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Ministerial Conference on Environment and Development in Asia and the Pacific

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### **In-depth review of critical environment and development challenges and response strategies in Asia and the Pacific**

## **Emerging challenges and trends in water resources management**

### **Note by the secretariat**

#### *Summary*

The present document reviews the current status of water resources management in the region and identifies the challenges associated with it. The review leads to the identification of regional trends and emerging regional priorities for more inclusive and sustainable development. Also identified are priority thematic areas for more effective and systematic regional cooperation in water resources management for socio-economic development in the region. Three programmes are proposed for priority action on economic growth, poverty eradication and coping with climate change. The first programme for priority action—sustainable urban development and water resources management—is regarded as having high potential and is recommended as a possible initiative of the Ministerial Conference.

The Conference may wish to discuss the issues and challenges highlighted in the present document and provide guidance on follow-up action, especially on the possibility of establishing a regional initiative on sustainable urban development and water resources management.

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### **Introduction: emerging water resources challenges**

1. The Asia-Pacific region's water resources are increasingly vulnerable and being threatened. Unsustainable development paths have led the region to the limits of its ecological carrying capacity. A growing population's need for water for food, raw materials and energy is increasingly competing with nature's own demands for water to sustain already imperilled ecosystems and the services on which livelihoods depend. High demand for water from all these sectors is outstripping the natural replenishment of resources and compromising future water availability.

2. Unsustainable rates of water withdrawal for various productive and domestic uses are aggravated by deteriorating water quality. Every day, millions of tons of untreated sewage and industrial and agricultural waste empty into the region's water systems. Clean water has become scarce, particularly in urban areas, and the poor continue to suffer most from water pollution and associated water shortages.

3. Asia and the Pacific is also the world's most vulnerable region with respect to natural disasters and climate variability. Densely populated countries such as China, India and the Philippines, have to face, on average, more than 10 water-related disasters per year.<sup>1</sup> Climate change is aggravating extreme conditions of either too much or not enough water. With such a high degree of uncertainty, the complexity of water-related

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<sup>1</sup> Demographic and Health Surveys (DHS) 2004-2008, accessed from: [www.measuredhs.com](http://www.measuredhs.com) on 15 November 2009 and Multiple Indicator Cluster Surveys (MICS) 2004-2008, accessed from [www.unicef.org/statistics/index\\_24302.html](http://www.unicef.org/statistics/index_24302.html) on 15 November 2009.

disaster risk management calls for better planning and significant investment in climate change adaptation.

4. Sustaining economic growth and providing basic water access for all also requires a revitalization of water infrastructure and significant investments. At the heart of the Millennium Development Goals, a safe water supply is recognized as key to promoting human development and achieving sustainable development.

5. These investment requirements do not just pose a financial challenge; they also carry implications for the ecological carrying capacity of the region.<sup>2</sup> Drawing additional water resources in these times of uncertainty carries the risk of pushing the region beyond its ecological capacity and causing irreversible damage to ecosystems.

6. A green growth water management path can help address these constraints and help finance much needed investments. By factoring in the costs of water use to the environment, unsustainable water consumption and production trends can be reversed. Eco-efficient water infrastructure options are also available and make it possible to realize the two goals of protecting the environment and sustaining and boosting growth. Water reuse, rainwater harvesting, integrated storm water management and decentralized wastewater management are some of these approaches.

## **I. Status of water resources management**

### **A. Household water security<sup>3</sup>**

7. Significant achievements have been made towards meeting the Millennium Development Goal on safe water access between 1990 and 2008. Asia and the Pacific as a whole is an early achiever for halving the proportion of people without access to safe drinking water, but not sanitation.<sup>4</sup> Between 1990 and 2008, the proportion of the region's population with access to improved drinking water sources increased from 74 to 88 per cent; in practical terms, that means 1.2 billion people. The access rate increased in all Asia-Pacific subregions except for Central Asia and the Pacific, where it stayed the same.

8. Compared with water supply, sanitation coverage is in a dire state. Only about 54 per cent of the region's population has access to improved sanitation. Access to sanitation also varies considerably between subregions. The most rapid progress has been in North-East Asia, which, between 1990 and 2008, increased access by 12 percentage points, and in South-East Asia, where the increase was 22 percentage points. The situation in South and South-West Asia is more difficult. Although the number of people with

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<sup>2</sup> *Financing an Inclusive and Green Future* (United Nations publication, Sales No. E.10.II.F.4).

<sup>3</sup> The term "household water security", as used in the present document, is intended to highlight the need for access to water and sanitation but also opportunities for safety and quality of life at the household level as a foundation for sustainable economic growth.

<sup>4</sup> *Achieving the Millennium Development Goals in an Era of Global Uncertainty: Asia-Pacific Regional Report 2009/10* (United Nations publication, Sales No. E.08.II.F.10).

access has doubled since 1990, this still means that, by 2008, average coverage was only 38 per cent and the number of people without access was actually higher than in 2005.

9. Poor drinking water quality and inadequate sanitation threaten human health and productivity. According to the World Health Organization (WHO), 88 per cent of diarrhoea incidents are attributed to poor sanitation and dirty water.<sup>5</sup> In South and South-East Asia, diarrhoea is responsible for up to 8.5 per cent of all deaths, which is the highest rate in the world, followed by Africa, with 7.7 per cent of deaths.<sup>6</sup> These numbers reveal a grim reality, that lack of access to basic infrastructure has led to poverty and poor health, but they also conceal the region's vast hidden potential for development.

