Preface

Historically, the process of population expansion and industrial development in urban areas has proved disastrous to the quality of both ground and surface waters. Receiving waters have often become waste receptacles, subject to increasing flow volumes and effluents harmful to both quality and ecology. In 1970, the urban population was almost 1.4 billion around half of which lived in more developed and the other half in less developed regions. By 1990, the urban population had increased by 86% with two-thirds of this increase in less developed regions. It is predicted that by 2010, the global urban population will reach 3.7 billion with a doubling of the 1990 urban population occurring in less developed regions of the world. This will mean that the world's fastest growing and largest cities will be situated in those regions having the lowest GNP. In most of these cities, municipal and industrial wastes are disposed to the natural environment generally without adequate treatment. On the other hand, the major part of the total world pollution load is generated within developed urban areas. This fact makes the issue of sanitation and controlled waste handling in large cities of developed regions, a key issue of global format. Just to keep pace with the population increase in the less developed countries, another 1.3 billion people must be supplied with water, sanitation and waste disposal facilities. This scenario raises the question as to what extent our present wastewater treatment solutions are realistic alternatives for developing countries? A further aspect of this problem is that traditional sewage systems designed and built in the late nineteenth century are still in use in many cities and are frequently in poor repair causing leakage to groundwater. Costs of replacement or rehabilitation are often prohibitively high. The dramatic expansion of urbanized areas which has been witnessed over the last few decades is likely to continue into the next millennium in most countries of the world. Such, often unplanned, growth leading to the emergence of conurbations and megacities poses threats to both the availability and quality of surface water and groundwater resources. These threats are both unprecedented and of immense scale when viewed from political, social and economic perspectives. Some of the identified major environmental impacts and issues include:

- the disruption of the natural hydrological cycle whereby infiltration and recharge to subsurface aquifer systems are reduced and surface runoff is increased in both volume and rate due to the changing land use and growth in impermeable surface area leading to increased downstream flooding;

- declining water levels and possible land subsidence due to groundwater mining;

- increased pollutant loads to water courses and surface water bodies from runoff discharges and sewage outfalls of poor quality;

- leakage to groundwater from old and poorly maintained urban sewers;

- extensive soil and groundwater contamination arising from industrial leakages or spills of hazardous industrial chemicals or poorly planned solid and liquid waste disposal practices;

- increased artificial surface water infiltration and recharge from source control devices leading to poor groundwater quality;

- reduction in ecological habitat and species diversity of the receiving water body;

- need for integrated land use and catchment planning, i.e. the land use planning process itself as a barrier to successful management of urban growth through minimization of runoff/groundwater impacts.

The management and control of water quality within large urban catchments demands an integrated and interdisciplinary approach involving engineers, scientists, ecologists and planners. Forecasting environmental risks and the design of mitigating measures to reduce them is, however, prone to much uncertainty due to factors such as extreme spatial variability of land use, land cover, the heterogeneity of the geologic materials and difficulties associated with the description and parameterization of the coupled flow, transport and chemical transformation processes involved. The papers in this volume provide such an international interdisciplinary perspective and illustrate that recourse to fundamental principles, common sense, and ecological awareness, as well as changes in attitudes to water resource exploitation and pollution are necessary if sustainable urban development is to be achieved. The new objectives must be to avoid accumulation of non-degradable hazardous substances and to adapt the waste output to what natural processes can effectively and efficiently assimilate with water management integrated with management of other parts of the related urban system such as solid waste disposal, transportation systems etc. Only through such coordinated, integrated approaches will public opinion adequately appreciate the value of urban water as a common heritage possessing cultural as well as environmental benefits. In the words of Claude Monet, the distinguished French impressionist painter, "....watching a little city stream, flowing in reed, is worth the Mona Lisa's smile".

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