Integrated Urban Resources Management Strategy

Water
Abstract

This paper examines the water crisis being faced by many cities around the world and then identifies key themes of a water strategy, in particular, integrated urban water resources management (IUWRM).

With over 1.4 billion people lacking access to clean, safe water and 3.35 billion cases of illness and 5.3 million deaths caused each year by unsafe water, urban water management is coming to the forefront of government agendas.

Water management strategies include water audits, demand management, IUWRM and water sheds. It is generally agreed that water and environmental management must be integrated. It is further agreed that water should be viewed as an economic good that requires equitable allocation, appropriate pricing and sustainable usage.

Applied at the catchment level and covering the entire urban water cycle, IUWRM is a participatory planning and implementation process, which brings together stakeholders to determine how to meet society's long-term needs for water and coastal resources while maintaining essential ecological services and economic benefits. The components of IUWRM are discussed in this paper, along with recommendations for an IUWRM strategy.
The Water Crisis

Clean, safe water can be brought to the 1.4 billion people around the world without it for as little as $50 per person, which can prevent many of the 3.35 billion cases of illness and 5.3 million deaths caused each year by unsafe water, says a United Nations analysis. At any given time, an estimated one half of people in developing countries are suffering from diseases caused either directly by infection through the consumption of contaminated water or food, or indirectly by disease-carrying organisms (vectors), such as mosquitoes, that breed in water. These diseases include diarrhea, schistosomiasis, dengue fever, infection by intestinal worms, malaria, river blindness (onchocerciasis) and trachoma (which alone causes almost six million cases of blindness or severe complications annually).

In many countries, water shortages stem from inefficient use, degradation of the available water by pollution and the unsustainable use of underground water in aquifers, the UN says. For example, 40 to 60% of water used by utilities is lost to leakage, theft and poor accounting.

How bad is the water crisis?

- Every 8 seconds, a child dies from a water-related disease
- 50% of people in developing countries suffer from one or more water-related diseases
- 80% of diseases in the developing world are caused by contaminated water
- 50% of people on earth lack adequate sanitation
- 20% of freshwater fish species have been pushed to the edge of extinction from contaminated water.

Not only is the toll a human tragedy, but it means these people are less able to carry on productive lives, and this undermines social and economic development," says Klaus Töpfer, Executive Director of the UN Environment Programme (UNEP). Dr. Töpfer notes women and girls in developing countries spend more than 10 million person-years in aggregate each year fetching water from distant, often polluted sources. Water can be provided in rural and low-income urban areas through the utilisation of low-cost technologies that include handpumps, gravity-fed systems and rainwater collection, which would be built to serve entire rural villages or urban neighborhoods, rather than bringing indoor plumbing to individual houses. The provisions would include pumps, pipes, the training of workers, and the development and strengthening of water management practices.

Urbanisation and the Water Crisis

The consequences of the increasing global water scarcity will largely be felt in the arid and semi-arid areas, in rapidly growing coastal regions and in the megacities of the developing world. Water scientists predict that many of these cities already are, or will be, unable to provide safe, clean water and adequate sanitation facilities for their citizens - two fundamental requirements for human well being and dignity.
The problem will be magnified by rapid urban growth. In 1950, there were less than 100 cities with a population in excess of 1 million; by 2025, that number is expected to rise to 650. By the year 2000, some 23 cities - 18 of them in the developing world - will have populations exceeding 10 million. On a global scale, half of the world's people will live in urban areas.

Some of the world's largest cities, including Beijing, Buenos Aires, Dhaka, Lima and Mexico City, depend heavily on groundwater for their water supply, but it is unlikely that dependence on aquifers, which take many years to recharge, will be sustainable. Groundwater from aquifers beneath or close to Mexico City, for example, provides it with more than 3.2 billion litres per day, but already water shortages occur in many parts of the capital.

As urban populations grow, water use will need to shift from agriculture to municipal and industrial uses, making decisions about allocating between different sectors difficult. Water scarcity is aggravated by four principal human failures.

Water scarcity is aggravated by six principal factors:

1. Reluctance to treat water as an economic as well as a public good resulting in inefficient water use practices by households, industries and agriculture - Farmers pay too little to cover the whole cost of water resources development; very often in developing countries households pay a lumpsum tariff for their water use.
2. Excessive reliance in many places on inefficient institutions for water and wastewater services. There is no incentive to improve their efficiency and reliability under the current organisations.
3. Fragmented management of water between sectors and institutions, with little regard for conflicts between social, economic and environmental objectives; and
4. Inadequate recognition of the health and environmental concerns associated with current practices. Lack of trained engineers, data on water quality, and information dissemination systems further aggravates this problem. International agencies still do not have comprehensive understandings of water quality issues in developing countries as most of the experts are trained in developed, often temperate, countries.
5. Environmental degradation of water sources, in particular, reduced water quality and quantity due to pollution from urban or land-based activities. Too little money and attention are paid to improve such basic infrastructures as water and wastewater systems, while more money is spent for economic growth. Lack of consensus on "who should pay for water and wastewater" very often makes it difficult to build sustainable water and wastewater systems. One of the examples is the sewage treatment systems in Thailand; municipalities often refuse to manage and operate sewage treatment plants because people do not want to pay for their wastewater.
6. Inadequate use of alternative water sources. Alternative water sources other than groundwater and surface water are rarely explored. Desalination is too expensive; and rainwater harvesting is only good for small communities in remote areas. Wastewater reuse may be a future alternative but it requires a better understanding on the risks and benefits of water reuse.

We must adopt a new approach to water resources management in the new millennium so as to overcome these failures, reduce poverty and conserve the environment - all within the framework of sustainable development.
The Urban Water Strategy

Quite clearly, a concerted strategy for management of water resources in urban areas need to be put in place in order to avoid the crisis outlined above. Developing a framework for urban water management can draw inspiration and guidance from several global agreements and norms, including Agenda 21 itself, and the World Water Vision.

Preparatory work will have to map out the progress achieved vis-à-vis objectives outlined in Agenda 21, as well as the recommendations made in the World Water Vision. A 'situation report' on the status will have to be developed - urban water quality, usage and the policy and programme/project environment within which water is managed. Trends of water use and disposal at the community and urban levels will have to be monitored and comparative analyses made to understand the dimensions of the problem. Water issues will clearly have to be linked with other pressing urban problems including health, food security, poverty, education and other issues.

An integrated urban water resource management plan, for example, will have to move towards empowering communities to decide on the level of access to safe water and hygienic living conditions. It will have to produce more food, create more sustainable livelihoods per unit of water applied, and ensure access for all to food required for healthy and productive lives. It will also have to manage human water use to conserve the quantity and quality of freshwater and terrestrial ecosystems that provide services to humans and all living things. Some of the key themes to develop a coherent water strategy for urban areas will clearly have to move towards, and revolve around, the following issues:

- **Water Audits**: How can water audits be performed? Who and why should it be done? How will such audits help in developing a more integrated water management plan? Water audits provide a comprehensive appraisal of natural and urban water resource base. It assists in water policy assessment and development, investment decisions, monitoring and evaluating program and policy performance; and direct resource management, particularly by local government.
- **Demand Management**: Clearly, the way forward in effective mitigation of the water crisis is demand management - in understanding water usage in urban areas, in developing tools and strategies for a deeper and broader reduction, reuse/recycle of water for different purposes. Community education and awareness-building is a critical component in water demand management, as is effective stakeholder participation in decision-making and policy development. Water pricing issues are also included here.
- **Integrated urban water resource management (IUWRM)**: IUWRM (see Box 1 and Table 1) is an emerging concept that covers the entire urban water cycle, including rainwater, desalination, ground and surface water, etc., as well as storage and distribution, treatment, recycling and disposal, and the protection, conservation and exploitation of water resources at their origin. It also covers empowering local communities to decide on the level of access to safe water and hygienic living conditions, the need to produce more food, and the need to create more sustainable livelihoods per unit of water, and the need to manage human water use to conserve the quantity and quality of freshwater and terrestrial ecosystems that provide services to humans and all living things.
- **Urban watersheds**: The issues of managing urban water supply, wastewater and stormwater can be viewed in an integrative manner by looking at urban areas as watersheds. Such perspectives incorporate issues such as pollution of water resources,
surface run-off, rainwater harvesting from urban structures, etc. It includes the perspective of cities as 'metabolic units' that can be defined in terms of inputs/outputs and material balance as well as life cycle cost.

Box 1 - Principle Components of IUWRM

Integrated Urban Water Resources Management (IUWRM) is a participatory planning and implementation process, based on sound science, which brings together stakeholders to determine how to meet society's long-term needs for water and coastal resources while maintaining essential ecological services and economic benefits.

The principal components of an IUWRM system include:

- **Supply optimisation**, including assessments of surface and groundwater supplies, water balances, wastewater reuse, and environmental impacts of distribution and use options.
- **Demand management**, including cost-recovery policies, water use efficiency technologies, and decentralised water management authority.
- **Equitable access** to water resources through participatory and transparent management, including support for effective water users association, involvement of marginalised groups, and consideration of gender issues.
- **Improved policy, regulatory and institutional frameworks**, such as the implementation of the polluter-pays principle, water quality norms and standards, and market-based regulatory mechanisms.
- **Intersectoral approach** to decision-making, combining authority with responsibility for managing the water resource.

