



INTERNATIONAL HYDROLOGICAL PROGRAMME

An overview of selected policy documents on water resources management that contributed to the design of HELP (Hydrology for the Environment, Life and Policy)

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SC-2000/WS/39

IHP-V | Technical Documents in Hydrology | No. 38
UNESCO, Paris, 2000

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Summary

This publication summarizes various recent policy documents and international conference reports on the subject of water resources management. Many of these documents stress the urgent need for action to address declining global water security.

The documents summarized herein indicate that there are a number of recurring issues and recommendations with respect to water resources management:

1. Data on water resources are not sufficient.
2. Compared with water quantity, water quality has not received sufficient attention.
3. Water must be managed in an integrated manner through a multidisciplinary approach.
4. Implementation of integrated water resources management at the river basin level is needed.
5. Public awareness and stakeholder involvement must increase in policy-making.
6. Institutional frameworks need to be improved.

Further details on water resources policy is discussed in the Overview of Policy Issues section.

Since the 1990s, there have been various high profile meetings on global water resources management, each seeking to develop better practices for improving declining global water security. However, these meetings have not resulted in any follow-up scientific programme that would address, in a field context, the integration of the necessary technological response with policy and management considerations. In fact, as readers may notice, many of the documents reviewed herein do not recommend concrete approaches or actions for tackling emerging water resources issues. Unfortunately, there is a traditional separation between the water policy-makers/water management community and the scientific community. This gap has led to a new global initiative entitled HELP (Hydrology for the Environment, Life and Policy) which seeks to integrate the three communities of scientists, policy-makers, and water managers in order to achieve better management of world water resources.

Although not comprehensive, as it reviews only sampling of documents on the water management issue, the present publication aims to serve as a reference work for scientists, water managers, and policy-makers, who are the key actors in global water resources management. Parts of this document was presented to the HELP Task Force (established by the Fifth UNESCO/WMO International Conference on Hydrology in February 1999) for consultation during their development of *The Design and Implementation Strategy of the HELP Initiative* (HELP Task Force: 2000).

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Introduction

Since the 1990s, there have been various high profile meetings on global water resources management (e.g. the 1997 United Nations General Assembly Special Session), policy reviews by the UN (e.g. the UN Commission on Sustainable Development, 1998) and non-UN agencies (e.g. the Commission of the European Communities, 1998), each seeking to develop better practices for improving declining global water security.

In response, the World Conference on Science (Budapest, 26 June - 1 July 1999) called for the strengthening of national, regional and global environmental research programmes, with a particular emphasis on freshwater issues and the hydrological cycle (UNESCO and ICSU: 1999). Most recently, the World Water Council's Vision for Water, Life and the Environment and the associated Second World Water Forum on Water Security in the 21st Century (The Hague, March 2000) highlighted 'water' as the most critical environmental issue of the 21st century. The Ministerial Declaration of The Hague on Water Security outlined seven principal challenges for achieving water security: 1) meeting basic needs, 2) securing the food supply, 3) protecting ecosystems, 4) sharing water resources, 5) managing risks, 6) valuing water, and 7) governing wisely (World Water Forum: 2000).

Despite these high profile activities, no comprehensive global initiative has been forthcoming that would address, in a field context, the integration of the necessary technological response with policy and management considerations. On the contrary, hydrometric and water quality networks fundamental to providing sound data for updating and addressing water policy needs have been in a state of decline globally since the 1980s. Moreover, there remains a traditional separation between the policy-maker/water management community and the scientific community, especially regarding the setting of the research agenda and the exchange of information for use in management. As a result, there is a significant time lag in the implementation of scientific outputs to the benefit of society and a lack of problem-driven science.

Although not comprehensive, as it contains only a sampling of documents on the water management issue, the present document aims to serve as a reference work for scientists, water managers, and policy-makers, who are the key actors in global water resources management. In particular, scientists need to understand the policy-making process and the context in which decisions are made. Similarly, policy-makers need to have adequate appreciation of science, and pose the right questions to scientists and adopt a long-term perspective (although this second objective is beyond the scope of this publication). Finally, water managers must be included in this process because they play an important facilitating role between the scientists and policy-makers.

The structure of each summary is organized as follows:

1. Title of the document
2. Date
3. Author
4. Scope
5. Issues discussed

The documents summarized herein are listed in the Table of Contents.

Overview of Policy Issues

Many of the documents reviewed herein address similar policy issues with respect to water resources management. The recurring policy issues are as follows:

1. Data on water resources are not sufficient.
2. Compared with water quantity, water quality has not received sufficient attention.
3. Water must be managed in an integrated manner through a multidisciplinary approach.
4. Implementation of integrated water resources management at the river basin level is needed.
5. Public awareness and stakeholder involvement must increase in policy-making.
6. Institutional frameworks need to be improved.

In general, most of the documents recognize that there is a shortage of data on water resources. For example, *World Water Resources: A New Appraisal and Assessment for the 21st Century* (Shiklomanov: 1998) maintained that there is little data in many regions of the world and few exchanges of available data. In response, the Commission on Sustainable Development, in *Decisions of the Commission on Sustainable Development* (1998), encouraged governments to establish and maintain effective information and monitoring networks and promote the exchange and dissemination of information on policy formulation, planning, and operational decisions. Also, *Water Quality Management: Proposal* (Kindler and Helmer: 1998) pointed out that “[w]ater quality and quantity data systems are failing to provide the kinds of information governments need to develop, implement and monitor water quality policies and programmes” (p. 6). In particular, insufficient understanding of water quality was stressed in *A Comprehensive Global Water Quality Initiative* (Water Quality Task Group: 1997), *Water Quality Management: Proposal* (Kindler and Helmer: 1998), and *Summary and Recommendations of the International Conference on World Water Resources at the Beginning of the 21st Century: Water: A Looming Crisis?* (UNESCO: 1998). In order to address these shortcomings, two documents reviewed herein recommended setting up pilot basins to further study and analyze water resources. *A Comprehensive Global Water Quality Initiative* (Water Quality Task Group: 1997) recommended setting up a global network of 200-300 basins covering a wide range of climatic, hydrological and biophysical environments to study and collect data. This initiative also anticipated the networking of stakeholders in individual basins as a complementary outcome. Similarly, the Organization of American States, in *Status and Proposed Actions to Continue the Implementation of the Initiatives on Water Resources and Coastal Areas of the Plan of Action for the Sustainable Development of the Americas* (1999), discussed developing pilot projects in river basins. This document suggested that benefits and comparative advantages could be obtained by adopting the river basin as the planning unit.

Moreover, some of the documents stressed the importance of a multidisciplinary approach to integrated water management. For example, *Freshwater: A Challenge for Research and Innovation* (EU Joint Research Centre: 1998) discussed the lack of an integrated approach to the solution of potential water problems. Similarly, *Water Resources Management - A World Bank Policy Paper* (The World Bank: 1993) argued that land and water management activities as well as water quality and quantity issues need to be integrated within basins or watersheds. Furthermore, *Summary and Recommendations of the International Conference on World Water Resources at the Beginning of the 21st Century: Water: A Looming Crisis?* (UNESCO: 1998) recommended integrating the management of water-related information with that of biophysical environment, human society, and the economy. This document also called for the mobilization of many types of expertise, both in social and scientific domain, to address water scarcity issues.

Furthermore, the need for raising public awareness and increasing stakeholder involvement in water management were highlighted in a few documents. *The Bank's Policy on Paper:*

Working Paper (Asian Development Bank: 1998) asserted that insufficient political and public awareness and a lack of community participation are the major problems faced by the member countries of the Asian Development Bank. Furthermore, the World Bank's *Water Resources Management - A World Bank Policy Paper* (1993) argued that "[p]articipation in planning, operating, and maintaining irrigation works and facilities to supply water and sanitation services increases the likelihood that these will be well maintained and contributes to community cohesion and empowerment in ways that can spread to other development activities" (p. 56). To achieve this, the World Bank urged governments to play a role in fostering user participation by providing technical training for water user associations and community or institutional organizers. Moreover, the Organization of American States, in *Status and Proposed Actions to Continue the Implementation of the Initiatives on Water Resources and Coastal Areas of the Plan of Action for the Sustainable Development of the Americas* (1999), recommended promoting and strengthening partnership among the public sector, the private sector, and civil society through a transparent, consultative and participatory process of policy development and implementation.