10. Conversely, adequate water and sanitation are linked to various desirable developmental outcomes, such as healthy ecosystems and productive livelihoods. Once basic needs have been met, water is used for productive purposes, particularly in poorer households, where livelihoods depend on the availability of natural resources. Water and sanitation have thus been linked directly to growth in the gross domestic product through increases in tourism, foreign direct investment, labour productivity and agricultural outputs. According to a study of four South-East Asian countries, the economic benefits of achieving universal access to sanitation range from between \$5.4 billion to \$27 billion.<sup>7</sup>

11. Extreme weather conditions can jeopardize these gains and threaten household water adequacy and availability. Droughts reduce drinking water availability, for example through falling groundwater tables and reduced surface water flows. Floods and storms also have catastrophic consequences, damaging household properties and basic water infrastructure, and spreading disease. Many water supply and sanitation systems are vulnerable to external shocks. As the number of water-related disasters is increasing with climate change, household water and sanitation access is affected.

## **1. Low sustainability of infrastructure**

12. These observations raise the question of the sustainability of water supply and sanitation systems. Even if access is established, natural disasters and functionality levels can determine whether systems will continue to be used to cover needs. Achievements in providing basic infrastructure should not only be assessed against a coverage target. It is important to ensure that the systems built are functional, reliable, affordable and responsive to needs and that they are financially sustainable.

13. A system sustainability study conducted by ESCAP in selected communities in five countries warns against a regression in achievements,

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<sup>5</sup> United Nations Children's Fund and World Health Organization, "Diarrhoea: Why children are still dying and what can be done", accessed from [www.who.int/child\\_adolescent\\_health/documents/9789241598415/en/index.html](http://www.who.int/child_adolescent_health/documents/9789241598415/en/index.html) on 15 June 2010.

<sup>6</sup> WHO, "Water-related diseases", accessed from [www.who.int/water\\_sanitation\\_health/diseases/diarrhoea/en/](http://www.who.int/water_sanitation_health/diseases/diarrhoea/en/) on 15 June 2010.

<sup>7</sup> G. Hutton, U.E. Rodriguez, L. Napitupulu and others, *Economic Impacts of Sanitation in Southeast Asia*, World Bank, Water and Sanitation Program, 2008.

as many systems were found not to be functioning effectively. There are many reasons for this, but the most prevalent ones are the limited capacity to manage these systems and poor financial sustainability. Users are not always willing to pay, as the benefits of access to water and sanitation are not immediately visible to them. Governments and international organizations need to work in concert to generate demand and ultimately willingness to pay for these important services.

## **2. Inequality in access to water and sanitation**

14. Persistent income and gender inequalities also cast clouds over achievements. A basic typology analysis proved that richer urban households are in a better position to secure safe water and adequate sanitation. Inequalities in access to water between rich and poor households are evident all over Asia, but for sanitation, the gap is even more striking. The largest such discrepancies occur in urban environments, particularly in smaller cities. Women's unfulfilled potential also hampers progress. Women tend to invest more of their money in their families' health. To deal with water shortages or poor quality, women and children also have to travel longer distances. Yet, in male-dominated environments, women's role in household decisions on water and sanitation remains marginal.

## **B. Stretched carrying capacity**

### **1. Water availability**

15. Water withdrawal for industrial, agricultural and domestic uses is necessary to support socio-economic development. However, some countries, such as Cambodia and the Lao People's Democratic Republic, hardly utilize 1 per cent of their total available water. Others, such as Uzbekistan and Tajikistan, withdraw very close to or even more than their total surface and groundwater combined. Both groups of countries are at risk. The latter group will not be able to support current water production and development trends for long. Over-exploitation can modify water distribution and cause water crises in parts of the region. For the former group, the potential for further water withdrawals may be high. However, to secure water for development, endowment alone is not enough. Water scarcity can occur even in countries with rich renewable resources if water is not properly conserved, used and distributed among households, farms, industry and the environment.<sup>8</sup>

16. The overall amount of water available for development across the region is on a steep decline. Although critical conditions of freshwater availability appear to be quite localized in a number of countries, an analysis of existing data from a new development angle reveals wider critical trends. The Index of Water Available for Development (IWAD) examines the current trend towards rapidly increasing water withdrawal in relation to the limited amount of renewable freshwater resources. A study of IWAD shows that the development space provided by water is shrinking across the region.<sup>9</sup> Once existing demand for agricultural development, domestic supply and industrial

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<sup>8</sup> *ESCAP Statistical Yearbook for Asia and the Pacific 2009* (United Nations publication, Sales No. E.10.II.F.1).

<sup>9</sup> IWAD is defined as the ratio between (a) the total amount of a country's internal renewable water resources minus total water withdrawals in a particular year and (b) that country's corresponding balance as at 1980.

development is satisfied, a diminished level of internal renewable freshwater resources is available. As defined, IWAD only illustrates an initial attempt to depict “water adequacy” in terms of freshwater availability within each country, assuming that current common practices continue—that is, no major water reuse or recycling efforts. On the basis of this initial estimate, Asia-Pacific countries have experienced as much as a 50 per cent reduction in the amount of water available for development relative to 1980 benchmark levels.

17. For those countries whose water withdrawals have exceeded their internal renewable freshwater resources (Pakistan and Uzbekistan), IWAD reflects trends of dependency on external renewable water resources in comparison with the status of water withdrawal in 1980. What this dependency highlights is how human “mis-use” and “over-use” undermine future prospects for harnessing water for development.<sup>10</sup>

## 2. Water quality

18. The ecological carrying capacity of the region is further affected by the deteriorating water quality of water bodies. Even relatively water-rich countries, such as Bhutan, Indonesia, Malaysia and Papua New Guinea, are now facing water supply and quality constraints in major cities. Population growth, growing water consumption, environmental damage, harmful agricultural activities, poor management of water catchment areas, industrialization and groundwater overuse are responsible for this plight.

