

On the Path to New Strategies in Urban Water Management

The most important functions of urban water management (UWM) are the prevention of water- and feces-borne diseases, avoidance of floods in developed areas and securing of the ecological integrity of surface waters. With the systematic construction and upgrading of conventional wastewater systems which collect the wastewater and treat it in centralized sewage treatment plants, it has largely been possible to perform these functions in the industrialized countries of the North; however, these practices contradict important sustainability criteria.

The Development of Urban Water Management in Industrialized Countries

Improved Sanitation in Developed Regions through Urban Drainage

Viewed historically, the first goal of urban water management was the improvement of sanitation. As a result of the Industrial Revolution, many people moved to urban areas in search of work over the last century, both in Europe and in North America. This dramatic increase in population density was coupled with a deterioration in public hygiene; feces and refuse were disposed of in streets and backyards. Apart from esthetic concerns, hygienic problems increased and with them the contamination of wells and drinking water, ultimately resulting in widespread epidemics.

As urban areas developed in climatic zones with ample precipitation distributed evenly throughout the year, canals had to be constructed in order to divert the rainwater and prevent floods. As the problems increased, it was obvious that the existing drainage canals would be used for disposing of fecal waste, infested with human pathogens, from the developed areas as well. In this way, the water-borne sewage system was born; i.e., the concept of urban drainage, which is still used in the industrialized countries of the North and in several regions of the South.

From Urban Sanitation to Water Protection

The introduction of water-flushed toilets and the disinfection of drinking water in large water supply systems have markedly

improved the hygienic situation in urban areas and brought water – and feces-borne diseases largely under control. Epidemics resulting from insufficient urban hygiene have only rarely occurred in Europe and North America over the past century.

As a consequence of the input of pollutants into natural waters, new problems arose. The rapid growth of urban areas led to a pollution load which significantly exceeded the assimilation and self-purifying capacity of natural waters. Sewage disposal systems had to be successively upgraded by additional sewage treatment plants. If at first simple sedimentation systems had sufficed, soon only biological treatment could reduce the pollutants to a degree that would be

tolerated by the rivers and streams that received the treated water. Economic development and increased production of chemicals after the Second World War caused both a quantitative increase and qualitative change in urban pollutants. Together with increasing demands on the environment, existing sewage treatment plants must be continually upgraded and expanded with additional treatment stages.

Deficiency of Conventional Urban Water Management with Regard to Sustainability

Central water supplies, water-borne sewage systems and centralised sewage treatment plants could, to a large degree, solve the problems of sanitation and aquatic ecology in the highly industrialized countries of the North. Incumbent in this progress though, are large investments and high maintenance and operating costs. In this system, nutrients such as phosphorus and nitrogen are regarded as hazardous water pollutants – not resources. This view is understandable (i.e., given today's market prices for energy, nitrogen and phosphorus fertilizers), but does not correspond to the basic criteria of sustainability. The situation



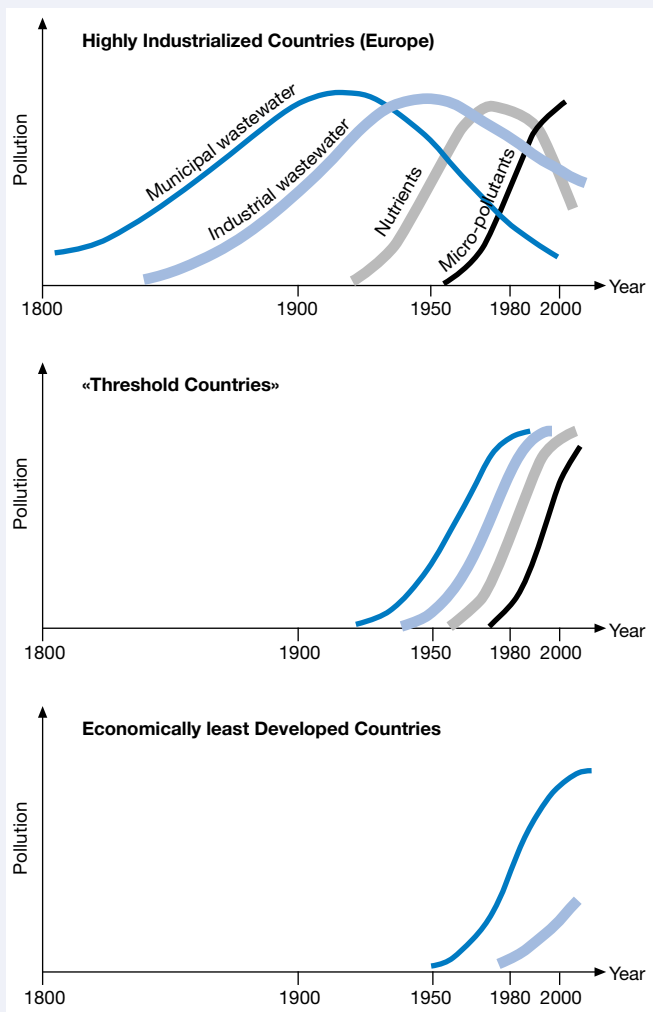


Fig. 1 The succession of water pollution in different countries.