In addition, the following documents emphasized the improvement of institutional frameworks as an important issue in water management. *Water Quality Management: Proposal* (Kindler and Helmer: 1998) called for the improvement of institutional frameworks so that there would be horizontal and vertical coordination at local, national, and regional levels. Moreover, the Asian Development Bank in *The Bank's Policy on Water: Working Paper* (1998) outlined the problems encountered by its member countries, such as fragmented and overlapping responsibilities among agencies involved in water projects and a general shortage of institutional capacity to meet the increasing needs in service delivery and resource management. The World Bank also mentioned the need to develop institutional frameworks and separate policy, planning, and regulatory functions from operational functions at each level of government.

Conclusion

Summaries in this publication indicate that there is a general recognition of the urgent necessity to improve water resources management. As discussed above, many documents reviewed herein refer to common policy issues. Some of them suggest specific policy implementation but many do not recommend any concrete approaches or actions for tackling emerging water resources issues. The few exceptions include *A Comprehensive Global Water Quality Initiative* (Water Quality Task Group: 1997), *Freshwater: A Challenge for Research and Innovation* (EU Joint Research Centre: 1998), and *Summary and Recommendations of the International Conference on World Water Resources at the Beginning of the 21st Century: Water: A Looming Crisis?* (UNESCO: 1998), which set the foundations for integrating scientific response with water management and water policy issues. However, there has been no follow-up scientific programme globally that addresses key water resource management issues in the field and which closely integrates policy and management needs. This gap has led to a new global initiative entitled HELP (Hydrology for the Environment, Life and Policy) which works under the principle that research should be responsive to water-related policy and development issues. HELP also seeks to integrate the three communities of scientists, policy-makers, and water managers through a global network of experimental hydrological catchments with the aim of facilitating communication among them so that better management of world water resources can be achieved. Parts of this publication was presented to the HELP Task Force (established by the Fifth UNESCO/WMO International Conference on Hydrology, Geneva, 8-12 February 1999) for consultation during their development of *The Design and Implementation Strategy of the HELP Initiative* (HELP Task Force: 2000). We hope that this publication will also provide a baseline document for consultation by the wider scientific,

water policy, and water management community towards the implementation of HELP in the selected HELP drainage basins.

The present publication was written by Aki Yamaguchi, who is currently a consultant to the Division of Water Sciences at UNESCO in Paris, and by Anna Wesselink, a former consultant to the same Division.

Summaries of Publications

1. *Water Resources Management – A World Bank Policy Paper*

Date: 1993

Author: The World Bank

Scope: Discusses key elements of a new approach toward water resources management and provides a framework for the World Bank's water resource activities.

Issues discussed:

- World Bank-supported investments in water resources management have often encountered implementation, operational, and social problems. Underlying these problems is a vicious cycle of poor-quality and unreliable services that results in consumers' unwillingness to pay for such services, which in turn generates inadequate operating funds and further deterioration in services.
- The proposed new approach to water management builds on the lessons from these experiences. At its core is the adoption of a comprehensive policy framework and the treatment of water as an economic good, combined with decentralised management and delivery structures, greater reliance on pricing, and fuller participation by stakeholders.
- Recognising that water management has frequently been fragmented in the past, the new approach stresses a comprehensive framework for formulating country-specific policies and public decisions that take into account the interdependencies that characterise water resources.
- The framework would facilitate the consideration of relationships between the ecosystem and socio-economic activities in river basins.
- Efficiency in water management must be improved through the greater use of pricing and through greater reliance on decentralization, user participation, privatization, and financial autonomy to enhance accountability and improve performance incentives.
- Water resources should be managed in the context of a national water strategy that reflects the nation's social, economic, and environmental objectives and based on an assessment of the country's water resources.
- Surface and groundwater resources are physically linked; thus, their management and development should also be linked. Land and water management activities as well as issues of quantity and quality need to be integrated within basins or watersheds so that upstream and downstream linkages are recognized and activities in one part of the river basins take into account their impact on other parts.
- In many cases, inadequate and unreliable data constitute a serious constraint to developing and implementing a country's water resource strategy and to managing water effectively.
- It is often the case that regulatory systems and coordination structures do exist but function poorly because they lack authority and the appropriate resources for enforcement. Governments authorize water use but allocations and priorities are often vaguely stated or are absent and many uses such as instream or environmental uses may be overlooked. Governments should develop institutional arrangements that encourage water-related agencies to coordinate and establish mutually agreed upon priorities and policies for investment,

regulation, and allocation, especially for the management of river basins. An important principle in assigning responsibility is that policy, planning, and regulatory functions must be separated from operational functions at each level of government.

- Although many farmers are very poor in an absolute sense, they are willing to pay for good quality and reliable irrigation services that raise and stabilize their income. Thus, the critical issue is providing these poor farmers with reliable, profitable, and sustainable irrigation services. Small-scale, low-cost technologies are especially needed for rural water supplies in the developing world.
- Participation in planning, operating, and maintaining irrigation works and facilities to supply water and sanitation services increases the likelihood that these will be well maintained and will contribute to community cohesion and empowerment in ways that can spread to other development activities. Governments can play an important role in fostering user participation by providing technical training for water user associations and community or institutional organizers.
- The mix between the private and public capital for investments in water resources will need to change, with the private sector share increasing sharply. However, the availability of private capital will depend to an important extent on the general development of the local capital market. A mix of user charges, beneficiary taxes, central government transfers (grants and loans), and municipal and utility bonds will be required to meet future demand for investment.
- Governments should intensify efforts to achieve flood control with non-structural measures that are less costly, yet no less effective in preventing these disasters, than more expensive structural measures. These include a combination of market incentives and regulatory policies to reduce pollution, soil erosion, waterlogging, and flood runoff.
- To restore polluted groundwater and to prevent further contamination, appropriate environmental standards and codes of practice for safe transport, transfer, storage, and disposal of hazardous and toxic wastes should be established and implemented.
- The role of the World Bank:

The World Bank will focus its efforts on countries where significant problems exist or are emerging involving water scarcity, service efficiency, water allocation, or environmental damage. Its economic and sector work, lending, technical assistance, and participation in international initiatives will aim to promote policy and regulatory reforms; institutional adaptation and capacity building; environmental protection and restoration; and when requested, cooperation in managing shared international watercourses.

The World Bank will encourage and assist countries to develop a systematic framework for incorporating cross-sectoral and ecosystem interdependencies into the formulation of policies, regulations, and public investment plans that are suitable to the particular country's situation.

The World Bank is ready to support capacity building by enhancing analytical capabilities, adopting participatory techniques, and strengthening databases, as well as by conducting water resource assessments and related institutional changes.

In order to facilitate the collection of data, the World Bank will support the use of modern technologies for hydrologic and environmental monitoring and for surveys and data processing, taking into account the relationship between the costs and benefits of more detailed information.

The World Bank will help governments to reform and establish a strong legal and regulatory framework to tackle social concerns, monopoly pricing, and environmental protection. Similarly, the Bank will support the adaptation of institutional structures at the national and regional levels to coordinate the formulation and implementation of policies for improved water management and public investment programs.

The Bank will promote river basins as an effective way to integrate and monitor activities concerning land use, availability and quality of water, conjunctive use of surface and groundwater resources, biodiversity, floodplain and drought risk management, and protection of river basin environments.

2. *A Comprehensive Global Water Quality Initiative*

Date: 7-11 July 1997

Author: Water Quality Task Group

Scope: A proposal for a worldwide programme of water quality research.

Issues discussed:

- Increasing demands on available water (population pressure, industrial development, and lack of sanitation and wastewater treatment) with exacerbation of pressures by climate variability and change.
- One of the principal causes for water scarcity is degradation in water quality. Water quality degradation causes a critical reduction in the amount of freshwater available for potable, agricultural and industrial use. Human health and biodiversity are at immediate risk.
- With the exception of the GEMS/Water database, water quality has not received sufficient attention. Hence, there is a lack of comprehensive understanding of processes and appropriate management tools, and a lack of data. Moreover, the global water-quality database remains limited on similar lines to the hydrometric database that existed prior to the UNESCO International Hydrological Decade in the early 1960s.
- The primary objective of this initiative is to improve freshwater quality globally by providing the scientific basis and associated management techniques. Delays in implementation of this programme could mean loss of millions of lives, extinction of entire ecosystems and most assuredly major constraints to economic and social development.
- The programme will proceed through inception, design, and operations. The inception phase will consist of planning workshops, followed by a stakeholders conference. The design phase will detail start-up in the selected basins and will incorporate information as it becomes available. The operations phase will deal with the management, collection, integration, data analysis, dissemination, and review/feedback of programme deliverables within and from a regional and global perspective among basins.
- Proposals include:
 1. Take a process-oriented approach and analyze water quality evolution along pathways throughout a basin in order to understand linkages between natural environment and human demands.
 2. Develop understanding of hydrological systems at a range of temporal and spatial scales and for a range of biophysical conditions.
 3. Compare responses from similar basins to different management options in order to develop more robust management strategies.
- Recommended actions and expected outcomes include:
 1. Set up a global network of 200-300 basins to be studied, at the 50,000-100,000 km² scale, covering a wide range of climatic, hydrogeological and biophysical environments and facing the full range of pressures from population and economic development. The collected data will contribute to the global view of status and trends of important water-quality parameters, which will be extremely important for data deficient areas.
 2. An important outcome of the comparative analysis and the individual basin assessments will be reporting of emerging issues and unknown relationships among human and

environmental factors and water quality. Another product will be the networking of stakeholders in individual basins.

