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**AGENDA 21 AND INTEGRATED WATER RESOURCES MANAGEMENT IN
LATIN AMERICA AND THE CARIBBEAN ***

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I. INTRODUCTION

The purpose of the present document is to make a number of observations as regards the degree of adherence by the Governments of Latin America and the Caribbean to the agreements in chapter 18 of Agenda 21 and, in particular, to ascertain whether follow-up activities are being undertaken with a view to compliance with the goals fixed for the year 2000 concerning integrated management and use of water resources. These goals are as follows:

- i) the design and launch of national programmes of action, with defined costs and goals, and the setting up of appropriate institutional structures and legal instruments;
- ii) implementation of efficient water-use programmes with the aim of achieving sustainable schemes of water resources development.

These actions should be undertaken on the basis of the conditions currently prevailing in the different countries of Latin America and the Caribbean, the backgrounds and circumstances of which are extremely diverse. There are many historical cultural, social, economic and structural factors which either stimulate or hinder social investment and participation in the development and conservation of water resources. It is a well known fact that institutional, economic and legal considerations play a preponderant role in the integrated management of these resources.

1. Water resources in Latin America

Water is used for human consumption, sanitation, the generation of energy, production in the farming and manufacturing sectors, transportation, recreation and the maintenance of environmental systems. Water, as a natural resource, has a set of very unique characteristics, since it constitutes one of the principal means by which environmental impacts are transmitted and is present in all ecological systems. Until recently, in the essentially wet region of Latin America and the Caribbean, water has been treated as an abundant resource. Such a misconception takes on special importance when efforts are made to address the problems of growing demand, competition for the use of water among sectors and, especially, water pollution.

The average annual rainfall in the region is estimated at 1,500 mm, which is more than 50% above the world average. More than 90% of the population of Latin America lives in areas that receive between 500 and 2,000 mm of rainfall annually, which shows that nature was generous in its endowment of water systems. Nevertheless, as always occurs, the spatial distribution of rainfall and rivers is sufficiently diverse as to result in the existence of areas with serious problems of water excess, characterized by flooding, alongside areas of major water deficit, in which irrigation constitutes the only means of maintaining viable social systems.

a) Water resources development

According to estimates by the Food and Agriculture Organization of the United Nations (FAO), the total irrigated area in Latin America and the Caribbean stood at almost 15.9 million hectares in 1991, equivalent to a little more than 10% of the arable land, farmland and permanently cultivated lands combined.

United Nations studies indicate that the net installed capacity for producing hydroelectricity in Latin America and the Caribbean amounted to almost 98.8 million kilowatts in 1991. This is equal to just over 12% of the region's economically exploitable hydroelectric potential.

According to recent calculations by the Pan American Health Organization (PAHO), some 333 million people, representing 80% of the urban population and 53% of the rural population, have access to supply of drinking water and almost 285 million, representing 74% of the urban population and 30% of the rural population, have access to sanitation services.

Even though the above figures imply a relatively low rate of overall use of water resources, use has been increasing in recent decades and, at the same time, there have been major changes in the sectoral composition of demand for water. Particularly noteworthy are the increases observed in urban demand, which unfortunately are accompanied by growing levels of water pollution.

b) Water management

In most Latin American countries, responsibility for the management of water resources is shared by several institutions. In turn, a number of regional bodies are devoted to a given common use. It is also quite usual for ever present problems such as water pollution to figure on the agendas of a great many institutions, centralized agencies, municipalities, irrigation departments, water supply companies, hydroelectric companies, etc. Pollution is the issue for which responsibility is spread over the greatest number of institutions. This entails the need in most countries for agencies able to take charge of coordinating institutions with a view to achieving integrated water resources management.

2. The recent economic crisis in the region

In the last decade, the majority of countries in Latin America and the Caribbean have suffered setbacks in the economic and social spheres. As countries entered the 1990s, they faced the burden of the recession that took place in the 1980s, a growing government deficit and other long-standing problems such as the external debt. The magnitude of the slump was such that ECLAC termed the period the "lost decade".

This process of economic decline was characterized by the following phenomena:

- * Persistent deficits in government budgets and in the balance of trade. The State is living beyond its means;
- * Debt accumulation, both internally and externally, by the private and public sectors alike. The level of debt is out of all proportion to national income and debt servicing has become unsustainable with the result that there is no possibility of paying it off;

- * Rising inflation, as the result of the fact that the growth in money supply has been above that of real output. The monthly increase in general prices levels has exceeded the 10% mark in a number of countries, resulting, in some cases, in hyperinflation;
- * Overvaluation of the currency, to the extent that the local currency is rising faster than the exchange rate;
- * Trade deficits, due to the fact that imports expand faster than exports.

It should be stressed that these processes strongly affect the manner in which resources are allocated for the provision of basic services, such as education and health, and for addressing environmental problems, etc. Water resources play a key role in this issue. All these aspects are relegated to the back burner, in the face of the extent of the crisis and the pressures generated by the need to stabilize the economy.

3. Water resources management in an economy in crisis

When severe economic recession hits a traditional Latin American country, where the State is responsible for the bulk of water resources management, the entire range of available economic adjustment instruments is called upon. Many of the adjustment tools prove unworkable in times of crisis and instability, since rising inflation rates generate the familiar Tanzig effect, leading to a significant reduction in government revenue in the short term. This is accompanied by a lag in the real value of rates charged for delivering public services, such as water, electricity, etc. These lags in rates lead to a drastic reduction in the operating capacity of the enterprises which administer the services. Consequently, situations arise whereby it is not even possible to finance operating and maintenance costs.

In conditions of relative stability, periods of financial imbalance in these companies have been overcome to some degree by government budget allocations, either by way of subsidies or by temporary financing arrangements that deal with short-term economic problems. Nevertheless, in periods when there is a growing need for adjustment, central Governments take steps to limit and reduce expenses to the greatest degree possible. This means that the financial requirements of public-sector enterprises are neglected and, short of resources, they become indebted (serving only to worsen the overall problem), postpone or discontinue investment and neglect maintenance. This, in turn, leads to a situation characterized by a growing failure to meet demand, a reduction in the quality of the services offered, and a general deterioration of administrative infrastructure.

At the same time, wages in the public sector lose ground, prompting the departure of some competent managers with administrative, technical or entrepreneurial skills. This causes a deterioration in the quality of human resources at management levels in the industry and in water services. Current experience in Brazil and Argentina indicates that this drain of human resources and the general deterioration at the organizational level have a prolonged effect over time, since it takes a long time to regain standards of efficiency in management.

This trend towards decay in both the quantity and quality of the range of services leads to crisis in the systems. The public image of service companies deteriorates to such an extent that there is a general consensus in the community concerning the need for profound change. In this regard, private-sector companies come to be seen as an option for inducing truly beneficial change in terms of improved

service and efficiency. As a result, beginning in the late 1980s, most countries in Latin America have embarked on the privatization of their large public enterprises.

The structural changes undergone have led to a thorough reorganization of government institutions, clearly characterized by the leading role assigned to private capital in the provision of services, as well as a greater trend towards decentralized management of natural resources and the environment. This is accompanied by the requirement, born out of the crisis, for services to be self-financing; accordingly, the rates structure in place must at a very minimum cover operating and maintenance costs and, in most cases, capital costs associated with the expansion of systems. In situations where this holds true, explicit subsidies are incorporated for purposes of redistribution, for example in Chile, Mexico and Colombia.

4. The water industry and integrated management

Government in Latin America and the Caribbean has traditionally been organized on a sectoral basis. So it is that the Government has specialized in activities related to the uses of water resources, the most important of which normally include hydroelectricity production, provision of drinking water, and irrigation as well as other forms of use. Of this range of activities, the generation of hydroelectricity is generally the most systematically developed and modern in the countries of the region. The next most important activities, in terms of the level of development, are water supply and sanitation services, although these are characterized by contrasts in development in the region. The least well developed activity, in terms of aspects such as technology, organization, and finance, is irrigation. It is very common in Latin America to find that so-called "private irrigation" is much more developed, both in practice and at the institutional level, than government projects.

There is a notable absence of an institutional framework that provides for integrated management of water resources, though efforts are being made in this direction. While environmental ministries or independent authorities may meet an unsatisfied social need, they have yet to achieve their broader objective. One major exception in this respect is Mexico, where the water industry has always been under a single authority. This arrangement was reinforced in 1989 with the creation of the National Water Commission, which is taking the lead in the decentralization that is being brought to bear in the sector. The rest of the countries have yet to overcome the formidable barrier represented by institutional coordination.

The most drastic consequence of this lack of integrated management is its effect on the least protected element, the environment associated with water resources. Given the public good nature of the water environment, it can only be conserved through budget allocations or community action. Normally, it falls within the jurisdiction of a multitude of administrative agencies, none of which can rarely give it priority. Even though this situation fosters the emergence of non-governmental organizations, it must be noted that in the absence of appropriate institutional development, the environment will continue to deteriorate in a possibly irreversible process, or at any rate the cost of reversing this process may well become prohibitive.

5. Riverbasin management as an instrument for sustainable development and integrated water resources management

Recently a new concept has emerged: sustainable development. This concept is based on the notion of intergenerational equity, which means that the current generation should not compromise future generations' chances of obtaining the elements vital for the satisfaction of their material needs and for their enjoyment of a healthy environment.

In this context, the idea of integrated natural resources management emerges once again, this time with the focus on riverbasins. The idea is to integrate, within the area defined by a water system, the management of all the resources (at least water and soils) and other components of the environmental systems found within the riverbasin.

Although chapter 18 of Agenda 21 contains recommendations with respect to water based largely on a sectoral point of view (drinking water, sustainable urban development, sustainable rural development, etc.), it also does, however, emphasize the importance of riverbasins; thus paragraph 36 states:

"The complex interconnectedness of freshwater systems demands that freshwater management be holistic (taking a catchment approach)".

Many countries in the region are incorporating the water resources approach of managing from the perspective of riverbasins, since this makes it possible to identify and deal more easily with the externalities generated in the environmental system, both on account of the effects of water management on other resources, and those which, being exogenous to the water sector, have an impact on it.

For example, Colombia has several examples of riverbasins which are managed by an integrated administrative system; these have proved very successful, and as a result new environmental legislation bears its imprint to some extent. Chile has decided to develop the management of riverbasins as a means to permit that water systems detect and take account of externalities, something that the market for water alone cannot do. In Brazil, the experiments that are proving to be the most successful in the domain of water resources management are those which are being carried out at the riverbasin level. In Mexico, riverbasin management is sponsored by the relevant authority as a desirable complement to water management.

It is clear that in federal countries, which are characterized by many levels of government, integrated management of water resources is more feasible and straightforward when carried out at the riverbasin level.

II. WATER RESOURCES MANAGEMENT IN SELECTED COUNTRIES

A. ARGENTINA

1. Introduction

Between 1975 and 1990, Argentina suffered a severe economic crisis, with serious deterioration of the regional economies and unprecedented low levels of investment, and suffered two significant bouts of hyperinflation. As a result of this economic recession, there has been considerable neglect of the environmental issue and water resources management in general.

The process of industrialization which began in Argentina in the 1930s has resulted in a totally imbalanced spatial distribution of economic activity. More than 70% of the population of almost 33 million inhabitants live in the humid Pampa and of these, almost half or 11.5 million live in Greater Buenos Aires. Although it is true that the greatest environmental problems are to be found there, the same situation occurs, though to varying degrees, in all the provincial cities with populations of over 50,000.

Many urban settlements are located in high-risk areas and this, together with uncontrolled urban expansion, generates environmental problems. Less than 40% of the urban population has access to sewerage systems while some 3,600 rural communities have no such facilities at all. One of the major consequences of this situation is the prevalence of infectious and contagious diseases. As a result, the country has a general morbidity index of 8.7%, compared with 1% in countries which have successfully met water supply and sanitation needs.

Almost half of all manufacturing activity is concentrated in Greater Buenos Aires, located in a haphazard, unsuitable fashion in residential areas. The lack of prevention and control of pollution results in a situation where the effects of manufacturing activity are very dangerous: meat processing plants, tanneries and large numbers of small and medium-sized industries all use large quantities of water and produce major volumes of organic and chemical effluents, with consequences which are highly risky for health and the quality of life. Recent cases of pollution by dangerous toxic products have resulted in several deaths.

For the reasons outlined above, pollution levels in the rivers that flow through Buenos Aires are extremely high; indeed, the rivers could be described as open sewers. These rivers flow through densely populated areas and flow into the River Plate in the most primitive fashion, absolutely untreated. The effluents they contain pollute the shores and the water of the River Plate, generating serious risks for the intake of drinking water for the Greater Buenos Aires area. This situation is repeated to a greater or lesser extent in all inhabited areas throughout the country.

The expansion of agriculture over the last 80 years has resulted in the loss of almost two thirds of Argentina's forest resources. At the same time, this resulted in soil erosion threatening significant areas of agricultural production and endangering many sources of water. It is known that almost half of the surface area of the country suffers from wind and water erosion; water erosion, in particular, affects the humid pampa. Only recently have conservationist practices been disseminated and applied in farming.

Moreover, there is a problem with desertification, in many cases caused by poor management of irrigated areas in the arid and semi-arid parts of the country. There is a widespread salinization problem caused by incorrect practices as well as the lack of drainage. Similarly, the quality of major sources of groundwater is also deteriorating.

