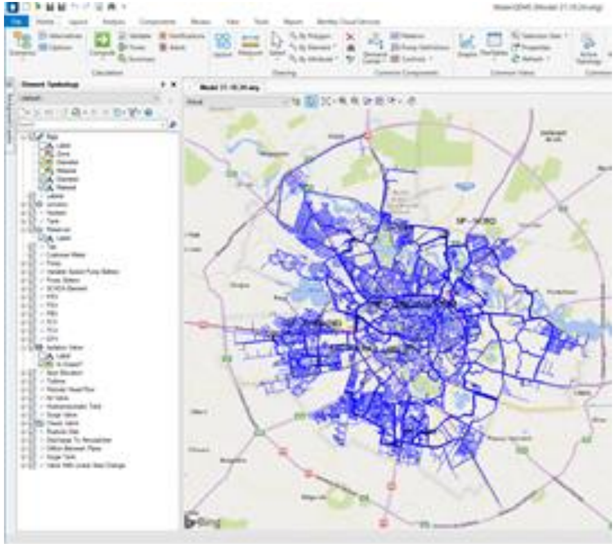
Hydraulic modelling

Objectives:

- Identifying the water network losses by modelling various parameters: pressure / flows / quality;
- Water balance on the trunk pipelines to determine potential water losses
- Optimal pipe replacement and network extension.



Strategical model



Detailed model

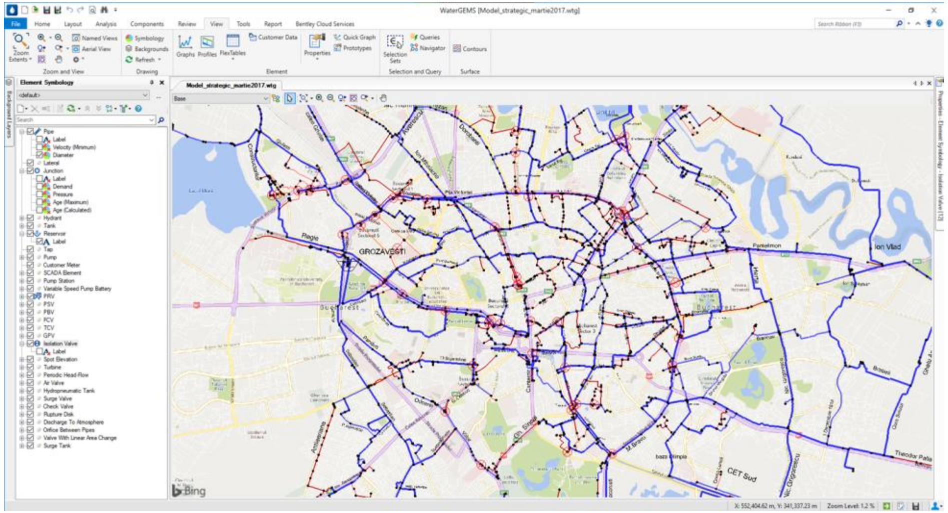
Hydraulic modelling

Strategical model

- contain 1st pumping stage;
- main pipes with DN > 250 mm.

Used for:

- Pressure management for 1st pumping stage;
- 1st step for creating DMAs;
- Better knowledge for system function;
- Identify main losses zones & major low efficiency problems.



