ADB

WATER for ALL

Asia-Pacific Water Forum

Asian Water Development Outlook 2007

Achieving water security for Asia

Asian Water Development Outlook 2007

Achieving water security for Asia

ISBN 978-981-4136-06-8

Abbreviations

ADB	Asian Development Bank
APWF	Asia-Pacific Water Forum
AWDO	Asian Water Development Outlook
DMC	developing member countries
GCS	government, corporate, society
GDP	gross domestic product
HDI	Human Development Index
IDWA	Index of Drinking Water Adequacy
IRWR	internal renewable water resource
JICA	Japan International Cooperation Agency
MDG	Millennium Development Goal
NGO	nongovernment organization
O&M	operation and maintenance
PPP	purchasing power parity
PPWSA	Phnom Penh Water Supply Authority
PRC	People's Republic of China
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children's Fund
WDI	World Development Indicators
WHO	World Health Organization
WPI	Water Poverty Index
WSS	water supply and sanitation

Contents

Contents of Enclosed CD-ROM

Discussion Papers

Contents of Enclosed CD-ROM (cont.)

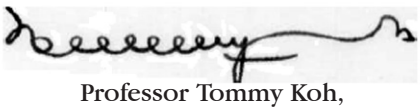
APWF Foreword

The Asia-Pacific Water Forum (APWF) seeks to encourage collaborative efforts on water resources management and accelerate the effective integration of water resources management into the socioeconomic development process of the Asia and Pacific region. This *Asian Water Development Outlook 2007* report marks an early milestone in the Forum's progress. Established only in September 2006, the APWF is a result of the Joint Declaration issued by the Water Ministers of the Asia-Pacific Region at the Fourth World Water Forum, Mexico City six months earlier.

It is remarkable that so much information needed for the future management of the water and sanitation sectors in the Asia and Pacific region has already been assembled, analyzed, and made available through this timely report. These experiences and analyses, and the recommendations that can be drawn from them contribute directly to the First Asia-Pacific Water Summit, held in December 2007.

The APWF Governing Council expresses its deep appreciation to Asian Development Bank and partner institutions for bringing the region's water supply and sanitation sector issues together in this report.

APWF sincerely hopes that this contribution to meeting the present and coming challenges in the water supply and sanitation sector will be found useful to the many public, private, nongovernment, and community-based organizations and interested individuals who share its vision of bringing safe water and sanitation to everyone in the region.



Professor Tommy Koh,
Ambassador-at-large, Singapore
Chair, Governing Council
Asia-Pacific Water Forum

ADB Foreword

The *Asian Water Development Outlook 2007* is a contribution by the Asian Development Bank (ADB) to make a forward-looking assessment of the possible water future of the world's most populous region. It is now increasingly being recognized that water is likely to be a major critical resource issue all over the world, and that the social, economic, and environmental future of Asia is likely to depend on how efficiently and equitably this resource will be managed in the coming years.

The *Outlook* is aimed at Asian policy makers and those interested in understanding the complexities and dimensions of current and future water problems, and how these can be addressed successfully in policy terms. Its main objective is to raise awareness of water-related issues and to stimulate an informed debate on how best to manage Asia's water future. These are important and complex issues, and their timely management can contribute to the achievement of all the water-associated Millennium Development Goals and beyond.

This report brings together a wide range of water-related issues, problems, and challenges from a future-oriented, multidisciplinary, and multisectoral perspective from around the Asia and Pacific region. Highlighted are important topics that have been neglected or are being inadequately considered in most countries of the region. Among these is the urgent need to address the inherent interrelationships between water and other important development-related sectors, like energy, food, and the environment. The future of Asian countries will be determined not by developments in any one of these sectors but rather in the interactions among all of them. Developments in all of these sectors will affect water, and, in turn, water developments will affect all these sectors. The accelerating change in demographics, such as rural–urban migration and an increasingly elderly population, is another unexplored area with major implications for water management. Many developing countries may risk mortgaging their water security in a decade or two if sanitation is used in a restricted sense of collecting and transferring untreated sewage to another area thereby contaminating freshwater sources. The importance of South–South knowledge and experience transfer in an Asian context through the identification and objective

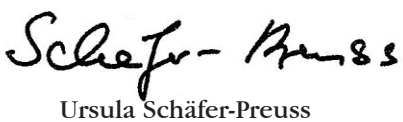
analyses of good practices is emphasized.

The report is cautiously optimistic on Asia's water future. It points out that with existing knowledge, experience, and technology, the water problems of the Asian developing countries are solvable. The main constraint is not physical scarcity of water, though this could be an issue in some areas, but inappropriate management practices.

The *Outlook*, which is expected to be the first of a series of analyses on the future water situation of Asia, focuses on urban water and wastewater management. It notes that the status of provision of clean and drinkable water continues to be a serious concern in many Asian urban centers. Of even greater concern are inadequate wastewater management practices—collection, proper treatment, and safe disposal of wastewater. As a result of this neglect, water bodies in and around urban centers are often seriously contaminated, affecting the health of both people and ecosystems. However, to improve the situation, there must be reliable data on physical as well as social, economic, and environmental factors, presently lacking in many countries, on which to base sound policies. Solving urban drinkable water and wastewater problems will require strong political will, accelerating demand from civil society to solve these problems, adequate financial and managerial support, and intensive capacity-building efforts at all levels.

The report is an independent analysis commissioned by ADB, and is the result of a collaborative effort by a team of eminent experts led by Prof. Asit K. Biswas, and ably supported by Mr. Geoffrey Bridges, Mr. Arthur McIntosh, Prof. Bhanoji Rao, Prof. Olli Varis, and Dr. Geoffrey Wright, with support from ADB's Water Community of Practice. The report will help policy makers and civil society better understand the various issues associated with water, aiming at developing a common approach to meet the major challenges.

ADB's commitment to the sector is shown in our Water Financing Program 2006–2010, in which investments in water are expected to double and be directed toward reforms and capacity development programs in rural communities, cities, and river basins; and in the associated Water Financing Partnership Facility to mobilize cofinancing and investments from development partners. We encourage other partners to join us in this crucial endeavor.



Ursula Schäfer-Preuss
Vice President, Knowledge Management and Sustainable Development
Asian Development Bank

About *AWDO 2007*

The *Asian Water Development Outlook (AWDO) 2007* is a package of factual information, data, experiences, and solutions to problems in the water and sanitation sector of countries in the Asia and Pacific region. It provides comparative data for the sector in a number of countries and new perspectives on present issues in the sector and their relationships with other sectors, and looks at the sometimes startling and thought-provoking implications of present global trends on the future of the sector.

It begins with a sweeping overview of the sector by Asit Biswas that explains why some countries, cities, and rural areas around the world have succeeded in providing their populations with good water supply and sanitation and others have not. Developing countries face much more difficult problems than developed countries because the gradual pace of development in the former allowed the sector to keep up with and plan ahead of expansion, unlike in developing countries where development is taking place at relatively breathtaking speed, defying the efforts in many cases of public providers to cope with such problems as populations that are both increasing and aging, industrial demand for and pollution of water, and infrastructure needs for waste collection and treatment.

Worldwide, competition for water is increasing apace in response to growing energy—including biofuel production—and food needs, and for the environment itself, an equally legitimate user of water. In Asian developing countries, the problems of coping with these demands are exacerbated by the often short seasonal nature of rainfall, which must be stored to enable it to last from one season to the next.

However, as Prof. Biswas points out "It is likely that if there will be a water crisis in the future, it will not come because of actual physical scarcity of water, as many predict at present, but because of continuing neglect of proper wastewater management practices. Continuation of the present trend will make available water sources increasingly more contaminated, and will make provision of clean water more and more expensive, as well as more complex and difficult to manage. By diluting seriously the definition of access to clean water and considering sanitation only in a very restricted sense, developing countries, including many in Asia, are mortgaging their future in terms of water security."

In the past, population growth has generally not been considered to be directly related to water management.

However, the fact is that populations affect water in terms of demand, use patterns, and management practices. Similarly, water affects populations directly in terms of health (for example, waterborne diseases affect mortality rates), and indirectly, through such issues as regional development, employment generation, and gender-related matters. A related, major factor that is still not being adequately considered in Asian countries is the implication of an increasingly aging population on water-related issues. This is likely to be an important policy issue in nearly all Asian countries during the next 3–4 decades.

It is now widely accepted that the global climate is changing. This is creating a new level of uncertainty in water planning and management processes because it is difficult to manage water projects without knowing the likely future distribution of rainfall and temperature over space and time. We cannot even predict with any degree of confidence the annual average changes in rainfall and temperature over a country as a whole, let alone for specific areas considered for planning purposes. Thus, climate change is likely to introduce high levels of risks and uncertainties that the water profession simply may not be able to handle with any degree of confidence, at least over the near term. All this will make efficient water planning and management an exceedingly complex and difficult task during the post-2025 period. This aspect needs urgent attention and accelerated research from water scientists and climatologists, especially in the Asian monsoon countries, if serious water-related stresses are to be avoided in the future.

In the future, water issues in Asian developing countries are likely to be quite different from those in the past. While historical knowledge is always useful, solving the water problems of the future will require additional skills, innovative approaches, and new mindsets. It will also require a more holistic approach that can successfully coordinate the energy, food, environment, and industrial policies of a nation, all of which have intimate linkages to water. Each will affect the others and, in turn, be affected by the others. Policies in all these areas will similarly be influenced by external forces like demographic transitions, advances in technology and communication, globalization, free trade, and increasing social activism.

All these factors within and beyond the sector will make future water management in Asia a far more complex task than ever before. It will be a formidable challenge, but one that must and can be met because the knowledge, experience, and technology to solve the problems in a timely manner already exist within Asia, not in one location but within the region as a whole. A synergistic net needs to be cast to identify and collect all the successful attempts for possible replication in other parts of Asia.

Basic to solving both sectoral and intersectoral water problems is the presence of adequate capacity at all levels, which is often not the case in Asian developing countries. Capacity development must receive much higher priority from both national water authorities and external support agencies. Equally, the external support agencies must ensure that the types of capacity development activities they support will actually help to improve substantially the water management practices of Asian developing countries, where conditions are different from

those in the industrialized countries. Further, the results must be sustainable over the long term.

One of the main purposes of the *AWDO 2007* is to focus the attention of national leaders and key decision makers on the need to increase investments in the water sector if Millennium Development Goal (MDG) targets are to be achieved by 2015. Although some countries have made good progress, others need to make dramatic improvements. This is shown quantitatively and qualitatively for twelve countries from the region by Geoff Bridges. He finds several common issues that need to be resolved if countries are to meet these targets, including poor sectoral management; poor management of water resources; high water connection fees that prevent the urban poor from being connected, and low tariffs that do not reflect the true service cost for sustainability; and lack of awareness among consumers of the "true" value and scarcity of water.

The solutions to these problems are implied in their descriptions. However, there are two key needs to make measurable progress. One is to collect better quality and more comprehensive data, especially from water utilities, so that real problem areas can be pinpointed. Bridges uses an international data set that, although based on 2004 information, overcomes the inconsistencies and "optimism" often appearing in national data sets. The other is to implement and enforce existing policies and legislation—policy development is not the issue. This can only happen if there is accountability and a strong regulation/monitoring regime in place.

One measure of progress in these and another 11 countries that together comprise 99% of the Asian developing country population is a new composite drinking water indicator, the Index of Drinking Water Adequacy (IDWA). The index was devised by Bhanoji Rao and is an average of five components: measures of access, capacity, quality, resources, and use. The individual components can be used to indicate directions for policy, program, and project actions. The new index seeks to overcome some of the limitations of an existing indicator, the Water Poverty Index.

It is timely in that, half way through the MDGs timeframe, some countries may wish to fine-tune the goal and targets on water (and sanitation as per the Johannesburg Summit of 2002). IDWA can be expanded, depending on data availability, to include for example, dissolved oxygen concentration and suspended solids that could be combined into a quality index that can then enter the final composite IDWA. Similarly, the index could include sanitation if at least one or two good sanitation indicators were available, not only reflecting access to toilet facilities but also waste collection and disposal and sewage treatment. However, as Prof. Rao points out, the accuracy and consistency of national data may be a stumbling block at present.

Major intersectoral problems associated with water—population growth and aging, the economic and social transition in developing countries, issues related to energy, food production, environment, and climate variation and change—are presented in detail by Olli Varis. Population growth means more food is needed from shrinking agricultural land, which points to the need to improve efficiency of soil and water use. Low quality of water or limited access to water is one of the key determinants of poverty. At the same time, the poor cause a significant proportion

of global water quality problems, such as through uncontrolled deforestation. Thus, investing in poverty reduction is an important policy measure in working against further degradation of water resources and the environment.

Of importance is that 96% of contemporary renewable energy production comes from either biomass or hydropower. These both rely completely on water resources management. In this regard, joint management of rivers and aquifers is of crucial importance in most parts of Asia because the bulk of the region's population lives in river basins that include more than one state. Varis observes that in efforts toward regional integration, water is a subject that far more often increases cooperation than causes conflicts.

Progress in water resources development and management is being made using different approaches in different countries across Asia. Geoff Wright describes some of these advances. He finds that there are some common features in successful management examples from around the region, including stable and strong institutional frameworks; high level of cooperation and coordination among agencies; strategic and integrated planning in place; effective stakeholder and community participation; and reliable and comprehensive data and information, and decision-support tools in use. He gives examples and useful models to follow.

Water supply issues are discussed by Arthur McIntosh. Adequacy of clean water, a basic human need, has become a critical factor. The supply problems that have become most urgent are water quality and pollution, water conservation, and water and demand-side management. Water quality and pollution solutions include treating pollution at source, addressing disposal of solid residues from municipal treatment, monitoring water quality, investing in wastewater treatment on a large scale, and seeking local government/community and nongovernment organization partnerships. Conservation can be improved through rainwater and stormwater harvesting and storage, incentives for water conservation, and regaining a respect or reverence for water, which has held a prominent place in all religions as the essence of life. Managing demand is basically a matter of adjusting tariffs. The present low tariffs common across much of the region not only result in degraded systems, but also perpetuate an inequitable subsidy to the rich, not the poor. In many cases, the solution may only require improved awareness by politicians.

The parallel issue is connecting the urban poor to piped water. McIntosh lists the many obstacles and options to overcome them, the best option being that the public or private utility borrows for connection fees, allowing poor consumers to pay over a long period with minimal tariff increase.

A pressing problem associated with pollution is open defecation in parts of the region, which concerns the health and dignity of a great many people, not to mention the environmental aspect. Community-led total sanitation efforts, which focus on demand creation, have not only successfully overcome the low demand for sanitation, but have also delivered significant changes in collective behavior, resulting in improved health for all.

The *AWDO 2007* multimedia CD-ROM also contains a large amount of published reference material, particularly from the Asian Development Bank, Asit Biswas and Cecilia Tortajada of the Third

World Centre for Water Management in Mexico, World Bank, Japan Bank for International Cooperation, and Japan International Cooperation Agency. There are summaries of more than 100 experience documents from around the region as well as video and audio files illustrating good practice solutions in specific situations.

A common message from many papers in the *AWDO 2007* is that commitment and leadership need to be further developed among senior managers and officials. Finding champions who recognize the importance of implementing water management reforms and having the vision and courage to promote them may be the greatest challenge of all. The *AWDO 2007* offers many examples of ways to overcome these and the other problems faced by Asian developing countries in the water supply and sanitation sector. The *AWDO 2007* is a recipe for action.