2. Environmental policy

The situation described above has been largely ignored in the political and institutional arena. In fact, the problems of urban and industrial pollution have never been properly addressed in Argentina, although there have been some unsuccessful attempts over time. The picture is the same as regards most environmental problems in rural areas.

It can be stated that the problems of environmental deterioration in Argentina are mainly due to the lack of suitable policies and legislation in the domain, together with inconsistent and inefficient enforcement of the existing regulations. This is compounded by the lack of available information and inadequate public awareness of the nature and magnitude of environmental problems.

At present, there is no specific policy on environmental or natural resources management in Argentina, nor is there any general legislation on the environment. The clearest statement of the country's approach to the environment is expressed in the decree creating the Secretariat of Natural Resources and the Human Environment.

Environmental policy objectives must be consistent with the country's constitutional make-up, under which ownership rights of water and other natural resources pertain to the provincial Governments. This implies that they are directly responsible for preserving the quality of the environment in their areas of administration. Any federal law, therefore, would need the support of the provincial Governments to achieve its objectives.

This pattern of ownership of natural resources and, therefore, of responsibility for the environment, has both advantages and disadvantages. Disadvantages of this division of responsibilities among institutions include the fact that this situation has given rise to many conflicts and has generated an extremely diverse basis for managing the resources of the country, as many provinces have paid little attention to the issue resulting in significant weaknesses in the institutional development of the sector. The advantage of this division of responsibilities lies in the fact that it facilitates the current process of decentralization of decision-making in this sphere, since the provinces with the more advanced strategies concerning the environment and conservation of their natural resources can take measures more quickly.

3. Institutional aspects of the environment

Important steps have recently been taken to control the deterioration of the environment described above. Most noteworthy of these have been the establishment of the Secretariat of Natural Resources and the Human Environment and the enactment of the law on hazardous wastes.

a) The Secretariat of Natural Resources and the Human Environment

The Secretariat of Natural Resources and the Human Environment (SRNAH), established in 1992, reports to the Office of the President and is responsible for coordinating environmental initiatives at the federal level. The responsibilities of the Secretariat include protection, conservation, monitoring and prevention with respect to water resources at the national level. This new entity replaces the Department of Environmental Policy and the Department of Natural Resources which previously formed part of the Department of Agriculture and Livestock Production of the Ministry of Economic Affairs.

The Secretariat of Natural Resources and the Human Environment (SRNAH) was faced with limitations from its inception. As a new organization, its budget is still quite modest. Moreover, its workforce is highly biased in favour of administrative staff, who make up more than two thirds of the total. This reduces both the technical abilities and the performance of the agency. Moreover, only a small percentage of the few professional staff that it does employ have academic qualifications in environmental subjects. This is partly due to the fact that the staff has been transferred from the original agencies mentioned above. The National Institute of Water Sciences and Technologies (INCYTH) comes under its authority.

b) The provincial Governments

The Governments of the provinces, as well as the municipalities on occasion, have agencies that deal with environmental questions. In some provinces, these agencies are more developed than their federal counterparts. Moreover, there have been occasions when agreements on environmental legislation have been signed among provinces in order to develop consistent regional policies on the issue. The provinces of La Rioja, San Juan, Mendoza and San Luis provide a case in point.

Although several provincial Governments have given priority to environmental questions in response to public concerns, the policies thus formulated have not established explicit links between economic, educational and social policies. At the same time, though many provinces have designated authorities to be responsible for implementing existing legislation, these agencies face major limitations in terms of staff training and technical proficiency, and this prevents them by and large from attaining their goals. The agencies lack the administrative ability for turning overall policy statements into regulations and procedures that provide for implementation.

c) The Federal Environmental Council

The Federal Environmental Council has recently been created, made up of the existing provincial environmental entities, together with the Secretariat of Natural Resources and the Human Environment. The main purpose of this Council is to provide for an agreement on the environment at the federal level.

The middle of 1993 saw approval of this agreement, whose objectives are to promote environmental policies at the national level, establish a framework for agreements between the federal Government and provincial Governments and to streamline environmental protection and make it more efficient, in accordance with the principles of Agenda 21.

Although the present agreement is more an expression of good will than a guide for future action, the fact that it was signed is an important step towards the development of a consistent environmental policy with agreed specific programmes.

d) Law on Hazardous Wastes

Legislation has recently been passed to control hazardous waste emissions, which are mostly of industrial origin, which pose a threat to human health or to the environment. This set of regulations has given rise to a large number of legal cases and this, in turn, has prompted large industrial plants in Greater Buenos Aires to implement measures to deal with the treatment of waste. Nevertheless, it will be a long time before the current regulations are fully implemented.

4. Water resources policy and management

The Constitution of 1853 created a system of government that is representative, republican and federal and affirmed that water resources are part of public property. In Argentina, the main responsibility for water resources management lies with the provinces or the municipalities, except where these resources are interprovincial or international waters. The result is a complex system of federal, provincial and municipal institutions with jurisdiction over water resource management. As a result, each province has its own policy and set of management practices.

a) Institutional structure

The administrative reform begun in 1989 was aimed primarily at reducing the public sector and has left the water sector without a high-level institution to represent it. It went from being a State Secretariat (Vice-Ministerial) to an Undersecretaryship in the early 1980s, but remained attached to the Ministry of Public Works and Services. In 1990 it was given the status of National Directorate and made subordinate to the Ministry of Economic Affairs.

In recent years, management at the federal level has been quite anarchic. Agencies from the Ministries of Health and Social Welfare, Interior, Economic Affairs and the Secretariat of Natural Resources and the Human Environment (SRNMA), among others, have taken action independently and in an uncoordinated fashion. The seriousness of this situation is highlighted in cases such as the outbreak of cholera, when all the agencies involved attempt to join the fight, but their efforts prove inefficient and lacking in continuity.

b) Integrated water resources management and riverbasin management

Argentina has had no significant experience in integrated water resources management, since historically management of the resource has been strictly sectoral. There have been a number of experiences with respect to riverbasins, in which the various relevant agencies and other interested parties have been represented on Riverbasin Committees, with a view to the implementation of integrated water management in both its quantity and quality aspects. Most of these experiences have been unsuccessful, in that the agencies created at the riverbasin level have not had authority to handle financial resources, and have been dependent, both from the administrative and financial points of view, on the federal Government and the various provincial Governments that created them.

In spite of the unfavourable context in which these attempts have been made, there have been some valuable experiences; these include those of the international River Plate Riverbasin Agency, the Bermejo River Regional Corporation (COREBE), the Colorado River Interprovincial Commission (COIRCO), and the San Roque Lake Riverbasin Committee among others. Nearly all these experiences have resulted in progress in the form of agreements and joint plans among the parties involved in the riverbasin and, in some cases, substantial investments have been made to overcome various types of problems. However, integrated water resources management has not yet become a reality. The decentralization currently being implemented in Argentina has given a considerable stimulus to this sort of association based on the establishment of riverbasin committees or agencies.

As in the case of the environment, the water industry is better organized at the provincial level than at the federal level. While the more developed provinces are characterized by predominantly sectoral water management, initiatives are currently being carried out to reach an organizational level providing for integrated water resources management. This is happening in Corrientes, Jujuy, Mendoza, Salta and San Juan, all provinces that have begun to coordinate their institutions, some of them forming what are known as "Water Offices". Today these initiatives are characterized by the motivation of their actors and their investment capacity, and for this reason efforts to support their institutional and technical development are high priority.

5. Water use by sector

a) Water supply and sanitation

Until 15 years ago, the supply of drinking water and sewerage systems was undertaken by a national company, the National Sanitation Works (OSN), through a system of regional branches and operational agencies in the most important centres. With the advent of decentralization in 1980, responsibility for administration of the industry was transferred from the federal Government to the provinces. This process was sudden and in some cases traumatic, due to scanty institution-building in the provinces, and the poverty of the population. In most cases, responsibility for this new plan was taken on by the provincial Governments, and sometimes by municipalities, which continued to deliver these services. The original company with nationwide coverage remained in existence, but only to service the federal capital and in thirteen districts of Buenos Aires province. Finally, in 1993, this company was privatized by concession.

It should be stated that no significant development of this sector has occurred in the last 15 years and that increases in coverage have been slight and generally achieved at the cost of the deterioration of the existing systems. In 1993, barely two thirds of the total population had access to drinking water, and only one third enjoyed access to sewerage systems. The limited coverage of sewer networks and the lack of sewage treatment pose a huge risk, in the light of the outbreak of cholera; already there have been more than 2,000 cases of cholera in Argentina, as well as other gastrointestinal diseases.

Only rarely do there exist medium- or long-term plans to develop the sector at the provincial level; nor is there any financial policy that would facilitate expansion of services, outside of the role performed by the Federal Council on Potable Water and Sanitation (COFAPyS), responsible for coordinating drinking water and sewerage programmes.

The inefficiency of the agencies responsible for these services has created an environment that is favourable to the current privatization process. It needs to be borne in mind that privatization, in the Argentine context, refers not to the transfer of assets to the private sector, but rather the granting of a concession to a private entity for the administration and operation of the systems. Concessions are granted for a given number of years, generally 30, and it is stipulated that the concessionaire comply with basic standards concerning inter alia water quality and pressure, the state of effluents before final discharge and coverage targets.

Argentinean experience indicates that cooperatives have been the most successful institutional arrangement for the provision of drinking water and sanitation services, particularly in rural areas.

b) Irrigation and drainage

In Argentina, irrigation is the responsibility of the provincial Governments; this notwithstanding, the National Water and Electricity Corporation (AYEE), a former public company, was in charge of a number of irrigation districts. The manner in which irrigation is managed is characterized by great diversity. Each province has its own history and culture of irrigation, as well as its own management institutions. A number of very centralized organizations exist alongside autonomous, corporations, state enterprises, etc. User participation has taken many forms, ranging from direct involvement in water management, as in Mendoza and San Juan, to the role of mere user, as formerly occurred in organizations in Salta and Jujuy. In many provinces, where irrigation is not important, no specific entities have been created.

Currently, in the wake of privatization and dismemberment of AYEE, the provincial Governments have taken over the management of all irrigation districts. At the same time, as part of the process of government reform, management of the systems has begun to be transferred to the irrigators; in many cases, such as Salta, these initiatives are being promoted by producer organizations. In Mendoza, where water management has been decentralized for more than a century, steps are being taken to confer on the irrigators those functions and responsibilities that presently still pertain to the central authority.

c) Hydroelectricity

Until 1990, the hydroelectricity industry was administered by the National Water and Electricity Corporation, responsible for the development of Argentina's hydroelectric infrastructure and for energy management, and by several regional companies; the most important of these was Hydroeléctrica Norpatagónica, S.A. (HIDRONOR), a public corporation whose main responsibility was the hydroelectric generation from the water resources located in northern Patagonia.

During the previous Government's term in office, privatization of the industry proceeded apace. An institutional framework was set up to regulate the industry, comprising the Ministry of Energy, which sets policies for the industry and has administrative responsibilities regarding generation, transport, distribution, rates, bulk users, despatch and other issues; the National Electricity Regulatory Agency (ENRE), whose main functions involve monitoring and encouraging competitive practices, quality control, entry into and exit from the industry, and questions concerning charges; and the Compañía Administradora del Mercado Mayorista Eléctrico Sociedad Anónima (CAMMESA), primarily in charge of coordinating despatch operations, setting wholesale prices and administering the economic transactions performed via the National Interconnected System.

There are also specific institutions established to carry out projects involving other countries, such as the Joint Argentine/Uruguayan Technical Commission for Salto Grande and the Joint Yacyretá Commission, in charge of building and operating the Yacyretá dam between Argentina and Paraguay.

d) Water pollution

The issue of water quality has long been ignored in Argentina, with a variety of agencies having jurisdiction; the spheres of responsibility of these agencies are characterized both by excessive overlapping and by the fact that vast areas are not covered.

The federal agency responsible for this area is the Secretariat of Natural Resources and the Human Environment, which at present is involved in the restoration of the most polluted rivers in Buenos Aires; a total of US\$ 150 million has been allocated for this purpose. Furthermore, this agency has just signed a loan agreement for more than US\$ 30 million mainly to finance institution-building geared towards environmental management, with a particular emphasis on industrial pollution and riverbasin management.

Since water pollution management is a provincial responsibility, progress on the issue varies widely over the country. One of the most advanced provinces is Mendoza, which has recently enacted a general environmental law, together with a law dealing specifically with water resources. The latter provides for the Mendoza Sanitation Works, formerly a provincial enterprise, to become a joint-stock company, on a legal basis similar to that found in Chile. In addition, the Provincial Water Supply and Sanitation Agency (EPAS) was set up, with responsibility for:

- i) establishing the regulatory framework and supervising all drinking water supply and sanitation companies; and
- ii) monitoring and controlling water quality in the province, and for assuming the central role in water pollution control.

B. BRAZIL

1. Introduction

Brazil is endowed with large quantities of fresh water, equivalent to 20% of the world total. The country has enormous potential for hydroelectric development and irrigation. However, the distribution of the water is far from even. The semi-arid and arid north-east has only a few months of rain per year and suffers from frequent droughts. Other areas have excess water, as a result of which they routinely suffer from problems associated with floods and landslides.

