

Water Development, Supply and Management, Volume 2

United Nations Water Conference

Summary and Main Documents

Edited by
ASIT K. BISWAS

Pergamon Press

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Volume 2

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This book is dedicated to

YAHIA ABDEL MAGEED

Secretary General, UN Water Conference

A token of esteem for a great statesman and engineer,

and

A mark of true regard for a friend.

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Preface

The beginning of the preparation for a world water conference dates back to June 1972, when the Economic and Social Council of the United Nations, commonly known as ECOSOC, adopted a resolution requesting studies be undertaken on the "desirability of, and possible topics for, an international water conference." In December 1975, the General Assembly of the United Nations adopted a resolution endorsing the recommendation of the ECOSOC that a United Nations Water Conference should be held. This world Conference was held at Mar del Plata, Argentina, during 14th to 25th March, 1977.

The Water Conference is the fifth world conference held under the aegis of the United Nations, where political leaders from member countries assembled to discuss major global problems. The earlier world conferences were on the Human Environment (Stockholm, 1972), Population (Bucharest, 1974), Food (Rome, 1974) and Human Settlements (Vancouver, 1976). It would be followed by conferences on Desertification (Nairobi, 1977) and Science and Technology (venue yet to be decided, 1979).

It would be a serious error if the Water Conference is considered in isolation, without any reference to the world conferences that have been held earlier or will follow later. For example, the Stockholm Conference recommended farsighted actions to ensure preservation of water quality and protection of the environment from large scale water development projects. The World Population Conference discussed the interrelationships between population, resources — including water — and environment. Increase in population and the satisfaction of basic human needs of each individual will need more food, energy and raw materials, and water is a basic requisite for production of all these components. The World Food Conference recognized the importance of water for agricultural development, and the need for further expansion of irrigated agriculture. It specifically recommended a comprehensive action programme by Governments and international organizations to expand irrigation, to promote efficient water conservation and use, and to control more effectively damages caused by floods, droughts, waterlogging and salinity. Similarly, the Vancouver Conference on the Human Settlements discussed the lack of clean water for the vast majority of the rural population of the world, and recommended a target of 1990 to provide clean water to all communities.

Just as the prior UN world conferences had an impact on the Water Conference, so will it on the conferences following. For the Desertification Conference that concluded in Nairobi, in September, 1977, water management in arid lands was an important consideration, and a resolution was passed at Mar del Plata, specifically for this conference.

The Water Conference produced many valuable documentations. Among these were four conference background papers, reports of five regional meetings, consolidated action recommendations, papers from different UN organizations, special papers commissioned by the Secretariat, and some 250 thematic papers prepared by individual countries. I was directly involved with the preparation of one

of the major background papers — analysis of the present and future activities of the UN system in the area of water, and also for the consolidated action recommendations, which eventually became known as the Mar del Plata Action Plan. All these papers are available in the full Conference proceedings, in four volumes, also edited by myself and published by Pergamon Press. The Proceedings would provide authoritative information to the world community, much of which is not easily available. The present summary volume contains selected essential papers prepared for the Conference, which should be of interest to everyone engaged in water resources activities. In other words, the summary volume is an attempt to provide to individuals essential documents of the Conference at a reasonable price.

Finally, no discussion of the Water Conference can be complete without a word about its Secretary General, Yahia Abdel Mageed, currently Minister of Irrigation of Sudan. Appointed less than a year before the Conference, he did the impossible task of holding one of the most successful world gatherings held so far. Compared to other world conferences, there was very little political bickerings at Mar del Plata, which was undoubtedly due to the behind the scene activities of an extremely competent and efficient Secretary General. What is even more remarkable is that Mr. Mageed made it all possible with a very small Secretariat and a shoe-string budget, which was even less than one-third of the total budget for the audio-visual projects alone for the Vancouver Conference on Human Settlements! Everything considered, it was an outstanding achievement.

Asit K. Biswas
Editor

Editor's Introduction

*All the rivers run into the sea,
Yet the sea is not full;
Unto the place from whence the rivers come,
Thither they return again.*

Ecclesiastes 1:7

Water, said the Greek philosopher Pindar, as early as the fifth century B.C., is the best of all things. It may perhaps be an overstatement, but it is certainly not surprising, especially when it is considered that it has been one of the most precious commodities throughout man's recorded history. Water makes life - human, animal or plant - in the biosphere possible, and without it life and civilization can not develop or survive. Wars have been fought in the past over the availability of water, and even now relations between several countries are strained due to disputes over management of shared water resources.

Because of the important role water plays in human survival, it has always been a subject of great interest, and the entire history of mankind can be written in terms of its need for water. From the very beginning, man realized that water is essential for the satisfaction of basic human needs, and hence early civilisations flourished on lands made fertile by major rivers: Tigris and Euphrates in Mesopotamia, Nile in Egypt, Indus in India, and Huang-Ho in China. As early as 3000 B.C., the Egyptians had already developed intricate water resources networks, especially irrigation systems. The historian, Herodotus, provides a vivid description of these early Egyptian water development works, and he was so impressed by the role of the River Nile in the country's survival that he called Egypt "the gift of the Nile".

The importance of water can be further amplified by the fact that the Greek philosopher, Empedocles of Agrigentum (490-430 B.C.), considered water to be one of the four primary elements or roots (*rhizomata*) from which all the materials of the world were constituted. The other three basic elements were air, fire and earth; the last two in the present day can be interpreted as energy and land. One can thus argue that such a concept was the forerunner of the molecular theory of materials, and water was considered to be so important that it was accepted as one of the fundamental building blocks of nature. Even great philosophers like Plato and Aristotle accepted this concept of water as a fundamental element, with only minor modifications.

The magnitude and complexity of water resources development and management problems in the early days were not complex. Population was small, *per capita* demand was low and water was plentiful. When there were water-related problems like droughts or floods, man simply migrated to a better location. Pollution loads were low, mainly of an organic nature, and water courses assimilated whatever load that entered without serious deterioration of water quality. Thus, right from the beginning man tended to treat water as gift from God - a "free" resource - and his birthright to use and squander as he saw fit. This

freewheeling concept, until recent times, did not pose serious management problems. Hence, until the early twentieth century, the demand for water, its efficiency of use and its quality were generally secondary issues.

This scenario started to change in the developed countries with the advent of the Industrial Revolution. Workers from agricultural sectors in rural areas started to migrate to urban centres, attracted by burgeoning industrial employment. One of its undesirable side-effects was the development of centres of dense population. As the industries in the cities developed, more workers migrated from the rural areas, which in turn attracted more industries, and this created a somewhat vicious circle.

Industries were often unfortunately located in close proximity to water bodies because of the ease with which waste products could be discharged to the receiving waters at no direct economic cost. Furthermore, cities discharged their sewage into the water bodies without much treatment, thus compounding the problem. Even today, some major cities like Montreal, Canada, discharges sewage to nearby watercourses without even primary treatment. Such developments contributed to growing water pollution near centres of dense population. In medieval Paris, the streets were often like open sewers, but the River Seine was clean, and one could see fish swimming in the clear water. Times have now changed. Today the streets of Paris are clean, but the Seine is murky and gray, and one would indeed be fortunate to see any fish.

The situation in developing countries was somewhat different. From a global perspective, the water situation can be visualized within two extremes. At one extreme are the highly urbanized cities of advanced industrialized countries, where the vast majority of population have inhouse connections and sewerage services, backed by adequate infrastructure and institutional arrangements, having access to adequate financing, high level technology and necessary service personnel. At the other extreme is the rural sector of developing countries, having no service of any kind for either potable water or excreta disposal. Herein lies a major development dilemma, the rich get richer, the poor, poorer. In many urban centres, if one can afford the capital costs, clean piped water could be cheap enough for the rich to fill their swimming pools, while the poor may have to pay two or three times as much, per unit quantity of water, to buy by the bucket from a tanker. Even then, these urban poors may be luckier than their rural counterparts, who get their water, often contaminated, from whatever sources they can.

There is no doubt that the total amount of water available globally, if used efficiently, can meet vastly higher human needs. Current estimates indicate that the total volume of water on earth is 1.4×10^9 km³, 97.3 per cent of which is ocean water, and, therefore cannot be used by man except for fisheries and navigation. Only 2.7 per cent is fresh water, 77.2 per cent of which is stored in polar ice-caps and glaciers, 22.4 per cent as ground water and soil moisture (about two-third lies deeper than 750 metres below the surface), 0.35 per cent in lakes and swamps, 0.04 per cent in the atmosphere and less than 0.01 per cent is in streams. In other words, nearly 90 per cent of fresh water is stored in ice-caps, glaciers and as deep ground water, and as such is not easily accessible. For all practical purposes, it is surface water in rivers, streams and lakes, amounting to less than half of 1 per cent of available fresh water, that constitutes the basic available supply for man, even though ground water has been heavily developed in certain parts of the world.