19. Countries that are relatively less well endowed with water, such as Central Asian and South and South-West Asian countries, are even more severely affected when water quality deteriorates. Countries with the least available water per person also tend to have poor water quality. Among the countries where the impact of poor water quality on socio-economic conditions is increasingly being recognized are Azerbaijan, Bhutan, the Democratic People’s Republic of Korea, Georgia, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, the Maldives, Mongolia, Myanmar, Nepal, Papua New Guinea, Tajikistan, Turkmenistan and Uzbekistan.<sup>11</sup>

20. The main water pollutants of concern in the region are microbial pollutants (mainly from domestic sewage), toxic chemicals and heavy metals (from agricultural activity, waste disposal and industrial production processes) and phosphates and nitrates (from agricultural production, domestic sewage and industrial discharge). Measures to reduce pollution from point sources, such as industrial processes and reuse of treated wastewater, have had some success, but reducing water pollution from non-point sources, such as agricultural production, urban runoff, domestic sewage (particularly where water treatment infrastructure is lacking), and from groundwater-contaminating sources, such as sewage systems and landfills, is increasingly

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<sup>10</sup> This ESCAP study involved reconstitution the FAO Aquastat Database to fill gaps in records for many countries in the region, thus allowing consistent comparison among countries for a reliable picture of these countries and most parts of the region.

<sup>11</sup> Food and Agriculture Organization of the United Nations, AQUASTAT global information system, 2010, accessed from <http://www.fao.org/nr/water/aquastat/main/index.stm>, on 28 June 2010.

difficult to achieve. Naturally occurring contaminants pose a particular threat to groundwater quality.

21. Domestic sewerage is a particular concern, as it affects ecosystems close to densely populated areas. The total volume of wastewater currently produced in urban areas is estimated to be between 150 and 250 million cubic metres per day. Either this wastewater is discharged directly into open water bodies or else it leaches into the subsoil. The consequences range from poor human health and increased infant mortality to complete environmental degradation. Particularly in cities, many small waterways are covered to allow more space for roads or commercial areas, put into concrete beds, used mostly to facilitate storm run-off or simply used as open sewers. There are many reasons for this deterioration of watercourses in cities: demand for land, lack of proper sanitation, insufficient drainage, or simply lack of appreciation of the environmental and ecological value of these waterways.

### **C. Hotspots**

22. The many threats to water resources paint a complex and worrisome picture. To better focus and prioritize regional action, the secretariat has identified “hotspots” as part of the study on the state of environmental sustainability (see E/ESCAP/MCED(6)/1). Hotspots are countries, areas or ecosystems with overlapping challenges of poor access to water and sanitation, deteriorating water quality, limited water availability and increased exposure to climate change and water-related disasters. The hotspots identified include the Aral Sea and the glacier of the Himalayan Mountains

23. As seen in table 1, South-East Asian countries are at crossroads of development. High growth rates provide financing for better water resources management, but development priorities ignore the risks from disasters, climate change and poor household water and sanitation access. India, Pakistan and Uzbekistan are also facing exceptional circumstances due to insufficient preparedness for natural disasters and climate change in the case of India and unsustainable patterns of water use in Pakistan and Uzbekistan. Basic access to sanitation remains a determining concern for Bangladesh.

**Table 1**  
**Consolidated layers of water hotspots**

	1	2	3	4	5	6	7	8	9	10	Total
Indonesia				×	×	×	×	×		×	6
Philippines	×			×	×	×	×	×			6
Papua New Guinea			×		×	×	×		×	×	6
Lao People's Democratic Republic					×	×	×	×	×	×	6
Cambodia					×	×	×	×	×	×	6
Uzbekistan	×	×	×				×	×			5
Thailand				×	×	×	×	×			5
Myanmar			×		×	×	×	×			5
India	×				×		×	×		×	5
Pakistan	×	×		×				×			5
Bangladesh					×	×		×		×	4
Viet Nam					×	×	×	×			4
Timor-Leste					×	×	×			×	4
Malaysia				×	×	×	×				4
China					×	×		×		×	4
Afghanistan	×								×	×	3
Nepal			×					×		×	3
Pacific islands						×		×		×	3
Mongolia			×					×		×	3
Maldives	×		×					×			3
Kazakhstan			×				×	×			3
Democratic People's Republic of Korea			×		×						2
Turkmenistan			×				×				2
Tajikistan			×				×				2
Kyrgyzstan			×				×				2
Iran (Islamic Republic of)								×			1
Azerbaijan			×								1
Sri Lanka								×			1
Georgia			×								1
Republic of Korea					×						1
Bhutan			×								1
Australia							×				1
<b>Prevalence (countries affected)</b>	<b>6</b>	<b>2</b>	<b>14</b>	<b>5</b>	<b>15</b>	<b>13</b>	<b>17</b>	<b>19</b>	<b>4</b>	<b>12</b>	

*Legend*

<b>No.</b>	<b>Type of Hotspot</b>	<b>No.</b>	<b>Type of Hotspot</b>
1	Increasing water scarcity threat	6	Cyclone-prone
2	High water utilization	7	Drought-prone
3	Poor water quality and low water endowment	8	Ecosystem/Climate change
4	Deteriorating water quality	9	Drinking water
5	Flood-prone	10	Sanitation