The accelerating increase in the population, the extensive industrialization that has occurred in the country, and the resulting expansion of the cities, together with the significant economic development that has taken place over the last decade, have all created growing demand for water. The use of water resources for hydroelectric, irrigation, domestic and other purposes, has not been managed in a comprehensive fashion; rather sectoral management has been the order of the day. Although irrigation represents the most important use of water in terms of volume, most of the water systems are operated in accordance with the needs for hydroelectricity, notwithstanding important exceptions.

As a consequence, the development of water resources has been marked by the absence of comprehensive, system-wide management. Competing uses for water, competition between states that share riverbasins and other similar situations have all generated a growing number of problems and there is still no legal or regulatory framework that would satisfactorily address these.

As in other countries, most urban and industrial sewerage systems dump effluents directly into rivers without any sort of treatment. This pollution problem is extremely serious in virtually all the large cities, and particularly so in São Paulo.

The majority of water intakes for irrigation, the functioning of small hydroelectric plants, as well as most intakes set up in various sources by the private sector —many of which operate through pumps— have been installed without any authorization or the appropriate registration. Many town councils responsible for drainage systems act in a similar way, and are not overly interested in the environmental impacts generated.

2. Water resources in the 1988 Constitution

According to the new Constitution, water is a public good, as is hydroelectricity. The development of water resources is, therefore, a prerogative of the federal Government, which coordinates these activities with the states, with benefits distributed among the state, federal and municipal Governments. The federal Government is also responsible for interstate waterways, as well as for disaster prevention, particularly with regard to floods and droughts. The federal Government's role is to create a system for managing water resources at the national level and to establish criteria for the granting of water rights. The formulation and implementation of social and economic development plans fall within the sphere of competence of the federal Government, which has sole responsibility for water legislation. However, this responsibility can be delegated.

The federal, state and municipal Governments are jointly responsible for environmental protection, health care, pollution control, the alleviation of poverty and social integration. They also share responsibility for the registering, follow-up and monitoring of water rights. The rules governing cooperation among the different levels of government must be determined by federal law, in accordance with the Constitution.

All three levels of government can legislate in the areas of pollution control, resource conservation and environmental protection. The federal Government is responsible for basic law while the states can enact supplementary legislation. In the absence of federal legislation, the states have full authority to administer water use in accordance with their particular set of circumstances. The waters within the states, together with subterranean waters, belong to the state where they are located; interstate waters belong to the federal Government, as does water stored behind federal dams.

Article 43 of the National Constitution empowers the federal Government to create development zones in low-income regions during periods of drought, in which priorities for water use must reflect considerations of an economic or social nature. In these zones, the role of the federal Government is to promote the reclamation of arid lands, cooperating with the owners of small- and medium-size farms to locate sources of water and small irrigation systems .

3. The proposed Water Law

State and federal Governments are currently discussing proposed legislation, based on the above-mentioned constitutional principles. Some states have already enacted their own legislation.

The bill on national water resources policy, which was submitted to National Congress in 1991, provides for the creation of a national system for managing water resources, and the allocation of the necessary funds.

The key merit of this bill lies in the fact that it creates an environment conducive to the formulation of a National Water Resources Policy, in order to ensure the harmonious integrated use of water resources, and to promote the development and well-being of Brazilian society.

The policy instruments specifically set out comprise the granting of rights to use water resources, charging of rates for water use, cost recovery for multiple-purpose projects and the setting-up of areas for the preservation of public springs and sources of water for human consumption. In addition, it is stipulated that those responsible for emitting effluents must meet standards established for pollution control.

This bill provides for the creation of a national system for managing water resources, as well as the execution of a National Water Resources Plan. The guidelines formulated for the administration of these resources are as follows:

- i) consideration of regional variations;
- ii) coordination among the three levels of government;

- iii) encouragement of the decentralization of activities through the delegation of many responsibilities of the federal Government to the states;
- iv) promotion of technical, institutional and financial cooperation among users; and
- v) encouraging participation by the communities involved.

The national system for managing water resources has the following basic structure: first, an association at the national level; and second, an association for each region; it also involves riverbasin committees and an executive secretariat. The national association is to be made up of representatives from all government agencies with responsibilities in the area of water resources, and envisages the participation of regional representatives. The national association will be responsible for formulating overall guidelines for the National Water Resources Plan and for promoting all initiatives which lead to the plan's implementation.

A special role is assigned to the riverbasin committees. These will be made up of representatives from public bodies with a particular interest in water resources, either in their use or in their conservation. Municipalities, users of water and possibly sub-riverbasin committees or user associations will be represented on the riverbasin committees.

The distribution of the 6% of royalties on the income obtained from the sale of hydroelectric power is to be maintained; the current allocation is 45% for the states and 45% for the municipalities in which generating stations are located. However, in a new development, allocations are made of some 6% to the National Department for Water Resources and Electric Energy (DNAEE), 2% to scientific and technical projects, 1% to the Special Secretariat for the Environment and 1% to the Ministry of the Armed Forces. A total of 65% of the funds earmarked to the DNAEE will be set aside for the operation of the hydrometeorological network with the balance channelled to formalizing the system of water resources management, including the formulation of projects for integrated riverbasin management. Responsibility for water resources has recently been transferred from DNAEE to the Ministry of the Environment.

The project has generated a number of responses, some of which are outlined below:

- i) pressures for its implementation as soon as possible;
- ii) opposition to the traditional predominance of the energy sector (DNAEE);
- iii) protection of sectoral powers;
- iv) calls to speed up decentralization and decentralize water resources management;
- v) concern that several states are developing their own management systems, which has the potential to complicate the future creation of a national system; and
- vi) fear that the system proposed may be too inflexible, and may constrain the more democratic, decentralized plans adopted in some states, such as São Paulo.

4. The current institutional and administrative structure

The fact that there exist many levels of management of water resources, including the federal Government and the various state Governments, together with the existence of different water property rights, which may be federal or state, adds a dimension of tremendous complexity to the issue of water management, producing a situation that mirrors that of Argentina.

Thus, responsibility for monitoring water quantity and quality is frequently shared among several government agencies. In the case of the federal Government, for example, the agency responsible for allocating water rights is normally the DNAEE, which is under the authority of the Ministry of Energy and Mines. Irrigation rights involving waters under federal jurisdiction are the responsibility of the Irrigation Secretariat (SIR), which is answerable to the Ministry of Regional Integration, while rights on state rivers are administered by the relevant agencies in the states concerned. Furthermore, at each level of government, management responsibilities are shared among various sectoral agencies.

a) Roles of the DNAEE and the SIR

The National Department for Water Resources and Electric Energy (DNAEE) and the Irrigation Secretariat (SIR) share responsibility for water resources management at the federal level; they have reached a series of agreements to develop a joint action programme with the aim of making progress towards integrated water resources management; to begin with, they have begun initiatives aimed at standardizing the allocation of water-use rights. In addition, officials from both agencies maintain close operational links.

The cooperation which exists between the SIR and the DNAEE is based on the principles formulated at a meeting of experts conducted in 1983 in Brazil, where the need for integrated water resources management was established. Both organizations then actively followed up the international meetings held in Dublin, and later, the United Nations Conference on Environment and Development. In this regard, therefore, Agenda 21 is considered a fundamental basis for the policies that are being formulated to establish integrated water resources management.

In the near future it is probable that authority over the Irrigation Secretariat will be transferred to the Ministry of Agriculture and Agrarian Reform. This situation generates a climate of uncertainty that tends to minimize or postpone the progress made in terms of organizational development towards integrated water resources management.

The Irrigation Secretariat is a support organization of the Ministry and collaborates with entities such as the Companhia de Desenvolvimento do Vale do Rio São Francisco (CODEVASF) and the National Department of Works against Droughts (DNOCS). Administration of DNOCS projects was transferred to the Secretariat when DNOCS was abolished in March 1990. At present, the Irrigation Secretariat (SIR) has a relatively small staff, but the bulk of the technical personnel responsible for irrigation have remained on the staff, and this is a guarantee of the continuity of the steps already taken towards water resources management at the federal level.

Government strategy has been to promote equitable and efficient use of water resources, but the enthusiasm with which this goal has been pursued has depended on political and economic conditions. Efforts to achieve this objective run up against several problems, and in particular the lack of a proper

system for the granting of water rights, the absence of administrative controls for avoiding conflicts and the inadequate existing information base. There is no useful information on water resources, either with respect to quantity or quality, at any level of government. The preparation of a register of irrigators or users of water for irrigation purposes was begun in 1985 but has suffered various interruptions and is still not finished.

b) Financing and the economic crisis

One major weakness of the agencies involved in water resources management at the federal level has been the significant cutback in staff and the reduced budget on which they have had to operate during the previous Government's term in office. For example, of the 70 professional staff devoted to the general issue of water resources that the DNAEE used to employ, only five remain.

The Irrigation Secretariat (SIR) has begun negotiations with the World Bank concerning the financing of pilot irrigation projects, involving the active participation of the irrigators, and for testing decentralized self-financed management schemes.

One important consideration is that since 1989, federal laws 7990 and 8001 have stipulated that hydroelectricity companies must pay royalties, which are to be distributed among the states and the municipalities as compensation for the areas flooded by the dams. Part of the funds thus generated are channelled to the Brazilian Institute for the Environment and Natural Resources, while a further part is used to finance schemes for water resources monitoring and management.

5. The strategy and degree of development of water resources management

a) A strategy for the sector

In formulating policies for the water sector, the aim is to increase productivity and yields on irrigated lands, boost hydroelectricity generation, increase water supply for industrial and domestic uses and facilitate navigation. The National Water Resources Policy also pays special attention to the problems of flooding, drought prevention, pollution control and other environmental effects.

A review of the bills under discussion at the federal level, and of some similar bills at the state level, indicates that the central components of the strategy are decentralization, the investment by private capital, the application of cost and efficiency criteria, cost recovery and environmental protection.

b) Institution-building

Generally speaking, Brazil needs to make a major effort in the area of institution-building and must seek sources of financing to satisfy social needs; such tasks pose considerable difficulties. This situation has prompted the federal Government to instruct the Strategic Affairs Secretariat, which is attached to the Office of the President, to collaborate in the quest for sources of financing for the water industry and the building of its institutions while the discussion of the legal framework for the sector continues in Congress. For this purpose, a Water Resources Subcommittee has been established, made up of important

organizations such as the Brazilian Water Resources Association, which has made a major contribution to raising national awareness of the critical situation facing water resources and the need for implementing suitable management practices.

Despite the above, the process of formalizing a framework that facilitates integrated water resources management is extremely slow. The federal Government is actively following up the 1991 bill that will enable it to implement a national water resources policy and develop a national water resources management scheme.

While this process is taking place at the federal level, some states, such as São Paulo, Santa Catarina, Ceará and Paraná, have made significant progress towards integrated sustainable water resources management, but many others have still to tackle this task.

6. Requirements for integrated management

At present, resource planning and management in Brazil are conducted in a strictly sectoral framework, and there are very few examples of integrated development or multi-purpose management. Annex 1 analyses the cases of Ceará, Rio Doce and Paraná, where significant progress has been made. These examples aside, a great many riverbasins and water projects face problems which have yet to be adequately solved. There is general agreement that the following concepts must be included in a national water resources policy:

- i) an organization which provides for integrated management (intersectoral, interinstitutional, interdisciplinary and multi-purpose);
- ii) effective coordination of institutions;
- iii) a framework for planning appropriate water resources management;
- iv) common guidelines for designing projects and programmes;
- v) suitable criteria and procedures for guaranteeing water rights, both in terms of sources and discharge;
- vi) more accurate information, especially for the granting of water rights;
- vii) scheme for costs recovery;
- viii) user participation;
- ix) standards governing allocation and use of water, to ensure equitable distribution among states, uses and users.

The current institutional framework appears very fragmented, and is characterized by a degree of specialization in sectoral uses of water as well as by its extreme vulnerability to administrative and political changes. Moreover, in most of the states, the tasks of control and management of water quality are totally unrelated to the criteria which govern quantity allocation. The legislation focuses on

administrative aspects, and lays down basic principles concerning water rights and recognition of existing uses. Nevertheless, guidelines concerning allocation are still not established.

A national information system also needs to be created, given the requirement for a systematic operational plan for evaluating programmes and projects. Likewise, it is necessary to adopt a cost recovery plan and implement it from both the legal and administrative points of view. A system for registering water rights and discharge rights also needs to be created. It is necessary to establish principles governing conflict resolution and other situations related to watercourses crossing state lines, together with the operational regulations for federal dams, in accordance with the various uses of water. Finally, it is necessary to consolidate the authority for granting water rights at the federal level.

A real capacity for integrated water resources management has not yet been developed, given that the institutions which do exist have only sectoral jurisdiction and lack the necessary powers for intersectoral water resources management.

C. COLOMBIA

1. Introduction

The spatial and temporal distribution of water in Colombia is very varied (in the southeast of the country); the Amazonian region features rainfall above 2,000 mm while the La Guajira desert, receives less than 400 mm of annual rainfall.

Population and economic activity are less concentrated in Colombia than in most of the countries in the region. However, urban and industrial development tends to be more intense on the Bogotá plain, occupying highly productive agricultural lands. As in most of Latin America, the most critical problems of industrial and urban pollution, congestion, etc., are found in the metropolitan area of Bogotá.