While reasonably accurate estimates of the total volume of water in the earth is available, information on its quality leaves much to be desired. Thus, with very few exceptions, even approximate continental or global assessments of the different water quality parameters are not known. Nor is much known about the magnitude and type of organic wastes from municipalities and industry that are entering water courses, and rapidly constituting growing hazard to human health and environment. Even in a major advanced industrialized country, like the United States, according to the 1976 report of its National Commission on Water Quality, 92 per cent of suspended solids, 37 per cent of biochemical oxygen demand and 98 per cent of the coliform bacteria will still remain uncontrolled in natural surface water, *even* when all discharges from point sources have been eliminated. This is largely due to agricultural activities. Currently there are no general measurements of volumes of synthetic organic compounds and heavy metals reaching water courses, and eventually the oceans.

Toxic chemicals and heavy metals are serious hazards to environmental health. They are gradually dispersed to ecosystems, other than the one intended, by evaporation and subsequent precipitation, or by drainage waters. For example, it has been estimated that England receives nearly 36 metric tons of chlorinated hydrocarbon as fallout per year. Such dispersal mechanisms mean that the toxic substances can be detected in areas far away from the points of application. Thus, significant quantities of pesticides, including DDT and its derivatives, have been found in animals in Antarctica, like penguins and their eggs, skua and fish, even though there is no agriculture, no insect life and no use of pesticides.

Water plays an important part as a medium through which toxic chemicals are dispersed to the ecosystems by selective concentration, as they pass relatively unchanged through successive levels of food chains and food webs. For example, in Lake Michigan, the concentration of DDT in lake sediments was 0.0085 ppm. Invertebrate primary consumers concentrated this to 0.41 ppm, their fish predators to 3 to 8 ppm, and the herring gulls predatory on the fish had levels no less than 3.177 ppm. This means the level of concentration increased by nearly 374,000 times between the lake sediments and the gulls.

The effect of such selective concentration means that the toxic effects of chemicals are more readily noticeable in top carnivores. Thus, discharge of mercury in the Minimata Bay, Japan, increased the mercury content of fish to dangerous levels, so much so that the fishermen who depended on fish as a major source of food, suffered heavily from mercury poisoning. Currently, this form of disease is often known as Minimata, and in addition to Japan, severe mercury poisoning, under similar circumstances, have been noted in Canada, especially among Indians having fish as their staple diet.

In addition to above environmental health implications, the quality of water available has direct relations to human health. Use of potable water will undoubtedly reduce health hazards like cholera, typhoid, infectious hepatitis and bacillary dysentery. It would further reduce human contacts with vectors of water-borne diseases like schistosomiasis, trypanosomiasis, and guinea worm. Some have estimated that the Gambian sleeping sickness can be reduced by 80 per cent by good water development schemes. While this figure may be somewhat optimistic, there is no doubt that the provision of potable water will significantly reduce the incidence of the dreaded sleeping sickness disease by reducing the exposure of human beings to Tsetse flies during the water collection journey. Similarly, guinea worm infection, which currently affects some 48 million people, chiefly in the Indian sub-continent and West Africa, can also

be reduced. Currently, water and health situation, on a global basis, has been estimated as follows:

Gastro-enteritis, 400 million cases every year;

Schistosomiasis, 200 million cases every year;

Filariasis, 200 million cases every year;

Malaria, 160 million cases every year;

Onchocerciasis, 20-40 million cases every year.

These statistics clearly indicate that the health and economic costs of water-related diseases are considerable, and much of such costs can be reduced by rational water resources development and management. Availability of potable water in rural communities would eliminate the water collection journey, mainly of women and children of developing countries, who currently spend up to five hours every day collecting the family water requirements. Such chores take up to 12 per cent of daytime calorie needs of most carriers in non-dry areas, and up to 25 per cent or more in mountainous regions. Since women are not traditionally the most well-nourished members of the family, elimination of water collection journey, by the availability of potable water closer to home, has not only implications in terms of reduced disease propagation, but also in terms of nutrition, a fact often overlooked by planners and politicians. Furthermore, the time freed can be used for learning and productive work.

There is no doubt that the total amount of water available globally, if distributed equally, can meet much higher demands. The problem, however, is that water is not equitably distributed either in space or in time. In some parts of the world, there may be too much water and floods could be a perennial problem, whereas in other parts, especially in arid regions, there may not be enough water to sustain all water-related activities throughout the year. Thus, in areas of both water abundance and shortage, it is important to institute appropriate water resources development and management policies so as to alleviate the problems of floods and droughts, and to ensure in the process that adequate water of right quantity and quality is available on a long-term sustaining basis. Such policies would include implementation of rational conservation plans and pollution control strategies, so that deterioration of water quality can be prevented, thus ensuring the total stock of available water is usable for different purposes.

If the earlier general assessment of the world-wide conditions is considered in conjunction with the following factors, the urgency of immediate rational water development and management becomes apparent:

- (a) It took nearly a million years for the first billion people to appear on earth, but the next billion is due in only another 15 years. The world population is expected to reach 6.5 billion by the year 2000. The basic human needs of the additional 2.5 billion people have to be satisfied in slightly over 3 decades. Basic human needs may be considered to be food, clothing and shelter, and public services provided by and for the community at large, such as safe drinking water, sanitation, public transport, and minimum health services. Satisfaction of basic human needs for the additional 2.5 billion people means more water to supply these goods and services.
- (b) According to the World Health Organization, 1200 million people, or 30 per cent of the present world population, lack safe drinking water,

and 1400 million people have no sanitary waste disposal facilities. Lack of proper excreta disposal has an immediate impact on water quality, especially in areas where safe water is in short supply. It contaminates the water sources, and thus contributes to spread of diseases. Currently some 5 million people die every year from such water-borne diseases as cholera, typhoid, diarrhea, dysentery, malaria and intestinal worm infections.

- (c) Unplanned industrial expansion and population pressures in large urban areas are straining available water supply. As urban areas grow, more water becomes necessary and simultaneously more waste is being generated, some of which is disposed off in to watercourses, thus degrading water quality. In other words, more and more water becomes necessary, but at the same time the quality of available supply is being degraded.
- (d) The daily water demand for a human being varies between 1.5 and 20 litres, depending on climate and physical activity. The daily *per capita* in-house water use varies from 3 to 700 litres. A ten-year study in Singapore indicates that as domestic water use goes up, disease rates go down. It concluded that 90 litres of high quality water seemed to be the "social minimum" for prevention of water-borne diseases.
- (e) Agriculture is the greatest user of water, accounting for some 80 per cent of all consumption: comparable figure for the United States is slightly above 40 per cent. It takes approximately 1000 tons of water to grow one ton of grain and 2000 tons to grow one ton of rice. In addition, animal husbandry and fisheries require abundant water.
- (f) In 1975, according to the Food and Agricultural Organization, the total area irrigated in the world amounted to 223 million hectares, of which 93 million hectares was in developing countries. Some 15 per cent of the world's cropland is irrigated, yielding from 30 to 40 per cent of all agricultural production. The amount of water used by irrigated crops is nearly 1,300,000 million cubic metres, but because of losses in storage, conveyance and use, the total amount used increases to almost 3,000,000 million cubic metres.
- (g) By 1990, it is estimated that the total area irrigated in the world would increase to 223 million hectares, of which 119 million hectares would be in developing countries. Expanding and maintaining irrigated areas to 1990 is going to be a challenging task, and its magnitude can be judged by the following requirements for the developing market economy countries only:
 - 22.5 million hectares of new irrigation;
 - 45 million hectares of irrigation improvement;
 - 78.2 million hectares of drainage improvement, including 52.4 million hectares on irrigated land;
 - 438,000 million m³ of additional water;
 - \$97,800 million of investment at 1975 prices.
- (h) Increased agricultural activities in marginal areas have often over exploited water availability. In many areas, more groundwater is being withdrawn than can be replenished naturally, thus contributing to major management problems.
- (i) Industry is a heavy user of water. In the United States, industrial water demands account for nearly 40 per cent of the total water

requirements, and five major industrial groups — food and kindred products, pulp and paper, chemicals, petroleum, coal products and primary metals — account for slightly more than 85 per cent of total industrial requirements. However, nearly 60 to 80 per cent of water required for industrial processing is for cooling and need not be of a high quality.

- (j) Irrational use of water is contributing to the loss of productive soil due to waterlogging, salinization, alkalization and erosion. On a global scale, at least 200 to 300 thousand hectares of irrigated land is lost every year due to salinization and waterlogging. In the Nubariya area of Egypt, water level is increasing at the rate of one mm every day. Current estimates indicate that 20 to 25 million hectares of land that is saline at present was fertile and productive at one time.
- (k) Water conservation practices have not received adequate attention so far. The efficiency of use of irrigation water is still low in most countries, and losses of up to 70 to 80 per cent are not exactly uncommon. Over-watering is often endemic, and it is virtually certain that most current estimates of water needs for irrigation are grossly overstated to account for this loss. Similarly in the industrial sector, many products can be manufactured with significantly less water than currently being used. For example, water requirements to manufacture one ton of paperboard vary from 62,000 to 376,000 litres, the higher figure being over six times the lower one. In some urban centres of developing countries, as much as 50 per cent of all the water stored and conveyed is being lost due to leakages.