Table 1 – Integrated Urban Water Resources Management

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<tr>
<th>IUWRM activity</th>
<th>Basic approach</th>
<th>Comprehensive approach</th>
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<tbody>
<tr>
<td>1. Establish regional &amp; catchment goals</td>
<td>Short-term needs considering long-term factors</td>
<td>Long-term needs considering short-term impacts</td>
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<tr>
<td>2. Comprehensive information base</td>
<td>Obtain existing information and experience</td>
<td>Combined available information with new data reflecting management needs</td>
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<tr>
<td>3. Projecting future conditions</td>
<td>Predictions based on recent experience and goals</td>
<td>Develop alternative scenarios reflecting alternative goals and investments</td>
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<tr>
<td>4. Governance</td>
<td>Accept existing but review concepts that assist in new goals</td>
<td>Analyse alternative concepts and opportunities for change</td>
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<tr>
<td>5. Strategy development</td>
<td>Design activities consistent with multiple existing goals</td>
<td>Consider alternative strategies and their relative value in achieving multiple objectives</td>
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<tr>
<td>6. Environmental integration</td>
<td>Considered sustainability of projects in the context of present and likely policies on sustainability</td>
<td>Develop integrated programs that optimally achieve multiple objectives to assure asset and environmental sustainability</td>
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<td>7. Operating practices</td>
<td>Assure coordination of present and proposed activities</td>
<td>Create new efficient operating practices to optimise public service</td>
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Conclusions: Some Key Recommendations for an IURWM Strategy

IUWRM should be applied at catchment level. The catchment is the smallest complete hydrological unit of analysis and management. Integrated catchment management (ICM), therefore, becomes the practical operating approach. Although this approach is obviously sound and finds wide acceptance, too narrow an interpretation should be avoided.

It is critical to integrate water and environmental management. This principle is widely and strongly supported. IUWRM can be strengthened through the integration of Environmental Impact Assessments (EIAs), water resources modeling and land use planning. It should also be understood that a catchment or watershed approach implies that water should be managed alongside the management of codependent natural resources, namely soil, forests, air and biota.

A systems approach is necessary – a true systems approach recognises the individual components as well as the linkages between them, and that a disturbance at one point in the system will be translated to other parts of the system. Sometimes the effect on another part of the system may be indirect, and may be damped out due to natural resilience and disturbance. Sometimes the effect will be direct, significant and may increase in degree as it moves through the system. While systems analysis is appropriate, analyses and models that are too complex to be translated into useful knowledge should be avoided.

Full participation by all stakeholders, including workers and the community is critical – this will involve new institutional arrangements. There must be a high level of autonomy, but this must at the same time be associated with transparency and accountability for all decisions. In this context Vision 21 states: The real breakthrough came when the agencies all recognised that the most effective action came from the energy of people themselves. Care should be taken to ensure that those participating in any catchment management structure do indeed represent a designated group or sector of society. It is also important to ensure that representatives provide feedback to the constituencies they represent IUWRM seeks to combine interests, priorities and disciplines as a multi-stakeholder planning and management process for natural resources within the catchment ecosystem, centered on water. Driven bottom-up by local needs and priorities, and top-down by regulatory responsibilities, it must be adaptive, evolving dynamically with changing conditions.

Attention should be given to social dimensions – this requires attention to, amongst other things, the use of social impact assessments, workplace indicators and other tools to ensure that the social dimension of a sustainable water policy is implemented. This will include the promotion of equitable access, enhanced role of women, and the employment and income implications of change.

Capacity building should be undertaken – at many levels in the process, even at the governmental level - stakeholders lack the necessary knowledge and skills for full application of IUWRM. Community stakeholders may not be familiar with the concept of water resource
management, catchment management, corporate governance, and their role in these. Many, even in developed countries, do not even know what a catchment or watershed is. The water stakeholders must, therefore, collaborate in designing and implementing strategic elements of capacity building as part of the evolving IUWRM process. Capacity building categories include education and awareness raising about water; information resources for policy making; regulations and compliance; basic infrastructure and market stability. Early and ongoing stakeholder collaboration and communication in capacity building is also important from the point viewpoint of “leveling the playing field” in anticipation of disputes that may arise. Filling strategic skills/capacity gaps supports IUWRM, facilitates dispute resolution, and builds practical understanding of the scope of sustainable natural resource development challenges and opportunities.

Availability of information and the capacity to use it to make policy and predict responses should be ensured. This implies, firstly, sufficient information on hydrological, bio-physical, economic, social and environmental characteristics of a catchment to allow informed policy choices to be made; and secondly, some ability to predict the most important responses of the catchment system to factors such as effluent discharges, diffuse pollution, changes in agricultural or other land use practices and the building of water retaining structures. The latter hinges on the adequacy of scientific models: Models should be as complex as the problem requires and no more so. It is recognised that predicting ecosystem response to perturbation with reasonable confidence is severely taxing current scientific capabilities, stimulating ongoing research.