New Insights on Water Security in Asia

Asit K. Biswas

I. The Changing Water Management Landscape in Asia

According to Leonardo da Vinci, water is the driver of nature. It could have been considered to be an overstatement in the 16th century during his lifetime, but nearly half a millennium later, Leonardo's view on water can be considered prophetic. Water is increasingly being realized to be the lifeblood of the planet and it is certainly not an overstatement to claim that without rational water development and its efficient management, the future social and economic development of Asian developing countries will be seriously constrained or even jeopardized. The eminent economist and Prime Minister of India, Manmohan Singh, has noted that if India's current economic growth rate is to be maintained and if all the people of the country, especially the poor and the vulnerable, are to share the benefits of rapid economic growth, two resource issues need priority consideration: energy and water. The Prime Minister further noted that if these two issues can be properly addressed, and if all the members of the society can have adequate access to energy and water, many of the existing societal problems can be resolved.

It has been well known for millennia that human survival and ecosystem conservation depend on the reliable availability of adequate water of appropriate quality. It is equally well known from prehistoric times that food and

Children collecting water, Afghanistan

Nepalese farmer pumping water for irrigation

Major policy changes in the water and energy sectors will be needed in the near future to balance water and energy uses in agriculture and stabilize the levels of declining groundwater tables

agricultural production requires water. As the human population grew, the food requirement increased as well, and with it water demands for producing the necessary food. The water-food interrelationships have always been important, but in recent years, these linkages have become more and more complex because of social and environmental concerns, technological developments, globalization, and management practices.

With the advent of the industrial revolution, the situation changed dramatically. The industrial requirements for water started to increase very significantly, as did the need for collection, treatment, and safe disposal of wastewater. In quantitative terms, the industrial water needs of many Asian countries have now exceeded domestic needs and are increasing at a much faster pace, especially as industrialization often has had to start from historically low bases.

Environmental issues for water management became important during the 1970s, not only in Asia but also the rest of the world. Increasingly, all development activities, including those on water, had to consider environmental implications seriously and comprehensively. These considerations received considerable momentum during the 1980s, and are now universally accepted as an integral requirement for efficient and rational water management.

With rapid industrialization and

demands for a better quality of life, energy requirements have gone up as well. In recent years, the energy needs of Asian developing countries are increasing very rapidly and are likely to continue to do so for the foreseeable future. This comparatively recent development has major water-related implications, which for the most part have been ignored by both water and energy professionals and policy makers.

Water and Food

Water is essential for food production. As the Asian population grows in the coming decades, more and more crop production will be needed for human and animal consumption. Equally, as Asian countries continue to make economic progress, increasingly more and more people will become affluent; thus, many are likely to change their dietary patterns and eat more protein, such as in meat and milk. This will further increase water requirements because animal husbandry requires more water than crop production.

This, however, does not mean that water demands for producing this additional food requirement will increase concomitantly. This is because there is no one-to-one relationship between water requirement and food production. Crop yields can be increased in different ways, including more efficient use of fertilizers and pesticides, better quality seeds, and improved management practices. In addition, the food produced should not be the only consideration. In reality, it is the food that is available to consumers that counts. Regrettably, in many Asian countries, 25–50% of crops, fruits, and vegetables produced at present are not consumed because of heavy losses at every stage of production, transportation, distribution, and storage. Reduction of these losses alone would increase food availability greatly, without any reference to water. Accordingly, there are many factors that affect the total food availability to consumers, and water is not necessarily the most important factor. These issues have complex interrelationships and are often location specific. Thus, it is often dangerous, and mostly misleading, to draw generalized conclusions on the quantity of additional water that may be needed to increase the availability of food to consumers in Asian countries, without additional comprehensive studies.

Agriculture is by far the major user of water in Asia. In many Asian countries, agricultural water use accounts for nearly 90% of total water use. However, this percentage has been declining steadily in recent years in Asia as a whole, as in the rest of the world. In contrast, industrial water use has been increasing. Nevertheless, in absolute quantitative terms, agricultural water

Watering crops in the Philippines

A major challenge for Asian developing countries in the areas of water, energy, food, and the environment is how to coordinate appropriately all the concerned resource policies, legal and regulatory frameworks, and institutions responsible for formulating and implementing these policies

uses in most Asian countries have been increasing.

A major problem with agricultural water use has been that many Asian countries have been pursuing incorrect policies in terms of water and energy used for groundwater pumping. Farmers in some subregions at present do not pay for the actual volume of groundwater pumped for irrigation. In addition, energy costs for pumping are very heavily subsidized by many governments. Accordingly, farmers often pump more groundwater than is needed for optimizing crop production. This over-pumping is resulting in a steady decline of groundwater levels in many Asian aquifers. As the groundwater levels decline, more energy is needed to pump the same quantity of water. Because the energy costs for farmers are heavily subsidized, the financial losses of many public electricity boards are continuing to escalate. This has contributed to a vicious cycle of overuse of groundwater, declining aquifer levels, increasing losses to the electricity boards, and increasing adverse environmental impacts (like land subsidence), none of which are sustainable on a long-term basis. Thus, major policy changes in the water and energy sectors will be needed in the near future to balance water and energy uses and stabilize the levels of declining groundwater tables.

In the future, these types of intersectoral policies need to be carefully analyzed, formulated, and implemented. Equally, the policies in any specific sector have to be coordinated with the policies in associated sectors. The current and past practices of formulating policies in one sector without adequate consideration of and coordination with the policies in the other sectors will become increasingly costly, inefficient, and unsustainable. Herein will lie a major future challenge for Asian developing countries: how to integrate appropriately all the concerned resource policies in the areas of water, energy, food, and the environment; the legal and regulatory frameworks necessary to support these policies; and the institutions responsible for formulating and implementing these policies. Such integration has been very difficult to accomplish in the past and is likely to be even more complex and difficult in the future. Yet, this will be an important and critical requirement of the future that must now receive greater attention from Asian governments, research institutions, and academe.

Water pumping for agricultural use in Nepal

Water and the Environment

An increasing social and political concern arose in the 1970s about the impact of water development and management policies and practices on the environment. Since about 1995, the implications of environmental management policies on water development and management have received increasing attention. During the past 35 years, water and environment policies have affected each other in many significant ways, sometimes positively, but at other times adversely. These interacting impacts—in terms of their distribution in time and space and in scale—are mostly site specific.

During the early part of the global environmental movement, the primary focus was on how to stop all types of pollution. For example, during the United Nations Conference on the Human Environment, held in Stockholm in 1972, the main water-related concerns considered were preventing water pollution and the impact of acid rain on forests and lakes. Shortly after, there was a backlash from some sectors of society on all types of large infrastructure development projects. This was especially relevant for large dams and irrigation projects. In this "small is beautiful" era, all large development projects attracted considerable criticism, some of which was justified but some was fictional.

Water plant and reservoir in the Lao People's Democratic Republic

During the 1980s and 1990s, large water development projects all over the world, and especially in Asia, came under considerable criticism from social and environmental activists and the nongovernment organization (NGO) movement. This movement probably reached its peak with controversies associated with the construction of some large dams—the Sardar Sarovar and the Tehri dams in India, and Arun II Dam in Nepal—and the Nagara Barrage (to prevent saltwater intrusion) in Japan. These controversies had both positive and negative impacts on future water development activities.

On the positive side, many social and environmental considerations that were not properly addressed earlier started to receive increased attention. Environmental and social impact analyses became the norm, rather than exception. Issues like involuntary resettlements and adverse environmental and ecosystem impacts due to large infrastructure development projects became important concerns. Indeed the pressure from certain sectors of society was such that these shortcomings not only received considerable attention, but planners and policy makers were forced to respond to them promptly and adequately. Consequently, many undesirable or even unanticipated aspects of the development activities were properly considered and often appropriate ameliorative actions were taken. This probably would not have happened at least within the observed time scales, without concerted opposition from certain sectors of society.

Indonesian residences adjacent to a sewage canal

The negative consequences of these controversies have been that many water infrastructure development projects that should have been constructed for poverty reduction, employment generation, and raising the living standards of the people made little headway. Several funding agencies stayed away from supporting these projects because of the controversies surrounding them, which consistently received considerable national and international media attention. For some unexplained reasons, water projects created more controversies than other types of development activities.

The situation has started to improve in recent years, especially during the present, post-2000, period, when it is being increasingly realized that infrastructure development must receive priority attention in all Asian developing countries. Equally, however, these structures need to be planned and managed in such a way that they are technically feasible, economically efficient, socially acceptable, and environmentally friendly. As societal perceptions have changed and the knowledge base to plan and manage water infrastructure has improved, it is now possible to improve the earlier practices significantly by maximizing the positive economic, social, and environmental impacts,

Wastewater pollution in Manila

minimizing the negative impacts, and ensuring that the people who are likely to pay the costs of the projects (i.e., those in involuntary resettlement) are explicitly made their direct beneficiaries. With this changing mindset and better understanding and appreciation of environment-development linkages, it is likely that the overall discussion of water development and environmental issues will become more objective and less polarizing in the future.

While this aspect of large water developments and their environmental implications has received considerable attention from the media and policy makers, another environmental issue has received somewhat benign neglect: increasing water contamination from point and nonpoint sources because of accelerating domestic, industrial, and agricultural activities. The provision of clean water supply has received considerable attention from policy makers in Asian developing countries, but commensurate interest in wastewater collection, treatment, and disposal has often been conspicuous by its relative absence. Regrettably, there are only limited signs that this attitude is starting to change.

And yet, increasing water pollution is a major issue for nearly all Asian developing countries. Unless the present perceptions and attitudes change radically, it is likely to be a critical water problem of the future. This is because at the domestic level, nearly all water that enters the household is eventually discharged as wastewater. Even in many urban centers where wastewater is collected through sewer systems, it is often discharged to freshwater bodies, land, or oceans with only limited, or even no, treatment. This means that the problem of increasing wastewater contamination is not being solved: it is being simply transferred from one location to another. The philosophy has been somewhat akin to "out of sight, out of mind."

The situation is becoming even more serious and complex with industrial wastewater discharges, which also, for the most part, receive inadequate treatment in nearly all Asian developing countries. Few Asian urban centers have functional secondary and tertiary waste treatment plants. Many primary waste treatment plants are nonfunctional for significant periods of time because of poor design, inadequate management and political interest, public apathy, and similar causes. Even when these plants function, most operate below their design efficiencies. The domestic wastes are primarily organic, as a result of which they degrade over a limited time. However, the situation is more complex and serious for industrial wastes, which contain significant amounts of

Increasing water pollution from accelerating domestic, industrial, and agricultural activities is a major issue for nearly all Asian developing countries. Unless the present perceptions and attitudes change radically, it is likely to be a critical water problem of the future

conservative elements that may be toxic to human beings and ecosystems, and are not easily biodegradable.

With rapid industrial and urban growth, environmentally-sound wastewater disposal in all Asian developing countries is rapidly becoming a serious social and human health issue. In addition, as the nearby surface water and groundwater sources for urban centers are being increasingly contaminated with domestic and industrial waste, these sources will require higher levels of treatment before they can be used safely as potable water. The treatment processes needed to decontaminate polluted sources are likely to become increasingly sophisticated and expensive, which may not be an attractive or feasible alternative for many urban areas because of economic and technology management constraints in the coming decades.

Many countries have now accepted, or are in the process of accepting, that the environment is a legitimate user of water

Water reservoir in China

Because wastewater management is often viewed, at least in terms of practice, primarily as collection and then disposal in nearby rivers, lakes, and oceans, water bodies within and around urban centers are already highly contaminated. Land disposal of wastewater is also contaminating groundwater, which is often an important source of drinking water.

These assessments refer only to point sources of contamination from domestic and industrial users: nonpoint sources are not covered. Because the use of agricultural chemicals in many Asian developing countries is still somewhat limited, nonpoint sources of pollution are still not as serious as point sources. However, as there is increasing emphasis on improving crop production per unit area to enhance both farmers' incomes and food security, more and more agricultural chemicals are likely to be used in the future. This will further aggravate the water quality situation, because control and management of nonpoint sources of pollution are very complex and difficult tasks, as even the most developed countries like Japan and the United States have experienced.

Thus, in a macro sense, a major challenge facing Asian developing countries is how quickly and how efficiently current wastewater management practices and processes can be substantially improved. Considering the cost of construction and efficient operation of wastewater management systems, and the number of trained and experienced personnel needed to manage them—ranging from managers to plant operators and technicians, who are mostly not available at present—resolution of this problem in the foreseeable future will be a Herculean task.

Another macro issue in the water and environment area is likely to stem from the increasing acceptance of the concept of environmental flows. Many countries have now accepted, or are in the process of accepting, that the environment is a legitimate user of water. This means that certain quantities of the flows in rivers

have to be earmarked for environmental and ecosystem use.

It is highly likely that in the foreseeable future, there will be increasing acceptance of this concept in Asian developing countries. This will present two types of problems, one conceptual and the other practical. At the conceptual level, considerable work needs to be done as to how environmental flows of rivers can be reliably estimated for the various Asian countries, with different climatic regimes, physical and ecosystem conditions, and other associated requirements. How can such flows be reliably estimated for both perennial and ephemeral rivers? Considerable progress has been made on estimating environmental flows in recent years, but much work remains before the scientific community will agree on a reliable and uncontroversial methodology.

At the practical level, water resources of many of the Asian rivers are already fully allocated and, in some cases, over-allocated, especially during the dry seasons and drought periods. Under such conditions, new allocations of water to the environment will mean that some existing allocations to domestic, industrial, and agricultural sectors have to be reduced. Socially and politically, it will not be an easy task to reduce the current allocations to existing users so that this amount can be diverted for environmental use. In addition, for transboundary rivers, as well as interstate rivers in federal countries like India and Pakistan, this will raise new sets of legal issues, especially when inter- and intra-country treaties already exist for water allocations to various state parties. Considering it often takes 20 years or more to negotiate new water allocation treaties for transboundary and interstate rivers, implementation of the concept of environmental flows will not be an easy process in many Asian locations.

Finally, the impact of the environment, especially through natural disasters, on water and sanitation infrastructure, cannot be forgotten. As much as possible, infrastructure has to be designed to withstand floods, earthquakes, and other natural disasters—the 2004 tsunami in Aceh Province, Indonesia, being a good example (Box 1).

Box 1: Natural Disasters and their Impact on Water Supply and Sanitation – The Indonesia Tsunami Experience

The tsunami that followed a massive earthquake on 26 December 2004 off Indonesia, devastated the human population living on the coastline of Aceh Province and parts of North Sumatra Province. The rural water supply (dug wells and hand pumps) was hard-hit by the disaster. Significant damage was also experienced by water utilities in Aceh's urban areas. Total damage and losses in the sector were estimated at US$29.7 million (Rp276.4 billion), of which 96% was for water supply and the remainder for sanitation. Relatively little damage was done to the urban sanitation system, largely because sanitation was provided by septic tanks with no investment in sewerage. For water supply, two thirds of the damage was incurred by small-scale and private providers, and the balance by the water supply enterprises.

Source: BAPPENAS and the International Donor Community. 2005. Indonesia: Preliminary Damage and Cost Assessment – The December 26, 2004 Natural Disaster. http://www.adb.org/media/Articles/2005/6618_tsunami_impact_Indonesia/Aceh_Joint_Government_Donor_Damage_Assessment.pdf

Water and Energy

As the energy needs for Asian countries continue to increase significantly, the water requirements of the energy sector are likely to explode as well, a fact that has mostly escaped the attention of water and energy planners. Large-scale generation of electricity invariably requires water. Without water, hydropower, an important source of electricity in many Asian countries, cannot be generated. Equally, thermal power generation from coal, oil, or natural gas requires very large quantities of cooling water. Nuclear power requires even

Hydro energy–generating dam, Indonesia

more cooling water. If the current rate of 5–8% in annual increase in electricity consumption is to be maintained in many Asian developing countries for the indefinite future, as is expected at present, water requirements for the energy sector need to be carefully assessed, and then factored into national water policies. Already, in countries like France, the major user of water is the electricity-generating industry, not the agricultural sector.