These and other aspects of water resources development affect different countries in different ways, and all go to prove that *rational management of water resources can no longer be considered as only desirable, it is now an absolute must*. But the overall tasks must be viewed in a wider context. Management of water is essential, but the fundamental question that must be asked is for what? Not for itself, but for those who inhabit this "only one earth", and to provide a better quality of life to those segments of society who have not had the opportunity for hundreds of years. In the case of water, as in that of energy or any other resource issues which confront the world today, the problems must be viewed in the wider context of rational use of natural resource for the achievement of a sustainable development process, as envisioned by the New International Economic Order proclaimed by the United Nations.

This may pose an important question: will enough water be available for future developments in the world? Some have already suggested that water, rather than land, will be the major constraint for increasing world food production during the final years of this century. Two comments can be made about such statements. First, the majority of such statements come from people who have no special expertise on water, and thus it becomes comparatively easy to make such rash forecasts. Secondly, such concepts are basically neo-Malthusian, and like other similar concepts, it has been discarded by serious scholars.

To conclude, the major problem in the area of water resources is not one of Malthusian spectre of impending scarcity, but one of instituting more rational and better management practices. Water resources of different regions for which adequate data are not available have to be assessed, and based on such assessments, long-term development and management plans have to be established. Water and land should not appear as constraints in the overall planning process of a country, rather realistic development and production targets should be

matched to their availability. What is urgently needed is the formulation of long-term development policies, on a sustaining basis, that reflect changing water supply and demand patterns, consistent with efficient use, and better understanding of the social and environmental implications so that adverse impacts can be minimized. In fact, it can be successfully argued that the time has come when the emphasis should shift to comprehensive land and water planning, treating land and water as an integrated and interacting unit, rather than water planning *per se*.

Opening Statement

Yahia Abdel Mageed

The convening of the United Nations Water Conference is an event of historic importance. For the first time, the range and complexity of the problems of water development confronting mankind will be taken up in their totality by a world forum in a systematic and comprehensive manner. Consideration of the fundamental aspects of water policy, as distinct from the exclusively scientific and technological, also lends uniqueness to this Conference.

Although historically, water development has influenced the growth of the great river civilizations of antiquity, it was only in the nineteenth and twentieth centuries that application of new technologies ushered in the modern era of massive development of water resources in the Americas, Europe, Africa, Asia and the Pacific. The Second World War temporarily halted this trend as national and international resources were diverted to other sectors. But the post-war period and accompanying independence of many nations led to a revival of interest in the development of water resources in all countries, notably in a great majority of the developing nations.

This renewed interest was rooted in the hope that water development would assure the much longed-for economic and social development. Since water is essential to industry and agriculture, its development was perceived as the symbol of all development. Accordingly, water problems merited varying degrees of attention in many countries. But subsequent achievements in this area seldom matched those of earlier years. Further, the degree of water development rarely kept pace with growing aspirations for socio-economic development, particularly in the developing countries.

We only have to consider that a quarter of the world's population is now starving; another quarter is severely undernourished; by the year 2000, we shall have to provide food for some 6000 million people. At the same time, two thirds of the world's population — some 80 per cent in rural areas — have no access to adequate or safe water supply, and that figure will double by the year 2000 unless remedial action is taken. The resolution of these problems is far beyond the capability of any single or fragmented effort.

While water undoubtedly has the potential for aiding profound social and economic change, it was soon recognized in many countries that the prevailing forms of socio-economic organization tended to create critical constraints of capital and manpower. These have severely retarded efficient utilization and development of water resources. The resulting gap between potential and performance, between promise and progress, between ambition and achievement must be reckoned with in several countries today.

SOME PRINCIPAL CONCERNS

With this background in mind, it is pertinent to review some basic problems or issues which must engage our attention. I shall not attempt to deal with all these numerous and complicated problems exhaustively but shall confine myself to certain areas that merit priority.

First, the problem of community water supplies. When we recall the spectacular advances in science and technology that have occurred in our own lifetime when it has been possible to send man to outer space, it is surely paradoxical that here on earth, people should be denied a fundamental human right - a readily available supply of clean water for healthy survival and betterment.

Second, the problem of self-sufficiency in food production. Hopes of redressing the imbalance between the rich and poor in food production have come no closer to reality. Despite the efforts and achievements of the past decades, the general condition of the people in the developing countries has not improved. The 460 million deprived and hungry people of 1974 have now increased by a further 24 million and, in the absence of a dramatic breakthrough in the expansion of food and agricultural production, they will continue to increase by more than 12 million yearly.

At present about a tenth of the land area of the world is cultivated, and only about a sixth of this cultivated land is currently under irrigation. Yet this same irrigated land produces between 40 and 50 per cent of all agricultural output. It is clear that, if future famines are to be avoided, more land will have to be placed under irrigation.

Third, the problem of pollution. Many rivers and lakes are being increasingly polluted, as a result of the uncontrolled discharge of untreated effluents, both from industry and agriculture. This is contributing enormously to a rapid diminution of available supplies of good quality water for various domestic, industrial or agricultural purposes. Satisfactory remedies have yet to be formulated. Otherwise the results of our misuse will be passed on to future generations.

Fourth, the problem of shared water resources. It is a fact of contemporary life that there are important points of difference among many countries with regard to the problems of shared water resources. It appears that no significant progress can be achieved in the management and development of these resources without a more effective system or framework within which the differing national positions, interests or approaches can be harmonized so as to facilitate co-operation.

There are many opinions on the specific form such co-operation might take. But certainly, it may be stated quite unequivocally that these shared resources should be viewed as links to promote the bonds of unity, solidarity and fraternity among the nations sharing a common destiny.

These, then, are only four principal concerns I have chosen to mention here. Others include the incidence of floods, droughts, the water needs of industry, hydroelectric power generation, inland navigation, environment and health concerns, all of which are no less important. The degree of their importance is dependent upon different national and regional situations, which I am sure will receive your detailed consideration during the Conference.

It is necessary at this stage to refer to one of the principal constraints to more effective action, namely, the scarcity of capital and foreign exchange, particularly in the less-developed countries. Ways and means will have to be found for more effective mobilization of financial resources, both internal as well as external.

PRESENT INTERNATIONAL CLIMATE

We are here today to consider these and other water-related problems in the context of a world situation where nations have pledged themselves to work towards a New International Economic Order — an order which we hope will usher in a new set of more rational and equitable international political and economic relations. Also, we are meeting in a new international climate created by the dialogues of conferences at Stockholm, Paris, Nairobi, Rome and Vancouver. Countries of the world are now working towards the New Economic International Economic Order through such means as economic and technical co-operation among the developing countries, with the object of attaining collective self-reliance in their developmental effort. These emerging concepts and trends mark the transition from an earlier era of dependence on former colonial or metropolitan powers, to a new era of collective self-reliance and a new pattern of interdependence in the comity of nations. This transitional phase is a historic necessity if we are to create a new world, free from poverty, hunger and malnutrition — in short, a world free from the present inequity of vast areas of under-development coexisting alongside others of affluence. In consequence, at this Conference, it behoves us to consider the problems of water development against this background of the world situation. It is incumbent on us to take into account the present climate of international relations in order that water might be considered as an instrument for the promotion of a greater measure of international co-operation.

I am suggesting that such a broad perspective will be helpful because water development, particularly at the policy and decision-making level, faces the same problems as all other sectors of economic development, and cannot therefore be treated in complete isolation as an independent domain unrelated to other areas of development. A consideration of problems of development in general is obviously beyond the scope of this Conference but, nevertheless, it will be useful to recall this broad interconnexion while considering problems specific to the development of water resources.

PREPARATORY PROCESS

This brings me directly to the point that while some aspects of the water problems have general dimensions, many aspects are, by and large, unique to specific river basins, lakes and aquifers in different countries and regions. Due recognition and consideration had to be and was, in fact, given to this aspect of water problems in the preparatory process for this Conference. The regional economic commissions spearheaded the preparations for the regional meetings according to the guidelines set by the Committee on Natural Resources acting as the preparatory committee for the Conference. It is a matter of gratification to all of us that these regional preparatory meetings invariably involved broadbased, high-level participation. Each meeting was successful in that its reports and recommendations embody the needs, hopes and aspirations

of the respective regions. The vast fund of valuable expertise and experience accumulated by the various agencies of the United Nations system is presented in the special reports prepared by them on various subjects appropriate to their respective fields of competence. The preparatory work was, in fact, a combined effort of the whole United Nations system. The individual national experiences on specific aspects are outlined in the various thematic papers submitted by Governments. This preparatory process was devised to accomplish, and did in fact succeed in accomplishing, the extraction of the essence of the problems and their potential solution in the different geographic regions of the world and in the different sectoral uses of water, with due regard to the important infrastructural problems of education, manpower, training, research, etc., which underpin both the geographical as well as the functional areas of water problems.