3. Observations and analysis will need to continue for at least 12-15 years, but very intensive studies may be shorter. Comparative analysis will be facilitated by common protocols for observations, data storage and analyses.
4. The expected cost is US\$ 1.0 to 1.5 million/year/basin and opportunities for the strengthening of existing programmes at the national level need to be exploited.

3. *Fresh Water Initiative: EU Policy Objectives for CSD*

Date: 1997

Author: The EU

Scope: The EU's position with respect to the CSD meeting on the topic (see 4. *Decisions of the Commission on Sustainable Development*).

Issues discussed:

- The quantity of water of sufficient quality required to satisfy basic human needs in health and sanitation, together with equity and efficiency in water provision.
- Integrated approach to management of water, integration of land and water management, promotion of sustainable agricultural practices, control of discharges, and monitoring quality including biological effects.
- Food security and the discussion on the role of water in adding value to agricultural produce (concept of virtual water).
- Protection of the environment, biological diversity, viable ecosystems and water quality.
- Demand management including control of water use, regulatory and financial aspects, leakage control, and increasing efficiency.
- Strategic information management for informed decision making and emphasis on preventative rather than crisis management.
- Perspectives opened by science and technology (and education and training) to help resolve a range of problems concerning freshwater management and use.
- Proposals: Adoption by CSD of a Programme of Action 'Water 21' to achieve the above objectives. Agreement on certain principles is required:
 1. Importance of an integrated approach to water management and the consequent need for institutional development.
 2. Other important Agenda 21 issues should be taken into account (climate change, integrated coastal zone management, and conservation of biodiversity).
 3. Access to safe drinking water constitutes an economic and social fundamental right of each person.
 4. Definition of a strategic approach based on Chapter 18 of Agenda 21.
 5. Commitment by all states to develop local or national plans of sustainable management of freshwater based on a participatory approach.
 6. Commitment by international organizations and donor states to promote the implementation of these plans.
 7. Definition of priorities and identification of improved monitoring of progress.
 8. Management of international water bodies should be based on national strategies and the UN Convention on Non-Navigational Uses of International Watercourses.
 9. Implications of customary water uses.
 10. Implications of regarding water as an economic and social good.

- Guidance needs to be given on the preparation and implementation of river basin management plans, particularly on:
 1. Making difficult political decisions.
 2. Creating incentives for better arrangements.
 3. Improving data availability for decision making.
 4. Identifying future hot spots.
 5. Improving sanitation and promoting re-use of water.
 6. Increasing public awareness.
 7. Building effective partnerships public-private and improving public participation.

- Actions:
 1. Several meetings/workshops in order to prepare the CSD, e.g. Harare (January '98), Bonn (March '98), and Paris (March '98).
 2. Any CSD proposal should make best use of existing efforts: increase effectiveness of national actions, coordinate international action within one country, set clear roles for multilateral initiatives (e.g. GWP and WWC), and coordinate UN agencies.
 3. Funds should already be available in the light of earlier commitments on financial resources in relation to water made in the Beijing and Copenhagen declarations. Less direct contributions may be made through re-direction of existing training, technology transfer, private sector involvement, and development of water-efficient agricultural practices.

4. *Decisions of the Commission on Sustainable Development*

Decision 6/1: *Strategic Approaches to Freshwater Management*

Decision 6/4: *Review of the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States*

Date: 1998

Author: The Commission on Sustainable Development

Scope: UN policy document.

Issues discussed:

- Freshwater resources development, use, management and protection should be planned in an integrated manner, taking into account short-term and long-term needs.
- Priority should be accorded to the social dimension of freshwater management.
- Consideration of equitable and responsible use of water should become an integral part in water management at all levels.
- Development, use, management and protection of water so as to contribute to the eradication of poverty and the promotion of food security is an exceptionally important goal.
- Acknowledgement and protection of the role of all types of water bodies and the ecosystem in the water cycle is important.
- Links between water quality, sanitation and human health must be recognized.
- Proposals (only those most relevant are mentioned):
 1. Need to strengthen international cooperation and mutual coordination to support local, national and regional action.
 2. Need to strengthen local capacities.
 3. Need to address numerous gaps in knowledge, e.g. conservation of biological diversity, conservation and sustainable use of wetlands, understanding of hydrology and the availability and variability of water resources.
 4. Need to collect, store, process and analyze water-related data.

Extracts from the document (as mentioned in *Water: A Looming Crisis?*):

Decision 6/1 Strategic Approaches to Freshwater Management

The Commission, therefore:

10. Urges Governments, with the technical and financial support of the international community, where appropriate, to address the numerous gaps identified in the path towards integrated water resources development, management, protection and use. Areas that require further attention include: ... raising awareness of the scope and function of surface and groundwater resources;... the understanding of hydrology and the capacity to assess the availability and variability of water resources;

A. Information and data for decision-making

16. Information and data are key elements for assisting the management and use of water resources and in the protection of the environment. All states, according to their capacity and available resources, are encouraged to collect, store, process and analyse water related data in a transparent manner and make such data and forecasts publicly available in the framework of a participatory approach....

The Commission therefore:

17. Encourages Governments to establish and maintain effective information and monitoring networks and further promote the exchange and dissemination of information relevant for policy formulation, planning, investment and operational decisions, including data collected based on gender differences, where appropriate, regarding both surface and groundwater, and quantity, quality and uses as well as related ecosystems and to harmonise data collection at the local catchment and the basin/aquifer level. Information concerning all relevant factors affecting demand is also essential.

18. Stresses that effective management of water resources demands that attention should be paid to essential activities, all of which require fundamental knowledge about water resources as well as information about water quality, quantity and uses, including:

- (a) water resources planning and watershed management at local and national levels;
- (b) regulatory activities;
- (c) investments in infrastructure and technologies for remedying and preventing pollution; and
- (d) education and training.

19. Encourages Governments to facilitate the collection and dissemination of water data and documentation that enhances public awareness of important water-related issues, to improve the understanding of meteorology and processes related to water quantity and quality and the functioning of ecosystems, and to strengthen relevant information systems for forecasting and managing uncertainty regarding water resources. Such efforts on the part of developing countries, particularly the least developed countries, require support from the international community.

22. Invites Governments to establish or strengthen mechanisms for consultations on drought and flood preparedness and early warning systems and mitigation plans at all appropriate levels. They are encouraged to consider the establishment of rapid intervention systems to ensure that individuals and communities can be assisted in recovering from damage that they suffer from such extreme events. At the international level, there is, in particular, need to maintain support of these activities at the conclusion of the International Decade on Natural Disaster Reduction.

23. Calls upon the international community, including the United Nations system, to support national efforts in information and data collection and dissemination through coordinated and differentiated action. In particular in their respective fields, United Nations agencies and programmes and other international bodies should support Governments in the development and coordination of relevant data and information networks at the appropriate level, carry out periodic global assessments and analyses of water resources availability (both quality and quantity) and changes in demand, to

assist in identifying water related problems and environmental issues, and promote the broadest exchange and dissemination of relevant information, in particular to developing countries. Encourage access to, and exchange of, information in user friendly formats based on terminology easily understood.

B. Institutions, capacity-building and participation

26. Urges Governments to strengthen institutional and human capacities at the national, sub-national and local levels, in view of the complexity of implementing integrated water resource development and management strategies particularly in large urban settlements....Effective water resource development, management and protection requires appropriate tools for educating and training water management staff and water users at all levels and for ensuring that women, youth, indigenous people, and local communities have equal access to education and training programmes....

C. Technology transfer and research cooperation

32. Urges Governments, industry and international organization to promote technology transfer and research cooperation to foster sustainable agricultural practices which promote efficient water use and reduce pollution of surface water and groundwater....They should also improve water use efficiency in irrigated areas and improve the adaptation and productivity of drought-tolerant crop species....

37. Urges donor countries and international organizations to intensify their efforts and to accelerate their technical assistance programmes to developing countries, aimed at facilitating the transfer and diffusion of appropriate technologies. The United Nations system, as well as regional groupings, have an important role to play in facilitating the contact between those in need of assistance and those able to provide it. Less formal arrangements may also have a role to play.