## **D. Water management capacity**

### **1. Achievements in integrated water resources management**

24. At the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992,<sup>12</sup> the need for a new approach to water resources management was recognized and articulated as “integrated water resources management” (IWRM). IWRM is guided by a comprehensive vision for sustainable water management. IWRM-compliant water management strategies and implementation plans have to address the issues and needs of the three dimensions/pillars for sustainability—the environment, society and economy. Ten years after Rio, the World Summit on Sustainable Development, held in Johannesburg, South Africa,<sup>13</sup> adopted this new approach in a call for all countries to develop “IWRM and water efficiency plans”. Popular awareness and political will have taken time to shape, in order for water to be viewed as a resource which is fundamental to economic growth, poverty reduction, social equity and environmental sustainability. The evidence is clear: countries, particularly developing countries, are adopting IWRM principles in their policies, strategies, plans and legal frameworks for planning and managing the development of water resources, while trying to change water management “on the ground” accordingly.

25. Actual implementation of IWRM principles, however, has proven to be complicated, requiring the involvement of many actors at all levels of governance and civil society as well as a culture of inclusive consultation processes. As a result, the observed impact has not been as impressive as had been hoped. Given the progress made in understanding and accepting IWRM, it is important to focus efforts on capacity-building and to highlight the regional IWRM champions.

26. An indicative profile report on the current status of IWRM implementation in the region was presented at the fifth World Water Forum, which was held in March 2009. The profile report highlights the key water management problems in each subregion and gives an indicative compilation of the key legislative and institutional support for IWRM that has been implemented in each subregion. A proposed framework to facilitate IWRM implementation and monitoring at the country level for the region has also been developed.<sup>14</sup>

### **2. Water disputes and conflicts**

27. Despite increased application of IWRM principles, competition for water resources and the high intensity of their use have led to an increase in conflicts over water. Particularly over the past two decades, the number of

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<sup>12</sup> See *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992* (United Nations publication, Sales No. E.93.I.8 and corrigenda).

<sup>13</sup> See *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum).

<sup>14</sup> Jin Lee and others, “Status of IWRM implementation in the Asia-Pacific region”, ESCAP, unpublished report, December 2009.

reported water-related incidents has risen. Conflicts within countries are also dominating the picture, particularly since 1990. In China alone, the number of disputes related to water reached over 120,000 during the 1990s, according to official sources.<sup>15</sup> In India, efforts and resources in water management are often focused on “conflict management” between different states. Direct conflicts are most likely to emerge at the local level over an ill-considered dam, ambiguous withdrawal rights or deterioration of water quality. Allocation of increasingly scarce water resources has emerged as the principal cause of water conflicts. Against the current context of development, the most important challenge lies in balancing the different uses of water and in managing their economic, social and environmental impact.

## **II. Regional trends in water resources management**

### **A. Choosing green growth**

28. The Asia-Pacific region has actively chosen to depart from unsustainable consumption and production patterns and embark on a greener development path. Green growth, adopted at the fifth Ministerial Conference as the key regional strategy for achieving inclusive and sustainable development, has gained sufficient ground to be accepted as an effective approach. If green growth is fully operationalized in water resources management, it has the potential to provide the answer to the development dilemma of providing basic water and sanitation services to all and of sustaining economic growth while ensuring environmental sustainability. Some green growth components, briefly discussed below, were conceived to provide a framework for the integration of water resources management activities into the green growth strategy of development in the region.

#### **1. Eco-efficient water infrastructure**

29. Water infrastructure is shifting from predominantly short-term-benefit-oriented planning and development, or inappropriate land management practices, such as those experienced in some Pacific island countries, to a strategic and long-term-benefit planning concept which addresses the important role of ecological efficiency in development. In order to depart from the traditional approach focusing on short-term benefits, decentralization of the planning and decision-making process together with enhancement of public awareness and participation are essential. Decentralization is more conducive to the application of a diverse range of water conservation technologies and options and to the accommodation of population growth, drought, climate change and protection of important ecosystems. Decentralization also facilitates the development of multiple sources of water for the water supply, which could significantly increase the resilience of water resources management.

30. Such approaches need to be adopted within the national development planning process. Many countries—for example Cambodia, China, Malaysia and the Republic of Korea—have been pursuing eco-efficient water infrastructure development. Eco-efficient water infrastructure development for

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<sup>15</sup> For the purposes of this analysis, the term “conflict” refers not only to armed conflict but all water-related disputes that have necessitated mediation. Whether violent or not, these disputes have threatened the stability of the socio-economic development process.

better provision of water services could be envisaged in three different contexts. The first context is as a part of programmes on eco-city development to address urbanization challenges. Possible eco-efficient infrastructure solutions include urban river rehabilitation, storm water management, decentralized wastewater treatment, water reuse and recycling. The second context conducive to eco-efficient infrastructure development is in rural areas, where distance from centres makes traditional infrastructure expensive and inefficient. Modern irrigation systems, decentralized water and sanitation systems, water reuse and re-cycling, as well as rainwater harvesting are some of the most attractive solutions in the rural context.

31. The last context relates to the pressing need to clean the region's waterways, through a "wastewater revolution". The rapidly increasing demand for freshwater in the region makes treatment of wastewater for re-use necessary. ESCAP studies point to several innovative developments in terms of technology for wastewater treatment and river rehabilitation. Typically, wastewater treatment is centralized, but central sewage treatment plants require a very large space, are costly and are not without threats to health. Today, technology for compact small wastewater treatment plants has improved and offers many advantages, such as:

- (a) Minimizing the collection system in length and diameter and therefore lowering project costs significantly;
- (b) Reducing the necessity for pumping within the collection system or in the treatment unit;
- (c) Rapid and cheap implementation;
- (d) Minimal operation and maintenance;
- (e) Treating waste streams close to water bodies first and continuing the installation of treatment systems in a parallel or concentric way outward;
- (f) Minimizing the handling of solids—reducing the amount of sludge as much as possible and requiring the treatment system to be de-sludged only once a year;
- (g) Enhancing opportunities for reuse of wastewater.