The preparatory process had, in itself, many valuable lessons to offer:

First, it brought out the fact that water problems affect both the developed as well as developing countries. There are many similarities between the two sets of conditions but at the same time, there exist important dissimilarities in the nature of the problems. For instance, water pollution, a high-priority problem in developed industrial societies, has not yet reached the same dimensions in developing countries, given the relatively lower level of industrial development.

Second, the analytical review in the preparatory process showed that only 2 per cent of the water resources of Africa, and 3 per cent in Latin America, have so far been developed. It also showed that the present level of development of hydroelectric power in Africa and Latin America is only 6 - 8 per cent of the available potential - facts which point up the need for accelerated development.

Third, the very process of preparation for the Conference has generated a certain momentum on a global scale. A new consciousness was created. National committees were created or reactivated in some countries. New laws or decrees were promulgated in others. This momentum has not only to be maintained but further developed hereafter.

ROLE OF THE CONFERENCE

This Conference marks the culmination of a lengthy preparatory process involving your helpful participation. I am extremely happy to be able to extend to all of you the most cordial welcome and to express my sincere conviction that your participation in the Conference will impart a measure of unparalleled value to its subsequent recommendations and resolutions.

The Conference provides a unique opportunity for formulating an international consensus on a number of policy and operational measures. Should such a consensus emerge, you may consider the desirability and appropriateness of incorporating it in the form of a declaration which would provide a framework to guide the policies for future development of water resources - not with any rigidity but with sufficient flexibility to facilitate a consideration of differing situations and needs in different countries. Should it be possible to work towards such a declaration, that in itself would constitute an historic landmark in the field of water resource development.

In addition to this, I am sure that your deliberations will result in a number of practical recommendations for action in the various sectors and aspects of water development.

On the question of community water supplies and agriculture, here is an opportunity — may I say, even an obligation — to formulate a concrete plan of action with detailed, financial and manpower implications, and specific time-bound targets. You have already expressed your commitment at Vancouver to provide clean water for all by 1990, if possible. Let us now avoid generalities because there is no disagreement on objectives or strategies. Let us get down to specifics, assess what can be accomplished with our respective national resources and indicate specifically what we need by way of external assistance. Let there be no mistake that, in the ultimate analysis, real action lies at the national level — international assistance being essentially catalytic and effective only when there is dynamism and vigour in national action. There is a similar need to develop concrete action-oriented recommendations that will promote co-operation among developing countries specifically in the water sector, in order to combat pollution, floods and droughts and to provide the capital and manpower needs essential for further development and management.

In relation to the problem of shared water resources, if there is general agreement on the need for a code of conduct, this will be a significant advance in facilitating greater co-operation in the future among co-basin countries. I am not suggesting that a code of conduct should actually be evolved in this forum, but only that there should be agreement on the *need* for such a code, so that appropriate steps can be taken in the future, to set in motion a process to facilitate the eventual adoption of such a code of conduct with common consent. This would be a limited, but significant, advance in a seemingly intractable subject.

I am sure I will be echoing a common sentiment if I were to say that the deliberations of the Conference should not result in a mere set of generalized recommendations full of platitudes and cliches. In contrast, the Conference should result in a blueprint for action at the national, regional and international levels, valid for the next few decades.

We hope that the Conference will mark the beginning of a new era in the history of water development in the world. We expect that it will engender a new spirit of dedication to the betterment of all peoples; a new sense of awareness of the urgency and importance of water problems; a new climate for a better appreciation of these problems; higher levels of flow of funds through the channels of international financial assistance to the cause of development; and, in general, a firmer commitment on the part of all concerned to establish a real breakthrough so that our planet will be a better place to live in.

IMPLEMENTATION

Another important question that merits our consideration is the problem of implementation of recommendations. While the formulation of correct and comprehensive recommendations is important in itself, much of the effectiveness of the recommendations is impaired in the absence of equally effective mechanisms for their implementation. The discussions during the preparatory process brought up the question of what was sometimes called the "implementation gap" and the need for closing this gap.

The question of implementation has to be considered at different levels - national, regional and international. At the national level, effective public participation is the key to success, for experience has shown that lack of participation by the affected population has frequently led to sterile inefficiency in execution, whereas the active involvement of the people produces a galvanizing effect all round. No amount of policy formulation, institutional reorganization or legislative action, important as these all are, will lead to success without the involvement of the population.

At the national, subregional, regional and international levels, the need for closer and more effective co-ordination of all bilateral and multilateral governmental as well as non-governmental organizations, both within and outside the United Nations system is also recognized to be an imperative necessity for successful implementation.

It is obvious that the United Nations system has an important role to play. In fact, the system has to its merit a record of commendable work over the last few decades which the world will acknowledge. At the same time, the opinion is unanimous that there is considerable room for more effective co-ordination. The system has itself worked out proposals to improve co-ordination and make it more effective. This is an unprecedented opportunity for the Governments to impart a new vigour to international action and to enable it to carry out its expanded role and function in a more dynamic manner in assisting the Governments in facing the challenges of the future.

May I, in conclusion, be permitted to remind us of the great ferment in the world today. Over the greater part of the globe, there is considerable turmoil largely impelled by the prevalence of what has come to be referred to as a state of "underdevelopment". It will be no exaggeration to suggest that the development of water resources is an important means to combat this "underdevelopment" and thus to contribute to the greater well-being of mankind. Let not history say that a golden opportunity for arranging an orderly developmental progress of mankind presented itself to this generation but was not grasped in time. For, in the ultimate analysis, the success of this Conference will be measured not here at Mar del Plata, not by us, but by posterity over the sweep of history and by the measure to which our deliberations during the next two weeks influence the course of events over the next two decades.

United Nations Water Conference: A Perspective

Margaret R. Biswas

The United Nations Water Conference convened at Mar del Plata, Argentina, from 14 to 25 March, 1977, and was attended by 116 governments, the various United Nations agencies and organizations, intergovernmental organizations, 58 non-governmental organizations, and several liberation movements. China was once again absent from the World Forum: they did not participate at Habitat either. Yahia Abdel Mageed, former Minister of Irrigation and Hydro-electric Power of the Sudan, was Secretary-General of the Conference. Luis Urbano Jauregui, Head of the delegation of Argentina, served as President.

The Water Conference was first proposed by the Committee on Natural Resources in New York in 1971. It was approved by the Economic and Social Council in 1973 and endorsed by the United Nations General Assembly in December 1975 in Resolution 3513 (XXX). Since the early 1970's, the United Nations has been holding a series of conferences to create global strategies to meet problems that are beyond the power of any single nation to resolve and are of concern to the international community in its attempt to improve the quality of life of its people. The work and recommendations of these preceding United Nations conferences, notably those on Environment, Population, (1) Food, (2) and Human Settlements (3) contributed to the preparations for the Water Conference.

According to the resolutions of the Economic and Social Council, the Conference was to be convened to:

- exchange experience on water resources development and water uses;
- review new technologies;
- stimulate greater co-operation in the field of water;
- discuss comprehensively the problems raised by growing water demands where the stock of the resource was constant;
- to consider specific economic and administrative, as well as technical aspects of water resources planning and development, primarily directed towards water policy-makers.

The main purpose of the Conference was to promote a level of preparedness nationally, regionally, and internationally which would help the world avoid a water crisis of global dimensions by the end of the century. It was to deal with the problem of ensuring that the world had an adequate supply of water, of good quality, to meet the needs of a world population which is not only growing, but is also seeking improved economic and social conditions for all people.

Although water is a renewable resource, the total amount of water available on a global basis is constant, and estimated at 1.4×10^9 km³. Distribution of the world's water resources is shown in Table 1.

Table 1. Distribution of World's water resources

Location	Percentage
Ocean	97.3
Fresh	2.7
Distribution of fresh water:	
Ice cap and glaciers	77.2
Ground water and soil moisture	22.4
Lakes and swamps	0.35
Atmosphere	0.04
Stream channels	0.01

The water available for human use, though adequate in volume, is frequently available at the wrong place, at the wrong time and with the wrong quality. As population increases, the resulting demand for water for domestic, agricultural and industrial uses is causing serious strains on the planet's fixed water stock, while careless management, pollution and inadequate conservation threaten to reduce the availability of usable water. In addition, we have not yet learned to contain natural disasters, such as floods and droughts.

MAJOR CONFERENCE ISSUES

Kurt Waldheim, Secretary-General of the United Nations, in his opening address stated that the Conference was closely related to the aims of the United Nations concerning a more equitable and just world order. Every aspect of socio-economic development depends upon the availability of an adequate supply of water. More water will be necessary to provide food, manufactured goods and energy to sustain a world population which will have grown from 4 billion to 6 or 7 billion by the year 2000. Water development needs, he said, must be perceived in terms of comprehensive programmes; a project-by-project approach was no longer adequate. If world water resources are to meet human needs in the twenty-first century, radical new management approaches, like shifting water supplies from surplus to deficit regions, were necessary. New research such as utilization of polar ice-packs and improved technologies for such tasks as desalination of sea water must be fostered. This Conference demonstrated the ability to act before a disastrous crisis was upon us, but potential water crises may be faced in many parts of the world, unless the political will to co-operate in an unprecedented fashion is forthcoming.