FOLLOW-UP AND ASSESSMENT

The Commission on Sustainable Development:

53. Invites the United Nations Environment Programme (UNEP), in collaboration with other relevant United Nations bodies, to play a vital role in providing inputs through the provision of technical and scientific advice on environmental aspects of the sustainable development of freshwater resources. In the field of freshwater, UNEP could focus on assisting countries, especially developing countries, in strengthening their ability in this regard, in technology transfer and environmental institutional strengthening and on responding to requests for assistance in strengthening integrated river basin management. The potential of the Global Environment Monitoring System (GEMS) and other relevant global monitoring networks should be fully utilized. Such activities would provide an effective contribution to the work of the Commission.

Decision 6/4 Review of the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States

D. Freshwater resources

20. The Commission notes that for small island developing States, the conservation and sustainable management of freshwater resources is fundamentally dependent on sound knowledge and understanding of the water resources potential, and that there is a vital link to the management of coastal and marine resources and waste.

21. The lack of an adequate knowledge base and ongoing monitoring programmes, often compounded by the small size, remoteness, physical structure and rapid urbanization of small island developing States, exacerbates difficulties in management and adequate supply of freshwater resources, particularly in the smaller islands and coral atoll communities. The Commission encourages small island developing States, with the vital support of the international community, to establish and strengthen, as appropriate, geographic information system (GIS)-based data collection, storage, analysis and retrieval systems, including monitoring programmes, and appropriate institutional frameworks, including legislation and national coordinating mechanisms for the management of freshwater and groundwater resources, and to give high priority to the immediate development and implementation of appropriate national water action plans. The Commission notes the importance of the World Meteorological Organization's World Hydrological Cycle Observing System, in particular the Caribbean Hydrological Cycle Observing System.

24. ...The Commission calls on the international community to continue to provide support for regional and national efforts to promote sound water resources assessment and monitoring procedures, demand management and policy frameworks....

5. *EEA/WHO Monograph on Water Resources and Human Health in Europe*

Date: May 1998

Author: EEA and WHO

Scope: Description of the situation.

Issues discussed:

- Uneven distribution of water resources between countries.
- Pressures from agriculture, industry and domestic use will impact on quantity and quality of water resources. Climate change will also have an influence.
- Policies are in place to reduce anthropogenic impacts on water resources in a number of countries.
- The extent of provision of piped water supply varies across Europe and between rural and urban populations, with rural populations in Eastern Europe least well provided. Continuity is also a problem in these areas.
- Private and small public supplies are least reliable.
- Treatment is insufficient in some countries, especially in the East.
- Public sewage collection and treatment lags behind water supply.
- Microbiological contamination is of immediate concern and affects many people.
- Significant chemical pollution is often localised and may be affected by geology or anthropogenic contamination.
- Incidents of water-related diseases may be due to financial constraints and/or organisational disruption.
- Lack of data on quality of source and drinking water and occurrence of diseases.
- Inefficient use of water resources (pipe leakage, irrigation inefficiency) appears to be a significant problem.
- Efforts are still needed to ensure that Europe's population is supplied with safe drinking water. These include measures to control demand and reduce contamination, and also in infrastructure development.

6. *Freshwater: A Challenge for Research and Innovation*

Date: July 1998

Author: EU Joint Research Centre

Scope: Explaining to the public the European priorities for research and innovation in the area of freshwater management and use (amalgamation of EU policy documents and further consultations).

Issues discussed:

- The Task Force “Environment-Water” was established by the EC in 1996 in order to:
 1. Define water-research priorities in strict consultation with the various socio-economic actors concerned.
 2. Reinforce the co-ordination between relevant European, national and private research activities.
 3. Stimulate an environment favorable to innovation in this sector.
- The Key Action on “Sustainable Management and Quality of Water” is the main instrument available to the EC for implementing the actions proposed by the Task Force.
- Water availability, groundwater overexploitation and regulation through reservoirs.
- Water quality, most notably in relation to pollution by hazardous pollutants, organic pollutants and nutrients.
- Lack of understanding of the current status and possible evolution of freshwater resources.
- Lack of an integrated approach to the solution of potential water problems and the need to combat major flooding events.
- Lack of understanding of sources, pathways and impacts of hazardous pollutants.
- Need to combat the continuing and increasingly important threat from diffuse pollution sources to groundwater reserves.
- Need to combat regional water stress and droughts, the related possible deterioration of the resource and the threats associated with climate and land use change.
- Need to restore and rehabilitate damaged freshwater ecosystems and to minimize future environmental impacts of some water supply options.
- Lack of efficient and cost effective water treatment and network maintenance technologies.
- Policy responses:
 1. New environmental policies and initiatives (Fifth Environmental Action Programme, Groundwater Action Plan, Framework Directive on Water).
 2. Support of new institutional mechanisms (Task Force Environment-Water, European Topic Centre on Inland Waters).
 3. Increased funding of water research and demonstration (Fourth and Fifth Framework Programme).
 4. Greening of existing EU economic policies.
 5. Financing of projects (LIFE, THERME, PHARE, TACIS – acronyms not defined).

6. Sponsorship of increased international cooperation (UN programmes, Middle East Desalination Research Centre, and prioritisation of freshwater in UN General Assembly).
 - Priority actions:
 1. Water resources assessment and surveillance:
 - Develop indicators of the “overall status” of freshwater resources, quantitatively and qualitatively for both surface and ground waters.
 - Develop advanced monitoring frameworks geared to meet a variety of needs.
 - Understanding status and evolution of aquatic ecosystems.
 - Integration of hydrological models into global change models.
 2. Water resource management at the local/regional level:
 - Developing adequate decision support tools for water managers at local/regional level.
 - Rehabilitating polluted aquifers and damaged ecosystems.
 - Improving the scientific knowledge and technologies for the restoration of contaminated groundwaters, soils, sediments, and of disturbed freshwater ecosystems.
 - Assessing potential of artificial groundwater recharge to optimize water management.
 3. Pollution sources, pathways, impacts:
 - Concentrating collaborative research on key hazardous pollutants.
 - Developing a predictive approach.
 - Testing the relevance of EU wide epidemiological studies.
 - Better exploitation of knowledge and information. This may involve the setting-up of a concerted European initiative on (eco-) toxicological and epidemiological data.
 4. Water and waste water treatment:
 - Improving and extending biological treatment.
 - Safe re-use/disposal of treatment sludges.
 - Research on advanced water treatment technologies.
 - Application of desalination technologies.
 5. Urban water systems:
 - Exchanging and extending best management practices.
 - Improving network management and technologies.
 6. Water in agriculture:
 - Promoting water-efficient irrigation practices.
 - Promoting water-efficient agricultural practices.
 - Promoting water re-use in agriculture.
 7. Water conservation in industry:
 - Promoting water conservation in key industries.
 - Promoting water conservation in most common operations.
 8. Socio-economic framework:
 - Ensuring effective implementation of policies and facilitating adoption of alternative strategies.
 - Addressing socio-economic bottlenecks.
 - Contributing to development of alternative policies and strategies.
 9. International cooperation:
 - Clearing house to identify most appropriate European expertise.
 - Down-sizing and reducing the cost of technologies.
 - Demonstrating European technological and managerial know-how.
 10. Promotion of water research:
 - The networked European Water Research Observatory.

7. *GTOS (Global Terrestrial Observing System) Implementation Plan*

Date: December 1998

Author: FAO, ICSU, UNEP, UNESCO, and WMO

Scope: Discusses the origin and aims of GTOS program.

Issues discussed:

- Recognition of the need for good data of the right types by both national planners and scientists have brought these two user groups closer together resulting in the evolution of a new world-wide system for studying global change, i.e., the Global Observing System (GOS).
- GOS operates as three separate systems:
 1. The Global Climate Observing System (GCOS)
 2. The Global Ocean Observing System (GOOS)
 3. The Global Terrestrial Observing System (GTOS)
- GTOS is a long-term, integrated, user-driven observing system for monitoring the extent, form and function of terrestrial ecosystems. GTOS focuses on five issues of global concern: changes in land quality, availability of freshwater resources, loss of biodiversity, climate change, and impacts of pollution and toxicity.
- The central mission of GTOS is to provide policy makers, resource managers and researchers with access to the data needed to detect, quantify, locate, understand and warn of changes in the capacity of terrestrial ecosystems to support sustainable development and improvements in human welfare and to help advance scientific understanding of such changes.
- The philosophy underlying GTOS is that the land surfaces of the world are of fundamental importance. A proper understanding of the natural resources base is needed but there is no coordinated system for getting the necessary information.
- GTOS must focus on what users need in the way of terrestrial information and thus, end products must always be in forms relevant to the intended users.
- Data obtained through the GTOS networks will play a major role in helping countries move toward sustainable development for the following three reasons:
 1. Direct supply of data and information.
 2. Advice on national observing systems.
 3. Better scientific understanding.