In spite of the burgeoning demands of the electricity-generating industry for water, the growth rates of which are likely to remain at similar levels or even accelerate further in the coming decades, not one Asian developing country has seriously assessed the current and future water requirements of its energy sector. Furthermore, assuming that this water demand has to be met, what are the implications for water allocation to other existing uses, and also in terms of impacts on aquatic ecosystems? There is no question that the water requirements for the energy sector will increase significantly in the future, even if it is assumed that the existing systems for generation and distribution of energy become more efficient in the coming years.

In addition, there is considerable momentum in the production of crops for biofuel. If efficiently produced, biofuel can contribute to improving the energy security of some nations, but this will not come without social and economic costs. It will also have significant implications for many other natural resources, especially land and water, in terms of their availability and use patterns.

Asian biofuel production will require more and more water if this subsector expands, as expected. As the use of agricultural chemicals like pesticides and fertilizers increases to improve the yields of the biofuel crops, water bodies around such production systems may witness higher levels of nonpoint pollution. Accordingly, the production and processing of the biofuel crops are likely to bring with them attendant water quantity and quality implications. As long as these implications are clearly thought through in terms of social, economic, and environmental considerations, and appropriate remedial measures are implemented as and when required, the problems may be manageable. However, as of now, virtually no country has carefully analyzed the water, land, and social implications of increasing biofuel production, and then made appropriate policy decisions. These are important issues that need to be carefully analyzed by national policy makers in the future to enable them to make coordinated policies in terms of energy, land, water, the environment, and poverty reduction.

In addition, just as the energy industry requires large quantities of water to function, the water sector is equally an important user of energy for its operation. Energy requirements for pumping are already very significant in nearly all

Asian countries. As water and wastewater treatment plants increase exponentially in the coming years, the energy needed for their proper operation and maintenance will increase concomitantly. Thus, the water and energy sectors will be even more closely interlinked in the future than they are now. This will require increasing coordination and integration of policies related to the management of these two sectors.

Furthermore, with the reduction in the costs of desalination in recent years, it is becoming an important source for increasing supplies of water. Membrane technology is likely to be increasingly used in the future for wastewater treatment. By using the new generation of membranes and improved management practices, seawater desalination costs have fallen by a factor of three during the past decade. At the current cost of producing desalinated or decontaminated water (around US$0.45–0.60 per cubic meter) through reverse osmosis, the technique has become cost-effective for many countries for special situations and conditions (for example, island countries like Singapore). The cost of purifying brackish water is now even less: US$0.20–0.35 per cubic meter, depending on its salt content. These recent technological breakthroughs are bringing new alternatives toward solving water quantity and quality problems but have many other implications, especially in energy and technology management, which need to be carefully assessed before they can be successfully and extensively used on a sustainable basis in Asia.

Thus, it will become increasingly important for planners and policy makers to concurrently consider water and energy policies, especially in terms of their symbiotic relationship: each affects and is affected by the other. This interlinkage is likely to only intensify further in the future. Formulation of policies in either sector that do not consider such interlinkages and interrelationships are likely to become increasingly counterproductive, especially in social, economic, and environmental terms.

The rapidly changing landscape in Asia means that water management practices and processes are now faced with complex and intersectoral challenges from other resource and development sectors, the types of which have been seldom faced in the entire human history. Meeting these challenges successfully and in a timely manner will require new and innovative approaches and solutions. Past experiences and present practices are no longer enough.

As the energy needs for Asian countries continue to increase significantly, the water requirements of the energy sector, including the new biofuel subsector, are likely to rise as well

Inspecting Tangshan City Dongjiao Waterwaste Treatment Plant, People's Republic of China

II. Water-related Trends

Unlike in the past, it is no longer enough to consider only the current water trends to ensure efficient water management in Asia in the future. It will be increasingly essential to identify the present and likely future trends in other sectors that will significantly affect water management directly or indirectly. This will not be an easy task because much of Asia is undergoing a massive economic and social transformation, which is unleashing forces that often may have significant water implications. Some of these forces are known but often unquantifiable, while others are as yet unknown. In addition, Asian countries are not homogeneous in their social and economic development, or in the different factors that are likely to affect their development processes. Thus, it is not possible to draw a generalized picture of water-related trends in Asia that will be equally applicable all over the region. The issue becomes even more complex when the potential impacts of globalization, free trade, communication and information revolution, and concurrent quests for energy, food, environment, and water securities are considered. All these will affect the quantity and quality of available water through numerous pathways.

River bank slums, Manilla

In spite of the differing Asian conditions and situations, a general overview can be considered for several overarching transformational forces likely to affect Asian water management practices and processes. Among these transformational forces are demography, climate change, and technology, discussed in this section.

Demographic Transformation

Asia currently accounts for slightly over 60% of the global population, and also for almost two-thirds of global population growth. The Asian population is expected to grow by nearly 500 million within the next 10 years, and virtually all this growth is expected to be in urban areas.

South Asia is among the most densely populated areas of the world and has the highest concentration of poor people in the world. While the population growth rates in countries like Bangladesh and India have declined, they have not in Nepal and Pakistan.

Southeast Asia is less populated than South Asia, but it also has crowded areas, especially Java, part of the Philippines, and deltas of rivers like the Red, Mekong, Chao Phraya, and Irrawaddy. During the 80-year period 1970–2050, the population in this region is estimated to grow 3-fold. The corresponding estimate for South Asia is 3.4-fold, and for the People's Republic of China (PRC), 2-fold.

Large and growing populations exert increasing pressures on natural resources like land and water. However, the relationship between human population size and demand for natural resources is not a simple one. Throughout history, social and economic changes and factors like technological developments and better management practices have affected pressures on the natural resource base. This pattern is likely to continue for decades to come.

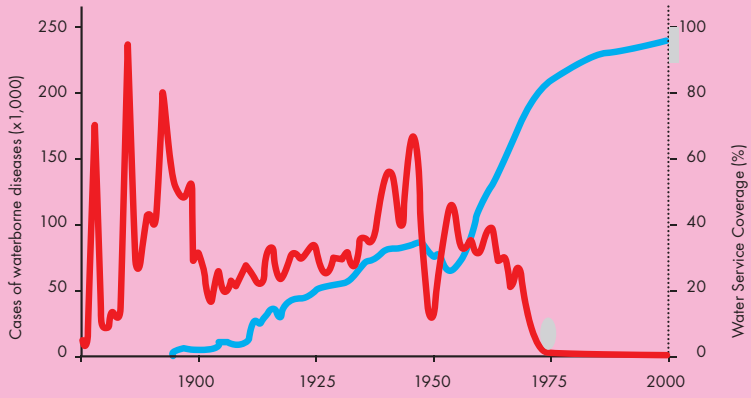
In the past, population growth has generally been considered to be exogenous to water management. This is not correct. Populations affect water in terms of demand, use patterns, and management practices. Similarly, water affects populations directly in terms of health (for example, waterborne diseases affect mortality rates), and indirectly, through such issues as regional development, employment generation, and gender-related matters. Box 2 illustrates how improving water supply has improved public health in Japan.

In terms of demographic transformations, two issues that are likely to affect water in increasing ways are urbanization and aging. These issues need special consideration.

Box 2: Increase in Water Service Coverage and Public Health Improvements through the Development of Small-scale Public Water Supply Services in Japan

Before World War II, waterworks were regarded as infrastructure that was available only in the central areas of Japanese cities. However, the national water service coverage significantly increased after the war and has now reached 97%. This is largely due to the rapid development of waterworks facilities during the 1960s and 1970s, which particularly targeted previously unserved areas. This was carried out by water utilities that serve a population of 5,000 or less and areas where public health issues were urgent. The national Government established a subsidy system in 1952 to develop and support small-scale public water supply services.

As shown in the Figure below, the number of outbreaks of water-related infectious diseases has dramatically decreased, particularly since the mid-1970s. This demonstrates that the development of waterworks played a significant role in public health improvement.



Source: Japan Water Works Association. Outline of Water Supply 2001, 30 August 2001.

Urbanization

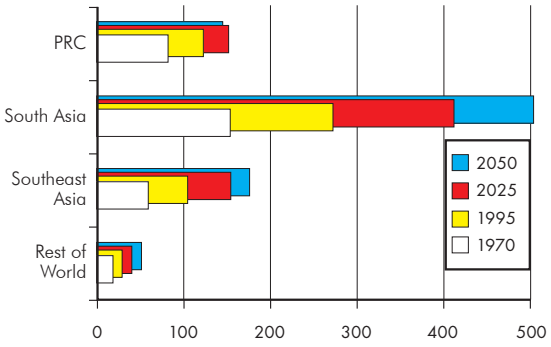
Globally, the rural and urban population is now roughly in balance. However, Asia has been behind Latin America in the extent of urbanization. Accordingly, Asian countries are likely to witness a massive urbanization process during the next 2 to 3 decades. While it is estimated that the Asian rural population will remain almost stationary between now and 2025, the urban population is likely to increase by 60%. Changes in population densities in South and Southeast Asia and the PRC are shown in Figure 1 for 1970–2050.

Massive urbanization, which is unprecedented in the entire Asian history, will present new types of water-related challenges that all countries will have to face. These challenges may not be similar to those expected at present. They could be of a wholly different character, and some may even be counter-intuitive. For example, considerable attention has been paid in recent years to the water and wastewater problems of the megacities,

Massive, unprecedented urbanization in Asia—especially the many small urban centers (<500,000 people)—will present new types of water- and wastewater-related challenges that all countries will have to face

Addressing the challenge of providing piped water to crowded slum communities

Figure 1: Population Density in Selected Parts of Asia and the Rest of the World (persons per square kilometer)



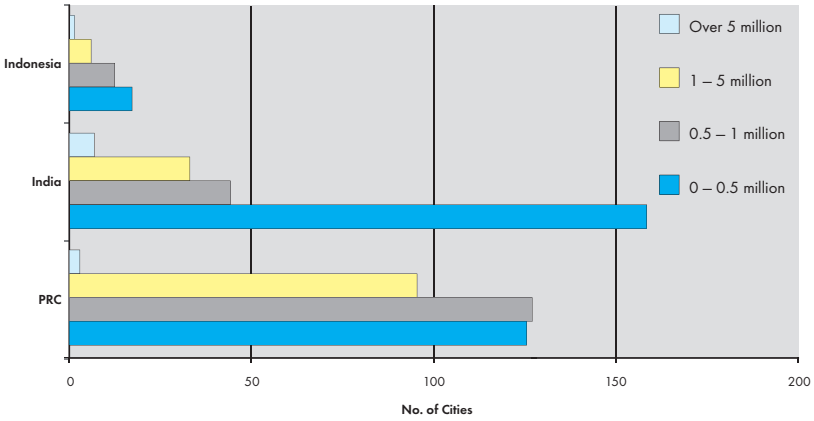
defined by the United Nations as having populations of more than 10 million. While Asian megacities consume the lion's share of national resources and interest, they represented only 3.7% of the global population in 2000. This is expected to increase to about 4.7% by 2015. The percentage of population living in the next category of large cities, between 5 and 10 million, is even less: 2.8% in 2000, and rising to 3.7% by 2015.

In contrast, urban centers of 500,000 or less accounted for 24.8% of the global population in 2000 (nearly seven times that of the megacities) and this is projected to increase to 27% by 2015. These centers have received scant attention from national and international institutions, and water and development professionals. Yet, the annual average population growth rate for these smaller urban centers is expected to increase from 23.2% during 1975–2000 (comparable growth rate for megacities was 5%, or less than a quarter) to 28.2% during 2000–2015, compared to 7.5% for megacities. Figure 2 shows that the majority of the cities in Indonesia and India have a maximum population of 500,000, while in the PRC, cities with populations of 500,000 and below are a

close second to cities with populations ranging from 500,000 to 1 million. Thus, solving the future water and wastewater problems of these small urban centers will need at least as much attention as the megacities, if not more. Their water problems are likely to be significantly more difficult to resolve than those of megacities, because these smaller centers do not have adequate financial and political power and technical and management capacities to handle their much higher urbanization rates. Even though the number of people involved in smaller centers is 6.7 times that of the megacities—and their growth rates are expected to be four times those of the megacities—it is a strange anomaly that these smaller centers are receiving conspicuously less attention from national and international policy makers. Unless the present policy and focus change radically, these centers are likely to be major water and wastewater "black-holes" of the future. Box 3 shows how the Republic of Korea addressed the problem of imbalanced water supply to benefit water-stressed areas.

Another issue worth noting is the dissimilarity in the urbanization processes between the megacities of the developed and developing world. Cities like London and New York grew progressively over nearly a century. This gradual growth enabled these cities to develop effectively their water and wastewater infrastructures and their management services. In contrast, the growth rates of the Asian megacities like Dhaka, Jakarta, or Karachi in recent decades have simply been explosive (Figure 3). They have invariably found it very difficult to run faster even to stay in the same place. Most simply have not been able to cope with the explosive growth rates.

Figure 2: City Size for Capital Cities and Urban Agglomerations



Source: Asian Development Bank and Cities Alliance: Cities with Slums, 2006. Urbanization and Sustainability in Asia. Case Studies of Good Practice.

To a certain extent, many of these megacities have managed to provide water to their residents, especially to the reasonably well maintained residential areas. However, in many cases, the water provided is not drinkable without additional treatment. Furthermore, they have progressively fallen behind in the collec-

Box 3: Formulation of Multi-regional Water Supply Systems with Expansion Water Supply Facilities

The Republic of Korea is setting up wide-area water supplies, which include waterworks adjustment by zone to use water resources more efficiently, and integrated waterworks systems by zone to improve the efficiency in managing water supply facilities. A wide-area water supply is a facility that provides purified water to at least two local communities that have suffered from a poor water supply system. It helps provide a large amount of water to a number of districts, and ensures a sustainable water supply for those districts. Moreover, it helps address the water supply imbalance between the districts.

A basic guideline on wide-area water supply was completed in 2003, dividing the nation into 12 zones based on the proximity to water facility and connection to the supply system. Multipurpose dams are being planned and constructed in different zones of some rivers and others are scheduled to be included in the near future.

Through these efforts, more water can be provided to water-stressed areas, which will contribute to resolving the imbalance of water supply among areas and to providing stable water supplies even in emergencies, such as drought.

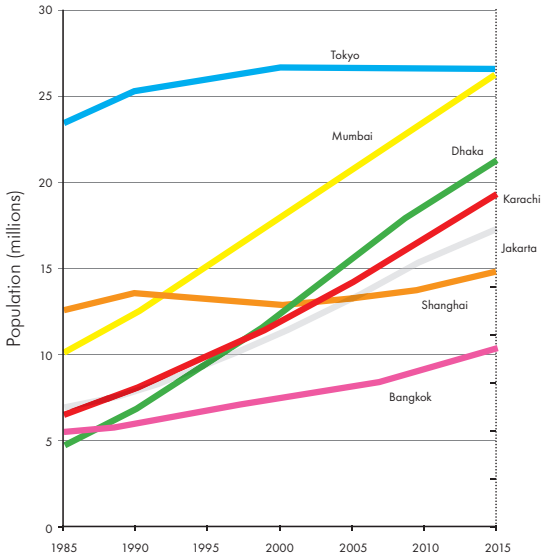
Source: Water Resources in Korea 2007, Ministry of Construction and Transportation, Republic of Korea.

tion, treatment, and environmentally safe disposal of wastewater. Wastewater may be collected from sections of these cities, but often is discharged to nearby rivers, lakes, or oceans without any treatment, or with only primary treatment. Because of this continuing neglect, water bodies in and around many urban centers of Asian developing countries are now heavily contaminated. This has already resulted in serious environmental and health problems. It is likely that if there will be a water crisis in the future, it will not come because of actual physical scarcity of water, as many predict at present, but because of continuing neglect of proper wastewater management practices. Continuation of the present trend will make available water sources increasingly more contaminated, and will make provision of clean water more and more expensive, as well as more complex and difficult to manage.