The Secretary-General of the Water Conference, Y.A. Mageed, outlined four principal concerns:

- (1). Community water supplies: Two-thirds of the world's population - some 80 per cent in rural areas - have no access to adequate or safe water supply, and that figure will double by the year 2000 unless remedial actions are taken.
- (2). Self-sufficiency in food production: The number of deprived and hungry people has increased by 24 million from 460 million in 1974 to 484 million and, in the

absence of a dramatic breakthrough in the expansion of food production, will continue to increase by more than 12 million yearly. At present, about a tenth of the land area of the world is cultivated and only one-sixth of this cultivated land is under irrigation, producing 40 - 50 per cent of all agricultural output. To avoid future famines, more land will have to be irrigated.

(3). Pollution: Satisfactory remedies for pollution from untreated effluents have yet to be formulated.

(4). Shared Water Resources: There must be a more effective system within which the differing national interests and approaches regarding shared resources can be harmonized. A general agreement on the need for a code of conduct, to be evolved later, would be a significant advance.

In many countries, he said, the prevailing forms of socio-economic organization created critical constraints of capital and manpower. Ways would have to be found for more effective mobilization of financial resources. Countries of the world were working towards a new economic order through such means as economic and technical co-operation among developed countries.

The preparatory process had highlighted regional problems. It showed that only 2 per cent of the water resources of Africa, and 3 per cent in Latin America had been developed. Only 6 - 8 per cent of available hydro-electric power in Africa and Latin America is developed. The process of preparation generated a momentum that must be maintained, if recommendations are to be implemented.

The question of implementation, according to Mageed, had to be considered at different levels - national, regional and international. Real action lay at the national level, international assistance being essentially catalytic and effective only when there was dynamic national action. At the national level, effective public participation is the key to success. At all levels, more effective co-ordination of all bilateral and multilateral governmental as well as non-governmental organizations is imperative. It was unanimously agreed that more effective co-ordination of the United Nations system was necessary.

Urging nations to take stock of their common destiny, Luis Urbano Jauregui, the Conference President, remarked that the United Nations Water Conference could mark the start of a new era: that of water rationally used, preserved and harmonized with the environment. The conservation and development of water are not isolated problems, nor can they be solved by any particular sector or region. They constitute a single theme: water as the heritage of mankind to serve the common good.

Gabriel Van Laethem, Under Secretary-General for Economic and Social Affairs of the United Nations, said that water was wasted too long since it was presumed to be abundant, renewable, and available at low cost or free of charge. Because its management has traditionally been within the public domain, it has not been the subject of a research effort comparable to that from which the great industrial technologies have benefited. Therefore, methods of water use have in many ways not developed since ancient times, and practices inherited from the Romans are still being used. While the solution of water problems depended in part upon scientists and engineers, it was primarily the responsibility of politicians who determined national measures and international co-operation.

The United States explained that recent water problems had led it to place more

emphasis on water management. Instead of water development, and greater concern for environmental aspects. It recognized that water supply is affected by a host of factors that have nothing to do with hydraulic engineering. Foremost among such factors was population. Though global population will double in the next 25 years, demand for water would double in far less time due to the increased need for water, intensive agriculture, and industrial technologies. The location of people was another factor. Instead of settling in places where water was abundant, people have been encouraged to settle where they must rely on complex systems to bring water to them. Countries with less than abundant water supplies or with high population growth in areas of marginal water availability should emphasize policies to reduce rates of population growth, encourage resource-oriented internal migration, stimulate reclamation and conservation, and adopt development technologies appropriate to specific water needs. Recognizing the need for accurate data to avert a water crisis, the United States is prepared to provide assistance to other nations interested in designing information systems. Data are, however, of little use without trained people. Because water resources management requires familiarity with the specific region, training should be done in and by the countries concerned.

The USSR stated that its population was concentrated in the West, while 80 per cent of its water resources were concentrated in Siberia and the Far East, where only one-third of its population and agriculture is located. The USSR was waging a planned struggle against pollution, but will not have clean water if other countries continue to discharge improperly treated effluents into rivers. It suggested the Conference facilitate international agreements which would prevent countries from discharging effluents into rivers. All governments should control and end pollution. Countries should also recycle water and reduce demand. New technical means for agriculture and other installed technology that uses small amounts of water should be developed. A way must be found to reduce the demand for water for agricultural crops. Efforts should be made to concentrate on crops that use less water.

Having reached the limit of its natural water potential, Israel was doing its utmost to increase efficiency in water use. In agriculture, Israel started by moving from gravity irrigation to sprinkling. Now direct dripping at the roots of the plant and automatic irrigation systems which reliably supply the exact quantity needed by the crop were being employed. Unconventional methods such as cloud seeding were also being used.

H.M. Horning, of the Food and Agriculture Organization (FAO), expressed similar concern. Since water resources are finite, increased use must be equated with reduction in waste, especially in agriculture, which accounts for some 80 per cent of world water consumption. Efficiency of use in crop production will assume overriding importance, and must find response from institutions already unable to cope. He said that the World Food Conference had suggested countries undertake an inventory of water resources available for agriculture in order to determine potential irrigation. It had emphasized flood control, drainage, and reclamation, and advocated small-scale projects in which farmers could participate.

FAO, continued Horning, felt action to overcome food and crop deficits must include:

- improvement of existing irrigation;
- expansion of irrigation and drainage to new land;

improvement and extension of rainfed agriculture and livestock production through better soil moisture management and through the opening up of new land;

protection of agricultural land against flooding and waterlogging and where necessary its reclamation; and

introduction or expansion of fish rearing in conjunction with rural development.

In the case of irrigation and drainage, the magnitude of a 15 year global target is estimated at some 45 million hectares of improved and 22 million hectares of new irrigation development, at a total cost of nearly 100 thousand million dollars.

Milos Holy, President of the International Commission on Irrigation and Drainage, maintained securing sufficient supplies of water for large-scale irrigation projects will be one of the principal future tasks of water management. It is estimated that by the year 2000 the world area under irrigation will be about 500 million hectares, double that of 1975. At an average increment of 10 million hectares of irrigated land per year, an increased water supply of 45,000 million m^3 a year will be required globally. The increased demand on water resources by 2000 will be 1,125,000 m^3 , which is roughly equal to the annual flow in the Congo River, only a little less than that which flows in the Rio de la Plata, almost 5 times more than flows in the River Indus and 14 times more than flows in the River Nile.

The importance of irrigation was further stressed by India:

"In the developing countries the preponderant use of water is for irrigation which accounts for more than ninety per cent of total consumption. This is because of the pivotal position that agriculture continues to occupy in their economies, both as the principal source of national income and the main source of employment. The pressure of population on land in these countries calls for both horizontal and vertical extension of areas that can be brought under cultivation and this means looking at water supply as the key input for maintaining the population/food balance. The great pressure of urbanization in these countries can be mitigated only by developing rural areas and there is no way to develop rural areas in many of these countries except by providing an assured irrigation facility."

Switzerland raised several salient questions. Is it wise to spend huge sums to provide water to the poor sections of major cities, or would the funds be better spent for rural development, which alone can halt the growth of these quarters? Should the provision of potable water be placed as most important, when 80 per cent of water utilization in the world is for agriculture? Is it sensible to spend millions on irrigation without trying to develop new types of grain requiring little water? Is the development of complex technology for fresh water more important than the development of new technology for conserving water? Switzerland concluded that more research was necessary, by both developed and developing countries, in order to answer these questions.

France, among others, maintained that, in agriculture, the main effort concerning proper use of water should be at the level of the farmer. Farming techniques

must be well adapted to the climate and environmentally sound. All water management must be closely linked to land use planning, whether agricultural or urban, since harnessing water resources modified the land and the ecology.

Although selective aspects of environmental problems were mentioned by most delegations, Mostafa Tolba, Executive Director of the United Nations Environment Programme (UNEP) and Secretary-General of the United Nations Conference on Desertification, provided a comprehensive review of the environmental implications of water resources development. He stated that a prior assessment of probable environmental impacts should be mandatory in the planning of all water development projects. Alternative patterns of development should be studied. There may be complex impacts on human health and settlements, land and ecosystems, including fish and wildlife. Water-borne diseases, such as malaria and schistosomiasis are all the more prevalent when the characteristics of water bodies favour the abundance of their hosts, mosquitoes and snails. Careless waste-water disposal contaminates water, and the death rate from gastroenteritis is higher in areas with unsafe water supplies.