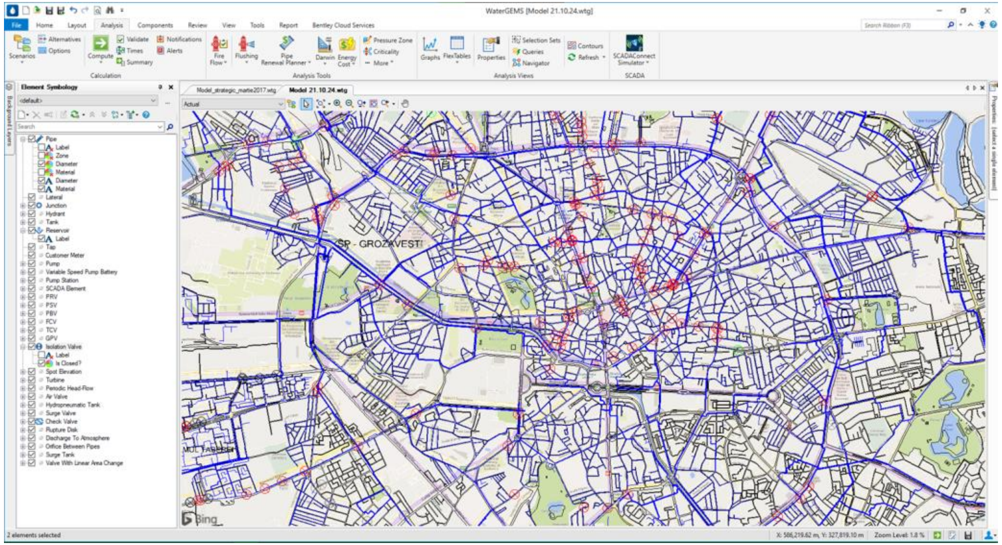
Hydraulic modelling

Detailed model

- contains all the network;

Used for:

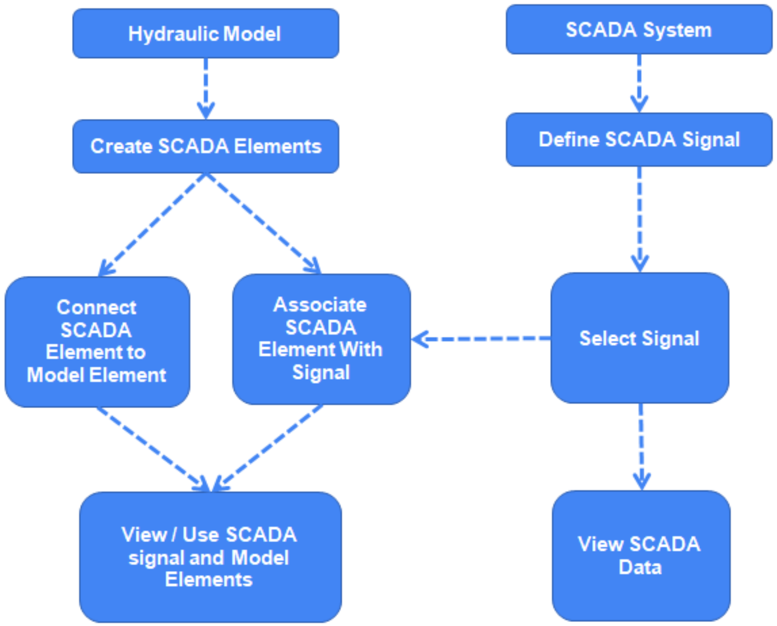
- Detailed pressure management at city scale;
- Optimizing the DMA's configuration and network functionality;
- Overall energy efficiency;
- Identify the area with possible apparent and real losses;
- Hydraulic impact analysis for main maintenance activity;
- Detailed knowledge of all water network function parameters;
- Identify the open district isolation valves;



Hydraulic modelling

Real-time modeling of Water Distribution

- The hydraulic simulations are a key part in the process of water supply;
- Each technology complements the other;
- Forecast and solve both design and operation issues;
- Information mobility across engineering and operations;
- Better decisions thanks to the simulation's ability to use real world SCADA data as the initial conditions;
- The results of the simulation can be passed back into the SCADA control system to help operations.



Conclusions

Based on our experiences we could state that there is not a prescription for actions (or their priority) that should be conducted in order to achieve a successful NRW reduction programme but we can recommend that for different stages of development, some actions are more efficient than the others, such as:

Beginner (NRW > 50%);

- installation of measurement systems for all inlets;
- design and deployment of SCADA system;
- design and deployment of GIS;
- design and deployment of a commercial database;
- metering of all customers.
- Basic design of DMAs;

Advanced (NRW= 20-30%);

- Smart metering, prioritized based on consumption;
- Workforce management in order to decrese intervention / repair time of leaks;
- Optimization of costs based on repair vs. replace comparison;

Medium (NRW= 30-50%);

- Design of hydraulic models;
- Optimize DMAs according to DWN length;
- Assessment of real and apparent losses for DMAs;
- Comprehensive operational actions within DMAs with high water losses;
- Pumping optimization programmes

Top class (NRW < 20%)

- Asset management application;
- Fully smart metering;
- Use of best available technologies for leak detection;

Thank you for your attention !

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