## 2. Pricing in costs to the environment

32. The Asia-Pacific development pattern has relied primarily on cheap natural and human resources. This paradigm, however, has created economies that run on two tracks: one with rapid advances in economic performance, and the other with persistent poverty and environmental degradation. To promote more balanced growth, the prices of production factors need to reflect the real cost, including costs to the environment and to ecosystem services. This shift has significant implications for water resources management.

33. First, the time horizons for assessing investments should be expanded. The benefits of access to water and sanitation, and of appropriate wastewater treatment, are not immediately visible to individuals. Better health, higher productivity and increased capabilities are not easy to quantify, take time to materialize and are often overshadowed, when compared to the relatively high capital and maintenance costs of water and sanitation systems. Allowing for

longer horizons and investment break-even points can improve decision-making.

34. The second implication is that costs to the environment should be factored in the prices charged for water and sanitation services. The costs of over-exploiting water resources are distributed equally among members of society and are not highly visible. Similarly, the costs of ecosystem degradation and river pollution caused by poor sanitation do not accrue to one group of people. In the absence of incentives, raising the prices of such basic services to reflect real costs and finance solutions could be met with resistance. To a certain extent, resistance can be addressed with awareness campaigns, whereby the benefits of eco-efficient infrastructure are explained and the willingness to pay begins to form. For the most poor, Governments need to step in and subsidize this transition to sustainable, adequate, eco-efficient infrastructure. Creating this market pull will also unlock new markets and investment opportunities and will help put the region on a sustainable green growth path.

### 3. Sustainable consumption and production

35. Water resources management is shifting from supply-oriented to more demand-oriented management. Large savings can be expected from demand management in water, energy and financial resources through increased efficiency and reduced consumption. Challenges for demand management include evaluation of availability and needs in watersheds, possible reallocation or storage expansion in existing reservoirs, balance between equity and efficiency in water use, inadequate legislative and institutional frameworks and the rising financial burden of ageing infrastructure.

36. The implementation of demand management measures has been uneven across the region, but interest in improving water use efficiency is growing in many countries. Singapore reduced urban domestic water demand from 176 litres per person per day in 1994 to 157 litres in 2007.<sup>16</sup> Leak detection programmes in Bangkok and Manila have enabled estimates of unaccounted-for water to be lowered and allowed the development of new infrastructure to be postponed.<sup>17</sup> Sydney Water in Australia began providing homes in the Hoxton Park area with two water supplies—recycled water and drinking water (dual reticulation)—in 2008.<sup>18</sup>

37. Integrated river basin management (IRBM) offers an effective way to manage specific river basins. IRBM can be considered a driver of IWRM as it covers overarching areas of policy, governance, legislation, advocacy, awareness and management. The trends of IRBM and IWRM over several decades will be examined, and ongoing efforts to identify priority actions will be discussed.

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<sup>16</sup> Tay Teck Kiang, “Singapore’s experience in water demand management”, accessed from [www.worldwatercongress2008.org/index.php?page=proceedings&abstract\\_id=461](http://www.worldwatercongress2008.org/index.php?page=proceedings&abstract_id=461) on 10 April 2010.

<sup>17</sup> United Nations Educational, Scientific and Cultural Organization, *World Water Development Report 3*, accessed from [www.unesco.org/water/wwap/wwdr/wwdr3/pdf/20\\_WWDR3\\_ch\\_9.pdf](http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/20_WWDR3_ch_9.pdf) on 29 June 2010 on 29 June 2010.

<sup>18</sup> Sydney Water, “Hoxton Park Recycled Water Scheme”, accessed from [www.sydneywater.com.au/Majorprojects/SouthWest/HoxtonPark/](http://www.sydneywater.com.au/Majorprojects/SouthWest/HoxtonPark/) on 29 June 2010.

## B. Adapting to climate change

38. In recent years, the impact of climate change, a result of global warming, has become increasingly clear, including the impact on water-related sectors. Observed warming over several decades has been linked to changes in the large-scale hydrological cycle, such as changing precipitation patterns.<sup>19</sup> Heightened intensity and variability of precipitation are projected to increase the risks of flooding and drought and therefore seasonal changes to river flows. For example, in the Mekong River, the maximum flow is projected to increase by 34 to 42 per cent in the basin and by 16 to 19 per cent in the delta. In contrast, the minimum flow is estimated to decline by 17 to 24 per cent in the basin and 26 to 29 per cent in the delta, suggesting an increase in flood risk during the dry season and possible water shortages in the dry season.

39. The Asia-Pacific region is a diverse region covering almost all the different types of climates: from the tropical rain forest to the temperate zone and from landlocked mountainous areas of the Himalaya to island States in the Pacific and Indian oceans. Therefore, vulnerability to floods, drought, snowmelts and sea level rise can be found in various places throughout the region. Some subregions, such as South-East Asia, may suffer both floods and drought in the same location but at different times.

40. Saltwater intrusion in estuaries is expected to move further inwards. Snowmelt and glaciers as well as rising snow lines would be unfavourable for downstream agriculture in South and Central Asia. The glacier area of north-western China is projected to decline by 27 per cent. The gross per capita availability of water in India is projected to decline by as much as 37 per cent. Changes in the runoff could have a significant effect on the power output of hydropower-generating countries, such as Tajikistan, and could increase demand for agricultural water in arid and semi-arid regions of Asia.

