Urban Drainage Role in Water Management Planning

Abstract of Ph.D. Thesis

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Prague, 1999

The problem of water sources sustainable usage is related to global changes and long-time horizons. However, the global sustainability could be achieved by application of the principles of sustainability in the water and waste water management in smaller territories – basins and/or regions. The "from global to detail" approach is being applicable for those issues. It allows to determine major water quality and/or quantity problems in region and - above all – to highlight the linkages among the causes and major problems. The reduction of space scales and more detailed investigation of problem causes is the consecutive action.

Application of such approach was the goal of the theses. The project involved three leves of application of proposed methodology including national, regional and local scale. The basin of Litavka river has been selected as study area for the regional scale investigation The methodology would be applied as the „pilot-project" for regional water management strategy in the Czech Republic in the future..

The Decision Support System has been designed to model pre-defined scenarios and its economical and technical incidence on national level. Relevant data needed for the application of the different models and for the evaluation of defined scenarios have been included in a database, comprising a combined GIS and database product.

The user has access to the data bases and modelling tools through a graphical/GIS interface allowing a user friendly specification of the scenario wanted to be investigated as well as an easy retrieval of the results generated by the models.

Within a particular basin the definition of a scenario includes a specification of the most important parameters involved. This e.g. includes the timeframe involved, allocation of selected effluent standards to some groups of point sources (by category, size and/or location), assignment of water quality objectives to selected river segments, assumed developments within the industrial and agricultural sectors, and others.

These parameters allow the user to explore the range of options offered by different interpretations of the EU and/or Czech directives, alternative technical strategies, specification of intermediate compliance targets and final timeframe for meeting the goals.

Based on the these specifications the water quality simulation will be employed to assess the resulting water quality conditions at given control points and hence the extent to which given objectives are met. The corresponding investment and O&M costs for individual sources and/or categories of users form inputs to the economic and financial models to provide a further evaluation of the cost implications. Key outputs in terms of water quality maps and economic/financial diagrams are being returned to the user interface.

Key parameters have been selected after discussion among local politics, experts and the others interest groups operating on regional level. The prevailing key parameters like water quality and quantity have been consecutively convert to technical terms (e.g. COD concentration for water quality and frequency curve of discharges for quantity) and quantified by experts.

The stream water quality model has been used for water quality modelling in case of Litavka river basin. The model allows to study the impact of waste loads on in-stream water quality and/or to identify the magnitude and quality characteristics of non-point waste loads. The monitoring system has been set up in accordance with selected simulation model. The long-term data series has been completed in short-term monitoring and used for system construction and adjusting of the model (steady state “calibration”).

Results of this kind of system evaluation have been used not only for measures proposal in technical sense, but especially made impulses to next studies in local, more detailed scales and promoted the cost-benefit solution.

The complex investigation of the integrated urban drainage (IUD) on the local scale is the approach accepted within the water and wastewater management. The combination of monitoring and computations using simulation models was the fundamental methodological approach for the description and assessment of the current state of the system and its behaviour. Successful application of simulation models for HD and WQ modelling were essential.

Nevertheless the number of processes are not fully understood and therefore not described by simulation models sufficiently. With respect to the lack of such tools the information must be obtained by analysis of measured values. Moreover it was necessary to collect the measured values for model calibration/verification procedure. The counter-weighted combination of monitoring and modelling was one of the basic conditions in order to reach the cost-benefit solution of IUD.

In the study area, the suspended solids coming from the urbanised catchment of the town of Pribram were identified as a source of contaminated sediments in the Litavka river. The next steps depend on the selection of measures to correct the identified defects. The methodology of a

technical solution remains a question, namely whether to take the way of building expensive objects in the sewerage network, which would comply with our requirements, or actively reduce the sources of pollution, direct the attention to alternative methods of discharging and treating sewage waters. The principle of building rain reservoirs, separators, or sedimentation tanks is more a solution of consequences rather than elimination of causes. On the other hand, however, this is a measure with a fast effect.

Using the sample assessment of the transport of suspended solids from the Pribramsky creek to the Litavka river, the process of a higher-order basin being affected by a lower-order one was described. This phenomenon appears in general in other basins, too. Under the existing conditions, however, a detailed assessment of transport and transformation processes in a regional scale, using mathematical models dynamically simulating the progress of pollution in recipients, is very expensive and difficult. Especially the collection of data necessary for simulations is very time consuming. The described methodology is based on hydrodynamic simulations of the sewerage system and the recipient and represents a less detailed, but still acceptable alternative.

The definition of the system has the significant effect on the investigation. The investigation within „small" catchment could neglect important interactions and lead to the incorrect conclusions. T*he investigation in „large" catchment does not allowed the required accuracy in some cases. The investigation using simplified methods on the regional level with the combination of monitoring and modelling focused on the specific problems should be the relevant and reliable approach.*