

# How can simulation modelling of water supply system provided by Aquion help you to improve supply of town and villages by drinking water?

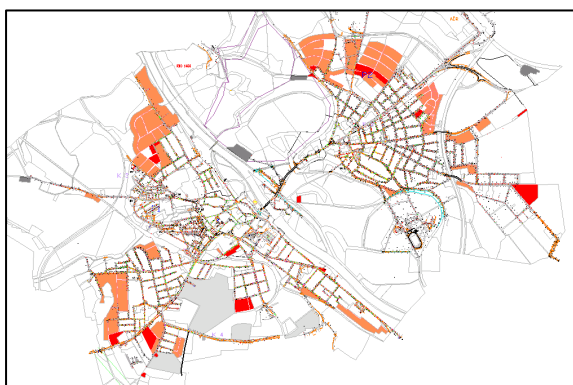
## Brief information about simulation modelling of water supply systems

Simulation model of water supply system can be used to prepare its development – a master plan - of water supply with long-term perspective to evaluate current state of the system considering future needs, to evaluate the conformity of proposed particular reconstruction or widening of the system with current and future needs and to help to solve operational questions of hydraulic capacities, water quality, fluctuation of operational parameters and to evaluate causes of accidents, their consequences including proposals to solve the problems. Aquion is using simulation modelling to solve all this problems since 1984. For the simulation we use our own software – SiteFlow. It includes US EPA EPANET to calculate water networks.

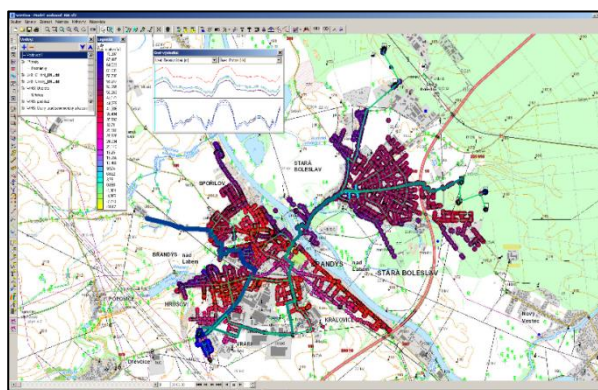
## How to guarantee proper long-term development of a town

A plan of development of water supply system is basic document of town or village that relates to the town land-use planning. The plan is essential for long-term planning of water sources, financial means and available grounds to secure water supply of inhabitants in a good standard. A properly set plan ensures fast and quality realization of town visions. At the same time the plan guarantees proper investment in reconstruction or development of current infrastructure.

Without master plan the development can be chaotic, without a solid fundament, and leads to waste of finance and human effort. In extreme cases absence of planning and simulation modelling can lead to an accident, the water supply can be affected and followed by human health hazard.



*Plan of town land use with pipe network*

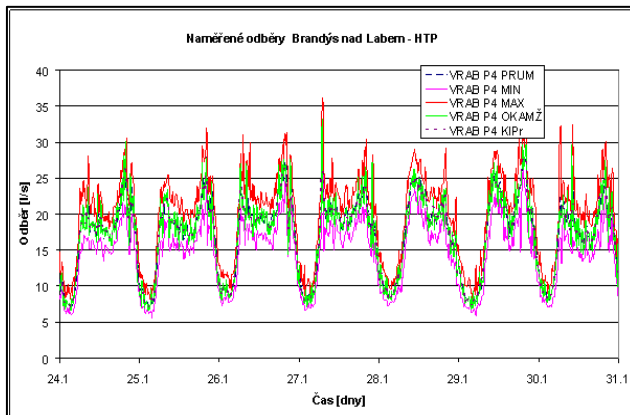


*Simulation model of water supply system - pressure*

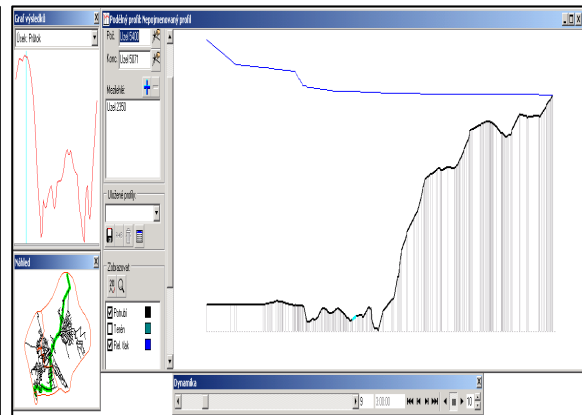
## How to improve function of current water supply system

Without a plan or a model the responsible staff for the operation and development of the system do not have complete information. This incomplete information can lead to a solutions without the right frame. Simulation model can be used to simulate current state of the system (analysing results of the model – calculated values of flows, velocities, pressures, ages of water, ratio of water sources, fluctuation of water table at reservoirs and fluctuation of all operational parameters). We receive a good knowledge about the functionality of the system. Based on model results it is possible to

propose proper operational and investment measures to improve current function of the system. Therefore we can evaluate current infrastructure with respect to the future development.