Water developments also have implications for human settlements since people must be resettled from impounded areas. Furthermore, inefficient use of water can cause waterlogging and salinity, which destroys arable land. Both proper land use and sound water management are also integral components of desertification control and reversal. Thus, the Water Conference and the Desertification Conference are closely interrelated.

Dr. Tolba concluded that water plays a major role in satisfying the basic and essential needs of food, shelter, clothing, health, education, and productive work. Satisfaction of the basic human needs of those billions who live below the level of subsistence is the most urgent challenge facing the international community.

Ibrahim Hussain, of the International Labour Organisation, told the Conference that productive employment is necessary to satisfy basic needs. Water resources development could provide work for millions, if appropriate technology were used. For small and large scale water projects, many activities in developing countries carried out by imported machines could be executed by relatively unskilled labour. Public participation in the planning process was also desirable.

The Netherlands suggested programmes in countries should not only be directed to the construction of the facilities, but also to preparatory and infrastructural elements. Among them are the education and involvement of the local population, promotional activities at various levels, the development and application of appropriate technologies and the establishment of institutional facilities, including those for training. Sharing of experiences between developing countries should be encouraged.

According to Martin Beyer, of UNICEF, the education of villagers was crucial for the proper use and maintenance of water supply installations. UNICEF encouraged the integration of health education into village water supply schemes and community participation. Its activities were based on the fact that up to 50 per cent of the population in developing countries are children and young people. The suffering and deaths caused by water-borne or water-related diseases are motivation enough for action. So is the drudgery of the women in many parts of the world, who with their children often have to spend large parts of their

days only to lug water to their homes miles away from the sources, which are mostly contaminated.

Kenya described how its *Harambee* groups (*Harambee* means "let us pull together") had developed rural water supplies on a self-help basis. Women had played a major role in this development. Kenya saw money and manpower as the main obstacle to water development in developing countries. Donor countries should finance training of local manpower.

With its meagre resources, Tanzania realized that water and other services could best be provided if the rural population was concentrated in the villages. In 1973, about 2 million people lived in villages, today there are over 13 million people living in 7684 villages. The objective is to provide each village with clean water within 5 years and everyone in rural areas within 20 years.

Liberia regarded lack of adequate information about water resources as one of the chief obstacles to all types of development in that country. With regard to shared resources, no agreements with neighbouring countries can be made until the facts about the rivers in all countries are known.

Zambia felt the most effective means of contributing to water resources development in Africa would be the establishment of a Water Resources Development Institute for training of technicians and professionals. The most urgent need was for short courses to bring engineers up-to-date. Morocco regarded training as the real bottleneck in the Third World, but also suggested the Conference promote research benefiting developing countries. The Third World should also carry out research as, for example, solar energy for desalination of brackish waters. Nigeria said personnel training facilities must be established on a regional basis where none exist, and existing facilities strengthened where inadequate.

The Sudan endorsed the recommendations of the African regional meeting, later adopted by the Conference, that countries establish scientific institutes in common river basins to promote studies, formulate plans for basin development, and promote training, so as to reduce dependence on foreign consultancy. The Sudan also outlined the water situation in Africa: only 3 per cent of the irrigable land in Africa is under irrigation and 2.5 per cent of the continent's water resources are developed. Though Africa has a third of the world's hydro-power potential, only 5.6 per cent of its potential is developed. The Sudan described its own long-term policy aimed at self-sufficiency in food production, and increased export of agricultural products.

Egypt stated it possessed the water and land resources and the man-power necessary to effectively solve its food problems. It was the responsibility of the rich and advanced nations to extend economic and technical aid such as soft loans and up-to-date technological methods, to Egypt and other developing nations.

Ethiopia said water losses by evaporation were higher in Africa than elsewhere in the world, and Africa was subject to highly variable seasonal water flows. Niger explained how the 1968-1975 drought marked the lives of 25 million Sahelians. A harvest of 4.5 million tons in an average year was reduced to only 2.9 million tons in 1973 and 1974. Loss of cattle, from 1969 to 1974, varied from 20 to 80 per cent, according to place, with an average of 30 per cent. The magnitude of the drought was due to the weakness of economic structures, especially the lack of water infrastructure that could have lessened its effects.

The difficulty facing the Sahel is not insufficiency of water: the irrigation potential is 1,500,000 hectares, while self-sufficiency in food by the year 2000 would require the irrigation of only 500,000 hectares. With regard to underground water, there are 10 billion m³ per year for extraction, while the needs of men, livestock and industry to 2000 are estimated at 2.5 billion m³ per year.

Chad pointed out that certain studies take too long to prepare. For a region such as the Sahel, studies must be rapid and produce concrete results, for the population cannot wait indefinitely.

Frequent references were also made to flood control. Faruk Berkol, Co-ordinator of United Nations Disaster Relief Office, said national development planning often overlooks the impact of natural water-related disasters. A primary aim of prevention is to restrict occupation of high-risk areas, in particular flood plains and low-lying coastal areas.

A few delegations complained of devastation by war. Vietnam stated that "war of aggression and sabotage" conducted by the United States against Vietnam largely interrupted large-scale water development which had now been resumed. Wells, pumping stations and dikes had been destroyed by bombings. Libya insisted only a small part of its water development plans had been realized because mine-fields from the Second World War still remain over large areas, making exploration for water resources difficult. The Colonial Powers "violated the innocence of our land and made it a playground for their armed conflict", Libya said. The mine-fields were still killing hundreds of people. Democratic Yemen said it is ironic that modern technology has been used to influence the environment for military purposes, when great areas of the world suffer from drought.

Great Britain said the solution to drought and other water problems in a developing country were not necessarily those which would be adopted in a developed country. Technology must be matched to the skills of those who are responsible for its operation. The drought of 1976 had reminded Great Britain that it still had much to learn.

France stressed that technology should not increase dependence. Technology of an advanced type should be promoted, provided that it is socially and economically adapted to the realities of each nation. Romania called for concrete actions to achieve a wide transfer of modern technology and technical assistance without political involvement. Libya and Mauritania advocated the transfer of research results at prices developing countries can afford. Pakistan recommended undertaking of research to improve the engineering economics of new techniques.

The Ukraine said broader use must be made of technologies that make little or no use of water and of non-polluting technologies. In Sweden, water requirements of industry had been greatly reduced by the use of water-saving technologies. At the same time, requirements of communities had stagnated with the over-all effect that water requirements in Sweden today are only half of that forecast just over 10 years ago.

The Philippines pointed out that to a large extent the technology to resolve many water problems already exists. What is required is the firm commitment at the national and international levels to provide financial and technical assistance, especially in the developing world. Indonesia and India, among others, suggested that water management was a field where technical co-operation between

developing countries might be as important as the transfer of technology from developed nations. India has pioneered many labour-intensive technologies for water development, for example, stone masonry construction as opposed to concrete.

Bradford Morse, Administrator of the United Nations Development Programme and Secretary-General of United Nations Conference on Technical Co-operation among Developing Countries to be held in Buenos Aires in 1978, stated that the forthcoming Conference could help all to utilize technology in a way which would preserve and re-invigorate age-old values that protected and respected natural resources, like water. Small-scale irrigation projects are indispensable in most developing areas. Schemes requiring massive investment take a long time to build and may have less impact on farmers and villages than smaller schemes. One example of opportunity for new technology applicable to local situations is the development of special "low head turbines" enabling villages to obtain hydro-power from local streams, as has already been done in China.

According to Morse, UNDP does not have the financial resources to facilitate the massive investment required to develop the water resources in developing nations, but the United Nations system does have a unique combination of human resources and skills to enable the planners in developing countries to focus on key issues and bring to them modern scientific knowledge. The UN system is a vehicle for aiding governments in mobilizing their own human and capital resources, although the major share of the development effort will have to come from within the countries themselves. Effective and stable water institutions must be created.

Saudi Arabia mentioned it is contributing more than 3 per cent of its gross national product for international assistance, of which 25 per cent is for water projects. It has made available \$10,500 million in loans and grants to other countries for water-related projects between 1973 and 1976.

Canada cited the report by WHO and the World Bank (E/CONF.70/14) which indicated that 88 per cent of recent funding for community water programmes has been provided by individual countries. It pledged more than \$361 million over the next 6 to 7 years for water projects in developing nations. Canada urged countries to give more priority to water development programmes when requesting assistance, and said it was taking a more active role in governing bodies in multilateral organizations to ensure that water projects are given sufficient priority.

The World Bank also maintained that water supply investment must compete more effectively in setting of national priorities. Every attempt must be made to mobilize funds through water charges in developing countries, but water supply rates should be designed to ensure that the poor can afford their needs. In 1976, the Bank lent \$300 million for water supply and sanitation projects, mostly for urban areas.