8. Long Term Vision for Water, Life and the Environment

Date: June 1998

Author: World Water Council

Scope: Project proposal for preparation of a policy document *World Water Vision*.

Issues discussed:

- The essence of the Vision exercise (the process of development of the Vision) is to assure that the end-product reflects the views of participants around the world and thus is widely supported.

- While the future is open and cannot be predicted, it is proposed to develop scenarios that would examine the forces shaping our world, the uncertainties that lie before us, and the implications for tomorrow of our actions today. To begin with this concerns one or more Business-As-Usual (BAU) scenarios that describe the result in the period 2010-2050 of not taking any further action. The differences between the BAU scenario(s) and the goals and values for the Vision determine the need for action.

- The goals set out by the Vision:
 1. Ensuring food security through aquaculture, rainfed and irrigated agriculture.
 2. Providing adequate water supply and sanitation services.
 3. Developing water resources for economic uses, including industrial water uses, energy production, navigation, tourism and recreation.
 4. Preserving essential environmental functions with increased emphasis on sustaining our ecosystems.

- The exchanges and interactions between water sector development and socio-economic development need to be better understood.

- Objectives:
 1. Develop a widely shared vision on the actions required to achieve a common set of water-related goals and commitment to carry out these actions.
 2. Raise awareness among the population and decision-makers to foster political will and leadership.
 3. Develop a vision of water management in the year 2025.
 4. Provide input to GWP investment strategy.

- The approach adopted by the Council is characterised as follows:
 1. A participatory approach with extensive consultation.
 2. Innovative thinking and emphasis on bringing together the best available data information and experience to develop a widely shared Vision.
 3. Emphasis on communication to reach a much wider audience than the water sector professionals.

- Expected output, between others, a range of possible scenarios for 2025, based on:
 1. Continuation of present attitudes (not satisfying economic need but destroying the environment).
 2. Fulfilment of economic needs while ignoring the environment.
 3. Fulfilment of economic needs while preventing further deterioration of the environment.
 4. Fulfilment of human and environmental needs.

9. *Preliminary Draft of a European Protocol on Water and Health*

Date: 1998

Author: Drafting group for the Preparation of the Draft Protocol on the Prevention, Control and Reduction of Water-Related Disease

Scope: Proposes a protocol to be signed by states and regional economic integration bodies in Europe.

Issues discussed:

- Water resources have limited recovery capacity from adverse human impacts.
- Water shortage (quantity and quality) results in public health consequences, affecting mostly the poor.
- Reduction of water related diseases can only be achieved through cooperation at all levels and between all sectors, both within countries and between states.
- The objective of the Protocol is to contribute to the protection of human health and well being and to promote sustainable development through improving water management and prevention, control and reduction of water-related diseases.
- The Protocol parties shall take all appropriate measures to prevent, control, and reduce water-related disease and to establish water-management systems to ensure sustainable use of water resources, ambient water quality which does not endanger human health and protection of the water environment.
- Protocol parties commit themselves to:
 1. Establishing national or local targets and target dates and reporting on progress.
 2. Setting up monitoring systems for achieving these targets.
 3. Setting up surveillance and early warning systems.
 4. Increasing public awareness, professional skills, research, development and information.
 5. Transboundary cooperation in shared water bodies.
 6. International cooperation and assistance.
 7. Meetings of the Protocol parties to keep continuous review of the implementation of the Protocol.

10. *Proposals for Council Decisions Concerning the Specific Programmes Implementing the Fifth Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (1998 to 2002)* (Only relevant parts available)

Date: 1998

Author: The CEC (for approval by the Council)

Scope: Sets a framework for EU subventions to research and development.

Issues discussed:

- There are four underlying key themes as described below.

Theme I Quality of life and management of living resources

- Key actions include:
 1. Health, food and environmental factors
 2. Control of infectious diseases
 3. Sustainable agriculture, fisheries and forestry

Theme II User-friendly information society

- Regarding the environment, focus on new monitoring, forecasting and decision support systems and services.
- The research, technological development, and demonstration will concentrate on areas including:
 1. Intelligent information systems on air/water/soil quality and for monitoring and management of natural resources.
 2. Advanced systems for water/air/sea/soil/waste pollution monitoring, prevention, and warning.
 3. Advanced management systems exploiting satellite imagery, remote sensing, sensor systems, real-time systems, and communication networks.

Theme III Competitive and sustainable growth

- The research, technological development, and demonstration will concentrate on areas including:
 1. Relationship between transport, land use, regional planning, environment, and health.
 2. Reduced congestion, energy consumption, pollution, and infrastructure degradation.

Theme IV Preserving the ecosystem

- The strategic objective of the programme is to contribute to sustainable development by focusing on key activities crucial for social well-being and economic competitiveness in Europe. The programme will encourage integrated multidisciplinary approaches seeking to solve problems with a European dimension for which scientific and technological developments are needed.

- The research, technological development, and demonstration will concentrate on tackling the following issues: 1) water scarcity and water quality, 2) global change, climate and biodiversity, 3) sustainable integrated management of marine resources, 4) city of tomorrow and cultural heritage, 5) cleaner energy systems including renewable energies, and 6) economical and efficient energy for a competitive Europe.

- Training will be of importance to ensure an appropriately qualified scientific community in the fields of this programme. This will be assured through the Marie Curie and complementary fellowship training schemes and advanced study and special courses.

- Key actions:

1. Sustainable management and quality of water

The research will focus on the following:

- 1) Development of integrated approaches for the management of water resources and wetlands as well as the development of treatment and purification technologies.
- 2) Technologies for monitoring and prevention of pollution, protection and management of groundwater and surface water resources.
- 3) Surveillance, early warning and communication systems.
- 4) Technologies for the regulation of stocks and technologies for arid and semi-arid regions and generally water-deficient regions.

2. Global change, climate and biodiversity

The priorities are:

- 1) To understand, detect, assess and predict global change processes.
- 2) To foster better understanding of ecosystems.
- 3) To develop scenarios and strategies for the prevention and mitigation of, and for possible adaptation to, the effects of global change, climate change and loss of biodiversity.
- 4) To support the development of the European component of the global observation systems for climate, terrestrial systems and oceans.

3. Sustainable marine ecosystems

The research objectives are:

- 1) To develop the scientific knowledge on marine processes, ecosystems and interactions.
- 2) To analyse causes, consequences, and possible solutions of the present anthropogenic impact on marine ecosystems.
- 3) To develop the capacity for monitoring and managing coastal phenomena.
- 4) To enable operational forecasting for offshore activities.

4. The city of tomorrow and cultural heritage

The priorities are:

- 1) Integrated approaches aiming at sustainable development of cities and rational management of resources.
- 2) Protection, conservation, and enhancement of European cultural heritage.
- 3) Development and demonstration of technologies for safe, economic, clean, effective and sustainable preservation, renovation, construction, dismantling and demolition of the built environment.
- 4) Comparative assessment and cost-effective implementation of strategies for sustainable transport systems in an urban environment.

5. Cleaner energy systems, including renewables

The priorities are:

- 1) Large-scale generation of electricity and /or heat with reduced CO₂ emissions from coal, biomass, or other fuels, including combined heat and power.
- 2) Development and demonstration of conversion technologies for the main new and renewable energy sources (e.g., biomass, fuel cells, wind, and solar technologies).
- 3) Integration of new and renewable energy sources into energy systems.
- 4) Cost-effective environmental abatement technologies for power production.

6. Economic and efficient energy for a competitive Europe.

The priorities are:

- 1) Technologies for the rational and efficient end use of energy.
- 2) Technologies for the storage of energy on both macro and micro scale.
- 3) More efficient exploration, extraction and production technologies for fossil fuels.
- 4) Improving the efficiency of new and renewable energy sources.
- 5) The elaboration of scenarios on supply and demand technologies in economy/environment/energy systems and their interactions and the analysis of the cost effectiveness and efficiency of all energy sources.

11. *Summary and Recommendations of the International Conference on World Water Resources at the Beginning of the 21st Century: Water: A Looming Crisis?*

Date: June 1998

Author: UNESCO

Scope: Conference proceedings and recommendations.