There is significant water pollution, affecting both of surface waters and groundwater. The principal pollutants are organic matter, pathogenic agents and effluents from industry. The main pollution problems occur in the riverbasins of the densely populated valleys, particularly on the Bogotá plain, and in the water systems supporting coastal settlements. The Cauca and Magdalena rivers receive the bulk of the urban, industrial and agricultural pollution produced in the sierra, and their condition is similar to other large rivers of the region: high content of organic matter, micro-organisms which cause waterborne diseases, pesticides, heavy metals, etc. Water systems present a high risk of landslides, floods, and drought, the latter occurring very frequently in the northeast of the country.

The lands with the greatest development potential are located mainly in the Andean valleys, where agriculture is well developed. The use of irrigation for growing fruit, vegetables and coffee (in the sierra) and for commercial crops (on the coast), is profitable because of the increased diversity and better yields that have been achieved. It should be remembered that this region experiences between 4 to 6 months of drought annually. Of the 810,000 hectares of irrigated farmland in the country, 347,000 hectares are managed by the private sector. The rest, currently managed by the Colombian Institute of Hydrology, Meteorology and Land Improvement (HIMAT), are also set to be transferred to the irrigators.

In the Andean area, the nature of the soil and the fact that rainfall is torrential cause serious erosion. Studies carried out by the National Institute for Renewable Natural Resources and the Environment (INDERENA) in 1977 showed that 49.2% of the country's land area is moderately to severely affected by water erosion; 22.9% is affected by landslides; and only 24.8% is unaffected by erosion. Millions of hectares of agricultural land are located in areas of high risk from water erosion. Associated with this phenomenon is the problem of downstream sediment deposits, which heightens the danger of flooding and reduces the capacity and useful life of the dams through silting. There are also problems of soil salinization: it has been estimated that in the Cauca river valley 70,000 hectares have been affected by this phenomenon. In addition, problems have been recorded with alkali deposits.

In 1990, 73% of the urban population was supplied with drinking water and 65% was connected to sewerage systems. In rural areas, Colombia has one of the better water supply services in Latin America, reflected by the fact that 80% of the rural population has access to drinking water.

Colombia has vast potential to generate hydroelectricity. In 1991, this source of energy accounted for 81% of the energy produced. Some of the hydroelectricity companies are run by municipalities, while others are autonomous central Government enterprises. A public autonomous corporation, Interconexión Eléctrica S.A., plans and operates the interconnected system. Recent years have seen a reform of the administrative framework and the opening of electricity production to the private sector.

Of all the countries studied, Colombia is leading the way in making the most radical changes to its administrative and legal structure as this relates to the environment in general and water resources in particular. Colombia has changed from having a traditional government structure, organized according to sectors of social and economic activity, to one with environmental and economic development objectives, marked by clear decentralization of power and the strengthening of schemes of a regional nature; however, there is a great deal of uncertainty about what the reformed agencies will eventually look like. The definitions in the institutional and legal framework are clear, but there are a great many procedures and decisions that have to be taken in accordance with the shape and organization of the new agencies. Nevertheless, it is generally agreed that the direction of change is both favourable and desirable.

2. Recent institutional and legal changes

The most radical changes that have occurred in the recent past are, first, the enactment of Law 99, on December 22, 1993, which provided for the creation of the Ministry of the Environment and a shake-up of the public-sector agencies responsible for the management and conservation of the environment and renewable natural resources, including water resources. A national environmental system was organized, and a series of regulations, discussed below, were issued. Second, in a restructuring of the Ministry of Economic Development that occurred on December 30, 1992, the water supply and sanitation sector was given a leading role.

Together with these changes in the legal and administrative superstructure, a series of other very important changes are being made. The present moment can be defined as a turning point for the Colombian administration, and the many changes taking place are opening a whole new direction for institutions. Despite the dizzy pace of change, the process is likely to prove successful in practice, to the extent that it focuses on decentralization of the administration, the "regionalization" of decision-making, cost recovery and self-financing of most of the activities.

3. Colombia's new environmental policy

a) Principles and strategy

The general principles of the new Colombian environmental law are captured by the following statement: that "the economic and social development of the country will be guided by the universal principles of sustainable development contained in the Rio Declaration on Environment and Development of June 1992"; this is the clearest expression yet of the impact of Agenda 21 on the organization of an overall national environmental system and an integrated water resources management plan within the framework of a more general policy. In addition to the above, the first article of the law provides for the objectives of maintaining biological diversity, respect for human rights and special protection for wetlands, springs and areas of groundwater recharge/water for human consumption receives priority over all other uses. The law also establishes that the lack of scientific knowledge which hampers specific environmental impacts from being ascertained will not be sufficient reason to defer the implementation of effective measures to prevent the degradation of the environment.

Another important aspect is the stipulation for the Government to seek to take into account environmental costs as well as the use of economic instruments to prevent, rectify and restore deterioration in the environment and to conserve renewable natural resources.

The law states that the countryside must be protected since it constitutes a common heritage, that the basic tool for decision-making will be environmental impact studies and that national environmental management will, in accordance with the constitution, be "decentralized, democratic and participatory". The creation of the national environment system is decreed in the first article.

The points alluded to in the first article of the law give a clear idea of just how revolutionary the position of the Colombian Government is with respect to management in the public sector, as the authorities are not only showing their general agreement, but are taking the lead in the process of transforming the State, in keeping with the broad features that in recent times have pointed towards success: a systemic approach, rational decision-making, decentralization, participation, cost recovery and self-financing.

b) The creation of the Ministry of the Environment

The creation of the Ministry of the Environment and the national environmental system presupposes the following hierarchical arrangement: the Ministry of the Environment, Regional Autonomous Corporations, Departments and, lastly, Districts or Municipalities. It is worth pointing out the importance that is given to the role of the Autonomous Regional Corporations. The Ministry of the Environment constitutes the organization that guides management of the environment and renewable natural resources; the Ministry is in charge of promoting a relationship of respect and harmony by man towards the environment as well as defining policies and regulations concerning renewal, conservation, protection, prioritization, management, use and exploitation of the country's renewable natural resources and its environment, in an effort to ensure sustainable development. With respect to environmental protection and renewable natural resources, the Ministry of the Environment will perform the functions previously carried out by the National Institute for Renewable Natural Resources and the Environment, the National Planning Department and the Ministries of Agriculture, Health, and Mining and Energy.

The Ministry of the Environment has all the key roles in policy formulation and in coordination with other levels of administration. It should be stressed that it is the Ministry which establishes quality standards and permitted emission limits, fixes rates governing the use and exploitation of renewable natural resources, and administers the National Environmental Fund (FONAM) and the Amazon Environmental Fund.

The Ministry of the Environment comprises the five following Directorates:

- the General Directorate for Human Settlements and Population;
- the General Directorate for the Physical Environment;
- the General Directorate for Forests and Wild Life;
- the General Directorate for Land Use Planning Environmental Prioritization; and
- the Sectoral Environmental Directorate.

At the same time, the national environmental funds and a body known as the National Environmental Council, comprising representatives from all the national Ministries, as well as associations, communities and other organizations, have been set up.

c) Technological Institutes

The law provides for the creation of, or changes to, a group of institutes that provide technological and scientific support, and this has entailed a series of changes to existing institutions. For example, the Colombian Institute of Hydrology, Meteorology and Land Improvement (HIMAT) has been renamed the National Land Improvement Institute (INAT), and responsibilities in the meteorological and hydrological fields have been transferred to a new agency, the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM). The basic functions of research into natural resources, that were performed by the National Institute for Renewable Natural Resources and the Environment (INDERENA), are also transferred to IDEAM; INDERENA is to be abolished within a period of no more than two years, delegating its other tasks to the Regional Autonomous Corporations.

Four additional institutes are to be set up, dealing respectively with coastal marine research, the study of biological resources, the Amazon and the environmental systems of the Pacific.

d) Regional Autonomous Corporations

The environmental law establishes the Regional Autonomous Corporations as public-service corporations, made up of territorial units that, on account of their characteristics, constitute a single geographical ecosystem or form a geopolitical, biogeographical or hydrogeographical unit. They are endowed with financial and administrative autonomy, their own assets and legal status. They are responsible, within their jurisdictions, for managing the environment and renewable natural resources, with a view to promoting sustainable development in keeping with the overall principles embodied in the

law. As can be seen, the riverbasin criterion is only one among several when determining the geographical jurisdictions of the Regional Autonomous Corporations.

The corporations are directed by a corporate assembly, made up of all the legal representatives of the territorial units in the jurisdiction. The corporation's administrative body is the executive council, made up of the governor or the governors of the departments in whose territory the corporation operates, a representative of the President of the Republic, a representative from the Ministry of the Environment, no more than four mayors from municipalities in the territory of the jurisdiction, two representatives from the private sector, one from the indigenous, or ethnic communities, traditionally settled in the territory, and representatives from non-profit organizations that are registered in the area of jurisdiction of the corporation, and whose aim is to protect renewable natural resources.

The law validates the 15 Regional Autonomous Corporations already in existence, eight of which undergo a change of name or jurisdiction, and establishes 11 additional regional corporations, bringing the total to 34. Each corporation's executive director will be designated by the executive council for a period of three years beginning in January 1995, and will be eligible for re-election. Up until that time, the President of Colombia will appoint or ratify the executive directors of regional corporations for 1994.

The Regional Autonomous Corporations will obtain income from the following sources:

- i) pollution charges;
- ii) a charge for water use; water use will be charged for at rates fixed by the national Government and the revenue thus obtained will be allocated for payment of the costs for protection and conservation of water resources;
- iii) a percentage of real estate taxes set aside for the environment, ranging between 15% and 25.9% of the amount collected under the heading of real estate tax;
- iv) transfer payments from the electricity industry. The hydroelectricity companies with installed power greater than 10,000 kW will transfer 6% of the gross revenue from sales of energy that they themselves have generated. Of this, 3% will be allocated to the Regional Autonomous Corporations, with the remaining 3% going to the municipalities and districts located in the riverbasin, at a ratio of 50/50. Thermal power plants will transfer 4% of the gross value of energy sales; and
- v) capital and income of the Regional Autonomous Corporations.

These financing plans put the corporations on a very sound financial footing, and will, provided they are well managed, have a very significant effect on the process of decentralizing political and economic power.

The law formalizes a system of environmental permits, obligatory for building projects, the setting up of industries or any other activity that may give rise to environmental degradation. The departments will continue to be responsible for the execution of projects involving irrigation, drainage, land reclamation, flood protection and regulation of streams or waterflows with a view to appropriate management and use of the riverbasins; these departments are to coordinate such activities with the

National Land Improvement System and the Regional Autonomous Corporation in whose jurisdiction the department is located.

The law establishes procedures for participation by the public, through environment-oriented administrative procedures and a procedure for handling petitions for intervention, and provides for public hearings on pending environmental decisions. Lastly, the law institutes a system of sanctions and measures for ensuring the enforcement of the law.

e) Environmental funds

The new law establishes the National Environmental Fund (FONAM) and the Amazon Environmental Fund. These funds simply constitute a special accounting system by the Ministry of the Environment, with legal status and independent funding, but with neither administrative structure nor staff.

The objective of FONAM is to finance the execution of activities, studies, research projects, plans, programmes, and other projects of public or social usefulness designed to strengthen environmental management, preservation, conservation, protection, improvement, and reclamation of the environment and an appropriate form of management of renewable natural resources for sustainable development. Funding for FONAM will be obtained from the following sources: items earmarked for it in the budgetary law; interest on loans it grants while carrying out its objectives; funds from foreign borrowing; financial returns on temporary liquidity surpluses; income from the national system of natural parks; funds generated by the exchange of foreign debt for environmental protection or improvement projects; 50% of the amount of charges levied and collected in compensation for activities undertaken; and funds received, either as donations or other gifts, whether from individuals or institutions, local or foreign.

4. Water supply and sanitation

a) Recent changes

During the 1980s, coverage of water supply and sanitation services lagged; in the case of the former, national coverage was less than 70% while coverage in the case of the latter amounted to 65%. Until recently, an urban development financing fund had operated with responsibilities in this area, but was unable to satisfy all the needs of the sector.

Beginning in 1988-1989, the Water Supply Sectoral Adjustment Plan (PAS) was implemented, with the specific goal of increasing the coverage of water supply and sewerage systems. Loans for this purpose were obtained from the World Bank to the order of US\$ 150 million, to which were added US\$ 300 million from its own resources and central Government contributions. In 1989, Law No. 57 provided for the creation of the National Development Financing Office (FINDETER), with the aim of promoting the municipalities' ability to provide water supply and sanitation services. In 1991, this financing agency began operations by setting up 10 regional offices responsible for implementing the PAS, whose purpose is to meet the needs with respect to both physical works and institutional development. Today FINDETER operates in 600 of the country's 1,034 municipalities.