According to Bernd Dietrich, of the World Health Organization, nearly 80 per cent of the rural population of the developing countries do not have access to safe water supply and more than 50 per cent of the urban population receive unsafe water. The situation concerning waste disposal is even worse. Globally, investments made since 1970 must be doubled; while for rural water supply alone four times more must be invested than in the last five years, if the Habitat target is to be reached. In this effort, governments will be faced with hard decisions, particularly in deciding whether to provide a high level of service to a few, or to aim at total population coverage rapidly through a lower level of service

in quantity and possibly quality. Hard decisions are also needed with respect to financing and servicing of additional water supplies and the sharing of their costs between the rich and the poor, and between the urban and rural population.

Germany emphasized giving priority to a basic supply for the entire population rather than improving the supply to population groups already served. It has contributed 2 billion DM to replenish the International Development Association, which is appropriate for financing water projects, and \$55 million to the International Fund for Agricultural Development which will support irrigation.

Arthur Davies, Secretary-General of the World Meteorological Organization, estimated that if an accurate assessment is to be made by the year 2000 of the world's water resources, about \$1500 million will be needed for surface water investigations and five to ten times more for groundwater. These figures may seem high, but they were small in comparison with the benefits they will bring to national economies. To help accomplish this task, WMO is developing a new Hydrological Operational Multipurpose System (HOMS).

ISSUES INVOLVING RESOLUTIONS

While the delegates recognized that the massive finances required for development of water resources will have to come largely through domestic efforts, they also realized that even provision of safe drinking water required a level of investment far beyond the capability of many developing nations. Many developing countries therefore advocated the establishment of a fund for water development, and varying ideas were put forward as to its exact nature. Some suggested the creation of a voluntary fund under United Nations auspices, while others proposed a percentage of the United Nations annual budget. Tanzania, among others, suggested the creation of an "International Fund for Accelerating the Provision of Water to the Rural Areas in Developing Countries", and urged countries to reduce their armaments and credit to the fund part of the money thus saved. Most developed countries expressed reservations about the need for a separate fund, and indicated that their governments were prepared to increase financial assistance through their bilateral or existing multilateral agencies.

The final resolution on "financing arrangements" requested the Secretary-General to prepare a study of the most effective and flexible mechanism to increase the flow of financial resources for water development, for presentation to the General Assembly at its 32nd session through the ECOSOC at its 63rd session. It also recommended additional financial allocations be made to existing bilateral and international organizations.

With regard to institutional arrangements within the United Nations system, most of the African group proposed that one organization have sole responsibility for water. Most delegations, however, called for more effective co-ordination and a more productive use of existing institutions, rather than the establishment of a new organization at the intergovernmental and intersecretariat levels. While some representatives favoured the establishment of a new intergovernmental body under the Economic and Social Council to co-ordinate the activities of the United Nations agencies dealing with water, others felt that the existing Committee on Natural Resources could best serve the purpose.

At the intersecretariat level, some proposals advocated a new organization to co-ordinate activities, while most favoured the strengthening of existing struc-

tures, assigning a central role to the Advisory Committee on Co-ordination (ACC). Many countries endorsed the ACC recommendations for co-ordination presented to the conference, including the creation of an inter-agency Water Resources Board composed of all UN organizations dealing with water, including the Regional Economic Commissions.

At the regional level, there was unanimous agreement that the Regional Economic Commissions should be strengthened, as this was the level at which most of the work needed to be done, and the sharing of experience was most practical. Therefore, the establishment of regional training centres was recommended. At the country level, Germany and the Netherlands among others, proposed strengthening the role of UNDP representatives, as it was the main institution responsible for technical co-operation.

The resolution adopted called for strengthening of the Regional Commissions and co-ordination of projects and programmes under the leadership of UNDP representatives. At the intergovernmental level, the ECOSOC and the Committee on Natural Resources should play a central role in the promotion of co-operation as a follow-up to the Plan of Action adopted by the Conference. The Conference also recommended that the Committee on Natural Resources examine the proposals in the ACC report (E/CONF.70/CBP.4) at its May 1977 session and submit its recommendations to the ECOSOC at its 63rd session in July 1977.

Another international issue that received a great deal of attention at the Conference was the problem of shared water resources. Most representatives felt the questions of shared resources should be solved through negotiation between the states concerned on the basis of equal rights and mutual agreement. After lengthy debate, the Conference arrived at a consensus that in the absence of an agreement, relevant information should be exchanged rather than not starting any major works. Germany and several others pointed out that if an intermediary such as an international organization was necessary, the consent of all riparian states must be obtained. Bangladesh proposed setting up a United Nations Centre on International Rivers, with regional branches. Discussions concentrated on techniques for resolving conflicts rather than any specific disagreements, and generally underlined the inadequacy of international law for transnational water resources. Several representatives advocated defining codes of conduct based on experience gained in successful international litigation. Such codes should be flexible, allowing for evolution, free exchange of information and facilitate the evaluation of information among co-riparian states. They should also accommodate administration of water resources during various stages of socio-economic development.

Closely associated to the management of shared natural resources was the question of trans-frontier pollution. Norway and Sweden stated that transnational pollution should be dealt with on a regional basis, as national measures were insufficient. Sweden, like Norway, had been seriously affected by long-distance airborne pollutants, mainly sulphur from other European states. Russia requested the Conference to facilitate international agreements which would prevent other countries from discharging pollutants into rivers. Iran believed international standards for water quality should be developed for international rivers and rivers discharging into the sea.

Mostafa Tolba, of UNEP, reminded the Conference that the major issues of water resources had been identified in the Declaration on the Human Environment at Stockholm. The principles of law for regulating trans-frontier pollution have

yet to be developed, but the whole question was under active consideration by organizations like the International Law Commission and the OECD, as well as by UNEP. It might be useful, he suggested, "to accelerate the study of international treaties, principles of international law, and international decisions widely accepted as binding, to help clarify the extent to which states may be prepared to accept principles that may put new obligations upon them". At present, when management of shared river basins is on a case-by-case basis, strengthened Regional Commissions, perhaps with the support of UNEP Regional Advisory Teams, could offer useful help.

A resolution on river commissions recommended to the Secretary-General to explore the possibility of organizing meetings between existing international river commissions. The Conference also called for a re-arrangement of priorities in the work of the International Law Commission, with a view to ensuring the codification of existing international examples of joint action to facilitate the progressive development of international law of shared waters. These activities should be co-ordinated with those of other international bodies with a view to the early conclusion of an international convention.

Pollution and other environmental aspects of water resources development were frequently mentioned. Excessive exploitation of resources in the absence of effective legislation and control could not continue. Waste-water treatment should also be backed with financial and legislative support. The Holy See pointed out the need to protect water against radio-active wastes. The spread of water-related diseases and loss of productive land to salinity and erosion must be prevented. Short-sighted forestry practices and over-grazing by livestock were destroying the capacity of land to absorb water, filter it, and recharge ground supplies. Water planning should be co-ordinated with land use, and be an integral part of overall development planning.

That most delegates from developing nations, however, regarded environmental considerations as a secondary issue to development was clearly demonstrated when a number of developing countries, led by Brazil, expressed strong opposition to a recommendation by the United States at the final plenary session, calling for an evaluation of the environmental costs of hydropower projects. Only industrialized nations, already developed, could afford such considerations, they contended. The Conference, however, adopted a comprehensive set of recommendations on environment, health and pollution control, and a resolution for development of industrial technologies, using little or no water, and facilitating recycling.

More efficient use of water was also emphasized and included development of technologies using less water and maintenance of existing water supply services. Sweden regarded transmission of information, whether to farmer or decision-maker, of utmost importance to improve utilization of water. Since agriculture consumed by far the greatest amount of water, accounting for up to 90 per cent, particularly in certain developing countries, the efficiency of its storage, distribution and application on the farm must be improved in project operations. France maintained that the main effort concerning efficient use of water should be at the level of the farmer. Other delegations, including the Netherlands, Sri Lanka and Indonesia, expressed the view that farmers should participate in the planning, operation and management of irrigation projects.

Public participation was regarded as essential in all forms of water development, especially the role of women, in community water supplies in developing

countries.

There was unanimous agreement on implementation of the Habitat recommendation to provide clean and adequate water supplies for all, by 1990, if possible, and the parallel improvement of sanitation. The Conference endorsed this aim by approving an action plan to reach the goal, drafted by WHO and the World Bank. As a focal point for these efforts, the Conference approved the proposal by developing countries to designate the decade 1980-1990 as the *International Drinking Water Supply and Sanitation Decade*. A plan of action was also adopted for agricultural water use. Another resolution stressed the need for strengthening assessment of water resources if these plans of action are to be implemented.

Two other resolutions welcomed forthcoming United Nations Conferences. A resolution on the "Role of Water in Combating Desertification" urged governments to participate in the United Nations Conference on Desertification, and recommended action with regard to water in countries facing desertification. The other resolution urged governments to participate in the United Nations Conference on Technical Co-operation among Developing Countries in Argentina in 1978 and recommended the United Nations system promote such co-operation in water resources development. Two resolutions of a more political nature dealt with water policies in occupied territories and the Panama Canal Zone. The resolutions and other recommendations of the Conference comprise the Mar del Plata Action Plan contained in this volume.

