



DHI CASE STORY

THE URBAN ON-LINE WATER (UOW) SYSTEM FOR ZURICH

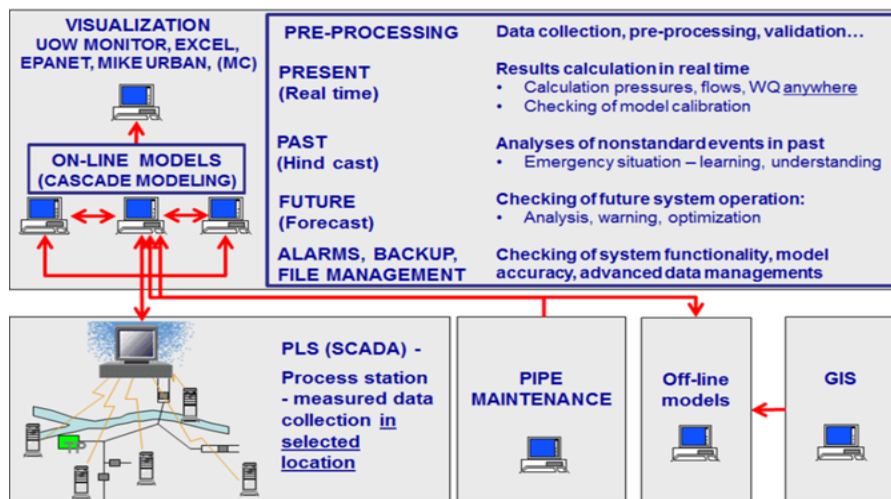
A monitoring system to improve the city's water distribution network performance

Due to a lack of information about the behaviour of, and hydraulic/quality conditions in the Zurich Water Supply (WVZ) network, WVZ started a pilot project with us. In this project, we set up an Urban On-line Water (UOW) modelling system in Hangzone Sonnenberg (HZS) – the third largest and most complex pressure zone of Zurich. The UOW consisted of on-line hydraulic and water quality models interconnected with the hydraulic and water quality sensors in the network.

This will help WVZ gain actual information about the hydraulic conditions, the mixing of water from different sources and the water quality in the network. In so doing, WVZ hopes to improve the system's overall performance (in terms of economy, service level and safety), through an increased ability to control and manage issues related to water flow, quality and security.

UNDERSTANDING THE ZURICH WATER SUPPLY (WVZ) NETWORK

The Zurich Water Supply (WVZ) network is approximately 1500 km long in total. Almost all inflows and outflows of the supply zones are measured in the supervisory control and data acquisition (SCADA) system. However, there are only a few water meters within the zone's network and pressure meters are installed in some shafts. Not all of them are integrated in the SCADA system.



SUMMARY

CLIENT

Zurich Water Supply (WVZ)

CHALLENGE

- Lack of information about the behaviour of, and hydraulic/quality conditions in the Zurich Water Supply (WVZ) network
- Need to understand the network, in order to detect changes in future quality variations within it
- Need to improve the overall performance of the water distribution network

SOLUTION

An Urban On-line Water (UOW) system, comprising hydraulic and water quality models

VALUE

- Helping WVZ gain actual information about the hydraulic conditions, the mixing of water from different sources and the water quality in the network
- Increased ability to control and manage issues related to water flow, quality and security within the city's water distribution network
- Contributing towards improvement in the network's overall performance, with respect to economy, service level and safety

LOCATION / COUNTRY

Zurich, Switzerland

UOW system functionality overview

As such, there's a dearth of information about the behaviour and the actual hydraulic and quality conditions in the network. WVZ wanted to know more about its network, in order to be able to detect changes in future water quality variations within the network. The solution: an on-line system of hydraulic and water quality models interconnected with hydraulic and water quality sensors in the network. This will help WVZ gain actual information about the hydraulic conditions, the mixing of water from different sources and the water quality in the network. In so doing, WVZ hopes to improve the system's overall performance (in terms of economy, service level and safety), through an increased ability to control and manage issues related to water flow, quality and security. To check if this goal is achievable, WVZ started a pilot project together with us, to set up an Urban On-line Water (UOW) system in Hangzone Sonnenberg (HZS) – the third largest pressure zone of Zurich. The zone, comprising 135 km of pipes (22,000 segments), one reservoir, eight pumping stations and four other main delivery points, is considered the most hydraulically complex zone in Zurich. WVZ went forward with the pilot project based on the assumption that if an on-line model can be implemented successfully in this zone, then it would be possible in every other pressure zone in Zurich.