Another major difference in terms of water management between developed and developing countries is that as the urban centers of the former expanded, their economies were growing as well. Accordingly, it was possible for them to harness financial resources for efficient urban water and wastewater management. For example, Japan could invest heavily in the conservation of urban water infrastructure after 1950 because it was also concurrently experiencing rapid economic growth. Such extensive infrastructure development and major improvements in management practices meant that unaccounted for water in a megacity like Tokyo could be reduced from an estimated immediate post-war proportion of 90% to about 8% at present, one of the best in the world. Equally, cities like Tokyo could invest heavily to control urban flooding, which would have been difficult if Japan's economy was not expanding during this period.

In contrast, the rates and extent of urbanization in developing Asia have generally far exceeded the capacities of the national and local governments to plan and manage the demographic transition process soundly, in terms of providing clean water and wastewater management services efficiently, equi-

Figure 3: Population Increases in Selected Asian Megacities



Riverside park, Suzhou Creek, People's Republic of China

Installing metered pipelines in Manila's Alitaptap community

tably, and sustainably. The impacts of this inadequately managed urbanization process are manifested in extensive air, water, land, and noise pollution, which is having, and will continue to have, major impacts on human health and the quality of life of urban dwellers, as well as imposing major costs on the respective economies.

Another urbanization-related problem is the sudden, fast rate of vertical growth, especially in the central business areas, often after decades, or even centuries, of primarily horizontal expansion. This has invariably contributed to a sudden surge in population densities in these areas, with concomitant high water and energy requirements, as well as generation of high waste (wastewater and solid waste) loads per unit area. The urban centers have simply not been able to cope successfully with such near instantaneous accelerating demands for water and wastewater management services. The problem is compounded by the prevailing unsatisfactory water supply and wastewater management services, absence of long-term planning, inadequate management of technical and administrative capabilities, lack of investment funds, and high levels of corruption.

There are, however, signs of hope. For example, in the PRC, the importance of providing clean drinking water and proper wastewater management services has started to receive increasing attention. Because the PRC's economy has grown substantially in recent years, the country can afford to provide good water and wastewater management services to its urban citizens. Tariffs have risen to meet costs and even resulted in lowered industrial consumption, as illustrated in Box 4. Water and wastewater issues have become priority considerations for the country's national, regional, and local policy makers. It is likely that countries like the PRC will make significant progress in urban water management during the coming decades.

Box 4: Tariff Reform in the People's Republic of China

In the PRC, domestic water supply tariff rates have increased by 126% in Zhangjiakou and 92% in Dalian since the beginning of 1998. Increases appear to have been well accepted by the population and affordability does not appear to be an issue, although in Zhangjiakou, a cash rebate equivalent to consumption of up to 5 cubic meters/month is paid twice yearly to certified poor households.

However, nondomestic consumption has clearly fallen in response to the price increases. In Dalian and Zhangjiakou, where nondomestic tariff rates have risen respectively by 110–150% and 180–190% since the beginning of 1998, industrial consumers reduced average consumption by 30%, implying high price elasticity. Consumption by one large industrial user in Zhangjiakou fell by 45%

Source: Asian Development Bank. 2002. Impact Evaluation Study on Water Supply and Sanitation Projects in Selected Developing Member Countries. (IES REG 2002-17). Manila. Website: http://www.adb.org/Documents/IES/Water/ies_reg_2002_17.pdf

Aging Population

A major factor that is still not being adequately considered in Asian countries is the implication of an increasingly aging population on water-related issues. The age structure of the global population, including in Asia, is undergoing rapid changes. For example, the number of elderly people (65 and over) was 131 million in 1950. This increased to 480 million in 2006, and is estimated to reach 1,465 million by 2050.

The issue of an increasingly elderly population has yet to receive adequate attention in Asia, except to a certain extent in Japan. And yet, it is likely to be an important policy issue in nearly all Asian countries during the next 3–4 decades. Countries like the PRC have at present a major demographic window of opportunity to restructure their economic development activities during the next 2–3 decades, with a trained, experienced, and energetic workforce. However, after 2010, the number of elderly people will start to increase quite rapidly, so much so that by 2030, the PRC will have more elderly people than the current population of the United States.

Increase in the number of elderly people will be also an important issue for the countries of South Asia (including India) and Southeast Asia. The steady aging of populations in East (excluding the PRC) and South (excluding India) Asia, and the two most populous Asian countries (PRC and India) are shown in Figure 4. The problem of increasing elderly populations will be a complex one for Asian countries to address. It will have major social and economic implications, and will affect the water sector through direct and indirect pathways.

The relationship between water management and an increasingly elderly population is completely unexplored territory at present, not only for Asia

Rest stop while collecting water, Afghanistan

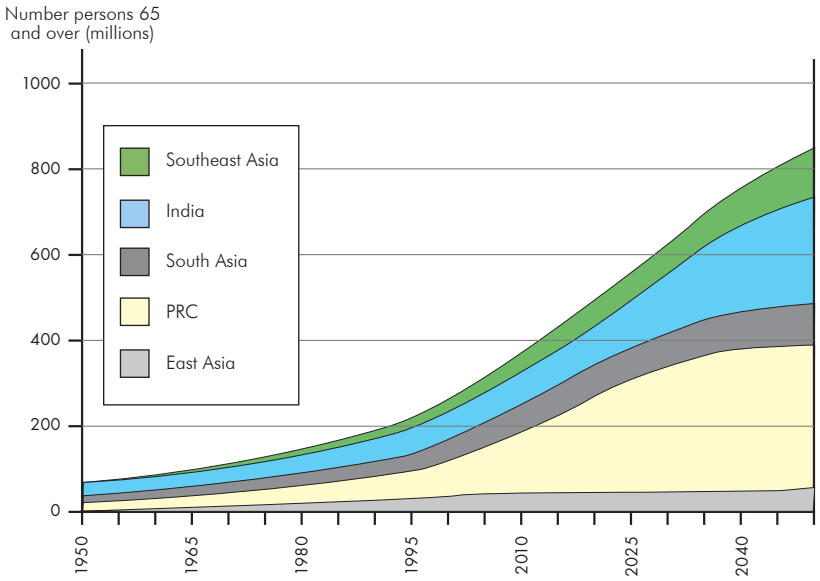
but also the world as a whole. It is likely that they will affect each other in a variety of ways, a few of which can be discussed in an anecdotal fashion.

First, in the context of rural and semi-urban areas of many Asian developing countries, and in the absence of water and wastewater connections at the household level, people are forced to use communal land and water bodies for hygienic purposes. For elderly people, routine daily hygiene practices become a chore, especially when physical movements become difficult, or when they are sick. With improvements in healthcare, education, and nutrition, people will be living for increasingly longer periods. Absence of water and wastewater collection facilities at home will pose particular burdens on an increasing elderly population.

Second, as the older generation of people retires from work, considerable knowledge, experience, and collective memory will be increasingly lost. In a country like Japan, many knowledgeable and experienced people will retire from the water sector during the next 5–10 years. The overall institutional knowledge and experience levels in the water sector may decline very suddenly, and this cannot be readily replaced by younger and new recruits. This has already been identified to be a serious issue in Japan.

Third, it is generally the young people who migrate to urban areas in search of better standards of living. Thus, the percentages of young people in the rural areas will continue to decline, with attendant decline in their economic, social, and cultural activities. This will accelerate the break down of the extended family systems. Consequently, the family support that was available to the earlier generations of elderly people will continue to decline steadily. This will contribute to increasing social and economic problems in terms of deteriorating lifestyles of the elderly and social stress to their family members who may have migrated to the urban areas.

Figure 4: Increasing Elderly Population in Asia



Note: South Asia excludes India, and East Asia excludes the PRC.
Source: Varis, O. 2007. *Water Resources and Development in Changing Asia.*

Pumping water, Chengdu, People's Republic China

Finally, virtually no research has been done on the water requirements of the elderly and their interrelationships with water through various social, economic, and cultural pathways. Not a single Asian institution is conducting serious research in these new issues, but they need to be studied diligently in the future.

Climate Change

Climate change is likely to increase the frequency of extreme events like droughts and floods. If so, water infrastructure and management practices have to be more robust and flexible, which will not be an easy task without significant increases in our current knowledge base

It is now widely accepted that the global climate is changing. This is creating a new level of uncertainty in water planning and management processes because it is difficult to manage water projects efficiently without appropriate information on the likely future distribution of rainfall and temperature patterns over space and time. At the present state of knowledge, it is not possible even to predict with any degree of confidence the annual average changes in rainfall and temperature over a country as a whole, let alone for specific areas considered for planning purposes. Furthermore, for water planning and management, changes in annual average rainfalls and temperatures over a country, or a large region, even if they could be predicted with a considerable degree of confidence, are likely to be of very limited use. Unfortunately, it is still not possible to predict even such macro changes in the climate parameters for the future.

Mega Dike or the FVR dike in central Luzon being supported by sand bags.

What is needed for efficiency and long-term water management is not annual average climatic information, but the extent of likely inter-annual and intra-annual variations. These are simply not possible to forecast at the present state of knowledge.

This, of course, is a global problem, and not strictly related to Asia. However, the problem is even more complex for the Asian monsoon countries, where most of the annual rainfall occurs within 60–100 hours, though these durations are not consecutive. It will be a very difficult task to predict how the rainfall patterns may change during these few hours of intense annual rains, which must be stored properly so that water is available for various uses over the entire year, and between years, especially during prolonged drought periods.

The current consensus is that climate change is likely to increase the frequency of extreme events like droughts and floods. If so, future water infrastructure and management practices will have to be more robust and flexible. Technologically and economically, it will not be an easy task to build in the appropriate flexibility and robustness without significant increases in our current knowledge base. This is unlikely to happen during the next 10, or even 20, years because of the complexities of the climatic processes involved, which are still not fully understood. Building flexibility and robustness in the design, construction, and maintenance of water infrastructure will also mean higher

financial costs, which may further strain the economies of some countries.

Thus, climate change is likely to introduce high levels of risks and uncertainties that the water profession simply may not be able to handle with any degree of confidence, at least over the near term. Superimposition of "normal" climatic fluctuations with the expected changes in climatic patterns will make efficient water planning and management an exceedingly complex and difficult task during the post-2025 period. This aspect needs urgent attention and accelerated research from water scientists and climatologists, especially in the Asian monsoon counties, if serious water-related stresses are to be avoided in the future.

Technology

Like climate change, technological developments are likely to introduce another set of uncertainties in water management practices and processes. However, unlike climate change, technological developments are much more likely to bring positive surprises in numerous aspects of water development and management.

The information and communication revolutions have had radical impacts on water. Management and analysis of water-related data have become far simpler economic and efficient processes than ever before in human history. Information storage, retrieval, and exchange have improved exponentially in recent years. South-South knowledge transfer, which was in its infancy some 25 years ago, has now come of age due to tremendous improvements in information management and exponentially declining costs. In future, these developments are likely to advance even further.

In a rapidly changing Asia, tomorrow's water problems can no longer be identified, let alone solved, with today's knowledge and yesterday's experience. A whole new mindset will be needed to identify and solve the future water supply and related problems

Water treatment plant maintenance, Manila

Another area that will have a major impact on water-use patterns will be biotechnological advances. These advances will help in the development of pest-resistant and drought-resistant crops, as well as crops that can be grown in marginal quality water, like saline water. The net impacts of these likely developments may be that crops can be grown with less water, and also with the use of marginal quality water.

Biotechnology is likely to help in many other ways. For example, a new variety of rice under field trial can survive for 3–4 weeks under flood water. Every year, hundreds of thousands of tons of rice crops are lost in Asia due to prolonged submergence under flood water. These new varieties of rice crops will be able to withstand most flooding.

Similarly, biotechnology is making rapid advances in wastewater treatment. It is highly likely that there will be further very substantial improvements and breakthroughs in these areas during

Box 5: Location-specific Water Solutions in the People's Republic of China

- In Beijing, a 30,000 square-meter housing complex with a rainwater recycling system was constructed to solve a water shortage problem.
- In the industrial southern city of Shenzhen, officials have introduced measures to use seawater to flush toilets to address water pollution.
- The Government is constructing a gigantic south-to-north diversion project to take water from the Yangtze River to the dwindling Yellow River in order to solve the problems of drought in the north and flooding in the south.
- In hilly Korla City, which gets whipped by sandstorms some 40 days every year, in Xinjiang Province, the local government installed a drip line irrigation system to provide water to more than 3,000 hectares of trees planted to address the problem of desertification.

Source: Asian Development Bank. Draft Countrywide Water Issues.

the coming decades. These could have profound effects on water quality management, which is now a very serious problem nearly all over developing Asia.

Another area where remarkable progress has been made during the past decade is membrane technology. With the new generation of membranes and improved management practices, seawater desalination costs have come down from US$1.50 to about US$0.50 per cubic meter during the past decade. Because a large proportion of the Asian population lives within 100 kilometers of a coast, provision of clean water for domestic, commercial, and industrial needs is no longer a physical constraint.

The water profession, in general, has not fully appreciated the implications of technological advances, which are likely to affect water-use patterns and requirements very significantly. However, even when the new technologies become available and cost-effective, national capacities to manage them properly need to be developed. Capacity building for managing water resources in the coming years, in spite of considerable rhetoric, is still not receiving enough attention in most Asian countries. It should be realized under a rapidly changing Asia, that tomorrow's water problems can no longer be identified, let alone solved, with today's knowledge and yesterday's experience. A whole new mindset will be needed to identify and solve future water-related problems, which will require substantial attention and additional investments in capacity building.

All the existing and the likely future trends indicate that there will be tremendous opportunities to solve the future water problems of all Asian countries. There will also be new sets of constraints that have to be overcome. The opportunities and constraints may differ from country to country and even within a country. Equally, solutions may be location specific, as illustrated for the PRC in Box 5. Asian countries that focus on finding and implementing solutions for the water-related problems that they are likely to face in the future will make remarkable progress in terms of water management. Water should no longer be a constraint for them to accelerated economic development or poverty reduction.

III. Urban Water Management

Water has many uses and its efficient management covers a multitude of issues, including nearly all development sectors and most disciplines. Accordingly, it is not possible to cover all aspects of water in one single issue of the *AWDO*. In addition, as noted, Asia is a large heterogeneous continent, where a set of issues of priority concern to one country may be of little interest to another. Thus, for the first edition of *AWDO*, the main focus is on urban water management. This is because in all Asian countries, the highest priority is invariably given to domestic water use. With accelerating urbanization in Asia, management of the entire water cycle in an urban context has become a priority consideration. Equally, urban water management is at present the major component of the ADB loan portfolio for the water sector. Other water issues, including rural water management, will be considered in subsequent *AWDO* reports.

Urban water management consists of three fundamental, but interrelated, services. First is the provision to households of clean water that is drinkable without additional treatment. Second is the collection of wastewater from all households and from industrial and commercial sources, which thereafter requires proper treatment and disposal in an environment-friendly way. Third is the efficient disposal of storm water, especially during the monsoon seasons. Often, only the first, provision of drinking water, is considered, while the other two services receive inadequate attention. Furthermore, even for drinking water supply, the focus tends to be on quantity; quality issues receive much less attention.

This boy enjoys clean drinking water direct from the tap in Phnom Penh, Cambodia

The importance of clean water supply and wastewater management became an important international issue following the United Nations Water Conference, held in Mar del Plata, Argentina, in March 1977. The Mar del Plata conference was the only meeting ever held on water at a high political level. This conference proposed that the decade of the 1980s be declared as the International Water Supply and Sanitation Decade, with the very ambitious objective of providing clean water and sanitation to every human being by the end of 1990. The proposal was subsequently approved unanimously by the United Nations General Assembly.

A retrospective analysis of that decade indicates that even though it did not reach its goals, it was a remarkably successful event. Because of the promulgation of the concept, hundreds of millions of people received accelerated access to water supply and sanitation, which may not have happened otherwise.