Decentralization is being conducted in accordance with the PAS and responsibility for the provision of the water supply has been transferred to the municipalities. As a consequence of these steps, the privatization and administrative decentralization of water supply systems has yielded a number of successes. One example is Barranquilla, where the government enterprise had to be declared bankrupt, because of its permanent and growing financial deficits. It has now been reformed as a semi-private company, with the private sector holding a 13% stake. The company is now self-financing and is generating profits. In other cases, too, the structure of companies have been modified to allow employees to become shareholders.

b) The current institutional framework of the water supply and sanitation industry

In December 1992, the structure of the Ministry of Economic Development was modified, with the incorporation of the water supply and sanitation sector at the vice-ministerial level. This development answered the need to provide the sector with a new institutional framework as part of the current decentralization process, as well as establish suitable regulations, and create information and monitoring systems. In addition to this vice-ministry and its corresponding directorate, an advisory and coordinating agency has been set up, known as the Supreme Council for Urban Development, Public Housing and Water Supply. Finally, the Regulatory Commission for Water Supply and Basic Sanitation was set up.

The Vice-ministry

The Vice-ministry is responsible for assisting the Ministry of Economic Development formulate policies, plans and programmes, relying specifically on the work performed by the Directorate of Water Supply and Basic Sanitation, and is in charge of drawing up a plan for sectoral development, in line with the national policy on economic and social development; providing technical and institutional assistance to sectional and local organizations; conducting research; obtaining external and domestic financing; and designing and promoting special programmes to extend services in rural and urban areas.

It must, therefore, establish the technical requirements which projects must satisfy and also the equipment and the procedures to be used by companies, when this is necessary in order to guarantee the quality of service; make annual projections concerning expanded coverage of service, identifying the required public investments; identify sources of financing for the industry; and determine the amount of government subsidies required, as well as the criteria applicable in this respect.

The Supreme Council for Urban Development, Public Housing and Water Supply

This organization comprises the Minister of Economic Development, the Minister of Health, the Director of the National Planning Department and the superintendents and presidents, managers or directors of relevant agencies.

The Water Supply and Basic Sanitation Regulatory Commission

This Commission, which came into operation in 1993 as a special unit without legal status, is the administrative arm of the Ministry. It comprises the Minister of Economic Development, the

corresponding Vice-Minister, the Minister of Health or a representative, the Director of the National Planning Department and three full-time professional advisors, nominated by the President of the Republic for a three-year term, with the possibility of re-appointment.

The functions of this Commission are: to foster competition among the providers of water supply and basic sanitation services and regulate monopolies in this area when competition is not possible; report any practices that are contrary to the regulations governing competition to the Industry and Trade Superintendency; and define efficiency criteria and develop guidelines and models for evaluating the financial, technical and administrative management of the companies providing regulated public services.

The Commission's job to establish as mandatory those technical standards which it deems necessary, set charges for regulated utilities and, when necessary, establish formulae for use by the public or private companies providing the services. The Commission may establish the extent to which charges are freely fixed. The Commission will also be responsible for establishing criteria and norms aimed at protecting the rights of users, and for billing, marketing and other aspects. It must monitor contracts in order to determine the units of measure and periodicity to be used when establishing consumption in regulated public services.

5. Irrigation and the new Land Improvement Law

The policies adopted during 1993 have resulted in important changes in the structure of irrigation. In January 1992, the Land Improvement Law was enacted, and in December of the same year HIMAT underwent a revamp in accordance with the Law of the Environment. The Government's main idea is to privatize the State-owned irrigation districts, in so far as possible, in an attempt to make them self-financing.

The purpose of this law is to regulate the construction of land improvement works for managing irrigation, drainage or flood protection, so as to improve agricultural productivity and monitor the protection and conservation of riverbasins. The authority which administers land improvement works will be responsible for obtaining the necessary concessions for the use of surface water and groundwater. The administrative unit of each irrigation district is responsible for granting use rights within its area of jurisdiction.

a) Administrative organization

The land improvement subsector will comprise the Ministry of Agriculture, the Supreme Council for Land Improvement in an advisory and coordinating role, and the National Land Improvement Institute (INAT), together with relevant private and public organizations. A National Land Improvement Fund will form part of the system, as the unit which administers funding for irrigation, drainage and flood protection projects.

The Supreme Council for Land Improvement is made up of the Minister of Agriculture, the Director of the National Planning Department, the Director-General responsible for environmental affairs and renewable natural resources, the President of the Agricultural Financial Support Fund, and representatives from research institutes, farmers and indigenous groups.

b) Criteria for project selection

INAT will serve as the Technical Secretariat of the Supreme Council for Land Improvement. The responsibilities of this Council include: selecting the projects; establishing the requirements that organizations must satisfy in executing works; establishing guidelines on forms of payment, deadlines, and other related aspects; and identifying the technical and economic parameters and criteria which serve as the basis for fixing charges for services that cover operating and maintenance costs. The Council will proceed in the same manner to determine ways to recover investments. It is also the job of the Council to stipulate the socio-economic conditions which users must meet in order to qualify for subsidies, which would be granted by way of reducing or writing off the recovery of investments.

The criteria for project selection include: the degree of interest expressed by the community where the project is to be carried out; the project's social rate of return; the location of the project with respect to ports used for export trade; and the proportion of small and medium-sized landholders.

In a parallel development, a National Land Improvement Fund (FONAT) has been created with the aim of financing studies, designs and the construction of irrigation, drainage and flood protection works. To be eligible to benefit from this law, the users in a land improvement district will be required to organize and form an association for the management and administration of the district.

Any agency which carries out works in a land improvement district has the right to recover totally or partially the investments made. A subsidy of 50% of investment recovery costs was made available for small farmers with limited ability to pay.

To sum up, it should be pointed out that, despite reform in Colombia, water resources continue to be sectorally associated with three Ministries: viz, Environment, Economic Development and Agriculture, though not now Health, and with coordination by the National Planning Department. This situation hampers an integrated approach to water resources management, and places a high degree of responsibility on the National Planning Department, the central Government and the autonomous corporations.

D. CHILE

1. Introduction

Chile has a wide variety of climatic conditions, ranging from the desert climate in the north to the glacial climate in the south. Chile's rivers are mainly of pluvial origin in winter and glacial in the spring and summer.

The run-off of the riverbasins north of 32°S is, as a rule, insufficient to irrigate all the land classified as irrigable and it is therefore necessary to build water capture and control works and to employ highly efficient and sophisticated irrigation techniques. In the central valley, between the Aconcagua and Itata rivers, there are periods of severe water shortage. The majority of the population, together with most economic activity, are concentrated in this area, which can be described as a region with a typically Mediterranean climate of cold wet winters and warm dry summers. Irrigation is necessary and constitutes the most important use of water, but there is also considerable demand for urban and industrial

consumption. Below the 38th parallel, average rainfall exceeds 2,000 mm annually. In the far south, rainfall declines to around 400 mm.

At present, as a result of government and private initiatives, 1,800,000 hectares of land are irrigated in Chile, but water supply is unreliable for 700,000 hectares of this land. Approximately 75% of agricultural output, equivalent to 7% of gross domestic product, is grown in irrigated areas.

Recent studies have identified the main problems for water resources management as pollution in the most densely populated areas and shortages in the far north and south. Almost all the sewage produced by the urban population and by industry is dumped untreated directly into the rivers or the sea.

As for basic water services, 97.4% of the urban population has access to drinking water and 82.6% are connected to sewerage systems. A total of 794 rural drinking water supply services serve 655,000 inhabitants, equivalent to 82% of the concentrated rural population. Chile has great potential for hydroelectricity generation and this source accounts for 75% of the electricity produced.

Chile was one of the first countries in the region to incorporate the rules of the market and the private sector into water resources management. In August 1981, a decree was enacted with force of law which, although it specifies that water is a public good owned by the State and grants the individual water use rights (art. 5), in actual fact now treats water strictly as a private good. In effect, article 21 states explicitly that the transfer, transmission and acquisition or loss by prescription of water use rights will be carried out in accordance with the regulations of the Civil Code. This is tantamount to saying that water is to be treated like any other tradable good.

In fact, the establishment of a market for water implies a series of administrative savings, given the operational decentralization involved. The role of the private sector goes beyond the sale and purchase of water rights, given that it also includes management of water rights and their allocation to the different users through the water watch committees. The public sector is responsible for monitoring and regulating the actions of the private sector. Discussions have occurred concerning the suitability of establishing an independent and decentralized administrative framework, subject to private law, which would deal with externalities related to water use; it is in this context that the Government is promoting the idea of Riverbasin Commissions.

Recently, the Framework Law on the Environment came into force, after a passage of more than a year through the National Congress. This law is essentially instrumental as regards the tools created and institutional as regards the management structure set up.

2. The current institutional and operational structure

In Chile, two ministries are directly involved with water resources. The first of these is the Ministry of Economic Affairs, Development and Reconstruction, attached to which are the Production Development Corporation (CORFO), an independent agency which holds the shares in government electricity and water supply companies, and the National Irrigation Commission, which is operationally dependent.

The second ministry is the Ministry of Public Works, to which are attached the General Water Directorate and the General Public Works Directorate, which includes the Directorate of Irrigation. The Sanitation Services Superintendency is operationally dependent on this Ministry.

a) The General Water Directorate (DGA)

Until now, the General Water Directorate has been the agency responsible for implementation of the water law. The principal duties of this agency are: research on and measurement of water resources through the National Hydrometric Service; planning, monitoring enforcement of the law and policing of waters in natural water bodies; oversight of the functioning of the water watch committees and other user organizations; establishment of water use rights in natural water bodies; carrying out of a public water survey; carrying out of studies to determine available resources.

In addition to these responsibilities, assigned to it by the Water Law, the DGA is laying the foundations for a more comprehensive national water policy. In this regard, progress has been made in defining new objectives for national water policy. These objectives consist in ratifying, as a basic legal principle, water resources as a national good for public use; developing its use in a rational and sustainable fashion; avoiding pollution and other processes of environmental deterioration; guaranteeing legal safeguards to users; promoting user organizations; incorporating the environmental dimension of property in water use rights, in order to require that their owners conform to guidelines for the conservation and recovery of water quality.

b) The Directorate of Irrigation

The Directorate of Irrigation of the Ministry of Public Works is responsible for studying, designing, building, maintaining, repairing and operating irrigation works built with public funds and not transferred to the private sector for administration.

c) The National Irrigation Commission

The Council of the National Irrigation Commission is made up of the Ministry of Economic Affairs, Development and Reconstruction, which it presides, as well as the Ministries of Public Works, Agriculture, Finance, and Planning and Cooperation. It is the task of the Commission to plan, study and evaluate integrated irrigation projects, supervise the different public and private organizations which manage irrigation projects, and sign agreements with individuals or businesses on irrigation studies or projects. An effort has been made to place the emphasis on the integrated exploitation of irrigation at the riverbasin level. In accordance with Law 18.450, enacted in 1985, the Commission is also in charge of a programme providing rebates on the cost of constructing and repairing irrigation or drainage works, as well as private-sector investments in mechanical irrigation, which can reach up to 75%. Poor farmers are eligible for a rebate of up to 95%.

d) User organizations

The Chilean Water Code stipulates that irrigators have to create associations or some other sort of organization that assumes responsibility for water management, encompassing construction, operations, conservation, as well as other aspects. These private-sector institutions, known as water communities, irrigator associations or watch committees, have played an active role in water resources management and the development of irrigation and drainage infrastructure for more than a century. The Federation of

Irrigators is the national body, and is an organization of some considerable social importance in Chile and is widely recognized for its track record.

e) The water supply and sanitation sector

The administration of sanitation services in Chile at the beginning of the 1970s was shared by a large range of agencies all with similar responsibilities, but which had neither administrative nor financial autonomy and which lacked an overall planning framework or criteria which might provide the sector with appropriate direction.

In the light of this situation, the National Sanitation Works Service (SENDOS) was created in 1977 to combine all the entities operating in the sector. SENDOS was an autonomous government agency, subject to public law, which enjoyed legal status and had its own assets. It was decentralized over the country and reported to the Government via the Ministry of Public Works. It was initially made up of a National Directorate and 11 Regional Directorates, one in each administrative region.

At the same time, two independent companies, the Metropolitan Sanitation Works Company (EMOS) and the Valparaíso Sanitation Company (ESVAL) were set up, in the Metropolitan Region and the Fifth Region respectively, under the jurisdiction of SENDOS.

Towards the end of 1989, it was considered convenient to redefine the role of the State in this sector, detaching activities related specifically to the delivery of the service, while emphasizing the State's subsidiary, regulatory and supervisory role. The reexamination of the regulations applicable to the sector prompted a reorganization of institutions, in accordance with the following guidelines:

- i) the distinction between the regulatory and supervisory tasks of the State and productive commercial tasks which are carried out by various agencies. In order to carry this out, the Sanitation Services Superintendency (SSS) and regional State companies were created;
- ii) the application of the same set of laws to both the regional State companies and the private companies operating in the sector;
- iii) the definition of a regulatory framework which provides for the regulation of natural monopolies;
- iv) the creation of a tariff system that encourages companies to be efficient and provides the appropriate signals to consumers and service-providers. In addition to this, a direct subsidy was made available to low-income users.

To sum up, a legal framework was put in place which provided stability to the sector and enabled companies to obtain the resources necessary to operate efficiently, generate adequate profits and eventually attract resources from the private sector for the development of services.

