Geophysical Research Abstracts, Vol. 7, 01288, 2005
SRef-ID: 1607-7962/gra/EGU05-A-01288

Challenges And Solutions In Urban Drainage Planning And Management

S. Rangarajan

Senior Project Manager, HydroQual, Inc.

1200 MacArthur Blvd., First Floor, Mahwah, New Jersey, USA. 07430

(srangarajan@hydroqual.com/Fax: + 201 529 5728/Phone: +201 529 5151 X 7162)

The technical, regulatory, socio-economic, and policy issues surrounding urban drainage systems are very complex. In the U.S., there are more than 700 municipalities serviced by combined sewers, and thousands of municipalities served by the separate sanitary and storm sewers. The typical urban drainage problems include: (1) overflows from combined and sanitary sewers and storm water discharges are high in flow volumes and associated pollutant loadings that can cause significant physical, chemical, and biological impacts on the receiving waters such as rivers, creeks, lakes, and estuaries; (2) basement flooding in homes that can result from heavy surcharging in sewer systems due to inadequate sewer capacities or blockages; and (3) street flooding due to inadequate or non-existent storm sewers in the urban drainage areas. Typically the sewer systems are constructed to convey design flows expected from, for example, a 5-year 24-hour storm. With significant population increases and associated drastic changes in landuses with residential and commercial developments, the design flows (estimated about 50 to 100 years ago when the sewers were built) can be experienced more frequently at the present time, thereby, increasing the flooding risk.

On the socio-economic side, the costs for system improvements to minimize flooding and sewer overflows can be enormous. Combined sewer systems often necessitate major structural improvements such as storage tanks, upsizing of combined and interceptor sewers, and plant upgrades to accommodate the increase in flows. These improvements can pose an enormous tax burden to the residents, and also to the municipal governments who may need to balance the infrastructure upgrades with competing priorities such as school education, health care, and transportation. In addition,

these upgrades can result in sustained interruption to services such as public road access and partial treatment of flows at the Sewage Treatment Plants due to construction and maintenance.

Most pollution control programs are implemented to meet certain regulatory obligations. The regulatory aspects for wet weather flow discharges (combined and sanitary sewer overflows, and storm water) are constantly evolving. The combined sewer overflow policy was released in 1994, with the expectation that the municipalities will achieve the nine minimum controls (non-structural practices such as street cleaning, sewer cleaning, and pump station retrofitting) by 1997, and will subsequently develop long-term control plans (capital-intensive pollution controls to achieve the desired water quality goals in the receiving water bodies). In a recent report to the U.S. Congress, the U.S. Environmental Protection Agency documents that only 77% of the municipalities have implemented nine minimum controls and only 34% have submitted draft long-term control plans. One of the primary reasons is the need to integrate wet weather control program requirements for combined and sanitary sewer overflows and storm water. Until a unified regulatory framework is developed, the municipalities are likely to be slow in developing pollution control initiatives on a piece-meal basis. Stakeholders such as public and environmental interest groups on the other hand are increasingly aware of water quality-related issues and expect more in terms of pollution reduction initiatives. Therefore, urban drainage planning and management in the present day context of technical, regulatory, and socio-economic issues is very challenging.

This presentation will summarize the common challenges faced and solutions developed by many U.S. municipalities to address their urban drainage planning and management problems. In addition, specific experiences from New York City will be described as a case study including the technical, regulatory and socio-economic issues. The technical issues will be highlighted in greater detail, with minimal emphasis on the regulatory and socio-economic issues in this presentation.

- Evolution of urban drainage models from simple rationale-approach based models to the current detailed models, and a discussion on the single- and continuous model evaluations performed in the past. Currently, InfoWorks is being used as a common model platform for all the 14 drainage areas in New York City.

- Distributed urban hydrologic modeling concepts to characterize the pollutant loads and peak/duration of flows from different land uses.

- Design of flow and water quality monitoring programs in sewer systems to support the flow and pollutant load characterization.

- Calibration of flows and pollutant loads from the storm water and combined sewer outfalls, along with sensitivity and uncertainty analyses to characterize the variability and their potential impacts on the decision- making process (e.g., design of storage tanks to capture combined sewer overflows).

- Use of radar-based rainfall data to support the finer spatial and temporal scales in urban drainage modeling.

- Uncertainty in regulatory mechanisms, and an attempt to unify the regulatory aspects for combined and sanitary sewer overflows and storm water. Specifically, the U.S. EPA's recent policies on watershed-based pollutant trading, watershed-based permits, and designated uses will be discussed.

- Use of public outreach and stakeholder involvement processes to assist in the development of cost-effective and stakeholder-approved pollution control programs.