41. All the above will contribute to increased water stress, with different vulnerabilities in different parts of the region. The heavily populated megadeltas in South, East and South-East Asia are expected to be at the greatest risk of increased river and coastal flooding. The interaction of climate change impacts with rapid development in southern and eastern Asia is expected to affect development growth and, consequently, Millennium Development Goal gains.

42. While efforts are being made to understand the extent of the impact of climate change and to adapt to it, effective adaptation and adaptive capacity in developing Asian countries will continue to be limited by various ecological, social and economic, technical, institutional and political constraints. Water recycling is a sustainable approach to adaptation and can be cost-effective in the long run. The treatment and reuse of wastewater is a potential solution, although current practices may still be expensive. The reduction of water wastage and leakage can cushion declines in precipitation. In areas where the projected wet season is expected to increase and the projected dry season is expected to decrease, planned water management interventions, such as dams and reservoirs, may help.

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<sup>19</sup> B.C. Bates, and others, "Technical Paper VI – Climate Change and Water", Intergovernmental Panel on Climate Change (IPCC), June 2008.

43. There is also a need to review existing hydrology and hydrological standards, particularly for new projects. Extreme conditions of rainfall intensities and river flows form the basis of the design, operation and maintenance of hydrological structures. New standards should take into account extreme weather conditions, which are changing due to the impact of climate change.

### **III. Emerging regional priorities and programmes of action**

#### **A. Emerging regional priorities**

44. After decades of strong economic growth, with a strong focus mainly on increasing gross national production to meet its increasing needs, Asia and the Pacific is on the verge of overstretching its ecological carrying capacity. High prices of food and energy, as well as water insecurity, are the manifestations of this overstretching.<sup>20</sup>

45. Rapid urbanization, industrialization, extensive and intensive agriculture development as well as the impact of climate change have resulted in exponentially increasing demand for water, which, in turn, are placing tremendous stress on the supply of water and the management of that precious resource. Three issues have emerged as regional priorities which must be addressed before water becomes a limiting factor for sustainable economic growth.

#### **1. Household water security**

46. Household water security is emerging as a new foundation for the water security discourse. Meeting the Millennium Development Goal targets remains a key priority for the region, but the benefits of access to water and sanitation extend beyond the basic need for life. Access to water and sanitation enhances productivity, enables small livelihood creation and creates business opportunities. More than sustaining life, household water security is considered a requirement to improve quality of life. The narrow definition of access to drinking water and sanitation facilities is thus expanded to accommodate a broader concept of household water security linked to socio-economic development. Emerging from this new trend are the following regional priorities:

(a) Governments and other stakeholders are increasingly recognizing the benefits associated with universal access to water and sanitation for human health, productivity and the environment. As a result, there are mounting pressures to reinforce political commitment to action and to raise the profile of water and sanitation as contributors to inclusive and sustainable development;

(b) Sanitation is understood as expanding beyond toilets. There is a need for behavioural change and for institutional reforms to address sanitation in its broader interpretation, which includes hygienic disposal of human excreta and grey water management. The momentum of the International Year for Sanitation (2008), for example, urged leaders in the region to assert that

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<sup>20</sup> Water insecurity, as used in this document, describes the lack of capacity to deliver expected socio-economic and environmental outcomes from investment in water resources.

sanitation improves not just human health (through access to toilets), but also environmental health, as domestic wastewater is a major contributor of bacterial contamination to groundwater supplies and rivers across the region.<sup>21</sup> The call for urgent action on collecting, treating and safely disposing of domestic wastewater was clearly expressed in the first and second East Asia Ministerial Conferences on Sanitation and Hygiene (Beppu, Japan, 2007 and Manila, 2010);

(c) Better monitoring and assessment of achievements is required. Many water supply and sanitation systems may be unsustainable because of poor functioning, inadequate capacity and financing or limited responsiveness to demand. The question remains whether recent progress, particularly with respect to water targets, represents a one-time event or a real take-off for the Asia-Pacific region;

(d) Equitable and sustainable water consumption requires better policies and regulation. Richer, urban households not only enjoy better access to water and sanitation. They also tend to pay less for it because they have access to generally low utility prices. Current water pricing practices end up subsidizing the rich and penalizing the poor, who sometimes pay five times as much, buying their water through vendors or walking long distances to reach a source;

(e) According to existing indicators, the countries that need to invest most in household water security are Cambodia and Afghanistan, followed by Papua New Guinea, the Lao People's Democratic Republic and Kiribati. These countries are among the poorest in the region, pointing to the urgency and importance of regional cooperation to support investment;

(f) Better measures and more systematic data collection are necessary for evidence-based policymaking. New indicators are needed in order to identify and measure various household water security components. Significantly more research is required in order to better establish the relationship and correlation between indicators and between "capacity" and "outcomes" observed on the ground.