The Sanitation Services Superintendency is, in addition, responsible for monitoring liquid industrial wastes through the application of Law 3.133, from 1916. In 1992, a draft set of regulations was formulated to adapt the law to Chile's current situation. A technical standard was also prepared to regulate the discharge of industrial waste into streams and sewerage systems. The Sanitation Services

Superintendency undertook a National Survey on the Discharge of Liquid Industrial Wastes, that identified more than 2,500 discharge sources.

f) The energy sector

The organization of the energy sector is very similar to that of the water supply sector, except that almost all the companies involved in generation and distribution are privately owned. There are three organizations responsible for policy formulation and management in the energy sector: the National Energy Commission (CNE), the Electricity and Fuels Superintendency (SEC) and Economic Load Dispatch Centres inside each interconnected system.

It is the role of the CNE, which comprises six ministries, to propose policies, law and standards for the sector, calculate prices which must be regulated and carry out indicative strategic planning. Companies are able to install generating plants not envisaged in the plan. The SEC's role is to ensure companies and equipment are in conformity with the legislation and standards in force. Lastly, the Economic Load Dispatch Centres, which are made up of generation/transmission companies in each interconnected system, are responsible for ensuring that generating plants operate at a minimum cost level.

3. A review of the Government's role in water resources

After 10 years of operation of the 1980 Water Law, the previous Government proposed draft legislation to modify the Law, but the proposal received a critical reception and is still under discussion in parliament.

a) The proposed changes

The proposed changes deal with four main areas. First, efforts are directed at restoring water's status as a public good owned by the Government as well as justifying the need for, and use of, standards in the area. As has been stated, the legislation currently in force makes it possible to request and obtain water resources in unlimited amounts and free of charge, the only condition being compliance with an administrative procedure. It is proposed to establish limits to the granting of water use rights, by making it compulsory to justify the need for the request for water and to ensure its effective use.

Second, the aim is to formulate standards concerning the conservation and protection of water and river beds, prompted by awareness of the fact that the current Water Code is limited in scope and does not cover all of the aspects that will be required in order to duly achieve that objective. The current Code is said to offer only a partial view, which, though it tends to reduce pollution in order to protect health or defend agriculture or to achieve sanitation goals, envisages no provisions whose specific aim is to preserve and protect national water resources.

It is hoped that the new legislation will provide for action to be taken in situations where serious pollution arises so as to spare third parties harmful effects, establish respect for the ecological flow so as to guarantee the survival of ecosystems, formulate standards which make it possible to avoid potential

destruction of natural river beds that are currently not protected at all, and develop a network of control stations for monitoring water quality.

Third, it is hoped to develop norms for integrated riverbasin management and for improving user organizations. There is a consensus that the problems currently facing both the basins and the users themselves include erosion and the consequent sedimentation, droughts and their implications for irrigation, periodic flooding resulting in damage which is generally heightened by human action, and pollution affecting practically all natural sources. To remedy this situation, a system of integrated riverbasin management is proposed, whose design takes into account European experiences and attempts to adapt them to Chilean needs.

Lastly, it is hoped to incorporate procedures tailored specifically to regional needs, since it is understood that a general law cannot take into account the great variety of environmental systems existing in Chile, ranging from the northern desert to the cold and rainy parts of the south.

b) Initiatives aimed at increasing efficiency

In addition to these new dimensions that hopefully can be incorporated, there are other elements which are designed to increase the efficiency of the 1981 Code. In the first place, an effort was made to temporarily limit the use of unused water rights, but such a move would probably be unconstitutional. More recent changes to the new bill include introducing a charge for the right to hold a concession, even if that right is not effectively exercised. The objective is to impose a charge on free ownership of water rights in order to facilitate their transfer and sale.

Another important element would be to empower the General Water Directorate to act in cases of groundwater development, where externalities occur in the form of injury to third parties or pollution of the groundwater resource.

Lastly, the possibility of including irrigation works among the public works offered in concession to the private sector is under study; as well as water supply systems, ports and roads.

4. Progress in riverbasin management

The General Waters Directorate, in cooperation with the Irrigation Directorate, is conducting a series of programmes for integrated riverbasin management. With this in mind, an integrated riverbasin management programme is taking shape within Chile's public sector, with the participation of a number of government agencies, such as the Ministry of Public Works, the Ministry of Agriculture, the Ministry of Planning and Cooperation, the National Commission on the Environment, among others.

The aim pursued in these actions is to establish an institutional infrastructure that encourages rational and integrated management of natural resources, improves water management, protects and preserves water resources, in both urban and rural areas.

At present, studies are being conducted into nine riverbasins, a sample which covers a substantial part of the country. The riverbasins covered are the San José, Aconcagua, Maipo, Mataquito, Maule, Bío

Bío, Imperial, Valdivia and Las Minas rivers. These riverbasins support almost 70% of Chile's population.

The problems that such integrated management seeks to address include the inappropriate use of renewable natural resources, conflicts among users, decreases in vegetation coverage, an increase in pollution phenomena, processes of erosion, sedimentation and silting, and the need to increase and improve the existing resource management infrastructure as well as improve coordination among the agencies and the actors involved in the riverbasins. It is worth pointing out at this stage that the water supply and sanitation sector is not being explicitly incorporated into the riverbasin proposals and studies.

5. The Framework Law on the Environment

The new law on the environment embodies the key principles of the environmental policy adopted in Chile. The law is operational, in that it creates management tools and establishes an institutional structure involving the National Environmental Commission, presided by the Minister/Secretary-General of the Office of the President and comprised of the Ministries of Economic Affairs, Public Works, Agriculture, National Assets, Public Health, Mining, Housing and Urban Development, Transport and Telecommunications, and Planning and Cooperation as well as 13 Regional Commissions (CONAMA, 1994).

The most important tool of environmental management provided for by the law is the System of Environmental Impact Assessments. Projects which will be subject to such an assessment include aqueducts, reservoirs and underground streams, dams, drainage works, dredging, river defences or any other significant alteration to a body of water or natural watercourse. The impact assessments will be presented to the National Commission or the relevant Regional Commission, which will be required to generate mechanisms which ensure the informed participation of the organized community in the assessment process of the environmental impact studies.

The law establishes procedures for enacting standards concerning environmental quality, emissions and the design, presentation and fulfilment of plans for natural resources management, including maintenance of waterflows. The law also introduces the general idea of responsibility for environmental damage. Lastly, the law provides for the creation of an Environmental Protection Fund whose purpose is to finance, either totally or partially, projects aimed at protecting or restoring the environment, preserve nature and conserve the environmental heritage. Resources for the Fund will come from gifts, the national budget, allocations via other laws or any other source.

E. MEXICO

1. Introduction

The annual rainfall in Mexico averages 780 mm, with a very diverse spatial distribution. About 42% of Mexico's territory, mainly in the north, receives rainfall of less than 500 mm per annum. In the southeast, 7% of the territory receives more than 2,000 mm of rainfall per annum. Given the spatial distribution of both rainfall and temperature, Mexico can be broken down in the following way: 31% desert and arid, 36% semiarid and 33% subhumid and wet.

Mexico has a natural storage capacity (in lakes) of 14,000 million m³, and a constructed capacity of more than 170,000 million m³. Groundwater constitutes an important source, with aquifers that cover an area of 470,000 km² and potential production of 31,000 million m³ per annum.

There is significant pollution of both surface water and groundwater, aggravated by the growth and concentration of the population and economic activity. The principal pollutants are organic matter and nutrients, pathogenic agents such as coliforms, heavy metals and pesticides. Manufacturing industry constitutes the main source of pollution (90%), especially sugar mills, oil refineries, and plants producing pulp and paper, textiles, chemical products and iron and steel. Next in importance comes domestic waste (9.5%), followed by extractive industries (0.5%). The main pollution problems occur in the riverbasins of the Mexico, Tula and Lerma valleys, where the largest urban settlements are located.

In rural areas, the topography of the land and the torrential nature of the rains combine to cause serious erosion problems. By its very nature, the water system presents risks of flash floods, inundations and droughts, the latter being very frequent in the northern part of the country. Some studies indicate that 6.5 million hectares used for agriculture are in areas with a high risk of erosion from water. This problem is accompanied by another: the depositing of sediments downstream, which increases the danger of flooding and reduces the capacity and useful life of dams through silting.

The main use of the water is for agriculture, which uses an average of 46,252 million m³ per annum, which constitutes 74.5% of the water available. It is worth noting that Mexico has more than 5.5 million hectares of land under irrigation, which puts it at the head of Latin America and the Caribbean in this respect. The next most important use is industry, which consumes 9,525 million m³ (15.3%), followed by domestic use, with 6,342 million m³ (10.3%). In addition, some 115,000 million m³ are used in hydroelectricity production.

In Mexico, water resources management has maintained a centralized structure for many years. Far from hindering the current process of decentralization, such a situation has facilitated it enormously. This is because water industry administrators are totally convinced of the need for these changes and of their advantages, and it is they themselves who initiated the devolution of management activities and who laid the groundwork for the bodies of law currently in force.

2. The National Water Commission (CNA)

The first step in implementing the water resources policy was to set up the National Water Commission, as an agency separate from the Ministry of Agriculture and Water Resources, in January 1989, a move that was subsequently confirmed by the National Water Law. The CNA is empowered to:

- i) administer the country's water, viz surface water and groundwater, both with respect to quantity and quality;
- ii) exercise authority in this area and promote efficient use of water resources and the preserve of their quality, for all uses and by all users;
- iii) put in place the economic mechanisms and financial incentives that promote efficient water use and, at the same time, increase the financing possibilities of the sector; and

- iv) preserve the role of the hydraulic-engineering works as the basis for sustainable development and improved well-being for the population.

3. The Mexican Water Technology Institute (IMTA)

The IMTA is an agency responsible for developing and implementing technologies which enable Mexico to make sustainable progress in the area of water resources of the sector and reports to the CNA. The efforts of this agency are primarily directed at promoting the efficient use of water and the preservation of its quality, a task which fits into the framework of the current decentralization and the strengthening of user associations in irrigation districts as well as suppliers of water supply and sanitation services.

In this respect, attention should be paid to the strengthening of the water industry's institutional capacity; human resources training programmes are a key requirement of the new organizations. By way of example, in the recent past the activities of the Mexican Water Technology Institute (IMTA) have been directed at the following areas: the testing and application of devices for the measurement and control of water for irrigation and urban uses, as well as the development of methodologies and practical procedures for the detection of leaks in water supply systems; design of systems and processes for the treatment of industrial and municipal waste water; design and testing of a programme for controlling aquatic weeds; development and application of methodologies and information systems for better water management; and the certification of equipment and devices used in the industry.

4. The National Water Law

In general terms, this law brings a considerable degree of modernization to water resources management, explicitly incorporating aspects such as the planning and programming of water management and the rational and efficient use of the resource. It reaffirms the federal Government's ownership of the water as inalienable and imprescriptible. It reflects modern currents of thought concerning the efficient use of natural resources and the preservation of their quality, and also touches on integrated water resources management, characterized by greater user participation and streamlining of sectoral planning. See annex II for a more complete description.

The objectives of the law are to regulate the use, exploitation, development, distribution and monitoring of water, as well as to preserve its quantity and quality in order to achieve sustainable integrated development of the resource. The law reaffirms the CNA as the administrative authority for national water affairs.

The CNA will set up Riverbasin Councils as coordinating consensus-building bodies, with the purpose of formulating and carrying out programmes and activities for better water management, development of water control works and the respective services and the preservation of the resources of the riverbasin. The Riverbasin Councils are, therefore, the primary instruments for integrated water resources management.

The Lerma-Chapala Riverbasin Council, established in January 1993, has begun to undertake activities for the equitable distribution of water among its member states, as well as measures to maintain the levels of Chapala lake and improve the quality of its waters. Riverbasin Councils are currently being

established for the Rio Bravo and in Mexico valley, both of which are areas of major importance in Mexico.

a) The decentralization of irrigation districts

Within a set period of time, the Commission will begin to turn over the administration and operation of the irrigation districts to the users, under the terms laid out by the law and its regulations. The districts will then be managed, preserved and maintained by the users themselves, who will be organized according to the criteria defined in the law.

Since 1989, 65% of the total area of the irrigation districts (2 million hectares) have been handed over to 251 irrigation associations. In effect, 25 irrigation districts have been transferred in their entirety and 13 partially.

Each irrigation district will establish a water committee which will determine regulations for the district. In using the water and the services, the users of the irrigation districts are required to adhere to the terms laid down by the regulations of the relevant district, and to pay the charges for the irrigation service that have been agreed to by the users themselves; these charges will need to cover at least the administration and operating costs of the service and those for the conservation and maintenance of the works. The charges will require authorization by the Commission, which may reject them if they do not comply with the above-mentioned requirements.

With respect to the use of water for agricultural purposes, the law stipulates that anyone who owns or occupies arable land will have rights to operate, use or develop the waters that they have received in the form of a concession by the Commission, and that these may be transferred.

b) Pollution control and water control works

The Commission is responsible for setting the standards for waste discharges, the assimilation and dilution capacities of national water bodies and the pollution loads they can absorb, as well as quality goals and timetables for reaching them.

The law states that water users themselves may build the water control works necessary for the operation, use or development of water, or may have them built by contractors. The administration and operation of these works will be the responsibility of the users or the associations which execute them.