The conference's objectives were:

- To take stock of the present knowledge of the world's water resources, taking into account both quantitative and qualitative aspects;
- To identify water problems to be faced in the next century due to the increased demand for water for human consumption and use, irrigation and industry;
- To recommend strategies to the international scientific community and the world's water resources managers and policy makers.

Issues discussed:

- Lack of adequate water services for a large part of the world population leads to water related diseases.
- Declining water quality and increasing contamination by organic micro-pollutants.
- Water quality data are often unavailable or inadequate and observation networks are declining.
- Water demand exceeds availability in some regions and prospects are worsening because of population growth, climate change, and catchment degradation.
- Integrated approaches to database and information management should be adopted. The variability of water resources in space and time, and not simply average conditions, should be available.
- The effects of human activities on water resources and the environment have to be separated from those resulting from the natural variability of climate.
- Stakeholder participation is vital to sustainable water resources management.
- Improved and integrated water management requires greater appreciation of the costs and value of water.
- Much remains to be done in raising the salience of water issues to policy makers.
- Conclusions and recommendations of workshops are summarised below:

Working Group 1 “Data and improvement of water resources assessment”

1. Water specialists should educate themselves about the needs of the people who use their products, so that they can better meet those needs and educate those users.
2. All relevant components of the hydrological system should be considered, and interdependencies among those components should be taken into account.
3. The scales, in time and space, at which water-related measurements are made, should be appropriate to the characteristic scales of the phenomena under consideration and the expected use of the information.
4. Indicators of the status and trend of water resources should be developed which can provide information that is user-friendly and comprehensible to non-specialists. Opportunities should continually be explored to ensure that data obtained for one purpose are made available for other purposes.
5. Information on the patterns of water demand and use should receive particular attention. Water-related information should be managed within the framework of the system under consideration (normally the river basin/aquifer system).
6. The management of water-related information should be integrated with that of information about related aspects of the biophysical environment (e.g. the requirements of migratory birds), human society (e.g. the recreational and amenity values of watercourses) and the economy (e.g. food production, and industrial use of process water).
7. Efforts should continue to be directed to understanding the physical and biological processes that control how hydrological systems function. A commensurate increase in data collection will be required, in terms of both the length of record and the range of variables.
8. Maintenance of basic monitoring programmes in representative or strategic locations is essential in order to enable “early warning” identification of long-term trends and to support the development and testing of hydrological models.
9. Formal quality assurance procedures for observational data and model implementation should be established, including adoption of appropriate common standards and documentation of procedures. Estimates of uncertainty should as a rule be made for observational data, water balances and model outputs.
10. Information should be available not simply on average conditions, but on the variability of water resources in time and space. There should be a particular focus on actual or potential stresses or “crises”.
11. The potential of modern computing, remote sensing and information management technologies should be fully utilized in order to:
 - Make inexpensive, routine observations and measurements that were hitherto not feasible using satellite imagery;
 - Develop computer-based methods (models, GIS) which can describe, explain and predict the behaviour of hydrological systems to the levels of accuracy and confidence required by decision makers;

- Develop economical procedures for combining “real world” observations with the outputs of computer models;
 - Provide up-to-date directories of water data and information, and how to access them;
 - Display water-related information in a way that is readily understood by non-specialists.
12. International efforts should be encouraged to establish regional and global monitoring and data management systems such as WHYCOS, the GRDC and GEMS/Water.
 13. Objective assessments of the capabilities of agencies, policies, laws and other aspects of the water management system - as well as of the water resource itself - should be available.
 14. New ways should be sought to finance the provision of water-related data and information.

Working Group 2 “Water quality and environmental impact”

1. Water quality and quantity are two aspects of water, interdependent and inseparable in all matters of monitoring and management. Therefore, global water assessment should be expanded to cover water quality, including the effects of climate change.
2. Surface and ground waters are interconnected parts of the water cycle, and should be studied and managed jointly in a holistic approach.
3. Some quality issues are affected by global processes and long-range transport, and should be addressed by global actions (e.g. acidification).
4. Monitoring programmes should take into account bio-magnification processes in food chains when used to determine the fate and effects of contaminants.
5. Wetlands are important elements of the environment and can be effective means for water quality treatment.
6. Water quality should not be neglected, even in the face of adverse economic conditions, with proper consideration to priorities of human needs.
7. There is a need for simple protocols for baseline ecological and chemical data gathering and analysis, which are adjusted regionally.
8. Systems for measuring, monitoring, analyzing, summarizing and disseminating water quality information should be strengthened and supported. The international community is called upon to provide help. The recommended density is at least 1 station per 100,000 people, the desirable level is 1 station per 10,000.
9. Hydrological and quality monitoring in large-scale socio-economic development plans should be emphasized.
10. Water quality studies should be global and process oriented. They should consider land use and combine site-specific studies in an integrated watershed management framework which considers local socio-economic and cultural conditions.
11. Different regions of the world face different hydrological and hydro-chemical conditions, e.g. humid versus arid and semi-arid zones. These should be recognized in studies, land and water management and policies.

12. Many water quality issues are local. They require local study, monitoring, policies and management.
13. There are still knowledge gaps in understanding the links between freshwater microbiology and hydrological processes and water quality.
14. Important emerging issues include micro-organic pollutants and micro-organisms.
15. Potable water quality and sanitation are high priorities for developing countries and dealing with them requires inter-agency collaboration.
16. It is wise to learn from your own and others' past successes and failures and adjust policies to local conditions for monitoring, water quality criteria, land use, pollution reduction. Take action on the basis of already available knowledge.
17. It is necessary to build capacity at the public, professional and institutional levels.
18. Water quality and human health should be dealt with in an interdisciplinary and inter-institutional manner.
19. Water quality laws, wherever they exist, should be enforced.
20. Public awareness and public participation are important elements of policies and actions for water quality management and environmental protection.
21. The agricultural community should be encouraged to support the reduction of non-point pollution.
22. Aggressive positive timely action can have a significant effect on reducing the concentration of pollutants in the aquatic environment and improving water quality.

Working Group 3 “Impact of human activity on water resources”

1. In defining water uses and water needs, computing methods need to be harmonized.
2. Time and spatial scales need to be evaluated, especially in terms of groundwater related issues.
3. Institutional reforms are necessary to address the increasing stress on water resources.
4. Sustainable water resources development requires an increase in stakeholder participation.
5. Public awareness needs to be strengthened at all levels.
6. Regulations and implementation of water laws need to be strengthened through institutional reform and capacity building.
7. Effective policies for water resources protection are required, especially in the case of groundwater.
8. There is a need for capacity building at all levels, which means the introduction of new multidisciplinary approaches in all the sciences, including natural and social sciences.

Working Group 4 “Extremes of water resources and their management”

1. Policy analysis should be conducted using computer-based reasoning supported by models and methods with scientific integrity, transparent enough to be easily understood, with participation of stakeholders and experts, proper consideration of the social dimension, and with focus on an integrated approach.
2. Measures to avert water conflicts should be promoted, including co-operation and exchange of information.
3. The water community should be on continued alert to collect scientific and socio-economic data.
4. Many types of expertise, both in the social and scientific domain, should be mobilized to address water scarcity issues.
5. Water should be recognized as an economic, environmental and social good. Beyond the basic necessity, water should be paid for, taking account the social and environmental impacts.

Working Group 5 “Economic and social aspects of water resources”

1. The working group recommends further studies to gain a better understanding of the value of water in its different uses and the scale of water infrastructure.
2. It is essential to ensure efficiency, transparency and accountability in water resources management as a prerequisite for sound financial management.
3. A price for water and water services is necessary, not only for economic reasons, but also because it will improve allocation of limited water resources between competing users. However, the basic minimum water needs must first be met in all countries.
4. Impact assessment of land use and climate change on water resources should be improved by a multidisciplinary approach.
5. In order to involve all stakeholders in the planning, design and funding of water projects, we need programmes which enhance public awareness of the issues, particularly among women and young people.
6. There is a need for studies on the cultural aspects of water, consumer behavior, and the willingness to pay for water and water services.
7. This new multidisciplinary approach requires collaboration and communication between water specialists and sociologists, for instance through special symposia.

12. *The Bank's Policy on Water: Working Paper*

Date: August 1998

Author: Asian Development Bank

Scope: The ADB's recommendations on water policy developed through a process of in-house analysis and dialogue among staff, followed by consultations with other policy stakeholders.