## 2. Water eco-efficiency

47. Eco-efficient water infrastructure is a strategic approach to harmonizing water infrastructure and the environment. Increasingly, eco-efficiency concerns are being included in national development plans and strategies. Examples in this direction are: the principles of IRBM, river conservation and rehabilitation, and storm water management, which include understanding the limits of ecological capacity within a river basin, softer approaches in river management, rainfall harvesting and modular wastewater infrastructures. To support this, ESCAP has developed eco-efficiency water infrastructure guidelines. Among the emerging trends are the following:

(a) Integrated storm water management (ISWM) has already been implemented in the more developed countries of the region. With increasing climate change risks and uncertainty, it becomes imperative that ISWM be extended to other countries of the region, particularly in the light of the need

<sup>21</sup> Follow-up Conference on the International Year of Sanitation, Tokyo, January 2010, accessed from <http://www.adb.org/Documents/Events/2010/international-sanitation-year/default.asp> on 29 June 2010.

for better urban development and integrated infrastructure planning. Integrated planning of storm water can improve ecological efficiency in the way society produces and consumes water. Drainage and general flood control can realize savings by controlling storm water damage, limiting the need to reconstruct water supply facilities and other unnecessary infrastructure investment, saving energy for pumping, developing new water sources, improving health, conserving watersheds and ecosystems, and reducing soil erosion;

(b) River and lake rehabilitation has vast potential in the region, as these natural water bodies have become receptacles for waters polluted through rapid urban development as well as intensive agriculture. Flooding and drought are expected to increase in both magnitude and frequency as a result of climate change. Rehabilitation of these natural water bodies can turn them into water supply sources during drought. Integrated storm water management can also prove invaluable during floods, as clean water bodies minimize the spread of polluted water and disease;

(c) Opportunities need to be created for knowledge sharing, the development of policy instruments, capacity-building and scaling up of pilot projects. ESCAP has already completed a number of capacity-building initiatives in several developing countries. In Malaysia, ESCAP supported the development of guidelines for eco-efficiency in water infrastructure for buildings which are recommended to be implemented in all public sector buildings. ESCAP is currently implementing a pilot project for an integrated storm water management system in cooperation with the Regional Department of Science and Technology of the Ministry of Science and Technology of the Philippines, addressing storm water and wastewater concerns. Concurrently, in Indonesia, a river rehabilitation programme is ongoing for a tributary of the Brantas River, looking at managing pollution from erosion, agricultural and animal waste in rural areas.

### **3. Wastewater revolution in Asia and the Pacific**

48. Increasing quantities of wastewater are continuously being released into the natural environment. There is a need to explore more innovative and sustainable ways to manage wastewater. Change should start from a paradigm shift in how water is used and reused in all aspects of economic activities. The wastewater revolution initiative, initiated and promoted by the Secretary-General's Advisory Board on Water and Sanitation with the launching of Hashimoto Action Plan II<sup>22</sup> in January 2010, looks at the rapidly deteriorating water environment in the Asia-Pacific region and the need to revolutionize the way wastewater is being handled and treated.<sup>23</sup>

(a) The wastewater revolution initiative highlights the urgency of the wastewater problem across the region. In many countries, 30-70 per cent of the drinking water produced is "lost". This is largely due to leaking distribution networks. At the same time, high-quality drinking water is often being used for cleaning, gardening and even toilet flushing. Of all the wastewater generated worldwide, only 15-20 per cent receives some level of

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<sup>22</sup> See [http://www.unsgab.org/HAP-II/HAP-II\\_en.pdf](http://www.unsgab.org/HAP-II/HAP-II_en.pdf).

<sup>23</sup> Other initiatives of the Advisory Board include water operator partnerships; financing; sanitation; monitoring; integrated water resources management; water and disasters.



treatment before being discharged into water sources; the remainder is discharged with its full load of pollution and toxic compounds;

(b) Most industries in developing regions do not apply cleaner production concepts. This leads to high pollution generation and to high water use per unit of product. Present day agricultural practices are also characterized by free of charge water abstraction, poorly managed irrigation schemes, outdated and damaging technology, and production of crops with high water demand in dry regions. Many examples of over-abstraction of ground- and surface-water exist. The very real possibility that the Aral Sea may disappear, mainly due to intensive irrigation upstream, shows that even the largest lakes in the world can be seriously affected;

(c) Recognizing that water pollution challenges are at a critical stage, ESCAP convened the Regional Dialogue on Wastewater Management in Kuala Lumpur on 15 and 16 June 2010. The outcome was the “Kuala Lumpur Initiatives”. Acknowledging current experiences and technologies, the Dialogue also reaffirmed the need to search for more sustainable alternatives and to call for commitment from member countries. Problems occurring and initiated at the local level need local solutions and therefore have to include all stakeholders at the local, national and regional levels. A rethinking of consumption patterns and the use of natural resources is critically needed. Considering the complexity of the issues as well as the multiple and cross-cutting actors, a framework of strategies and actions may be necessary in order to chart all initiatives and to ensure minimal gaps and overlaps.

## **B. Thematic areas for priority action**

### **1. Eco-city development programme for economic growth**

49. This programme will be developed from the perspective of water resources management, as a response to the rapid urbanization of the region and the high level of internal migration to urban centres. The main components of this programme are as follows:

(a) Eco-efficient water infrastructure that integrates water-related infrastructures into city development plans. This will include storm water management concepts, modular structures for wastewater treatment, rainfall harvesting for non-potable water use as well as flood detention and retention components/facilities to attenuate flood waters;

(b) Rehabilitating urban rivers back into clean, beautiful and vibrant natural systems that will provide space to support urban lifestyles and add value to those assets;

(c) Ensuring household water security. Providing access to water and sanitation enhances productivity, enables small livelihood creation and creates business opportunities to improve the quality of life. Household water security merits an expanded definition to accommodate a socio-economic development perspective in addition to water supply and sanitation.