The Commission will coordinate hydroelectric development with other uses of water. In this regard, the CNA, as the authority in water as distinct from hydroelectricity, sets the rules for the operation of dams. This is a totally new situation for Latin America and the Caribbean, since in most of the countries the hydroelectricity sector regulates the operation of dams according to its needs, without the express intervention of the other users of the water system.

c) Cost recovery

Lastly, the law refers to the recovery of public investment. The law stipulates that federal government investments will be recovered in accordance with the law on betterment levies for federal water control works, through the fixing of charges that the beneficiaries of such works will have to pay.

Operating, conservation and maintenance costs will be borne by the users of the services. In the case of irrigation districts or units, land titles or, where holders of a share in communal lands ("ejidatarios") or commune members are concerned, the rights to the use of the plots may be given in guarantee.

5. Water Rights Law

This law came into force in February 1993. It basically addresses the question of how much various users must pay for water use. Charges for the delivery of services will be fixed in accordance with the total cost of the service, including financial charges. The amount, form, place and date of payment of charges is indicated in each particular case.

a) The price of water

Article 222 of the law stipulates that all individuals or corporations who use or develop waters under federal jurisdiction are required to pay a charge for water. The following article specifies the amount of money which must be paid, per cubic metre, for each region defined by the Commission. In the case of the first region, which includes the Federal District, the minimum price is set at N\$ 1.30 (new pesos) per cubic metre. For the rest of the country, the charges are lower and vary from one region to the next.

Charges for the use of drinking water allocated to municipalities, semi-private agencies, etc., are fixed at between 60 and 70 new pesos per 1,000 m³, according to the region. Total receipts from all water supply and sewerage systems at current 1988 prices amounted to more than 5,000 million new pesos in 1993, as against 650 million new pesos collected in 1988. Charges are set in the same way for water used in hydroelectricity generation (kW/hour), aquiculture, resorts and recreational centres.

b) Payments for discharge of effluents

The law also stipulates the payments to be made for the disposition of effluents. The amount payable depends on the volume of the discharge, with a charge per m³, per kg of biochemical oxygen demand in the discharge and per kg of total suspended solids. An extremely simple polynomial formula, which considers only the three variables defined above, is used to make the calculation. Previously, other criteria had been taken into consideration, such as downstream water quality levels, but they were abandoned because of the complications involved in their use. It is important to note that dilution of discharges is penalized.

6. Water resources policy

In the light of the new definitions and the changes which have been made, the National Water Commission (CNA) states that the objectives of water resources policy are as follows:

- i) to develop the necessary water control works to eliminate existing weaknesses in water supply and sanitation services, as well as to strengthen the infrastructure to support the development of agriculture and other sectors of the economy. During the period 1989-1994, the water supply and sanitation sector received some 40% of international financing (US\$ 1.5 billion) for the National Water Supply and Sanitation Programme;
- ii) to encourage the efficient use of water, especially in regions marked by a severe shortage, or in areas of use, such as agriculture and water supply services, where the available infrastructure is not fully utilized and the level of efficiency is far below what is both possible and desirable;
- iii) to restore and improve water quality, particularly in the more polluted riverbasins and groundwater aquifers, and to make sure of the quality of the water supplied to the population and for other uses that may have a bearing on public health.

F. VENEZUELA

1. Introduction

Venezuela has abundant surface water resources, but their geographical distribution is characterized by marked regional differences. The right hand side of the Orinoco accounts for 85% of the run-off. The remaining 15% is distributed in an irregular manner; the most productive riverbasins are located on the southern slope of the Andean mountain chain.

The pattern of development has resulted in a high population density in the central-northern coastal axis and a considerably lower density in the Lake Maracaibo basin and the Andean valleys, an area which represents 10% of the surface area of the country but which contains 90% of the population and generates more than 90% of the gross domestic product. Furthermore, this is the part of the country with the least available amount of water and energy, and this results, for example, in very high and growing costs for the required expansion of water supply services to the metropolitan area of Caracas.

The high urban and industrial concentration, with a chaotic structure which results in the juxtaposition of actions and a wide variety of externalities, generates a syndrome akin to that already described in the case of urban sectors in other countries. It is precisely in these areas that industrial and urban pollution reaches critical levels which require public action. Attempts have been made to address this problem with an integrated approach through the creation of the Integrated Authorities, such as those in the River Tuy and Lake Valencia.

In contrast to the situation prevailing in the central-northern coastal axis, the area through which the Orinoco and Apure rivers run, which has tremendous water potential, is notably underpopulated. The environmental management strategy which has been adopted stresses the development of this axis.

The land with the greatest productive potential is found in the areas with the greatest pressures stemming from urbanization. In these areas, four to six months of annual drought restrict the alternatives for agricultural production and irrigation is, therefore, necessary; this need has given rise to multiple private and government projects. These are mostly located in the Andean valleys and in semi-arid areas, such as Barquisimeto, where there is extensive use of high-tech, micro-irrigation systems. The use of irrigation for the growing of fruit and vegetables is justified by the high profitability of this activity in the domestic market.

The relief of the Andean area, the steep slopes of most of the lands and the heavy rainfall, together with the traditional practice of growing corn, whether on its own or associated with bean production, result in serious soil erosion. This leads to reduced yields and problems downstream, such as floods and decreased reservoir capacity, as a result of sedimentation. Such is the extent of these phenomena that the authorities have been prompted to undertake riverbasin conservation projects.

With respect to basic water services, in 1989, 72% of the population had access to water supply services and 45% to a sewerage system. In small towns and rural areas, which account for 17% of the population of 20 million, coverage of water supply services stood at 40% and that of sewerage systems amounted to 14%.

Venezuela has great potential for hydroelectricity production. In 1991, 68% of the energy generated was derived from this source. Per capita consumption amounts to 2,881 KWh, which is one of the highest levels in the region. Electricity is available to 90% of the population.

b) The Ministry of the Environment and Renewable Natural Resources (MARNR) and administrative decentralization

Water resources management in Venezuela is centralized in the Ministry of the Environment and Renewable Natural Resources (MARNR); the Ministry is responsible, at the national level, for the environment as a whole, and for water resources in particular, and is in charge of their administration, use, regulation and other related aspects. MARNR has traditionally been responsible for designing and building water development projects.

Over the period 1989-1993, there has been a reduction in budgetary allocations to this Ministry, as a result of the economic and political crisis facing Venezuela. In the light of these constraints, and in order to satisfy new needs as regards the nature and quality of environmental services —a task which involves participation, decentralization, greater efficiency as well as other aspects—, the Ministry has revamped its administrative structure.

Decentralization of MARNR is taking place within the framework of the recently enacted Basic Law on the Decentralization, Delimitation and Transfer of Public Service Responsibilities; this law provides for several processes of administrative decentralization.

In this context, the Ministry has asked the regions to present the central Government with proposals for dealing with environmental problems; the Sectoral General Directorates and the respective Regional Directorate will then make a decision concerning the use of funds. It will be necessary to reach agreements, whose observance will be mandatory, and which will consider the following:

- i) identification of the environmental problems in the region;
- ii) rank of these problems according to their priority; and
- iii) determination of the scope and costs of the measures to be taken.

2. Criminal Law on the Environment

In January 1992, the Criminal Law on the Environment was passed by the Venezuelan Congress, and MARNR was put in charge of its implementation. Clearly, most of its provisions affect the water resource. The purpose of this law is to classify as criminal offenses any actions which breach regulations related to the conservation, protection and improvement of the environment, and to provide for the corresponding punishments. The law also provides for precautionary, restitution and reparation measures to be applied where appropriate.

The principal punishments envisaged by the law are imprisonment, arrest, fines and obligatory community service, all of which are applicable to individuals. Associated penalties are also mentioned, such as disqualification from holding public office, disqualification from exercising one's profession, and the obligation to destroy, neutralize or dispose of substances likely to cause damage to the environment or to public health.

The punishments applicable to companies will be fines and the forbidding, for a period ranging from three months to three years, of carrying out activities that cause pollution. If the damage is very serious, in addition to the fine, the factory or establishment will be closed or the activity prohibited definitively.

3. Structure of MARNR

The central operational units of the Ministry are the six sectoral general directorate: environmental information, environmental planning and management, environmental education, monitoring and control of the environment, environmental quality and the office in charge of the Orinoco-Apure Programme. In addition, there are 17 regional directorates.

Until the introduction of reforms, the Ministry comprised four autonomous services, devoted to forestry issues, wildlife and aquatic life, environmental development of the Amazon, and national geography and cartography.

a) Recent changes

Two new autonomous services have been set up that are of great importance to water resources management. These are the Autonomous Service for the Conservation, Administration and Development of Water Resources and the Autonomous Service for Soils and Riverbasin Conservation.

Until 1993, the following integrated authorities existed for the following water systems: the Yacambú-Quibor Area Agency, the Turimiquire Protection Area Agency, the Lake Maracaibo Coastal

Area Agency, the Guayana Environmental Programme, and the Los Roques Archipelago National Park Agency.

To these two new Autonomous Authorities have been added, the Lake Valencia and Northern Slope of the Coastal Range of the States of Aragua and Carabobo Riverbasin Agency, and the Tuy River and Northern Slope of the Coastal Range of the Federal District and the State of Miranda Riverbasin Agency.

In a complementary development, environmental management has been handed over to municipalities and Municipal Funds for Environmental Management have been created in order to facilitate this process. Financial resources for these will be obtained in the form of a non-recurrent tax on companies or the main economic activities and will be administered by way of a trust fund dedicated to the management of environmental problems.

b) Water resources management in MARNR and Agenda 21

The preparation of papers and proposals for action for the United Nations Conference on Environment and Development, held in Rio, together with follow-up activities conducted in MARNR, have resulted in the formation of an interinstitutional working group to study the best way to adapt water resources management in line with recommendations contained in chapter 18 of Agenda 21.

A number of proposals have emerged as a result of the activities of the working group. These include:

- i) the creation of a coordination unit to address water resources management, which could set goals for achieving the basic objectives in this area;
- ii) strengthening of the Ministry's water resource assessment programme;
- iii) protection of water resources in order to preserve the quality and sustainability of aquatic and other ecosystems;
- iv) extension of water supply and sanitation services.

c) Autonomous Service for the Conservation, Management and Rational Use of Water Resources (SARH)

This Autonomous Service was created in April 1993 by Decree 2888. The Service is responsible for the conservation, use and development of water resources through research, planning, management and promotion.

Its functions include:

- i) taking an active role in the formulation and assessment of water development policies;
- ii) taking part in the elaboration of the relevant technical standards;

- iii) coordinating the participation of other agencies associated with water resources management;
- iv) preparing a national inventory of water resources;
- v) planning management of these resources and developing and promoting scientific research in the area.

Its operations section will be required to design, evaluate and build the works projects for the use of the water resource, monitor the waters, promote training and environmental education programmes, implement mechanisms for generating and collecting financial resources, and other associated duties.

Funding for the Service will come from both ordinary and extraordinary annual budget allocations, goods and income of any nature generated by its activities, payments received for services rendered and funds allocated to it by states and municipalities. The Service will also receive donations and various other contributions, in addition to the funds generated from water management, as provided for in the relevant regulations.

The Decree specifies that the income received by the Service must be used for self-financing and to cover operating and investment costs.

It is clear from this outline that if this Autonomous Service does not have an adequate source of income or one derived from charging for services for water management, it will have difficulty in achieving the autonomy that would enable it to fully comply with its responsibilities.

The Directorate of Water Resources Planning, which was previously responsible for the development of plans and projects for the water industry, has now become part of SARH. The duties of the Directorate have changed drastically, and today its core activity is the formulation of regulations for water use concessions. Regulations are being currently developed that will govern Ministerial action in this area. MARNR will, through SARH, grant water resource rights for all uses, in accordance with the provisions established in legislation on forest land and waters, as well as water resources and riverbasin regulations.

Water supply companies will need to obtain from the Ministry the relevant concession for treating and distributing water. The water supply companies and the users will be bound by contract. Concessions and contracts will be granted on a payment basis, and will set out mechanisms designed to encourage more efficient use of water, as well as the contributions to be made to the Autonomous Services of MARNR.

d) Autonomous Service for Soils and Riverbasin Conservation

This Service, which is in charge of planning, organizing, coordinating, managing and promoting conservation and management policies and programmes for soils and riverbasins in Venezuela, was created as a result of the reorientation of the Riverbasin Conservation Directorate of MARNR, which now focuses on collecting basic information on the various riverbasins in the country. At present, the Service is carrying out a conservation project, financed by the Inter-American Development Bank (IDB), covering the upper and middle riverbasins of the Yaracuy, Tocuyo and Boconó rivers. The service is examining

other riverbasins with a view to the future financing and execution of conservation and development plans.

The responsibilities of the Service will be, *inter alia*, to formulate national policies and strategies; to design, evaluate and monitor plans, programmes and projects concerning soil conservation and riverbasin management; to exercise internal and interinstitutional coordination at the national, international and regional levels; and to cooperate with private and public, national and international organizations on research plans and the design of technical cooperation projects.

The Autonomous Service will receive funds from budgetary allocations, resources derived from various agreements, and revenue it obtains from providing its services or other activities, gifts and other contributions. One of the sources of income of the Service is set out in Decree 2331, dated June 1992. This decree sets the charges to be paid by the various agencies which use the natural resources in a given riverbasin, and which will be allocated to the conservation of the riverbasin. The agencies in question are those which operate and maintain reservoirs, aqueducts, irrigation and electricity generating facilities, as well as other infrastructure projects. The charges will be as follows:

- i) 0.5% of the amount paid by the users for each m³ of water taken from the source, using the average amount billed the previous year as a reference point;
- ii) 1% of the total billings for the sale of electricity.