Urban sewage canal in Thailand

Subsequently, the Millennium Development Goals (MDGs) incorporated part of the objectives of the water supply and sanitation decade. One of the goals is to reduce by half the number of people not having access to clean water, between 1990 and 2015. Improvement in sanitation is not a component of the MDGs. The Johannesburg Summit, in 2002, recommended an equivalent sanitation goal to reduce the number of people having no access to sanitation by half within the 1990–2015 period.

Considerable attention is now given by national and international institutions to the achievements of the MDG on water supply, and to the Johannesburg target on sanitation. However, in much of the global discussions during recent years, the focus has been almost exclusively on achieving the numerical targets; the real objectives and the philosophy behind the two targets are seldom discussed.

When the idea of the International Water Supply and Sanitation Decade was first proposed, its objective was that everyone should have access to clean water that is drinkable without any additional treatment. Similarly, it was expected that access to sanitation, at least in the urban context, meant that wastewater would be collected from households and then properly treated for safe disposal to the environment.

During the intervening years, somehow the philosophies behind these goals were lost, and the emphasis was transferred to the achievement of the numerical targets. For example, there has been limited discussion on the quality of the water supplied to urban households. The discussion has almost exclusively focused on provision of a certain quantum of water, irrespective of quality in terms of drinking. Consequently, in many Asian urban centers, each household, or block of flats, now acts as a mini-utility.

Water of indifferent quality is collected and stored in underground tanks and then pumped to overhead tanks. This water is then treated, sometimes even with membranes, before it can be consumed. Where the main utilities supply water intermittently (2–4 hours per day), the mini-utilities at the household level transform it to a 24-hour water supply, followed by treatment, at high economic costs. This certainly was not the thinking behind the supply goal of the water and sanitation decade.

A similar anomaly exists with the sanitation goal as well. Wastewater may now be collected from urban areas, but is mostly either not treated, or only receives partial treatment, before being discharged to rivers, lakes, or oceans. Thus, the contamination and health problems are simply shifted from the urban areas where the wastewater originates, to another location where fewer people may be affected. Because of this transfer of the problem from one location to another, rivers, lakes, and oceans in and around urban areas of developing Asian countries are now seriously contaminated. This is already having serious adverse health, social, economic, and environmental impacts. If the present unsatisfactory trends continue, in one or two decades, Asian developing countries are likely to face a crisis on water quality management that is unprecedented in human history. Thus, it is absolutely essential that new wastewater treatment facilities are constructed at a massive scale and are properly maintained, so that the water contamination problems can be progressively reduced.

By diluting seriously the definition of access to clean water and considering sanitation only in a very restricted sense, developing countries, including many in Asia, are mortgaging their future in terms of water security. Such mindsets, including the tenor of the global water policy dialogue, have to change very significantly.

The Asian situation is similar to the rest of the developing world. Studies carried out in Mexico by the Third World Centre for Water Management for the Inter-American Development Bank indicate that if instead of sanitation, access to proper wastewater management is considered, only about 11% of the population in Latin America was covered in 1990. No similar study is available for Asia, but a ballpark estimate of the Asian developing countries is likely to be somewhat similar to that of Latin America. If a similar approach is taken as the MDG to formulate a target for access to wastewater treatment, it will mean that by 2015, Asian developing countries need to increase access to around 50–60% of the population, about four times that at present. This will not be an easy task, and yet this must be the real target for Asian countries.

Meeting that target is all the more worthwhile because investing in the water sector is investing in all the MDGs, not just Target 10 and the Johannesburg target on sanitation. Safe water supplies immediately improve people's health and save them time, which they can use to study or improve their livelihoods, so they can earn more, eat more nutritiously, and enjoy more healthy lives. Improved sanitation protects the poor from socially and physically degrading surroundings, health risks, and exposure to dangerous environmental conditions. It is easy to see how $1 invested in the water sector turns into a benefit equivalent to $6. All too often, though, the expectation and analysis of benefits from water supply and sanitation projects are limited to the most common intended result—better health.

Many developing countries will mortgage their future in a decade or two in terms of water security, by considering sanitation only in a very restricted sense of collecting and transferring the untreated sewage to another area thereby contaminating freshwater sources

Access to Clean Water

The main reason for the prevailing unacceptable situation is widespread mismanagement of water utilities, as a result of which the utilities cannot be run professionally

No sane person will argue with the fact that all human beings should have access to clean and drinkable water and proper wastewater management. When people do not have access to one or both of these services, the social, economic, and environmental costs are high, as is the overall cost to the national economy. The main issue is not the need for these services, which are now universally accepted, but rather how can these be provided to everyone cost-effectively, equitably, and promptly.

In many Asian developing countries, including most of South Asia, intermittent water supply is at present the norm rather than an exception. Yet, problems associated with an intermittent water supply are well known. Among these are provision of contaminated water, wastage of water at all stages, need for bigger pipes in the network (thus higher economic cost) for water delivery in a short time, unreliable metering, high levels of corruption, and stress among the urban poor to obtain their supply each day.

New water connection for a poor Vietnamese household

For most Asian urban centers, at least those with populations of one million or more, there is no reason why a continuous water supply of a drinkable quality cannot be provided. The common excuse currently offered for the intermittent water supply is that there is not enough water to ensure a continuous supply. A quick review will indicate to any reasonably intelligent person that the professed reason has absolutely no scientific, technical, or economic validity. For example, supply may be intermittent, but during the short period the supply is available, most consumers withdraw enough water, which is then stored at the household level, to provide a continuous supply. If the supply were continuous, the households would use a similar amount of water, but spread over the entire day. Also, in many Asian urban centers, more than 50% of water that enters the system never reaches its designated consumers due to leakages and poor management. In addition, urban areas like Malé now provide a continuous drinkable water supply with an average household consumption of less than 10 cubic meters per month. Yet, other Asian urban centers that supply more than 2–3 times this amount to each household claim that they do not have enough water to assure continuous supply!

The main reason for the current unacceptable situation is widespread mismanagement of the water utilities, as a result of which the utilities cannot be run professionally. There are high levels of corruption and an apathetic and disenchanted public, which has now been conditioned to expect only suboptimal results from their utilities.

Water Pricing

There are many reasons for the current untenable situation. Probably the most prevalent one is the view that water is a social good, and so should be provided free or at highly subsidized prices. In contrast, current studies indicate that without appropriate water pricing, the present vicious cycle of waste, inefficiency, and lack of services to both the rich and the poor will continue. Lack of income of the utilities due to inadequate water pricing will ensure that the water systems are not properly maintained, and investment funds are not available for updating technology, improving management and technological capacities, expanding the networks, and providing wastewater management. There is no question that the era when drinkable water could be provided to everyone free or at highly subsidized rates on a long-term basis is now over.

What is needed is the exact corollary of the present vicious circle by its replacement with a virtuous circle. This will mean a system where the users pay for the services they want, the poor who cannot pay receive targeted subsidies, utilities provide water supply and wastewater management services efficiently and accountably, users cover the costs of the services, and public funds are used for public purposes.

This, of course, does not mean that we now have all the answers on how water should be priced for different consumers and for different uses. Some hard questions need to be asked and answered. For example, how can it be ensured that the poor have adequate access to reliable water and sanitation services at affordable prices while the rich are not subsidized? How, by whom, and through what processes should these services be managed so as to ensure that the objectives of the provision of reliable services, economic efficiency, universal access, and maximization of social welfare are met consistently and concurrently? What type of institutional frameworks and governance practices are needed to improve the present delivery services substantially? How can all these requirements be achieved efficiently and quickly, and the means used be socially and politically acceptable to society as a whole? These and many other similar questions need to be asked and answered by every water utility, whether public or private, and by the government services that regulate them.

What is becoming increasingly evident is that there is no one "best" solution that would be applicable for all Asian countries. What is needed is the identification of a community of "good practice" models from Asian urban centers that have made remarkable progress in providing clean water and wastewater management services in recent years. If such models were available, including an

It is impossible to continue with the traditional idea of providing required drinking water to everyone free of cost or at highly subsidized rates

Manila Water's "Mother" meters provide bulk billing to slum-dwelling communities

assessment of the enabling environments needed for such practices to function, those Asian urban centers searching for an applicable model could select the one that best suits them. The selected model then has to be carefully adapted to suit the specific local conditions.

Public-private Partnership

The discussion of private sector involvement in water and wastewater management has often become emotional, with hardened positions of both proponents and opponents. The issue was strongly and emotionally debated during the Second World Water Forum in The Hague in 2000, and the Third World Water Forum in Japan in 2003. The opponents of private sector involvement argued repeatedly and vehemently that water pricing is a "code word" for handing over an essential public service to the private sector, which will then make unseemly profits at the cost of the poor. During the Hague Forum, it was widely assumed that a few multinational corporations would "control" the water-related services of the urban areas of the world. They would become so big and powerful that the public regulators would not be able to control them.

By 2003, when the Third World Water Forum was convened, the goal posts of the debate had shifted. While in 2000, a few multinational corporations were increasing their outreach at a very rapid pace, a scant three years later, the same companies were in retreat. Saddled by huge debts and significant losses in many concessions, and facing steeply declining share prices, most of them had to curtail their expansion plans in the developing world.

The focus of the discussion is slowly changing for the better, focusing on the end societal goals: universal equitable provision of clean water and wastewater management at affordable and economic prices. The means—how the services are provided and by whom—are less relevant, as long as the goals are achieved.

In this respect, past discussions have not focused on the main issue. At present, only about 5–7% (estimates vary) of the global population receive water and wastewater services from the private sector. Under all foreseeable conditions, it is highly unlikely that even 15% of the global population will receive such services from the private sector by 2025. Accordingly, if at least 85% of the global population continues to receive these services from the public sector, the main focus for discussion needs to be on how the existing public sector services can be improved very significantly in the coming years.

It should be noted that two of the most efficient water-related service providers in the world, Singapore and Tokyo, belong to the public sector. Equally, some of the worst performances in Asian developing countries can be found in the public sector. Similarly, the performance of the private sector has not been consistently better than the public sector. Some water management concessions given to private sectors have been successful, but others have not. Results have varied within a country (for example, a private concession in Morocco, Casablanca could be considered a success but not that in Rabat), and sometimes even within the same metropolitan area (a private concession for one half of Manila has worked but that in the other half has not), or over time (a private concession in Buenos Aires only worked initially).

Two other new factors are worth noting. First is the emergence of new Asian private companies that have

developed enough expertise and technical and financial know how to consider management concessions within Asia, and later perhaps beyond Asia. In the electricity sector, a Singaporean concern is already managing the services in Sydney. It is likely that private sector companies and public-private consortiums from Asian countries, especially from India, the Philippines, and Singapore, may become increasingly active over the next decade.

The second is the increasing outsourcing of specific activities and services that the local private sector can perform more efficiently than the public sector. These could be in a variety of areas like information technology, meter reading and billing, leak detection and repair, vehicle management, etc. Public sector institutions like the Public Utilities Board of Singapore and National Water Supply and Drainage Board of Sri Lanka are already forging ahead with outsourcing, resulting in win-win situations.

In future, what is needed is an increasing dialogue between the public sector, the private sector, and civil society so that a good mutually acceptable solution is formulated specifically for the concerned urban center. The main objective should be to provide continuous drinkable water supply and adequate wastewater management to all the residents, cost-effectively, equitably, and promptly. How this can be accomplished, and by whom, should be best left to the urban centers concerned without external interference and dogmatic beliefs.

Wastewater Management

In general, wastewater management has received far lower priority in Asian developing countries than has provision of water supply. In addition, in most of the locations where wastewater management has been considered, the main focus has been on the collection of wastewater from urban areas for disposal elsewhere with limited, or even, no treatment. As more and more water is supplied to urban areas, and concomitant progress is not made on its collection, treatment, and disposal practices, the overall water quality situation will deteriorate progressively.

A major problem facing Asian countries is the provision of wastewater management in slums and peri-urban areas. Where individual or communal toilets are not available, open defecation creates health, social, and environmental problems. It is also against human dignity, especially for women, the elderly, and the sick. There is an increasing emphasis on controlling open defecation in these areas, but much more remains to be done, not only in terms of expansion of hygienic toilets and their long-term maintenance, but also collection and safe disposal of grey water. Provision of toilets, although an essential and important improvement, is not enough; it must be an integral component of a functional wastewater management policy. This is an area where significantly more progress is needed in Asian developing countries.

Checking water flow in Simao District, Yunnan Province, China

Rehabilitation of Urban Water and Wastewater Works

Much of the discussion during the recent decades has been on the construction and operation of new infrastructure for water supply and wastewater management. There is no question that, with rapid urbanization, Asian countries have to move more and more aggressively to construct and maintain new works.

However, there is another issue that needs urgent attention from all Asian policy makers. This is the rehabilitation and redevelopment of earlier water and wastewater infrastructure. Some of the infrastructure is well over 50-years old, and now not only past economic life, but also too small in view of increasing population density and higher per capita water use.

Even in Japan, many of the water and wastewater facilities were built during the 1950s and 1960s and need to be progressively replaced with new designs and materials that comply with the latest construction standards and planning and design requirements. The investments in new water and wastewater infrastructure started to decline in Japan after 2000, and now are less than what is needed for rehabilitation. If this trend continues, more and more facilities that should be replaced will not be rehabilitated. Consequently, they may be left to deteriorate. If so, they will require much higher investment later and may impose some social and environmental costs on the areas concerned.

While Japan did start to rehabilitate its structures seriously, the same cannot be said for most Asian countries. In fact, very few have drawn up operational plans as to how old infrastructure can be rehabilitated, both in terms of geographical coverage and over time. Even the extent of the problem is not known in most countries, nor is it known what type of investment funds and technical and managerial capacities will be needed for their timely and cost-effective renewal. This is an area that deserves more attention from all Asian countries in the future.

Index of Drinking Water Adequacy (IDWA) for Asia

The Human Development Index (HDI) is now a universally accepted indicator for overall national progress. It combines one indicator each of health and education with per capita income. It enables what is lacking at the country level on the three important dimensions of human development to be ascertained.

Inspired by the success of the HDI, an attempt has been made to develop an index of drinking water adequacy (IDWA). This has been applied to 23 developing member countries (DMCs) of ADB, which together account for 3.4 billion people (2004 estimates), and covers nearly 99% of the population of all 44 DMCs (see the Appendix). However, not enough information is available from the other 21 DMCs from national and/or global sources to fully develop the IDWA.

It should be noted that the IDWA values indicated in the Appendix are preliminary estimates. As more water-related data become available, and as the quality of data improves, IDWA will improve as well. Furthermore, with time, more methodological breakthroughs are likely, which will further advance the technical and intellectual foundations of the index. Detailed information on how the IDWA has been computed can be found in the CD-ROM included with the *AWDO 2007* report.

IDWA has four important components: per capita estimates of renewable

internal freshwater resources, access, capacity to buy water, and per capita water use by the domestic sector. To these factors is added an indirect proxy of the quality of drinking water. This is because of the paucity of reliable water quality data in nearly all the DMCs. The proxy used for water quality is diarrheal deaths per 100,000 people in 2000.

It should be noted that IDWA, in its present form, is not intended to provide a reliable ranking of countries with regard to access to safe drinking water on a sustained basis. Thus, the Index should not be used for inter-country ranking.

Even in its current form, IDWA provides a much better picture of the national situations than do access-only indicators. In fact, each of the five components could trigger a message, depending on the country-specific situation. IDWA can assist development policy, programs, and projects as a tool for assessment, monitoring, and benchmarking. For national policy makers and external support agencies, it could also be an instrument to make a good case for additional improvements and investments in drinking water so that the index value can move higher, toward 100.

IDWA can also assist countries in targeting one or more of its components to move further up the scale. For example, Papua New Guinea has adequate water resources, but not the wherewithal to supply water, which could receive priority attention. Similarly, Malaysia has an edge over the Republic of Korea in terms of resources and access, while the latter has a high level of capacity that needs to be converted into access, even in the absence of adequate water resources. India and the PRC have almost identical IDWA values, but there are stark differences in some of the components. The comparatively high use component in India has limited importance, especially when poor water quality is considered. Box 6 shows how Singapore is providing excellent drinking water despite inadequate internal water resources.