**2. Provision of water and sanitation services to rural areas for poverty alleviation**

50. This programme is part of regional efforts to decentralize water resources management:

(a) Ensuring household water security. As with urban areas, providing access to water and sanitation in rural areas enhances productivity, enables small livelihood creation and creates business opportunities to improve the quality of life;

(b) Water reuse and recycling for agricultural and other uses, upstream and downstream. This process will require that wastewater discharges upstream and downstream be fully treated in order to ensure that water is of adequate quality for all users;

(c) Rainwater harvesting to augment water supply needs and to attenuate floods and therefore induce infiltration through the ground to natural water bodies. Rainwater harvesting could also help reduce pollution from wastewater.

**3. Integrated sanitation development**

51. ESCAP implementation of a project funded by the Korea International Cooperation Agency on the development of eco-efficient water infrastructure in Asia and the Pacific, within the green growth strategy for sustainable development, is intended to produce integrated and holistic action plans. Particular attention has been paid to wastewater-related concerns. The Hashimoto Action Plan II, which was released by the Secretary-General's Advisory Board on Water and Sanitation in January 2010, has provided opportunities for synergy on a potential "wastewater revolution in Asia and the Pacific". Priority actions to address wastewater concerns include:

(a) Sharing experiences and approaches in wastewater management, exchanging latest developments on new technologies and strategies is an option;

(b) Recognizing that the net amount of wastewater discharged into the environment is higher than the water replenishment rate, new thinking is needed, and use, reuse and recycle principles need to be promoted;

(c) Translating the concept of a "wastewater revolution in Asia and the Pacific" into action at the local, national and regional levels. Consumption and production patterns vis-à-vis water use need to change so as to enable a paradigm shift in the perception and value systems related to managing water resources.

**4. Climate change adaptation**

52. Climate change has been and is manifested by the occurrence of more extreme weather conditions of floods and drought, affecting both highlands and deltas. Climate change impacts exacerbate challenges within the water sector. Since the Asia-Pacific region is home to two thirds of the world's poor and since the poor are least resilient and least prepared, the region faces challenges in achieving the Millennium Development Goals and the potential

of seeing some erosion of its past Millennium Development Goal achievements. This priority action consists of the following components:

- (a) Exploring policies, strategies and action plans to identify the types of vulnerability. Appropriate adaptation policies should also be explored and mainstreamed into national development agendas;
- (b) Building capacity to enhance resilience;
- (c) Identifying financial options for a prioritized adaptation programme.

### **C. The way forward: Programmes of action**

53. In this section, possible frameworks are proposed to solicit support for existing regional programmes, to mobilize participation in new initiatives and to provide coordination for maximum synergy among regional efforts.

#### **1. Programme of action for sustainable economic growth: Sustainable urban development and water resources management**

54. This programme of action is one of the priority areas of the green growth strategy of ESCAP in view of the importance of urban development for economic growth in the region. Urban areas currently produce about 80 per cent of the region's gross domestic product and are home to over 43 per cent of the total population of the region, and water is increasingly being recognized as the limiting factor in the economic growth of urban areas. This programme of action is expected to include the following priority activities:

- (a) To develop a regional strategy based on experiences and achievements of major existing regional efforts, such as the Kitakyushu Initiative, the Seoul Initiative for Green Growth, the ESCAP development account project on eco-efficient urban infrastructure and the ESCAP urban community development programme for a new comprehensive and integrated approach to water resources development in urban areas;
- (b) To compile lessons learned with a view to expanding the knowledge base on technologies and approaches that promote eco-efficient water infrastructure in the urban context;
- (c) To develop a detailed road map towards sustainable urban development and water resources management, mobilizing high-level political commitment;
- (d) To strengthen partnerships and generate buy-in for a road map, working with Governments, the private sector, international banks and civil society;
- (e) To solicit support and participation of key stakeholders, especially drivers for this programme, of the existing regional programmes, new initiatives and financing institutions for maximum synergy of regional efforts in urban development.

**2. Programme of action for poverty eradication: Provision of water services to rural areas**

55. The rural population currently accounts for about 58 per cent of the total population of the region. Extreme poverty is more pronounced in rural areas, among farmers. Sustainable water resources management must address the need for water in the agricultural sector, which is the most important water user—currently consuming up to 80 per cent of water withdrawals. In order to mitigate poverty effectively, water resources management must address the linkage between water and quality of life. Provision of water services to rural areas is expected to be a key driver in the application of IWRM to improve household water security, the modernization of irrigated agriculture and the enhancement of productivity. This programme is expected to include the following priority activities:

(a) To promote modernization of irrigation systems, linking up with regional efforts made by the Food and Agriculture Organization of the United Nations (FAO);

(b) To promote water eco-efficiency through rainwater harvesting, decentralization of wastewater management, provision of water services for multiple uses and better household water security;

(c) To reprioritize access to water and sanitation as a requirement for human health, productivity and livelihood creation, joining hands with systematic efforts made by the World Health Organization, the United Nations Children's Fund and the Asian Development Bank.

**3. Programme of action for better resilience: Climate change adaptation**

56. The impacts of climate change, especially in the water sector, could be widespread and far-reaching. Action is urgently needed for all countries to cope with climate change. However, the capacity of developing countries to adapt effectively to climate change is limited. For these reasons, this programme of action is expected to include the following priority activities:

(a) To develop a regional strategy with supporting policies and action plans to integrate adaptation measures into the socio-economic development process in the region, with special attention to extreme flooding and drought;

(b) To build a network of partners to share and develop the required information for climate change projection at scales below the ten-kilometre grid, as recommended by the Intergovernmental Panel on Climate Change (IPCC), in order to identify vulnerable areas within the region;

(c) To mobilize regional efforts and participation in identifying “no regret” options for climate change adaptation which will support green growth within the sustainable development and growth agenda.