Issues discussed:

- Water is a critical resource for sustainable economic development in the coming decades with population growth, rapid urbanization, and industrialization. More holistic approach to water policies, strategies, and projects is necessary in order to effectively address issues in water resource management.
- Asia has the lowest per capita availability of freshwater resources among the world's continents and some of the Bank's developing member countries are already facing severe water shortages, especially during the dry season.
- Most of the Bank's developing member countries have yet to adopt a policy to regulate water allocation and conservation. Problems that the member countries face include: a common lack of adequate legislation including water rights or entitlements, fragmented and overlapping responsibilities among a host of agencies involved in water projects, a lack of coordination and leadership, ineffective water resource planning and management, insufficient political and public awareness, a lack of community participation in resource planning and management, and a general shortage of institutional capacity to meet the increasing needs in service delivery and resource management.
- In addressing the water problems in the region, an understanding of the variability of conditions (e.g. water and land endowments, political and institutional histories, and socio-cultural contexts) in the Bank's developing member countries is required. A Bank policy on water should therefore be general enough to be applicable in the Bank's developing member countries across the region.
- Water has not been a targeted sector of special interest in the Bank's operations. Water projects have typically been identified, processed, administered, and evaluated within their subsector context, by the responsible divisions. However, the need for a more comprehensive and collaborative approach to water operations has become apparent.
- The water sector typically lacks a collective voice to decide on the necessary reforms and to negotiate the required resources. In this regard, the consultations have emphasized the need for the Bank's developing member countries to establish a water sector apex body in each country to oversee the reform process.
- The essence of the Bank's policy on water:
 1. Promote effective national water policies and action programs.
 2. Invest in water resource management in priority river basins.
 3. Improve water services through autonomous and accountable providers.
 4. Foster the efficient and sustainable use and conservation of water in society.
 5. Increase the mutually beneficial use of shared water resources.
 6. Facilitate stakeholder consultation, participation, and partnerships.
 7. Improve governance through capacity building, monitoring, and evaluation.

- The Bank's strategy to implement its policy on water:
 1. Providing integrated investment packages.
 2. Catalyzing investment in the region.
 3. Developing regional cooperation.
 4. Strengthening the Bank's capacity to deliver quality products and services.

13. *Water Quality Management: Proposal*

Date: August 1998

Author: J. Kindler and R. Helmer (at the Global Water Partnership 3rd Annual Consultative Group Meeting, Stockholm)

Scope: A proposal for a worldwide water quality improvement programme.

Issues discussed:

- Safeguarding drinking water supplies and devising effective water resources management approaches are important in order to alleviate poverty and ensure that the poor are the beneficiaries rather than the victims of bad water management decisions and policies.
- The science behind ecosystem health is not fully developed, and the general acceptance of a meaningful implementation of the concept is difficult. Nevertheless, it is recognized more and more often by developing countries that degraded (aquatic) ecosystem health is causing systemic failure in economic planning and development.
- Integrated water quality/quantity management needs to be developed. It is also important to consider wastewater as a resource and to consider actions for increased understanding of wastewater minimisation, re-use and recovery. Health, legal, and regulatory issues should be properly addressed and socio-cultural as well as religious aspects should be fully considered during the planning, implementation and operational phases of reuse systems in order for the practice to be accepted.
- Water quality and quantity data systems are failing to provide the kinds of information governments need to develop, implement, and monitor water quality policies and programmes.
- Most countries need upgrading of personnel and institutional capacity building for developing and applying existing water quality management knowledge to real-world water management issues. Transfer of existing knowledge and methodologies and training programmes are needed.
- Priority issues to be addressed:
 1. Lack of understanding of land-water-ecosystems processes, hence no guidelines for management.
 2. Lack of recognition of the value of wetlands (intrinsic as well as for buffering).
 3. Poor management of pollution from agriculture. The Water Quality programme must support approaches to these problems based on developing minimum input techniques and the use of integrated pest management supported by promotion of better policies and economic incentives.
 4. Poor general pollution control strategies despite available technologies. It is necessary to apply integrated management to the problem of allocating water of different quality to different users, to promote re-use mechanisms and increase water use efficiency to reduce unnecessary conflicts between water user groups.
 5. Poor institutional frameworks need to be improved so that there will be horizontal and vertical coordination across water quality issues at local, national, and regional levels.
 6. Lack of appropriate regulatory, legislative, planning and economic tools.
 7. Lack of monitoring and evaluation infrastructure has resulted in water quality management policies that are inappropriate and based on inadequate data.

- Activities: providing strategic assistance in the fields of:
 1. Approaches to water quality management.
 2. Awareness and policy dialogue.
 3. Synthesized existing knowledge.
 4. Research and development.
 5. Capacity building and training. The assistance will be delivered through a network of collaborating partners, initially mainly the GEMS/Water centers.

- The objective of the inception phase is to establish the programme that is comprized of an appropriate number of cooperating network partners with a geographical coverage corresponding to areas, where priority gaps have been identified and where there is a locally expressed urgent need for these gaps to be filled. The inception phase is estimated to last one year and to cost US\$ 150,000 - 200,000 covering mainly the organization of meetings at the regional level though the regional TACs (Technical Advisory Committees).

14. *World Water Resources: A New Appraisal and Assessment for the 21st Century*

Date: 1998

Author: Igor A. Shiklomanov of the State Hydrological Institute, St Petersburg

Scope: Monograph on world water resources.

Issues discussed:

- Drastic increase in global water withdrawal since the 1950's, affecting water quality, water resources potential and global water budget.
- Result is failure to meet demands in many regions, impeding economic development.
- Lack of data (e.g. groundwater data) in many regions of the world as well as lack of exchange of data.
- In order to assess future water resources in detail, it is insufficient to rely simply on volume data and natural variations in river runoff. It is also necessary to take into account changes due to human activities (anthropogenic factors).
- Agriculture is the largest consumer of water, accounting for some 80% of total water use. In the 1980s, the rate of global increase in irrigated areas dropped considerably in both developed and developing countries. That is primarily because of the high cost of irrigation networks, soil salinization due to the lack of proper drainage, the depletion of irrigation water-supplying sources, and the problems of environmental protection.
- The distribution of water resources over the complete land mass of Earth is uneven and quite unrelated to population spread or economic development. It is important to analyze the trends and rates of change in specific water availability in relation to socio-economic and physiographic conditions.
- Water bodies and water management systems are very sensitive to changes in climatic characteristics. The currently available scenarios of potential anthropogenic changes in regional climate are extremely uncertain.
- In the first half of the 21st century, water issues will be the most important global problem facing humankind.
- Priority measures:
 1. Economy in use and protection of water resources by a drastic decrease in specific water consumption, especially in irrigated land use and industry.
 2. Reduction or complete cessation of waste water discharge into hydrological systems.
 3. More use made of local water through seasonal and long-term river runoff regulation.
 4. Use of salt and brackish waters.
 5. Active influence on precipitation-forming processes.
 6. Use of storage in lakes, aquifers and glaciers.
 7. Spatial and temporal redistribution of water resources.
- Estimates for renewable water resources are based on observational data from hydrological networks. Therefore, their reliability is primarily determined by the conditions of these

networks: the number of hydrological sites, the character of their spatial distribution, the duration and continuity of observations, measurement quality and processing.

- In many developing countries, the hydrological network is weakly developed and the number of observation stations is being reduced. Urgent measures are to be undertaken by authoritative international organisation to improve the state of global hydrological networks and the collection, processing and exchange of hydrological information.
- It is vital to achieve close cooperation between scientists from different countries and international organizations dealing with the problems of hydrology, climatology, and the complex use and protection of water resources.

15. *Intergovernmental Council of the Management of Social Transformations Programme (MOST): Final Report*

Date: February 1999

Author: UNESCO

Scope: Final report and recommendations of the fourth session of the Intergovernmental Council of the MOST.

Issues discussed:

- Over the last four years, MOST has undertaken activities under three main headings: 1) multiculturalism, 2) cities, and 3) the interaction between local and global processes. Additional issues of poverty, social exclusion, governance, migration, and sustainability have been added to the above three themes.
- MOST has also concentrated on building interdisciplinary comparative research networks around its thematic research areas. MOST provides the social science dimension in several joint activities with the natural science activities such as the MAB and the IHP.
- Several member states stressed that the link between social sciences and policy-making, as the cornerstone of MOST, should be further developed in the next phase of the program. Also, the need to create new networks of researchers was emphasized.
- Research has to be made more practical and easily applied and strong efforts are needed to examine how to transfer research results to the policy-makers.
- Social scientists have an important role in trying to convince policymakers that a long-term perspective is important in combating social problems.
- Instead of seeking to have an impact on policy making, the social sciences should attempt to become more involved in ongoing public discussions and debates and in the decision-making process itself. Social sciences should optimize the use of new information and communication technologies, such as television and the Internet, to bridge the gap between social sciences and policy-making. Social science results must reach a wider public (a question of communication).