CONFERENCE ANALYSIS

The recommendations approved by the Conference are based on a consolidated set of proposals which emerged mainly from five regional preparatory meetings held in 1976. They were modified only slightly by the delegations in Committee. The preparatory process had contributed significantly to raising the consciousness of governments and scientists regarding their national and the global water situation. As Secretary-General Mageded stated in his opening address: "The very process of preparation has generated a certain momentum on a global scale. A new consciousness was created. National committees were created or re-activated in some countries. New laws or decrees were promulgated in others. This momentum has not only to be maintained, but further developed."

It is this awareness they create which is the major contribution of World Conferences held under the auspices of the United Nations. Globally, we have the basic technology, human resources and finances to solve water problems, especially in developing countries. The problem is a lack of awareness and political will both nationally and internationally. A World Conference is one of the few options available for creating awareness and political will at a global level. Nothing has done more to raise global consciousness regarding the lack of basic needs of an impoverished billion than World Conferences held by the United Nations.

The Water Conference resulted in unprecedented stock-taking of the whole range of water problems at the national, regional, and international levels, especially in developing countries, and their consideration by a world forum. Some 215 thematic papers on various aspects of water development and management were prepared by individual countries for the Conference. Much of the data and other information contained in papers prepared by many developing countries is difficult to find and will be helpful to international organizations and bilateral

donor agencies active in the water resources area.

The Conference itself provided a forum for exchange of experience, and doing business. One African delegate explained what the Conference meant to him: "I would have had to spend ten years travelling around the world in order to meet these people to discuss water problems with them". Present were representatives of all the United Nations agencies concerned with water, and members of most bilateral aid agencies, as well as the decision-makers and technical experts from respective nations. The representatives were the Ministers and other decision-makers responsible for policies and their implementation back home. Water resources planning, project authorization and the level of funding are all essentially political processes. Planners may decide the feasibility of the project, but politics decides the implementation of the plan.

It is frequently not realized that what distinguishes United Nations conferences from other international conferences is that they are action-oriented. There is considerable practical action before the conference, followed by implementation of the different recommendations to varying degrees afterwards. The Water Conference will have a profound impact on thinking and practice for the rest of this century.

Implementation of recommendations requires funding and the need for large-scale assistance to developing countries was repeatedly stressed. Documents prepared for the Conference indicate that for agricultural water use, the investment required for a 15 year programme is of the order of \$97 billion, that for the assessment of resources \$9 billion, and for community water supplies and sanitation \$132,940 million to meet the 1990 Habitat target. Although most of this money is to be provided by national budgets, most developing countries indicated that this level of investment was far beyond their capability and stressed the need for financial assistance. While donor countries rejected a new fund and few pledges were made, governments did express their intentions to increase funding through existing multilateral institutions and bilateral programmes. In donor countries with a democratic system of government, pledges are not definite anyway, and have to be ratified by parliament. Some Western nations admitted privately their preference for increasing bilateral funding. Recipient nations, however, tend to prefer assistance from international organizations which comes with no strings attached. There are valid arguments on both sides.

Although the financial figures appear formidable, they can be obtained if there is the political will. Equal and more money is constantly being found for other areas of expenditure. The money could easily be obtained by diverting a fraction of the money from armaments expenditure. As Barbara Ward has frequently emphasized, the human race might have clean water and adequate food by the end of the century for \$30 billion a year, one-tenth of the \$300 billion spent annually on armaments.

As several delegations pointed out, the available resources could be used more efficiently both by governments and agencies. Costs could be reduced in many instances by resorting to local manpower and materials. Most developing countries manufacture little or no construction equipment and import it with scarce foreign exchange, while much of the work could be done by labour, also reducing unemployment. Measures to renovate irrigation schemes and eradicate water-borne disease can also be highly labour-intensive. Once countries train more of their own professionals, fewer expensive foreign consultants would be required.

Secondly, there is at present money available for water resources development which is not being used because developing countries have not requested assistance. Canada has repeatedly stated that it wishes to give more money to water development, but nations, having other priorities, do not request such assistance. Furthermore, many developing countries do not have adequate expertise to plan good projects and formulate properly the project documents requesting aid. This is often the real constraint, rather than a lack of funds.

The designation of the period 1980/1990 as the International Drinking Water Supply and Sanitation Decade should help to marshal international investment in support of national action. As Mageed stated, international investment from 1971-1975 has been too low; for example, for community water supply only 12 per cent of urban costs and 9 per cent of rural costs. If the Decade is properly planned and further interest generated, there is no reason why in many countries the Habitat objective should not be attained. Although ideally the provision of rural water supply and sanitation should be part of an integrated rural development programme, this approach, though cheaper, would add considerably to the time necessary for implementation. Estimated populations of Third World nations with services are shown in Table 2.

Table 2. Estimated populations* of developing countries in 1975 with reasonably adequate community water supply and sanitation services

	Population served (from WHO survey)				
	Total population (UN estimates) in million	Community water supply		Sanitation	
		in million	%	in million	%
Urban	577	450	77	437	75
Rural	1419	313	22	209	15
Total	1996	763	38	646	33

* Not including the population of China

Source: Report on Community Water Supplies E/CONF. 70/14.

The situation varies considerably from country to country. In Africa, some countries like Tanzania and the Sudan are already implementing programmes for rural water supply, while in others not even plans have been formulated. The adoption of action programmes concerning drinking water supplies and agricultural water use were two of the major achievements of the Conference, affecting directly the basic needs of the most impoverished people.

The magnitude of the task of expanding and maintaining irrigated areas in the developing market economy countries is staggering, as can be seen from the programme to be executed by 1990 by the United Nations:

22 million hectares of new irrigation.

45 million hectares of improved irrigation.

78 million hectares of drainage.

440 thousand million cubic metres of additional irrigation water.

97 thousand million dollars of investment, at 1975 prices.

These investment costs, it must be realized, do not include irrigation costs in the developed world of an estimated 23.1 million hectares of new irrigation and improvements of 41.3 million hectares of existing irrigation.

Will the world provide this funding? A more realistic question is whether the world can afford not to provide it, when the global consequences of the resulting starvation are considered. What action will be taken remains to be seen.

It is only now that we are beginning to see the concrete accomplishments of the World Food and Population Conferences. The International Fund for Agricultural Development which, at the Food Conference, appeared almost a lost cause, is about to commence operation. At its disposal over the first three years, is an initial operating fund of 31 billion, much of which will be available for irrigation. Although a fertilizer fund had been discussed for years, it was not until after the World Food Conference that the International Fertilizer Supply Scheme was created. Frequently World Conferences act as such a catalyst for action both internationally and nationally. The plan to make the Sudan not only self-sufficient in food production, but also the bread-basket of the Arab world is a case in point. Similarly, the Water Conference will undoubtedly contribute to the acceleration of water resources development.

It may be considered a concrete achievement of the Conference that no new organization was created. Currently, United Nations agencies cover a wide spectrum of water development and another body might well create more complications than facilitate water development. What is necessary is better co-ordination of the United Nations system. The report *Present and Future Activities of the United Nations System in the Water Sector (E/CONF.70/CBP .4)** contained in the proceedings provides details of the constraints that must be overcome. Even though these constraints are rectified, problems will continue as long as governments give conflicting direction to the governing bodies of the different United Nations agencies and organizations, resulting in a competitive approach to development. For example, a Ministry of Health determines direction for WHO, while a Ministry of Agriculture gives direction to FAO, and so forth, but the approaches to water development of these Ministries are not co-ordinated by their national governments. Until governments co-ordinate their policies at the national level, co-ordination at the international level is unlikely to occur.

The Conference was too broad a forum to deal constructively with such a complex issue as shared water resources, and the problem remains a divisive political issue. Countries had difficulty in agreeing upon the term *shared water resources* and there was very little substantive discussion. Though many countries claimed to have co-operation policies, the reality of the situation is quite different.

In comparison to other UN World Conferences in recent years, the Water Conference was marked by little political confrontation and had by far the smallest budget among those which have been held. Much of the success of the Conference must be attributed to the Secretary-General, Maged, who was appointed less than a year before the Conference. Considering the short time available and the rather modest budget, Maged did an outstanding job. He was assisted in his efforts by a small, but highly competent secretariat, especially his technical secretary, Enzo Fano.

Since the Conference, the Committee on Natural Resources (CNR) decided at its May 1977 session to recommend to the ECOSOC that the CNR should meet in special

*See *Water Development and Management*, edited by Asit K. Biswas, Pergamon Press, Oxford, 1978.

session in 1978 in order to deal with the subject of water, as a follow-up to the Water Conference. As Mageed stated in his opening address to the Water Conference, the ultimate success of the deliberations of Mar del Plata will be determined by their influence on the course of events over the next two decades. The development of water resources, he concluded, was an important means of combating "under-development" and the turmoil it created in the greater part of the globe, thus contributing to the greater well-being of mankind.

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