In its present stage, IDWA is limited to water only; wastewater management is not considered. Conceptually, IDWA can be extended to incorporate wastewater management, if reasonable data for at least two additional indicators become available. These could be access to sanitation facilities and the extent of collection, treatment, and disposal of wastewater. Unfortunately, such data are not presently available at national levels. A separate composite index of wastewater management can also be considered when water quality data in the DMCs improve significantly.

Box 6: Singapore's Significant Success

Despite a lack of sufficient internal water resources (142 cubic meters per capita in 2004 as per the World Development Indicators, 2006), Singapore has done exceptionally well in regard to provision of top quality drinking water to its population. In addition to sourcing water from outside, it has developed not only desalination, but most importantly, what is known as "NEWater," water of great quality obtained from purification of recycled water.

In Singapore, the water supply is continuous and one can drink it straight from the tap. The country scores 100 on each of four IDWA components (access, capacity, use, and quality). Yet, because of an index value of 42 for the resource component, the IDWA based on five components is 88, lower than the values for Malaysia and the Republic of Korea (92 and 90, respectively).

Without the resource component, IDWAs for Malaysia and the Republic of Korea are 94 and 97, respectively, less than the 100 of Singapore. These differences are inevitable in any composite indicator and that is precisely why the IDWA uses a small number (five) of important components.

IV. Ways Forward

If some of the Asian DMCs face a water crisis in the future, it will *not* be because of physical scarcity of water, but because of inadequate or inappropriate water governance, including management practices, institutional arrangements, and sociopolitical conditions

There is no single way forward for Asian DMCs to ensure their future water security. Because of differing climatic, physical, social, economic, environmental, and institutional conditions, and because countries, and even parts of countries, are at different stages of development, there are simply no universal solutions. The Pacific Islands, for example, because of their generally small size and fragility, have quite different water problems to those of larger nations, and have developed their own regional action plan (Box 7). In addition, because the national, regional, and global conditions that affect water are changing rapidly, there is also a time dimension to the solutions—what may have been a viable solution a decade ago may not be so a decade from now. This means that water policies need to be updated periodically so that they reflect the requirements of the time and the foreseeable future.

We can confidently predict, on the basis of current assessments of water resources, expected water demands of the future, available technology, knowledge, and experience, that Asian DMCs should not experience, or expect, a crisis in the future because of physical scarcity of water. This is a conclusion that ADB reached about a decade ago and there is no reason to change that finding. What is important is to realize that, irrespective of the high level of rhetoric on the looming global water crisis and likely water wars due to increasing water scarcity, the fact is that there is now enough knowledge, technology, and expertise available in Asia to solve all its existing and future water problems. Nevertheless, some Asian DMCs will find it more difficult than others to ensure their future water security. This, however, is likely to be the general situation not only for the water sector, but also for all other development-related sectors in those countries.

If some of the Asian DMCs face a water crisis in the future, it will *not* be because of physical scarcity of water, but because of inadequate or inappropriate water governance, including management practices, institutional arrangements, and sociopolitical conditions, which now leave much to be desired. Continuation of the present state of affairs will ensure that the water situations in Asian DMCs can

only improve slowly. Considering the expected population growth, continuing urbanization, and increasing economic activities, this may mean, at least for the water sector, having to run faster to stay in the same place. This cannot be the preferred or acceptable solution.

Major and fundamental changes in water governance practices are needed in nearly all the Asian DMCs. There are many success stories in Asia of very significant improvements in water governance. For example, during the past 30 years, Singapore has made remarkable breakthroughs in its governance practices as a result of which it now has one of the best, if not the best, water supply, wastewater management, and overall catchment management in the world. In the process, the Public Utilities Board of Singapore has gained full confidence of the public in the level of services it consistently provides. Most of this transition has taken place within about two decades.

Similarly, the Phnom Penh Water Authority has managed to reduce its unaccounted-for water from about 90% in 1993 to about 8% at present, in spite of difficult political, economic, and social conditions during this period. The utility now provides drinkable water supply continuously, and is fully autonomous and financially independent. It uses absolutely no outsourcing to the private sector, and within a decade has shown what can be achieved given good leadership—which has radically transformed its governance—and full political weight behind that enlightened leadership.

It is now important for improving the performance of the water sector that a comprehensive search be made to identify similar success stories from all over Asia in areas like water supply, wastewater management, irrigation, and hydropower development. These successes need to be reviewed independently by knowledgeable and experienced water experts in terms of their veracity, long-term sustainability, and potential replicability in other parts of Asia. It will also be essential to analyze the enabling environment of each success to see how and why it managed to make remarkable progress, while most other Asian urban centers did not. We need to understand what conditions were instrumental in catalyzing the process, which, in turn, ensured their success.

A set of successful Asian good practice models is essential for South-South knowledge and experience transfer in the

Box 7: Uniqueness of the Pacific Islands

The ability of the Pacific island countries to manage the water sector effectively is constrained by their small size, fragility, natural vulnerability, and limited human and financial resource base. The challenges of sustainable water resources management in Pacific island countries were categorized into three broad thematic areas at the regional consultation on Water in Small Island Countries held in preparation for the 3rd World Water Forum in Kyoto 2003. These were:

1. Small island countries have uniquely fragile water resources due to their small size; lack of natural storage and competing land use; and vulnerability to natural and anthropogenic hazards, including drought, cyclones, and urban pollution.
2. Water service providers face challenging constraints to sustaining water and wastewater provision due to the lack of both human and financial resource bases, which restricts the availability of experienced staff and investment, and effectiveness of cost-recovery.
3. Water governance is highly complex due to specific sociopolitical and cultural structures relating to traditional community, and tribal and inter-island practices, rights, and interests.

These issues have all been addressed through the development of the Pacific Regional Action Plan on Sustainable Water Management (Pacific RAP). Endorsed by 18 countries, 16 at Head of State level, the Pacific RAP not only provides a coordinated and agreed approach but has significantly driven water up the national and regional agenda.

Source: Fourth World Water Forum, Mexico. 2006. Regional Document: Asia-Pacific – Local Actions for a Global Change http://www.worldwaterforum4.org.mx/uploads/TBL_DOCS_107_35.pdf

context of the special monsoon climatic conditions of the region. A major reason that European and North American models have often not been successful in Asia is not only differences in climatic conditions, but also in social, economic, and environmental conditions, and institutional and legal frameworks. Thus, successful models from Asian monsoon areas are likely to be more replicable to other Asian DMCs than are models directly imported from Europe and North America. However, the Asian models should only be applied after appropriate modifications for site-specific conditions.

Within this overall context and philosophy, some suggestions follow that are likely to be useful across most Asian DMCs for the way forward to water security. Nevertheless, note that the degrees of emphasis or priority given to each issue will vary from one country to another.

Improving Data Availability and Reliability

It is simply not possible to plan, develop, and manage water resources in any country on a long-term sustainable basis without the availability of reliable data on physical as well as social, economic, and environmental factors and composite indicators

A major issue in preparing the *AWDO 2007* has been the paucity of data on all aspects of water-related issues in Asian DMCs. Even when data were available, their reliability was often unknown. The problem was further compounded by the presence of either inconsistent national data sets or different data from various national sources on the same parameters, and/or significant differences in many cases between national and international data sets.

As a general rule, the Asian DMCs have better information, and also for longer periods, on water quantity than on water quality. Very limited, if any, information is available on the extent of water reuse and progress on recycling. This is an important gap because in all the Asian DMCs, water quality management will become a priority national issue in the foreseeable future, and there will be very significant increases in water reuse through formal or informal means. Similarly, availability of data is considerably better on hydrological, climatic, and similar physical factors than on social, economic, and environmental parameters. This situation appears to be improving, but slowly.

It is simply not possible to plan, develop, and manage water resources in any country on a long-term sustainable basis without the availability of reliable data on physical as well as social, economic, and environmental factors. Equally, it is not enough to collect data that are necessary and reliable; data must be readily accessible to the people who need them, ranging from national and international organizations to research and academic institutions, NGOs, and civil society in general. If the status of water development and management is to be improved, it is essential that collection, quality, and management of data receive significantly higher priority in all Asian DMCs than has been the case to date. Data accessibility needs to be substantially improved as well.

It should be noted that adequate and reliable data are needed at national, regional, and local levels, depending on the specific water activities that need to be carried out. Equally, without good data, we cannot monitor progress or performance of policies, programs, or projects adequately. Without monitoring, we cannot make definitive statements about the success of specific water-related activities, or their cost-effectiveness and impacts on people and the environment.

Major international institutions like ADB should encourage and assist DMCs to develop and maintain consistent data

Table 3: Proportions of Populations in Selected Countries Receiving Water and Sanitation Services (%)

Country	*Source and date*	*Overall water*	*Urban water*	*Rural water*	*Overall sanitation*	*Urban sanitation*	*Rural sanitation*
Cambodia	WHO/UNICEF (2004)	41	64	35	17	53	8
	Ministry of Planning (2005)	—	76	42	—	55	16
Fiji	WHO/UNICEF (2004)	47	43	51	72	87	55
	FAO (2002)[a]	70	—	—	—	—	—
Sri Lanka	WHO/UNICEF (2004)	79	98	74	91	98	89
	ABD[b] (2000/1 data yr)	82	98	70	80	97	—
	NWSDB (2005)[c]	—	39.5	—	—	—	—
Viet Nam	WHO/UNICEF (2004)	85	99	80	61	92	50
	Viet Nam Govt. (2004)[d]	70	—	58	—	—	41

FAO = Food and Agriculture Organization of the United Nations, UNICEF = United Nations Children's Fund, WHO = World Health Organization.
a Gateway to Land and Water Information, University of South Pacific, Samoa - Fiji National report.
b Country Strategy and Program Update 2006–2008.
c National Water Supply and Drainage Board Annual Report (NWSDB) (2005) – excludes some large municipalities, such as Kandy and Jaffna.
d Viet Nam Govt. (2004) Report on Viet Nam Development Goals.

sets across the entire Asian region. Such an effort will unquestionably improve data availability and accessibility, and may contribute to the reduction, or even elimination, of unreliable and conflicting data sets. For example, when the background work was carried out for the present report, it was noted that national and international data sets on achievements toward the MDG on water supply were very different. Some examples are given in Table 3 above. National data sets often tended to provide more optimistic pictures of progress. This may also be due to data errors and/or definitional problems in the data. For example, access to water can be defined in different ways by different countries and/or national and international institutions. Clear definitions of the data that are being collected are needed so that users are aware of the data's relevance, appropriateness, comparability, and limitations.

For data aggregation at national levels, all local data sets must use identical definitions of the parameters for which data are being collected. Equally, for comparison of national data sets, all DMCs should use consistent definitions and similar processes for collection, analysis, and interpretation. This is not happening at present at any significant or consistent scale, as a result of which apples and oranges are often being aggregated and compared. Accordingly, the present situation often may not give realistic views of water-related conditions, or help in formulating and implementing efficient policies, programs, and projects. To ensure efficient water planning and management in the future, data availability, quality, and access need to be improved significantly.

Forging Partnerships for Water Management

In the late 1990s, certain international institutions (not ADB) strongly and consistently promoted the participation of a few multinational corporations as the panacea for solving water and wastewater problems of major urban centers of the developing world. As noted earlier, by

A new paradigm of "business unusual" is needed that can solve the region's water and wastewater problems, in a cost-effective and equitable manner. This will require the formation of a new form of partnership, different from the earlier models, with three distinct partners—government, corporate (public or private), and society

the early 2000s, it was already generally recognized that these corporations were not going to deliver services as expected in terms of bringing new investments, connections for the poor, and significantly improved management practices. All these and other advantages were expected to make service delivery efficient, reliable, economic, and equitable, compared to the conditions that were prevalent under public sector utility management. The multinational corporations concerned also soon realized that they were not going to make a very attractive return for their shareholders for the next 2–3 decades from providing water and wastewater management services.

This form of public-private partnership did not work as well or as consistently as its proponents had anticipated. It is now also fully accepted by all the concerned parties that the existing water supply and wastewater management gap between what is needed and what is available at present in the Asian DMCs, is huge, and "business as usual" will not be able to provide the solution within a reasonable timeframe. A new paradigm of "business unusual" is needed that can solve the region's water and wastewater problems, preferably within a decade, in a cost-effective and equitable manner. This will require the formation of a new form of partnership, different from the earlier models, with three distinct partners—government, corporate (public or private), and society—each having very specific responsibilities for which it should be held accountable; let us call this the GCS model.

The tasks of government in this tripartite relationship could include formulation of an overall framework within which the three parties can operate, and the promulgation of regulatory regimes for the service providers. This would include such issues as determining the levels of service, identifying the beneficiaries, stipulating progress to be made over time in terms of extending service coverage and beneficiaries to be reached, establishing implementable policies for water pricing and cost recovery, ensuring

Box 8: Nonprofit Technical Cooperation Activities by Japanese Water Operators

The reconstruction process of water services in Cambodia—a country devastated under the Pol Pot regime and more than one decade of civil war thereafter—started with the development of a master plan by Japan International Cooperation Agency (JICA) in 1993. The Phnom Penh Water Supply Authority (PPWSA) recovered the capacity of water supply system from 65,000 cubic meters per day in 1993 to 235,000 cubic meters per day in 2003 with the harmonized assistance from the Japanese Government, Asian Development Bank, French Government, and World Bank.

Capacity development for operation and maintenance (O&M) was required to secure the sustainability of the reconstructed facilities. JICA implemented a technical cooperation project for the capacity building of PPWSA from 2003 to 2006. The aims of the project were (1) to improve the O&M capacity of water supply facilities, and (2) to improve a staff training system for the water supply system in Cambodia.

Engineers from the water operators of Kitakyusyu and Yokohama cities in Japan provided technical transfer to PPWSA engineers on the ground. These activities were conducted on a nonprofit basis, not a commercial one. JICA provided only actual costs required, such as travel and equipment. Three long-term engineers for 3 years and 32 short-term engineers in total worked in the Project. PPWSA obtained substantial high-level O&M capacity following completion of the Project.

Regarding the waterworks of provincial cities in Cambodia, rehabilitation works and capacity development are on the way. PPWSA, with the Ministry of Industry, Mine and Energy, is preparing the mechanism to disseminate its experiences of management of the water system to the provinces.

Source: Japan International Cooperation Agency (JICA)

proper standards of construction, and formulating transparent and enforceable legal procedures for awarding and managing contracts and resolution of potential conflicts.

The corporate partner could be public or private. If public, it should be an autonomous and accountable government entity with operational and financial autonomy and free from political and bureaucratic interference. In fact, many water utilities in Asian DMCs now fail to function efficiently because of the "excess baggage" they carry in terms of unnecessary rules, regulations, administrative requirements, and consistent bureaucratic and political interference. Under the existing conditions, it would indeed be a miracle if a utility succeeds in providing reliable levels of services efficiently and equitably to all on a sustainable basis. The responsibilities of the corporate partner must include high levels of consumer satisfaction and it should be fully accountable to its customers. The Phnom Penh Water Supply Authority is one such autonomous, public corporate partner; it has already revolutionized the water supply of that city. This type of model needs further consideration for possible use by other Asian DMCs. Box 8 shows how Phnom Penh Water Supply Authority improved its system by forging harmonized partnerships with the Japanese Government, ADB, the French Government, and World Bank.

The corporate partner could equally be a private company or a public sector company from another country or another region of the same country. However, whether it is a public or a private entity, it will have to abide by the same set of requirements and obligations. Each urban center should select which corporate model would best suit its needs, opportunities, and constraints, and should be determined without any preconceived dogma or hidden agenda.