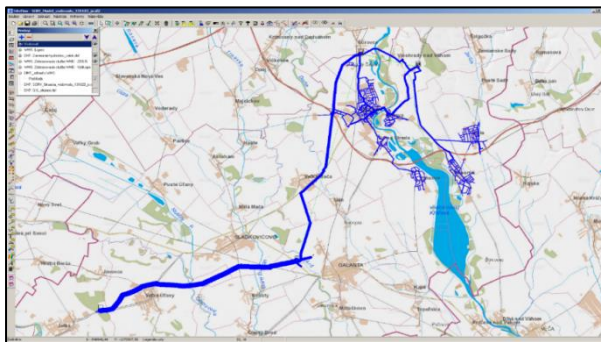
*Fluctuation of pressure*



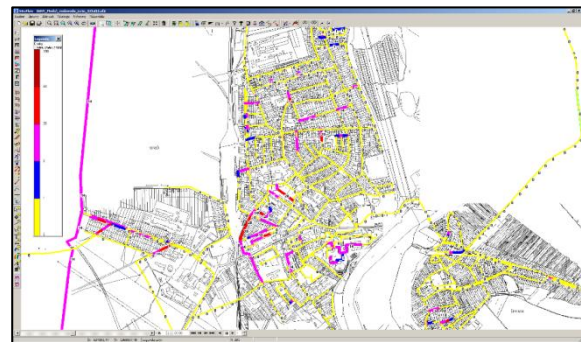
*Profiles with water head*

### How to evaluate suitability of proposed investment into infrastructure

Designer may not be sure about proposed solution while planning reconstruction or new construction of water network. Uncertainty is caused by unknown future requirements on the water supply system that may be different from today. When simply changing the pipe we do not concern development of the whole system. An additional investment into that same particular pipe can be necessary in future. If the simulation model is well prepared you can use it for fast evaluation if the technical parameters of proposed pipes are correct. Mainly it is the diameter of pipes, characteristics of pumps and pipeline path.



*Overview of a water supply system*



*Detail of the same system*

### How to solve operational problems using simulation model

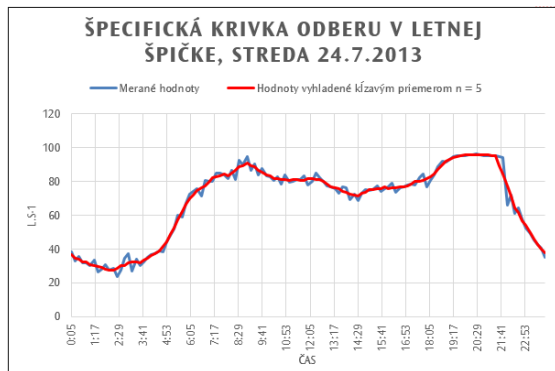
o deals with questions of improving water quality during its transport and distribution. Another example, almost impossible doing by hand, is the calculate age of water in the system. Simulation model of current state can be used to propose option of operational measures to improve function of water distribution system. Thus a lot of time, troubles and money can be saved.

### How to search for the causes of accidents and malfunctions

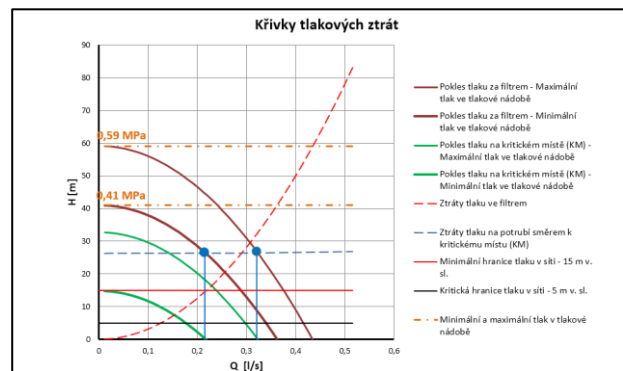
Thanks to simulation modelling of water supply system it is possible better and faster determine a cause of accident or malfunction, judge the impact of it and its potential dissemination into the system. Subsequently, solutions of elimination of the accident consequences can be proposed. In the

case of a break or accident, simulation model enables to fasten the process of solving it or quickly verifies if proposed measures are functional. The model can also help to inform the customers in affected area.

We were helping with different problems, eg. of the question why parts of distribution networks are without proper pressure when new pipes and pumping station was put into operation, deceased capacity of the whole system caused by the filter prior to the pressure tank. Other questions concerns dissemination of the pollution in the network, areas with decreased/increased pressure, or how to lead fine sediment from the network



*Specific curve of water consumption in summer*



*Analysis of pipe and pump characteristics*

### Questions that concerns simulation model

Very common question relates to the precision of the model. The model can be very accurate, with difference of modelled and real parameters of about 1-2 %. It depends on the accuracy of input data – if real inner diameter is used instead of nominal diameters, considering incrustation of pipes, accuracy of metering of water etc. Accuracy of the model is verified by metering the capacity of fire hydrants and by searching of causes of differences. Then the model is calibrated and reflects the reality very precisely.