Full-cost pricing should be complemented by targeted subsidies. This principle was strongly urged by the World Water Council at The Hague, the rationale being that users do not value water provided free or almost free and have no incentives to conserve water. Wide support for this principle was engendered, but also significant opposition from those who felt that the interests of the poor might not be sufficiently protected, even under an associated subsidy system, however well designed. Opposing views held that full-cost pricing, when applied in its narrowest sense, offends the principle that water is a public good, a human right, and not simply an economic good. Reiterating: The economic sustainability of water and sanitation services depends largely and appropriately on the recovery of costs through user fees or tariffs that are equitably assigned based on ability-to-pay. Under-served or unserved, marginalised users in many places already pay high financial costs of not having safe piped water, for example, because they are forced to pay for water trucked-in by suppliers. This water may be of dubious quality yet is expensive.

Central government should provide support through the creation and maintenance of an enabling environment. The role of central government in ICM should be one of leadership, aimed at facilitating and coordinating the development and transfer of skills, and assisting with the provision of technical advice and financial support, to local groups and individuals. Where specific areas of responsibility fall outside the mandate of a single government department, appropriate institutional arrangements are required to ensure effective inter-departmental collaboration. Effective IUWRM is a top-down meets bottom-up process.

Adoption of the best existing technologies and practices should be encouraged. This includes management instruments. Professional associations like IWA are primary sources of knowledge on BMPs (best management practices), and BAATs (best appropriate affordable technologies). Multi-stakeholder, consensus-oriented forums for IUWRM should avoid
lowest-common-denominator solutions through adherence to BMPs and BAATs that are adaptive to local needs.

Reliable and sustained financing needs to be ensured. In order to ensure successful implementation of IUWRM approaches, there should be a clear and long-term commitment from government to provide financial and human resources support. This is complemented by income from a healthy water and sanitation market, especially when local providers of goods and services that support the water sector are active players, and when there is active reinvestment in the sector.

Equitable allocation of water resources should be planned for. This implies improved decision-making, which is technically and scientifically informed, and can facilitate the resolution of conflicts over contentious issues. There are existing tools (e.g. multi-criteria analysis) to help decision-making in terms of balancing social, ecological and economic considerations. These should be tested and applied.

It is critical to recognise that water is an economic good. The recognition of water as an economic good is central to achieving equitable allocation and sustainable usage. Water allocations should be optimised by benefit and cost, and aim to maximise water benefits to society per unit cost. For example, low value uses could be reallocated to higher value uses such as basic drinking water supplies, if water quality permits. Similarly, lower quality water can be allocated to agricultural or industrial use.

Strengthening the role of women in water management is an important component of IURWM. A review by the World Bank of 121 water projects showed that ensuring women’s participation in decision-making positively affects both project quality and sustainability.
The UNEP - DTIE International Environmental Technology Centre

Established in April 1994, the International Environmental Technology Centre (IETC) is an integral part of the Division of Technology, Industry and Economics (DTIE) of the United Nations Environment Programme (UNEP). It has offices at two locations in Japan - Osaka and Shiga.

The Centre's main function is to promote the application of Environmentally Sound Technologies (ESTs) in developing countries and countries with economies in transition. IETC pays specific attention to urban problems, such as sewage, air pollution, solid waste, noise, and to the management of fresh water basins.

IETC is supported in its operations by two Japanese foundations: The Global Environment Centre Foundation (GEC), which is based in Osaka and handles urban environmental problems; and the International Lake Environment Committee Foundation (ILEC), which is located in Shiga Prefecture and contributes accumulated knowledge on sustainable management of fresh water resources.

IETC's mandate is based on Agenda 21, which came out of the UNCED process. Consequently IETC pursues a result-oriented work plan revolving around three issues, namely: (1) Improving access to information on ESTs; (2) Fostering technology cooperation, partnerships, adoption and use of ESTs; and (3) Building endogenous capacity.

IETC has secured specific results that have established it as a Centre of Excellence in its areas of specialty. Its products include: an overview on existing information sources for ESTs; a database of information on ESTs; a regular newsletter, a technical publication series and other media materials creating public awareness and disseminating information on ESTs; Local Agenda 21 documents developed for selected cities in collaboration with the UNCHS (Habitat)/UNEP Sustainable Cities Programme (SCP); training needs assessment surveys in the field of decision-making on technology transfer and management of ESTs; design and implementation of pilot training programmes for adoption, application and operation of ESTs; training materials for technology management of large cities and fresh water basins; and others.

The Centre coordinates its activities with substantive organisations within the UN system. IETC also seeks partnerships with international and bilateral finance institutions, technical assistance organisations, the private, academic and non-governmental sectors, foundations and corporations.

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