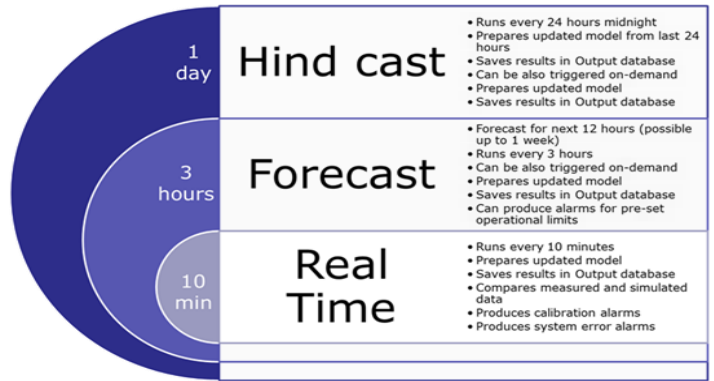
THE UOW SYSTEM – AN OVERVIEW

The UOW system interconnects the hydraulic models and SCADA (PLS) system and secures run of all processes of data transfer, pre-processing, validation, simulations and preparation of outputs in an automatic mode. The system retrieves measured data from the PLS and after validation uses them for update of one or several pre-prepared template models. After simulation, the selected hydraulic and water quality results are stored, automatically analysed and prepared for visualisation. The results of these simulations can be visualised in several applications such as a special ArcGIS extension - UOW Monitor, Excel spreadsheets. The selected simulation results can be received back in the PLS. The hydraulic models updated from the PLS are stored for further analysis in the off-line hydraulic modelling software.

Extra attention is paid to high model accuracy. A special procedure incorporates 'pipe maintenance' (current and planned closing of valves in the water distribution network). Automated processes were developed to check the difference between models and GIS and to update models from GIS geodatabase. The on-line simulation operates three different modes, each of them in a continuous cycle of predefined time steps. These three modes are as follows:

- **The real-time mode** runs every 10 minutes. It calculates current hydraulic and water quality conditions. The conditions in the system are automatically checked and any difference to the standard system behaviour is reported and can trigger an alarm. The same system allows checking of the model calibration level and high model accuracy is therefore secured.
- **The forecast mode** uses prediction of the model boundary conditions to produce a forecasting model and predict system behaviour for the next time period. As a standard, the following 12-hour forecast runs automatically every three hours. The results are stored in the database for automated analyses, reporting and alarming. The updated forecast model is ready for analysis in the simulation software.

The hind cast mode can be performed for any past event within a defined period (for example 2.5.2014 – 4.5.2014). It's also performed automatically, when typically at midnight runs simulation of the last day. The hind casting models can serve for the analyses of any past events.



UOW modules

The hydraulic models prepared by the UOW forecast and hind cast modules can be downloaded in our MIKE URBAN software packages. This allows the user to inspect the stored computed model in greater detail, in order to look for water distribution network problems as well as consequences of water supply system control, including:

- operation of the water sources and pumping stations
- control over filling and emptying of reservoirs
- water quality conditions optimisation
- maintenance and other operational measures optimisation
- investment planning

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“The migration of a standard offline hydraulic model into an on-line model and the calibration of this model was a very important task to learn a lot more about the everyday behaviour of the system. The setting up of measurement campaigns and the detailed calibration of the on-line model increased the knowledge even more. The pilot phase proved great additional value of the on-line system and is a good base for the model extension for all pressure zones in the area of the City of Zurich, adjustments of models, demands and visualisations due to increasing experience in the usage of the system and setting up of additional sensor locations for hydraulic and water quality monitoring.
Harald Tamowski, Stadt Zurich Wasser Versorgung

Contact: Zdenek Svitak - Z.Svitak@dhigroup.com
For more information visit: www.dhigroup.com