When modelling the system, a huge amount of results is available. Data can be analysed individually. Aquion prefers faster method – visualization of the results in the whole range of simulated system. In detail we analyse the data using profiles with parameters, time plots and even observing the results of simulation in time.



*Maximal pressure of water*



*Without a plan or a model it can result at least in accidental problems with operational parameters*

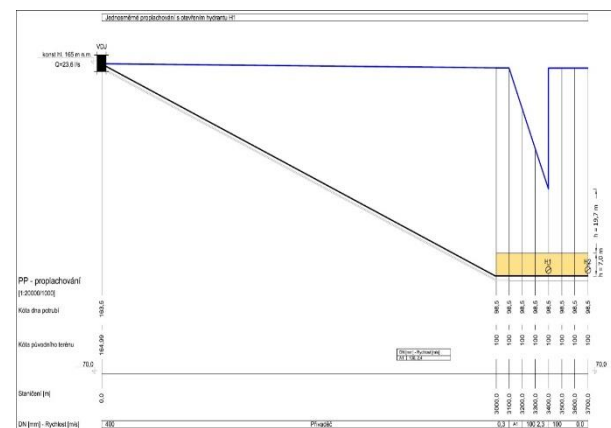
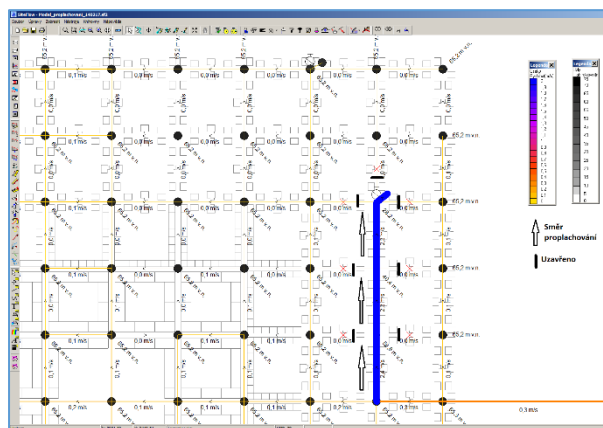
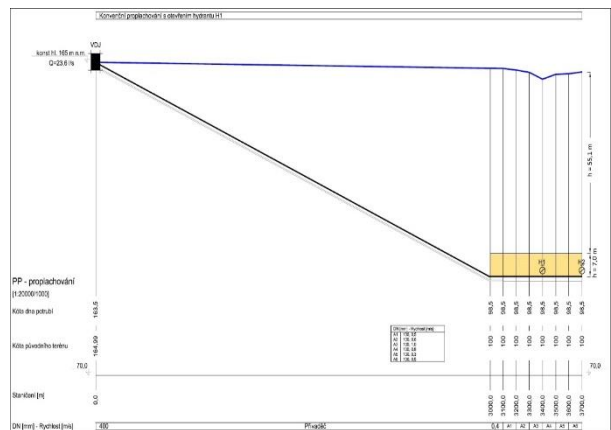
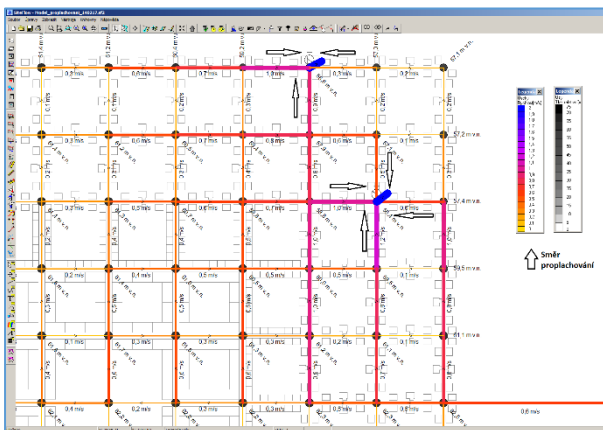
## Does it have any value to invest into a simulation model of water supply system?

Investment can include creation or purchase of detailed simulation model purchase of modelling software and training of employees – water simulation modelling specialists. Completed model provides information about current and future needs of the town water supply, concerning investments into the water supply system. At the same time it is possible to use the model for verification the system proper sizing, and to evaluate projects and existing and new plans. Operator then has profit from the complete understanding of water system function, with regard to hydraulic parameters, age of water and eventually water quality. Using simulation model is and to put operational measures to improve water supply parameters and operation

## Aquion and simulation modelling of water supply system

Aquion is modelling water supply systems from large conurbations up to small villages. We worked on Master plans (Brandýs nad Labem – Stará Boleslav, Zbiroh), on improving water quality in distribution system (Distribution system of Sereď, with the mains from pumping station Jelka – SK), on searching for the causes of low capacity of the small water distribution system of Malá Lečice, or on the setting the parameters of operation at Třebusice.

You can use services and software of Aquion in the whole scale of described tasks. Our services are ISO 9001:2008 certified. We are developing our own software for simulation of water supply systems – SiteFlow with UE EPA EPANET incorporated in it. For fire hydrants capacity measures we use our own equipment.



Comparison of conventional and unidirectional flushing – velocities and profiles with pressure head

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