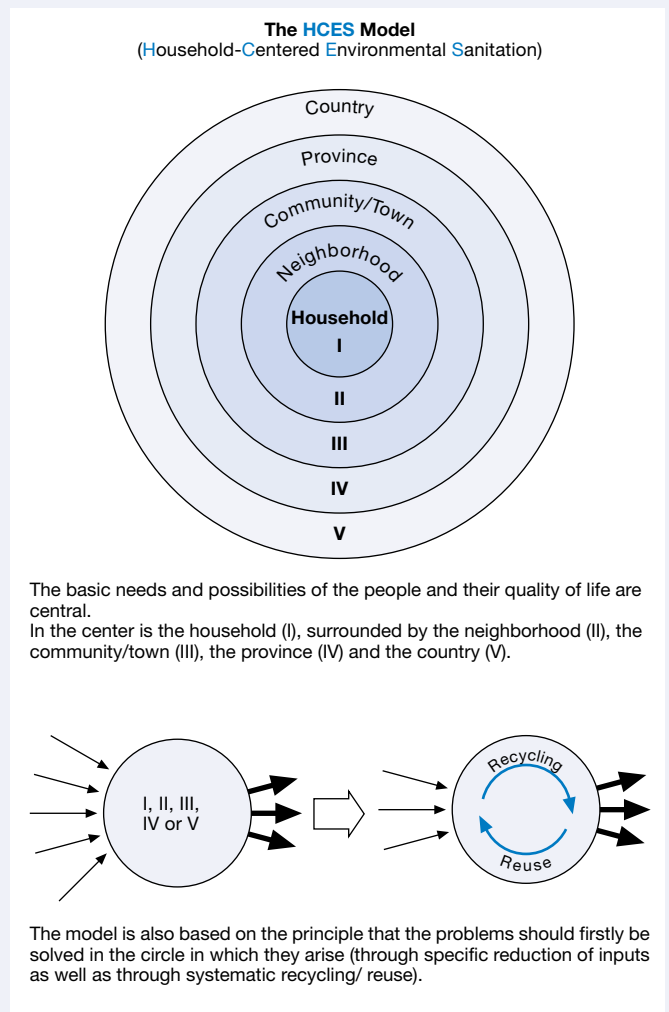


Fig. 2 Household-centered approach in Environmental Sanitation.

becomes dramatic if the present concept of urban water management does not remain a privilege of a small minority of the world's population in Europe and North America, as it is today, but also becomes the norm for the rapidly-growing urbanized regions of Asia, Latin America and Africa. Viewed from a global perspective, the development and implementation of new urban water management concepts are also necessary in the industrialized countries.

Current State of Urban Water and Waste Management in Developing Countries

Urban Sanitation Still Predominates

Despite enormous efforts made during the past 10–20 years, 1.2 billion people still have no access to clean drinking water. Three billion people lack hygienic excreta disposal systems, while less than half of the municipal refuse in developing countries is being collected, and even much less disposed of in an environmentally compatible

way. Consequently, four million people die each year from diarrheal diseases (e.g., cholera and typhoid fever), which are transmitted by feces and insufficient water supply systems. The World Health Organization estimates that 1.5 billion individuals are infested with parasites due to undisposed feces and refuse and are thereby weakened in their economic productivity. Therefore the primary goal of urban water and waste management for the majority of the world's population is still to find solutions to fundamental hygienic problems.

Environmental Problems are also Increasing

Even before the urban sanitation problems in developed countries are solved, the water ecological problems are also increasing markedly. While most water protection problems in today's industrialized countries have occurred and been dealt with progressively, these problems are arising simultaneously in many countries of the developing

world (Fig. 1). This is primarily the result of rapid industrialisation and urbanization. Ironically, this problem is exacerbated by the blind adoption of the urban water management practices developed in the industrialized countries of the North. Often financial resources are being allocated for the construction of sewer systems, but are sorely lacking for the construction and maintenance of centralized wastewater treatment plants. For example, in the cities of Latin America, a large part of the sewage is being collected in sewers, but only about 5% flows into sewage treatment plants, resulting in heavily polluted surface waters exceeding even the largest rivers' self-purification capacity.