16. *Status and Proposed Actions to Continue the Implementation of the Initiatives on Water Resources and Coastal Areas of the Plan of Action for the Sustainable Development of the Americas*

Date: 1999

Author: The Organization of American States

Scope: Discusses the development of and issues raised in an Inter-American Plan of Action on Water Resources Management (1992-1999).

Issues discussed:

- The Caribbean faces many challenges in managing its water resources in a socially acceptable, environmentally sustainable, and economically efficient manner. Problems include its vulnerability to global climate change factors, scarcity of freshwater on many islands, saltwater intrusion, inadequate pricing, poor operations and maintenance, institutional fragmentation, poor hydrological data collection and analysis, inappropriate land-use practices, and pollution.

- There is a regional consensus on the need for greater compliance with environmental and water laws and regulations in Mesoamerica but most of the countries in the region lack the institutional capacity for management.

- There is a need to increase and facilitate the exchange of information, not only to transfer knowledge among scientists and policy and decision-makers, but also to increase the involvement and awareness of the general public and private sector to this issue.

- South America, as a continent with abundant water resources, should give priority consideration to transboundary watershed management. Water supply and sanitation are fundamental and must be given high priority by the governments of the region if sustainable development is to be achieved.

- The Inter-American Technical Meeting on Water (December 1998) proposed the following actions:
 1. Encourage initiatives fostering the integrated management of water resources at the river basin level since the environmental problems involved can only be solved by proper management at this level.
 2. Include the subject of environmental disaster mitigation in all transboundary watershed agreements and projects.
 3. Develop pilot projects in river basin which demonstrate the benefits and comparative advantages obtained by adopting the river basin as the planning unit and encouraging the participation of local communities.
 4. Promote and strengthen partnership between the public sector, the private sector, and civil society, through a transparent, consultative and participatory process of policy development and implementation.
 5. Promote closer collaboration between water-resources specialists, legislators, and community leaders, in view of the technical flaws detected in the formulation of the legal and regulatory frameworks.
 6. Create mechanisms, as river basin management units, to solve conflicts that could arise in river basins shared by neighboring provinces or countries.
 7. Generate opportunities and mechanisms for cooperation between the public and private sectors to facilitate dissemination of efficient technologies.

17. *Sustainable Development: Concepts, Goals and Relevance to the Civil Works Program*

Date: May 1999

Author: Lynn R. Martin and Eugene Z. Stakhiv of the Institute for Water Resources

Scope: Examines the goals and recommendations identified in the President's Council on Sustainable Development (PCSD) report and discusses ways in which the U.S. Army Corps of Engineers could treat the concepts of sustainable development within the Civil Works program.

Issues discussed:

- The PCSD report, *Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future* (February 1996), addresses the challenges of creating sustainable development in the United States and the global community and highlights three primary goals: 1) economic prosperity, 2) environmental health, and 3) social well-being and equity.
- The PCSD report argues that social, economic, and environmental problems are intertwined and must be considered together. The report also emphasizes that there is a need to shift from single-minded advocacy to action that ensures progress in all three areas.
- The PCSD report emphasizes the concept of *stewardship*, which is defined as corporations and individuals embracing responsibility for actions that affect the environment and the overall quality of life.
- The PCSD report does not develop quantitative targets and views progress toward the above goals as "movement in the proper direction" of the indicators. These indicators are directional and conceptual and need to be improved so that the U.S.'s prosperity can be measured more accurately.
- The Council suggests that well-developed market incentives, used in conjunction with an appropriate regulatory framework, can provide the most efficient approach to natural resource management.
- Until recently, the Corps of Engineer has focused primarily on the economic objective. However, environmental and social concerns have not been ignored in Civil Works project development.
- While most of the principles presented by the PCSD report are applicable to individuals as well as governments, many of the proposed actions are best suited for local governments. Nevertheless, there is a role for federal agencies to provide an integrated and consistent framework within which related resource management problems can be addressed in a uniform manner.
- Within the Civil Works program, the application of the watershed perspective, multi-objective planning, and the integration of natural resources management into the management of operating projects provide opportunities to support the PCSD recommendations.
- Contemporary water resources management principles are compatible with sustainable development. Watersheds and river basins provide a hierarchical hydrologic/geographic system.

- There is no implementation guidance on how to achieve sustainable development and this concept may be most useful as a reminder to people of the complexity which exists in decisions about resource use.
- Sustainable development cannot be reached directly, but only approximately and indirectly, through a sustained period of confronting and resolving the conflicts between various objectives.

18. *Strategies for Achieving the International Development Targets: Addressing the Water Crisis – Healthier and More Productive Lives for Poor People*

Date: March 2000

Author: Department for International Development (DFID), UK

Scope: Discusses DFID's approach and strategy for water resources management.

Issues discussed:

- DFID's goal in water resources and environmental sanitation is to improve the lives of the poor by helping to increase and sustain their access to water resources and their use of environmental sanitation.
- Priority areas for DFID are: 1) to transform the policy and institutional environment within which decisions are taken to serve poor people, 2) to promote current models of best practice in water resources and environmental sanitation, and 3) to generate and share the creative research and knowledge essential in addressing future issues. The second point above includes issues such as integrated water resource management, sanitation and environmental health, disaster and conflict prevention, gender, improved and expanded services for the poor, and sustainability.
- The challenge for the international community is to manage water resources to ensure that the goal of poverty alleviation can be achieved within a safe and secure human environment.
- The absence of effective planning and management of scarce water resources is a major impediment to the elimination of poverty. Where legislation exists, it is not always aligned with water policy. Moreover, the institutions required for its implementation are frequently ineffective. On the other hand, where customary institutions and traditional water laws do exist, they are frequently overlooked or ignored.
- The international community urgently needs to develop coherent international frameworks to help resolve conflicts over shared water resources. That resolution should be based on integrated water resources management that uses good information and considers the needs of all competing groups of users.
- In many areas, water rather than land availability is likely to be the main constraint to agricultural production in the 21st century.
- Water supply and sanitation services have generally been managed by engineers who concentrate on the hardware, neglecting the political processes through which their advancements can be made sustainable.
- DFID will help poor people gain sustained access to improved and affordable water supplies and basic sanitation in the context of attention to broader environmental concerns.
- Consumption of at least a minimum quantity of safe water by everyone is economically efficient because of the health and other benefits that accrue.
- How can the international community address the global water resource and environmental sanitation crisis and meet the needs of both poor rural and urban communities?
- Water allocation among different users requires sound information on climate change,

population growth, international trade in food staples and other crops, and the advantages and economic returns of alternative uses of water. Decision-makers also need information on river and aquifer yields and on the quality of available water. In essence, the general principle to be followed in policy-making is that water quality should be matched to its intended purposes, and water quantity to its economic returns.

- Addressing the global water resource and environmental sanitation crisis requires effective participation by civil society.
- There is a need for the generation, evaluation, and sharing of new knowledge. There is also a need for a clear international research agenda concentrating on particular subjects. Such research and technological development should be demand-responsive and be directed to address the problems and issues of the world's poor.
- The results of research and technology should be made available to all those who could benefit from them. Dissemination of knowledge should be embedded in an interactive dialogue that helps all involved to produce and implement better solutions.
- Forming groups of poor people and allowing them to take their own initiatives can help build self esteem and social cohesion.
- Effective water governance requires thorough, scientifically accurate information about the water domain to be compiled and made widely available.
- Informed decision-making should be based on reliable information and a better understanding of the issues confronting international organizations, governments, and communities.
- DFID will support processes that can help to resolve conflicts over shared resources affecting national security or regional economic development.
- DFID will support initiatives in world trade that help water-scarce countries to feel more comfortable about being dependent on imported food.

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Acronyms and Abbreviations

ADB	Asian Development Bank
BAU	Business-As-Usual
CEC	Commission of the European Communities
CSD	Commission on Sustainable Development
DFID	Department for International Development (UK)
EC	European Commission
EEA	European Environment Agency
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GCOS	Global Climate Observing System
GEMS	Global Environmental Monitoring System
GIS	Geographic Information System
GOOS	Global Ocean Observing System
GOS	Global Observing System
GRDC	Global Runoff Data Centre
GTOS	Global Terrestrial Observing System
GWP	Global Water Partnership
HELP	Hydrology for the Environment, Life and Policy
ICSU	International Council for Science
IHP	International Hydrological Programme
MAB	Man and the Biosphere Programme
MOST	Management of Social Transformations Programme
NGO	Non-Governmental Organization
PCSD	President's Council on Sustainable Development
TACs	Technical Advisory Committees
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization
WHYCOS	World Hydrological Cycle Observing System
WMO	World Meteorological Organization
WWC	World Water Council