The third partner should be civil society, which, as a general rule, needs to move away from its current apathetic response to poor and unacceptable levels of water and wastewater service delivery. Consumers will have to pay a fair price for receiving water and wastewater services, so they need to be encouraged to demand good quality service. Here there is a need to explore both social and for-profit marketing opportunities to drive up demand (Box 9). The responsible civil society organizations should be empowered to demand necessary reforms, ensure that the urban poor receive the expected benefits, and complain vociferously when the system does not provide the stipulated levels of services.

Box 9: Business Model for Sanitation

Today's market for sanitation is dysfunctional, mainly due to muted demand and low priority among individuals and politicians. Low capacities in appropriate technologies and the lack of (freely) available sustainable sanitation designs for mass production prevent an efficient market for sanitation from emerging. There is a lack of incentives for innovation in technology and product design for sanitation. Despite the wonderful opportunities of 2.6 billion potential buyers, businesspersons still neglect the low-income sanitation market, due to a lack of awareness, localized demand, and established distribution channels.

To remedy this situation, we need to demonstrate that the low-income sanitation market is a profitable opportunity for both social and for-profit investors. We need to eventually make people want to buy sanitation. We must not underestimate the power of emotional appeal of the toilet as a status symbol and we need to fund the creation of a trend to drive the poor to demand sanitation through peer pressure.

With a coordinated approach across the water and sanitation community, identification of best practices, innovation, good market infrastructure, and driving prices down through all means continuously, we can create demand that will be viable for vendors to supply in large volume.

Source: Sim, J., Director/Founder of World Toilet Organization, Singapore

The GCS model, if implemented properly, has the potential to improve water and wastewater services in urban centers of many Asian DMCs. The model is also very flexible. Each urban center can devise its own model that will best suit its specific social, economic, institutional, and environmental conditions and constraints. The selection and adoption of the final model should come after a thorough review of the community of good practice models available from the Asian monsoon countries, an issue that has been discussed earlier.

A man drinks clean water in front of Cambodia's National Assembly in Phnom Penh

Improving Water Quality

Water quality management has mostly been a neglected issue in Asian DMCs. The health costs and social impacts are likely to be substantial at present. While these have not been carefully assessed for the region, the annual economic cost is likely to be billions of dollars. If the present trend continues, the costs are likely to escalate significantly over the coming years.

Institutional responsibilities for water quality management are highly fragmented at present. Equally, most institutions are not geared to manage water quality, let alone address the broader problems of the future. Accordingly, institutional strengthening and restructuring, inter-institutional coordination, and capacity building in technical, administrative, and managerial aspects are urgent requirements, as are significant improvements in the formulation and implementation of legal and regulatory regimes, and transparency and non-corruptibility of the associated administrative and management processes.

While economic instruments (bulk water charges, water rights, tradable permits, polluter-pays-principle, incentives when appropriate, etc.) can help the region in improving the current water quality conditions, a combination of economic instruments and a command-and-control system is likely to prove useful.

Conventional funds available for investments in controlling water pollution are now grossly inadequate. In addition, not all the funds available are being used efficiently. Considering the massive additional funding needed to manage water quality because of past neglect, it is highly unlikely that the public sector can generate the needed investment

funds. Funding that can be generated from private sector and multilateral and bilateral agencies will be useful, but even this is unlikely to be enough. New forms of funding mechanisms are needed, and need to be available on a sustained basis for a reasonable period of time. Loans for longer periods, like 40-year loans that are currently provided by the Japan Bank for International Cooperation, should be considered by other funding agencies.

In spite of the present deteriorating water quality in many Asian DMCs, the issue is not receiving the political priority and social attention it deserves at national and local levels. Overall governance, including political, legal, and institutional conditions, has often contributed to an environment that has not encouraged new investments. This situation needs to be changed.

Water quality management is much broader than simply construction and operation of wastewater treatment plants. A more comprehensive perspective is essential, which should consider factors like formulation and implementation of national water policies within which quality should be a priority issue, regular monitoring and evaluation of water quality, presence of appropriate and functional legal and institutional frameworks, and a well-structured capacity-building program for all levels.

Enhancing Capacity Development

Capacity development is an important requirement for Asian DMCs to ensure water security in the coming years. Unfortunately, even though the rhetoric on capacity development has been quite audible in recent years, appropriate capacity development that specifically addresses the needs of any one country has not received systematic and continuous attention. The attempts have often been ad hoc, have not addressed the priority areas that can really make a difference, and have generally built up capacities that are more appropriate for European and North American temperate climate conditions than for tropical and subtropical Asian conditions. Thus, instead of being a part of the solution, most of these programs have produced short-term results of a marginal nature.

Educational and training programs for water professionals need reviewing. Often they are academic and are not solution or application oriented. The academic programs need to be restructured if they are to solve the problems of the future, rather than the problems of the past. In other words, much of the current efforts for capacity development need a thorough review.

In this connection, it is useful to look at past Japanese efforts to build water management capacities. Japan invested nearly 70 cents for each dollar spent on infrastructure development in the education sector. In contrast, only about 7 cents are spent on capacity development in the water sector for each dollar spent on infrastructure development. The Asia and Pacific region recommended boosting the level of investment for capacity development during the Fourth World Water Forum. However, the world forums invariably produce a plethora of recommendations, very few of which are implemented. The recommendation on capacity building has been no different to this general rule. Yet, capacity development must receive much higher priority from both national water authorities and external support agencies. Equally, the external support agencies must ensure that the types of capacity development activities they support will

actually help to improve substantially the water management practices of Asian DMCs, where conditions are different from those in the industrialized countries. Further, the results must be sustainable over the long term.

Looking to the Future

As noted earlier, the future water-related issues of the Asian DMCs are likely to be quite different from those in the past. While historical knowledge is always useful, solving the water problems of the future will require additional skills, innovative approaches, and new mindsets. It will also require a more holistic approach that can successfully coordinate the energy, food, environment, and industrial policies of a nation, all of which have intimate linkages to water. Each will affect the others and, in turn, be affected by the others. Policies in all these areas will similarly be influenced by external forces like demographic transitions, advances in technology and communication, globalization, free trade, and increasing social activism.

All these factors will make future water management in Asia a far more complex task than ever before. It will be a formidable challenge, but one that must and can be met because the knowledge, experience, and technology to solve the problems in a timely manner already exist within Asia, not in one location but within the region as a whole. A synergistic net needs to be cast to identify and collect all the successful attempts for possible replication in other parts of Asia.

One is reminded of William Shakespeare's immortal words as to how the water future of the Asian DMCs will develop:

"The fault, dear Brutus, is not in our stars
But in ourselves, that we are underlings."

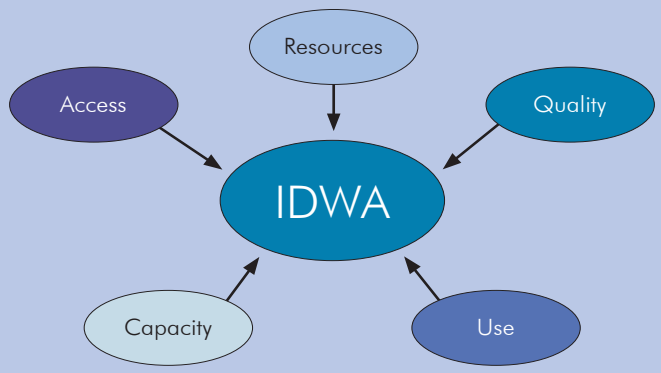
Solving the water problems of the future will require additional skills and capacity, innovative approaches, and new mindsets. It will also require a more holistic approach that can successfully coordinate the energy, food, environment, and industrial policies of a nation, all of which have direct linkages to water

Appendix

IDWA: Index of Drinking Water Adequacy

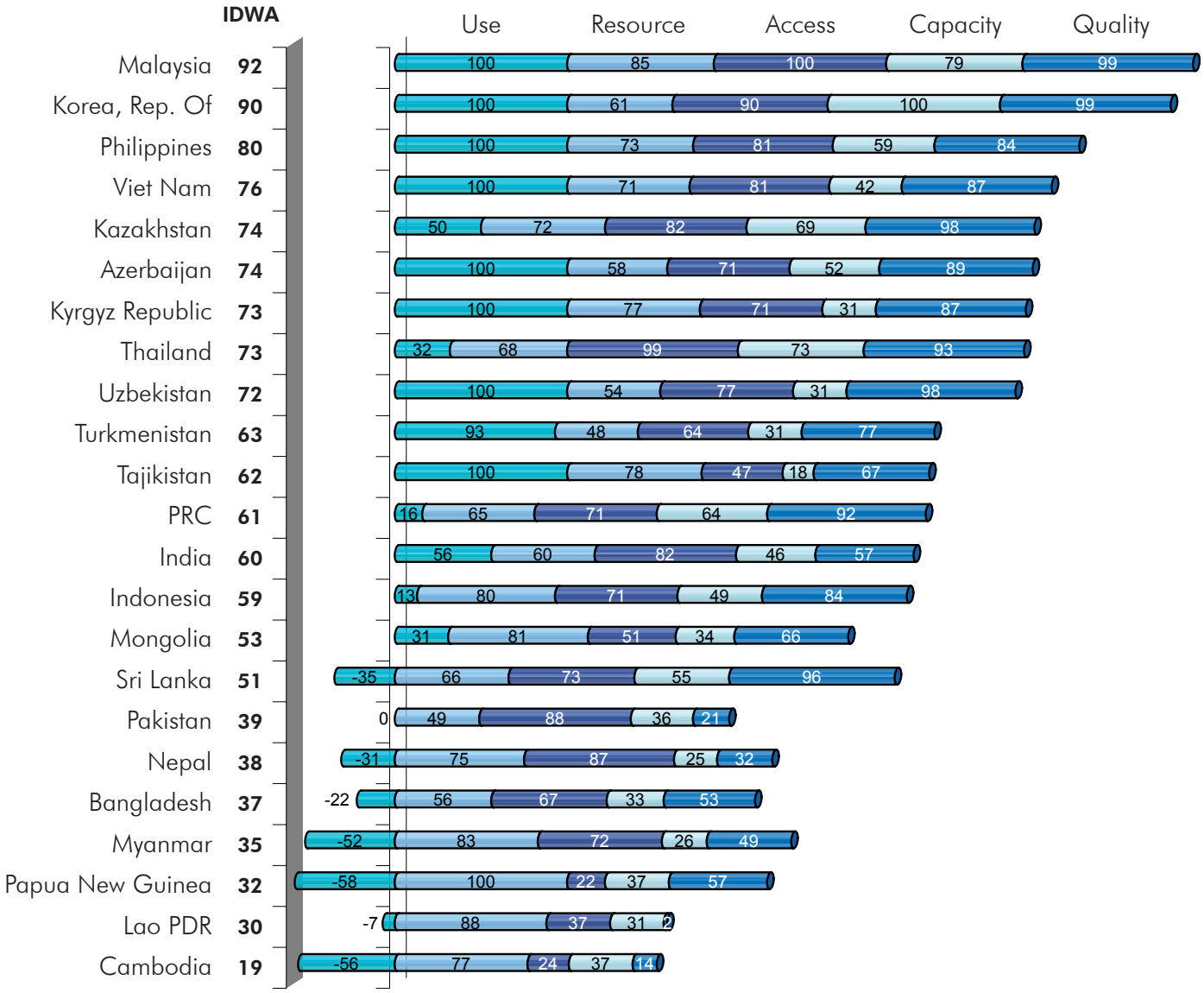
The *AWDO 2007* proposes a new Index of Drinking Water Adequacy (IDWA). IDWA is an average of five component indicators on most relevant variables, fully explained in the paper by Bhanoji Rao: (1) per capita internal renewable fresh water resources;[1] (2) percent of population with general access to a sustainable "improved" water source, which is one of the target indicators in the Millennium Development Goals (MDGs); (3) national capacity to purchase water, based on the proxy measure of per capita gross domestic product in purchasing power parity dollars (PPP $); (4) the extent of use of water by the domestic sector on a per capita basis measured against a norm; and (5) diarrheal deaths per 100,000 people used as an indirect measure of water quality. IDWA not only allows cross-country comparisons, but also helps in ascertaining which component is weak in a particular country, requiring priority attention.

Index of Drinking Water Adequacy (IDWA)



Index computation methodology is essentially the same as the one adopted to compute the Water Poverty Index (WPI), which was the method used to compute the Human Development Index (HDI) over the years. The method simply involves taking the variable, for example resource per capita, R_j for country j, and then estimating the percentage as follows:

Ranking based on IDWA



Indicator for country "j"= $[(R_j - R_{min})/(R_{max} - R_{min})] \times 100$

The index is computed for 2004 for 23 developing member countries (DMCs) of the Asian Development Bank (ADB), accounting for 99% of the total population of all 44 DMCs. The IDWA values of the 23 DMCs are given above to demonstrate the use and implications of the new index.

Comparing Malaysia and the Republic of Korea, the latter has a relative paucity of water resources and not quite 100% access. It has capacity to purchase/exploit water resources at a much higher level than Malaysia, but it is not translated into full access, and hence its IDWA is slightly lower.

The People's Republic of China (PRC) and India have about the same IDWA, but some of the component

differences are glaring. The PRC has lower access, despite higher economic capacity. It has constrained use, but high quality. India enjoys better access and higher use but low quality.

Bangladesh and Myanmar have IDWA values on the low side, with the two countries respectively occupying the 19th and 20th positions. Both fail especially on use, wherein the level is way below the norms adopted. Myanmar has relatively higher level of resources that have helped to step up access to a relatively high level. The country, however, fails on purchasing power and quality.

Cambodia has the lowest IDWA despite a fairly high level of resources. It has to step up "investments" to move up on all other components.

Endnote

1. Internal renewable water resources (IRWR) comprise the average annual flow of rivers and recharge of groundwater (aquifers) generated from endogenous (internal) precipitation. Natural incoming flows originating outside a country's borders are not included. Estimates of IRWR per capita are from the World Bank's WDI 2006 and they refer to 2004.

Annex 1

Country Papers Summary

The country papers of the *Asian Water Development Outlook (AWDO) 2007* provide a brief overview of 12 selected countries, covering the status and performance of the water sector, the key issues and challenges to be addressed, and an indication of the way forward. Data and background information for each country have been obtained primarily from published sources in the public domain, additional data collection and analysis being outside the scope of the literature search undertaken. Achievement of the country paper goals has been constrained by limited availability of data and published information on the current status, as well as detailed future plans.

Some of the limitations of the country papers are discussed in Box A1.1, with suggestions made concerning the possible direction of future revisions.

One of the main purposes of the *AWDO 2007* is to focus the attention of national leaders and key decision makers on the need to increase investments in the water sector if the MDG targets are to be achieved by 2015. Although some countries have made good progress, others need to make dramatic improvements as can be seen from Table A1.1. Nearly half of the

Box A1.1: Country Paper Limitations and Future Development Options

- The country papers are based on a literature search of materials and information in the public domain.
- References and data refer to different dates due to available source materials. Consistency, for example using Millennium Development Goals progress data, is preferable to using latest data that might not be authoritative or be based on the same definition.
- The main focus is on water supply and sanitation (WSS), with water resources and other subsectors covered generally. Future versions could update WSS data and consider focus on water resources, irrigation, conservation, or pollution control, etc.
- There is a need for much more comprehensive data on utilities, especially on sanitation and wastewater treatment, and proposed future investments, e.g., What is needed to achieve the goals? What proportion of gross domestic product is this? What is being allocated? How can the gap be filled? What gives the best return for every dollar invested?