New Concepts and Approaches Needed

There are a number of reasons why a large part of the world's population still has no access to safe drinking water and hygienic disposal of excreta and waste. This deplorable state of affairs is rooted in a lack

of political will at the governmental level, coupled with many other issues such as low prestige, the official lack of acknowledgment of the wastewater and solid waste sector, insufficient strategies on all levels, weak institutional infrastructure and inadequate and inefficient utilization of financial and natural resources. Due to the highly differing climatic, socio-economic and cultural factors, the concepts governing urban water management system in the industrialized North are unable to significantly improve the sanitary situation in developing countries and, under some circumstances, are even leading to the degradation of surface waters. Examples from China and other Asian countries suggest that the adoption of Western concepts even negatively influences the management of natural resources; nutrients not only cause environmental problems in receiving waters, but at the same time are lacking in local agriculture and must be replaced by artificial fertilizers requiring large amounts of energy.

A New Strategy for both Urban Water and Solid Waste Management

A working group appointed by the Water Supply and Sanitation Collaborative Council recently developed a vision for a new strategy in "Environmental sanitation in the 21st Century" under the direction of SANDEC, the research department for "Water and Sanitation in Developing Countries" at EAWAG [1]. The new strategy puts people and their quality of life at the center and can be symbolized by a concentric model: in the middle is the household, surrounded by the neighborhood, community/town, district and national government area (Fig. 2, [HCES model](#)). This concept is based on the following principles:

- Environmental sanitation problems are solved with priority in the circle in which they arise; only when this is not possible and when it is sensible to do otherwise are the problems transferred to the next circle.
- The **output** of solid and liquid waste is minimized for every circle by (a) the specific

reduction of waste-producing **inputs** such as water, materials and goods and by (b) systematic recycling and reuse within each circle.

This "household-centered" approach is different from the conventional approach of exporting the problems to the outer circles and having them solved by the government far from their source; instead, the responsibility for problem solving is shifted inwards, to where the problems originate. This new strategy seems especially promising for developing countries where governmental authorities are often not in a position to solve the problems of environmental sanitation without the active help and support of the population. However this approach is basically also applicable in industrialized countries. Although the situation in the industrialized countries greatly differs from that in developing nations, the general strategy of solving the environmental sanitation problems as close to their source is basically applicable everywhere. However, its implementation and the specific solutions probably look very different depending on physical, socio-economic and institutional conditions.

EAWAG's Activities on the Path to Sustainable Urban Water Management

Various efforts and projects are currently undertaken at EAWAG which focus on the development and implementation of new concepts and approaches in urban water management.

The projects in the Engineering Department focus on developing urban water management in industrialized countries; i.e., measures taken at the source should not jeopardize resources (Larsen and Gujer), historically evolved rules in decision-making should be rethought (Tillman), and valuable substances should not be lost (Steiner). Even if the results of these projects cannot be directly transferred to developing countries, their importance for developing countries should not be underestimated. It is

extremely important for professionals and decision-makers in developing countries to realize that even the industrialized countries question their conventional approaches in urban water management and are developing new strategies and concepts. In addition, large financial institutions in industrialized countries play an important role in the water industry's course of action in developing countries.

But if developing nations do not acquire their own experience and develop their own concepts, they will mostly continue to try to use those of the industrialized world. The activities and projects conducted by the Department of Water and Sanitation in DC (SANDEC) directly concern the types of problems prevailing in developing countries. Projects are mostly being carried out in close collaboration with local partners on aspects of water treatment in rural and semi-urban areas (Wegelin, p. 11/12), management of fecal sludge from latrines and septic tanks (Strauss and Montangero, p. 15/16), as well as solid waste management in slums (Zurbrugg, p. 13/14). Some of the current projects and their importance for sustainable urban water management and solid waste management in developing countries are presented and discussed in this issue of EAWAG news.



Roland Schertenleib, Engineer, Director of SANDEC, Research Department of Water and Sanitation in Developing Countries and lecturer at the ETHZ.



Willi Gujer, Prof. for urban sanitation with focus on biological sewage treatment and a comprehensive approach

[1] WSSCC/SANDEC (1999). Household-Centred Environmental Sanitation. *Report of the Hiltterfingen workshop on Environmental Sanitation in the 21st century.*