Table A1.1: Progress in Achieving MDG Targets, and IDWA Values

Country	*Urban water (%)*	*Rural water (%)*	*Urban sanitation (%)*	*Rural sanitation (%)*	*IDWA value*
Bangladesh	82	72	51	35	37
Cambodia	64	35	53	8	19
PRC	93	67	69	28	61
Fiji	43	51	87	55	n/a
India	95	83	59	22	60
Indonesia	87	69	73	40	59
Kazakhstan	97	73	87	52	74
Pakistan	96	89	92	41	39
Philippines	87	82	80	59	80
Samoa	90	87	100	100	n/a
Sri Lanka	98	74	98	89	51
Viet Nam	99	80	92	50	76

Key	Target already met	On track for 2015	Off-track — expected to hit target after 2015	Off-track and regressing

IDWA = index of drinking water adequacy; MDG = Millennium Development Goal
Coverage figures from published WHO/UNICEF data for 2004. Although not the latest data available from individual countries, which may use different definitions and are likely to be overoptimistic in their assessments, they provide consistency in performance comparisons. For Cambodia, definitions of improved facilities and urban/rural areas were changed after 1990, so MDG target progress from 1990 to 2004 is not directly comparable.

targets for 11 of the countries in the table will not be met by 2015!

The MDGs must not be considered as an end in themselves. Even for countries that have already met one or more of the water targets, attention must now be focused on the next stage—for instance, provision of services to the remaining 50% of the 1990 unserved proportion of the population, or stricter MDG definitions. The sometimes large variations in reported MDG progress illustrate the confusion and differences in interpretation of what constitutes an improved water supply or improved sanitation. Simply providing access does not necessarily mean all problems are solved and all benefits are received. For example, an improved water supply must also provide good quality water delivered at the tap, and improved sanitation must include effective waste disposal and wastewater treatment.

The reality in most of the 12 country papers is that water delivered from improved facilities may be substandard and sewage is not treated. It is also questionable whether it is appropriate to define goals and monitor progress in percentage terms as this requires very good base data and good on-going data collection. Percentages are a poor indicator when increases in the general population and the proportion of those served/unserved are considered, in addition to rural/urban migration which simply moves people from a rural MDG index to an urban one. It is very likely that current MDG achievement figures overestimate the real picture because the

Box A1.2: Common Issues (and some solutions) in Selected Countries

Too many players in the sector with poor clarity of responsibilities	Simplify and reform the sector
Poor implementation of policies, laws, and regulations	Enforce firmly and make people accountable regardless of whether private or public sector
Water resources poorly managed	Implement integrated water resource management on basin catchment area basis over long-term horizons, say 20 years
Water resources being used inefficiently	Improve poor irrigation practices
Water resource contamination from deforestation, mine discharges, untreated municipal and industrial effluents, agricultural fertilizer and pesticide run-off, saline irrigation drainage	Enforce pollution control measures
Poor service levels, possibly even where coverage reasonable	Increase supply hours, improve quality at the tap, etc.
High water connection fees prevent the urban poor from being connected	Give free connections and recover costs from tariff
Low tariffs do not reflect the true service cost for sustainability	Recover at least operating and maintenance costs initially
Low levels of municipal and industrial effluent treatment	Construct more treatment plants and improve operational performance
Limited institutional and managerial capacity in some departments and utilities	Increase institutional and human resources capacity
Conflicts of interest, e.g., where provincial governments set water tariffs and own utilities	Establish independent or highly respected regulator
Poor water sector governance	Make utilities autonomous—no political interference, ring-fence utility revenues, etc.
Consumers unaware of the "true" value and scarcity of water	Sensitize and educate, run public awareness campaigns

present MDG target definitions do not cover all necessary quantity and quality interventions, such as treatment of wastewater from improved sanitation.

Some of the main issues (and solutions) from the country papers are listed in Box A1.2.

Key messages from the country papers are:

- There is need for better quality and more comprehensive data, especially from water utilities.
- Policy development is not the issue; the need is for implementation and enforcement of existing policies and legislation. This can only be achieved if there is accountability and a strong regulation/monitoring regime in place.
- Many governments need to dramatically increase water sector investments, especially in sanitation. As a general guide, the aim should be to spend a minimum of 1% of gross domestic product on the water sector.

Annex 2

Annotated List of Discussion Papers

I. Access to Drinking Water and Sanitation in Asia: Indicators and Implications (Bhanoji Rao)

The inadequacies of existing indicators in the sector are discussed and a new measure of progress, the Index of Drinking Water Adequacy (IDWA) is described and values determined for 23 countries. This composite drinking water indicator is an average of five components: access, capacity, quality, resources, and use. The individual components can be used to indicate directions for policy, program, and project actions. The IDWA can be used to fine-tune Millennium Development Goal targets on water and can be expanded, depending on data availability, to include other water and sanitation parameters. The lack of accuracy and consistency of national data in many countries is a stumbling block at present.

II. Water Resources and Development in Changing Asia (Olli Varis)

This paper outlines the major intersectoral problems associated with water—population growth and aging, the economic and social transition in developing countries, and issues related to energy, food production, the environment, and climate variation and change. The need for more food will require greater efficiency of soil and water use. Poverty reduction efforts will be important in working against further degradation of water resources and the environment by the poor. Joint management of rivers and aquifers is of crucial importance in most parts of Asia because the bulk of the region's population lives in river basins that include more than one state.

III. Recent Advances in Water Resources Development and Management in Developing Countries in Asia (Geoff Wright)

Progress in water resources development and management is being made using different approaches in different countries across Asia. Common features in successful management include stable and strong institutional frameworks; high level of cooperation and coordination among agencies; strategic and integrated planning in place; effective stakeholder and community participation; and reliable and comprehensive data and information, and decision-support tools in use. One of the key institutional reforms in many countries is the establishment of national advisory and coordination bodies to deal with water resources. An increasing role of the private sector and consumer communities should also be promoted.

IV. Water Supply and Sanitation Issues in Asia (Arthur McIntosh)

Adequacy of clean water, a basic human need, has become a critical factor. The sectoral problems that have become most urgent, therefore, concern the resource: water quality and pollution, water conservation, and water and demand-side management. Solutions to water quality and pollution problems, water conservation, and managing demand are offered. Obstacles to the poor getting a connection to piped water are described and options for their connection are evaluated. The other pressing problem is open defecation in parts of the region, for which community-led total sanitation efforts have been very successful. The author notes that these and many other important sectoral issues can be addressed through improvement in governance and service levels and quality.

V. Integrated Water Resources Management: A Reassessment (Asit Biswas)

The concept of integrated water resources management (IWRM) has been around for some 60 years. It was "rediscovered" in the 1990s. The concept looks attractive, but a close analysis shows that there are many problems, both in concept and usage, especially for large projects. Indeed, there is no agreement on such fundamental issues as what aspects of water resource management should be integrated, how, by whom, or even if broad integration is possible. The author concludes that in the real world, the concept will be exceedingly difficult to implement.

Acknowledgments

The *Asian Water Development Outlook (AWDO) 2007* was prepared by the Asian Development Bank (ADB) and funded by the RETA 6388: Supporting the Asia-Pacific Water Forum (APWF), financed by the Japan Special Fund, funded by the Government of Japan.

K. E. Seetharam (task manager) in the Energy, Transport, and Water Division of the Regional Sustainable and Development Department (RSDD) in ADB coordinated the production of *AWDO* under the guidance of WooChong Um (Director), with administrative and research support from Maria Angelica Rongavilla, Vergel Latay, Eileen Santos, and Audrey Esteban.

The valuable contributions by the *AWDO* team of experts, ADB staff, and external experts are sincerely acknowledged. The team of experts comprised Asit Biswas (team leader), Bhanoji Rao, Olli Varis, Geoff Bridges, Arthur McIntosh, Geoff Wright, and Surampalli Rao, supported by Indrajit Banerjee, Stephen Logan, Kalinga Seneviratne (Asian Media Information and Communication Centre), and Jay Maclean.

Overall guidance and comments and inputs on the initial drafts of the report were provided by several experts: ADB: Liqun Jin, Bindu Lohani, Shyam Bajpai, Arjun Thapan, Wouter Lincklaen Arriens, Amy Leung, William Greene, Hun Kim, Katsuji, Matsunami, Omana Nair, Anand Chiplunkar, Rudolf Frauendorfer, and Daniel Cooney; APWF Governing Council: Tommy Koh, Ravi Narayanan and Erna Witoelar; APWF partner institutions: Thierry Facon (Food and Agriculture Organization Regional Office for Asia and the Pacific), Vadim Sokolov (Global Water Partnership Caucasus and Central Asia), Sastry Ramachandrula (Global Water Partnership South Asia), Kate Lazarus (International Union for Conservation of Nature and Natural Resources), Tarek Merabtene and

Kuniyoshi Takeuchi (International Centre for Water Hazard and Risk Management), Satoru Kurosawa (Japan Bank for International Cooperation), Hideaki Oda, Kenichi Tsukahara, Taeko Yokota and Noriko Yamaguchi (Japan Water Forum), IL-Pyo Hong and Matilda Park (Korea Water Forum), Khoo Teng Chye, Chan Yoon Kum, Han Tong Ng, Michael Toh, and Meng Kin Wong (Public Utilities Board, Singapore), Aurora Villaluna (Streams of Knowledge), Le Huu Ti (United Nations Economic and Social Commission for Asia and the Pacific), Andre Dzikus (United Nations Human Settlements Programme), Hubert Gijzen and Toshihiro Sonoda (United Nations Educational, Scientific, Cultural Organization), and Jan Luijendijk (UNESCO-IHE Institute for Water Education).

Comments and inputs on the draft country papers and other discussion papers for the *AWDO* CD ROM were provided by ADB regional department experts: Tomoo Ueda, Januar Hakim, Paul van Klaveren, Sanjay Penjor, Stephen Blaik, Sekhar Bonu, Shakeel Khan, Tatiana Gallego-Lizon, Hubert Jenny, Ian William Makin, Walter Kolkma, Rana Hasan and Guntur Sugiyarto; ADB resident mission officers: Hua Du, Md. Rafiqul Islam, Arjun Goswami, Raikhan Sabirova, Paul Van Im, Toru Shibuichi, Yaozhou Zhou, Wang Jianguo, Zhiming Niu, David Dole, Sirpa Jarvenpaa, Richard Phelps, Tiniarogo Mere Seniloli, Peter Fedon, Raza Farrukh, Richard W. A. Vokes, Mookiah Thiruchelvam, Ayumi Konishi, Hoang Nhat Dhong, Ho Le Phong, Eri Honda, Stephen Wermert, Asem Chakenova, Edgar Cua, H.S. Soewartono, Siti Hasanah, Thomas Crouch, Jia Xinning and Joven Balbosa; CH2M Hill World: Nancy Barnes and Greg Turner; Ministry of Health, Labor and Welfare, Japan: Sombo Yamamura; Japan Bank for International Cooperation: Satoru Kurosawa; Japan International Cooperation Agency: Mikio Ishiwatari; and Water Resources and Environmental Research Center, Korea: Jeongkon Kim.

Thanks are due to those who lent their time and expertise and provided inputs during the Experts' Consultation Meeting on *AWDO* at the Water Hub in Singapore on 23 August 2007: Government country representatives: M. Inamul Haque (Bangladesh), Basah Hernowo (Indonesia), Mao Saray and Chea Visoth (Cambodia), Cama Tuiloma (Fiji), M. Zahir Shah Mohmand (Pakistan), Li Yuanyuan (People's Republic of China), Nguyen Tuan Quang (Viet Nam); water champions: Ramon Alikpala, Apichart Anukalarmphai, Antonino Aquino, Khondaker Azharul Haq, Ricardo Macabebe, Joe Madiath and M. Irfan Shahzad ; APWF Governing Council: Ravi Narayanan and Erna Witoelar; APWF partner institutions: Siswoko Sastrodihardjo (Global Water Partnership Southeast Asia), Shinichi Masuda (Japan International Cooperation Agency), Yoji Matsui (Japan Water Works Association), Genichiro Tsukada (Ministry of Health, Labor and Welfare, Japan), Khoo Teng Chye, Ng Han Tong, Ridzuan Ismail and Sivaraman Arasu (Public Utilities Board, Singapore), Chen Lin (Public Utility Research Center, University of Florida), Kulwant Singh (United Nations Human Settlements Programme), Terrence Thompson (World Health Organization); Greg Turner (CH2M Hill World), Jack Sim (World Toilet Organization, Singapore), Eduardo Aralal (Lee Kwan Yew School, Singapore), and Charles Vorosmarty (Institute for the Study of

Earth, Oceans and Space, University of New Hampshire).

Special thanks are due to Ann Quon, Omana Nair, Jason Rush, Daniel Cooney, Nicholas Eric Vonklock, Graham James Dwyer and Raul del Rosario who provided comments on the *AWDO* media strategy; Ma. Priscila del Rosario, Cynthia Hidalgo and Muriel Ordoñez who provided publishing and printing advice; Yun Samean who provided the cover image for the report; Richard Abrina, Stephen Blaik, Paul Van Im, Hoang Nhat Po, Raza Farrukh, Md. Rafiqul Islam, Ayumi Konishi, Raikhan Sabirova, Antonio de Vera, Ramon Alikpala, Kalinga Seneviratne, Eric Sales, Ian Gill, Paul Del Rosario and Yun Samean who provided interior images for the report; Prof. Maria Mercedes Robles who moderated the media event during the Experts' Consultation Meeting; Narciso Prudente who contributed to the technical inputs for the country water sector profile, key performance indicators, and key issues.

Asian Water Development Outlook (AWDO) 2007

AWDO is a new publication commissioned by the Asian Development Bank (ADB) in view of the increasing importance of water in the future development scenarios of the Asia and Pacific region. In recent years, water has steadily gravitated toward the top of the national agendas of ADB's developing member countries. This is a desirable development because water is an essential requirement for human and ecosystems survival. In addition, water is a critical component for most development needs. Without adequate quantity and quality of water, it will not be possible to ensure food, energy, or environmental security of nations.

AWDO is aimed at Asian and Pacific leaders and policy makers and those interested in understanding the complexities and dimensions of the current and the future water problems, and how these can be addressed successfully in policy terms. Its main objective is to raise awareness of water-related issues and to stimulate an informed debate on how best to manage Asia's water future. These are important and complex issues, and their timely management can contribute to the achievement of all the water-associated Millennium Development Goals and beyond.

AWDO 2007 is ADB's first attempt to make a forward-looking assessment of the possible water future for the most populous region of the world. It is now increasingly being recognized that water is likely to be a major critical resource issue of the world, and that the social, economic, and environmental future of Asia is likely to depend on how efficiently and equitably this resource will be managed in the coming years.

About the Asian Development Bank

ADB aims to improve the welfare of the people in the Asia and Pacific region, particularly the nearly 1.9 billion who live on less than $2 a day. Despite many success stories, the region remains home to two thirds of the world's poor. ADB is a multilateral development finance institution owned by 67 members, 48 from the region and 19 from other parts of the globe. ADB's vision is a region free of poverty. Its mission is to help its developing member countries reduce poverty and improve their quality of life.

ADB's main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance. ADB's annual lending volume is typically about $6 billion, with technical assistance usually totaling about $180 million a year.

ADB's headquarters is in Manila. It has 26 offices around the world and more than 2,000 employees from over 50 countries.

About the Asia-Pacific Water Forum

The Asia-Pacific Water Forum (APWF) provides countries and organisations in the region with a common platform and voice to accelerate the process of effective integration of water resource management into the socioeconomic development process of Asia and the Pacific. The APWF is an independent, not-for-profit, non-partisan, non-political network.

The APWF's goal is to contribute to sustainable water management in order to achieve the targets of the MDGs in Asia and the Pacific by capitalizing on the region's diversity and rich history of experience in dealing with water as a fundamental part of human existence. Specifically, the APWF seeks to champion efforts aimed at boosting investments, building capacity, and enhancing cooperation in the water sector at the regional level and beyond.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/water

Asia-Pacific Water Forum
Secretariat: Japan Water Forum (JWF)
6th FI,1-8-1 Kojima Chiyoda-ku
Tokyo, Japan APAN 102-0083
Tel +81 3 5212 1645
Fax +81 3 5212 1649
office@apwf.org
www.apwf.org/