These amounts may be adjusted by the Executive depending on real national needs as regards the protection, conservation and renewal of riverbasins. It is stipulated that contributions from the various private and public agencies will be paid to the Autonomous Service of MARNR to be used for the aforementioned purpose.

e) The Tuy River and Northern Slope of the Coastal Range of the Federal District and the State of Miranda Riverbasin Agency

The Tuy river is the main source of water supply for the metropolitan area of Caracas. Given the complexity of the water-using activities located in this riverbasin, it was deemed necessary to form an Autonomous Authority for its management. This Agency is responsible for the integrated management of the Tuy river basin and the Northern slopes, and thus covers all aspects of land management and environmental protection, preservation and upgrading.

The responsibilities of the Agency are to:

- i) establish environmental standards and guidelines for the use of renewable natural resources and land management;
- ii) formulate, coordinate and execute plans and programmes in areas of research, management, administration, monitoring, regulating and environmental education;
- iii) coordinate and monitor the implementation of plans in the area, collaborating in the transfer of services to the regions and in decentralization, in accordance with existing regulations,

to identify and assess projects, and to manage the promotion, organization and execution of all the related activities.

The agency will soon achieve financial autonomy and is accorded total autonomy with respect to the generation of resources by means of agreements, the provision and billing of services and other activities. Funding will come from budget allocations, payments for services provided, revenue received in the form of donations, and from arrangements and agreements, and income from the issuing of bonds, when these are intended for the protection or recovery of the environment.

The activities of the Agency, which are to be related to land use, must be in accordance with the rulings of the basic law on the subject; in addition, the Agency will have the specific right to intervene in cases where projects are already situated in or it is proposed to locate them within "the critical area of priority treatment in the basin of the Tuy river".

The Agency will also have the right to intervene in the allocation of renewable natural resources, to the extent that it will be required to approve and authorize their use and development. The Agency will be responsible for monitoring the environment, dealing with petitions and carrying out environmental impact studies, before authorizing land use. The costs incurred by the Agency in providing services, including protection or emergency measures, will need to be paid back by those responsible.

f) The Lake Valencia and Northern Slope of the Coastal Range of the States of Aragua and Carabobo Riverbasin Agency

Lake Valencia is the focal point of the most heavily utilized riverbasin in Venezuela; it contains various types of settlements, a large number of industrial and food-processing facilities, and primary activities based on irrigation, breeding of livestock, etc. The result of all these activities has been increasing pollution levels in Lake Valencia and, since this is an interior basin, an imbalance in the hydrological cycle has occurred, leading to a progressive rise in water levels, which, in turn, has had an impact on areas bordering the lake.

To solve these problems, a project executive unit has been set up and a treatment plan designed and implemented. The bill for the total clean-up of the lake is estimated at US\$ 125 million. This will require a system of water by-passes, to divert away from the lake the effluents which affect its quantity and quality, and the construction of a series of treatment plants.

4. Water supply and sanitation services

The administration at the national level of water supply services has been the responsibility of the National Institute of Sanitation Works (INOS), an autonomous agency with nation-wide coverage. INOS is also in charge of the treatment and disposal of sewage.

The Ministry of Health and Social Welfare is responsible for water supply and sanitation in rural areas; there are also a number of regional corporations in charge of delivery of these kinds of services.

In the last five years, the sector has been undergoing reform. In the first place, INOS was decentralized and its various functions taken over by regional water companies, which report to the State-owned Hidrología Venezolana (HIDROVEN).

This process of decentralization was originally characterized by attempts to transfer companies to the regions or municipalities. However, the process also aims to encourage the participation of private companies in the industry; private companies could administer water and sewerage systems directly, lease them or operate them under a concession.

The State enterprises were granted autonomy in 1992, in a move which not only encompasses the operations they must undertake, but also the methods used to obtain funds. This is consistent with the importance attached to regional management in the current decentralization process.

At the same time, the idea of creating a State Environmental Council was aired, as a mechanism for interinstitutional coordination at the regional level, and as a tool for consensus-building, support and implementation of government policies.

Until now, apart from the aforementioned processes, no significant progress has been made towards private-sector participation or effective self-financing by the various water companies. The political and economic instability affecting the country is partly responsible for this situation, and has delayed a realistic adjustment of charges for public services.

5. Irrigation and drainage

In Venezuela, irrigation is the responsibility of the Ministry of Agriculture, while MARNR acts as the coordinating agency. The General Sectoral Directorate of Sanitation and Irrigation supervises, monitors and maintains public irrigation works. Although user associations have not been a common feature, except in the Andean region, a large amount of land has been irrigated by entirely private developments. Indeed, one of the points most often mentioned in discussions about a future water law has been the consideration given to all existing uses of water which have been developed using private irrigation.

6. Hydroelectricity

The Venezuelan electricity industry is made up of four State-owned companies and seven private companies. All are autonomous as regards management and provision of the service, but they are subject to government regulations under the Ministry of Energy and Mines. The Office for the Operation of Interconnected Systems (OPSIS) coordinates the activities of these companies and also, through a Planning Committee, formulates expansion plans. In 1990, hydroelectricity accounted for 61% of all the energy generated.

Two agencies have recently been created: a regulatory agency, known as the Regulatory Commission for Electrical Energy (CREE); and the Foundation for the Development of the Electricity Sector (FUNDELEC), whose purpose will be to provide technical support to CREE.

The arrangements for transferring funds from the energy sector to the regional or riverbasin management agencies are the main means of coordination in order to facilitate integrated water resources management.

7. The pending water resources and riverbasin regulations

Discussion is currently taking place concerning a draft set of regulations on water resources and riverbasins, and which are in the spirit of the Organic Law of the Environment, the Organic Law on Land Management and the Forest Lands and Waters Law. This draft set of regulations envisages the creation of a national system of water resources planning, involving the incorporation of regional plans.

According to the draft, MARNR would continue to play the leading role in water resources management. Among the initiatives envisaged are the elaboration of a national resources inventory, the preparation and updating of the national plan and the regional plans mentioned above, the granting of concessions, allocations and authorizations for water use, activities related to regulation and monitoring, planning of studies, projects, and standards, and promotion and development activities. In addition, consideration is being given to the creation of a National Planning Council for the Rational Use of Water Resources, as an advisory body to promote the implementation of the national and regional plans.

The draft sets out the procedure for the granting of authorizations and concessions for water resource use, to be administered by the MARNR. It is stipulated that all uses of public waters, whether by private individuals or the State, will require a concession.

In the case of concessions granted on a payment basis, the interested party will pay a royalty to the national Treasury for the use of the water resource; the amount of the royalty will be calculated on the basis of the quantity of water, its relative scarcity in the place of extraction, its quality, the variability of the regime and its energy potential. It should be pointed out that the amount, manner and timing of payment will be established by a joint agreement between the Ministry of Finance and MARNR. That means that the price of the water will be negotiated on a case by case basis.

The concession contract must include a description of the project, as well as specify where the water is taken from and the quantity disposed of, the life of the concession, conditions of payment and other terms. With respect to protection of the quality of water resources, it is specified that the quality of the water will be measured according to the relevant provisions contained in the basic law.

The proposed set of regulations also encompasses guidelines on riverbasin conservation, with particular reference to planning and bodies participating in riverbasin conservation projects.

Lastly, the draft regulations provide for a set of criteria for classifying and handling special aspects of the conservation and rational use of water and riverbasins.

III. MAIN CONCLUSIONS

The economic boom of the late 1970s marked the peak of public-sector participation in projects for water resource use, demonstrated by the construction or planning of a number of megaprojects, especially for generating hydroelectricity, but also including irrigation systems and inland water transport projects. Such participation by the public sector has fallen until it has almost disappeared in recent years. In most of the countries of the region, the role of the State has changed radically. The aim of this change have been to reduce or redirect public spending, especially capital investment, as well as increase the efficiency or delivery of services through their privatization or, at least, the creation of autonomous State enterprises. One of the consequences of these policies has been that the role of the central Government has changed from operating facilities to one of supervising the activities of third parties.

The manner in which these policies have been implemented differs from one country to the next, but, in general, the move is widespread and constitutes the first major change in trends in water management in more than half a century. The expansion of the State has come to an end. The context in which water resources policy is discussed has totally changed; there now exists the opportunity for implementing institutional arrangements based on the concept of integrated water resources management at the level of riverbasins, thus transferring responsibility from central Government to regional government, municipalities, and autonomous State enterprises.

The most noteworthy characteristics of water resources management in the region are as follows:

- a) The decentralization of water resources management, basically for the delivery of water-related services, is an inevitable process in all the countries studied in the region. This decentralization has assumed many forms, including the following:
 - the transfer of total responsibility for water resources management to a regional authority (corporation, state, or municipality);
 - the transfer of management to formally constituted user associations, particularly in the case of irrigation;
 - granting of concession for the services to public or private agencies;
 - direct privatization by tender;
 - the creation of markets for water: the allocation of water property rights which can be traded on the market.

- b) There is an undeniable trend to the self-financing of water-related services. The efforts of water authorities are directed at obtaining funding for creating infrastructure and facilitating the organizational development of the agencies that will administer the services.
- c) Although there is a major trend to establishing an overall regulatory framework for the sustainable and integrated management of water resources, what is not so clear is the trend towards the implementation of operational procedures which make it possible to:
 - set policies,
 - achieve institutional coordination,
 - create suitable planning mechanisms, and
 - ensure that initiatives are carried out.
- d) The new awareness of environmental issues means that now water resources are studied as an additional component of environmental systems. In many cases this has led to people losing sight of the "uniqueness" of water and, sometimes, its primary role as the lifeblood of environmental systems is forgotten. Colombia can be cited as an example where, in the process of developing modern environmental legislation, water resources were divided up institutionally, being placed under the jurisdiction of three different ministries. In Argentina also, great emphasis was placed on development of the environmental sector but this area remained under the express authority of another ministry.
- e) The new conditions which are found in Latin America and the Caribbean are pointing towards the requirement that saleable water services (drinking water, irrigation, hydroelectricity) finance the externalities associated with delivery of such services.
- f) A new source of financing for water management is emerging, viz, the payment of damages when an activity causes pollution. In this regard, it needs to be pointed out that pollution control is the area in which the region has the least experience, which explains why the Mexican experience should be studied. It is clear that Latin American and Caribbean countries must make progress in developing policies and strategies for controlling pollution; developing information bases; developing appropriate technologies; fostering institution-building and; setting up financial arrangements, among other activities.
- g) Water resources management at the riverbasin level would appear to be the most appropriate way of dealing with the externalities of the water system, both as regards the impacts resulting from the use of water and of the exogenous effects on the resource.
- h) In experiments in water resources management at the riverbasin level, there is still a strong emphasis placed on the study of the physical components of the systems, or on sectoral activities and investments. Organizational aspects, which are by far the most important, have not been developed. Colombia's corporations can be cited as a success in this regard.
- i) Progress towards sustainable and integrated water resources management is hindered by many factors. One of the most important is the tremendous deficiency which exists in the provision of water supply and sanitation, four years after the International Drinking Water Supply and Sanitation Decade ended. The urgent and growing sectoral needs, which have

intensified even more with the outbreak of cholera, have meant that the issue of integrated management has been given lower priority.

- j) Although it may be obvious, it is those countries that have managed their water industry better which have responded more coherently, effectively, and rapidly to problems such as cholera or natural disasters affecting the sector. In cases where the water authorities are weak or lack a central structure, the response has generally consisted in a variety of disjointed efforts, without defined impacts, or guarantees of continuity.
- k) Likewise, the better organized the water industry, the more rapid and appropriate the efforts to decentralize the industry. Mexico is a case in point.
- l) A number of countries in the region have still to achieve the institutional or social conditions which would enable them to effectively come to terms with the changing trends prevailing in the region, even though the political authorities do not doubt the wisdom of change, nor its urgency. Change needs to be feasible from the social point of view, as in Venezuela's case for example, or from the institutional point of view, as in Brazil's case.

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Annex I

**THE BRAZILIAN EXPERIENCE IN INTEGRATED WATER
AND RIVERBASIN MANAGEMENT****1. The case of Ceará**

Ceará, a state located in the arid northeast of Brazil, has formalized a system of water resources administration.

For this purpose, a State agency known as the Water Resources Secretariat has been set up, with responsibility for coordinating water policy in the state. The Water Works Superintendency was created for the implementation of infrastructure works for water supply and irrigation.

The Ceará Foundation for Meteorology and Water Resources was founded with the aim of supporting the technical and scientific management of water resources and for monitoring climate and water quality. Lastly, the State Water Resources Plan (PLANERH) was formulated in conjunction with the above-mentioned Water Resources Secretariat for the assessment, study and planning of the water resource.

The water resources policy implemented by the Government of Ceará envisages a series of actions:

- + A construction programme involving a network of permanent medium-sized reservoirs for regulating rivers and streams, thus guaranteeing water supply and irrigation for the whole state.
- + A programme of water transfer, through the integration of aqueducts so that water can be allocated to the areas that require it.
- + A regional project for irrigation, designed in such a way as to generate an irrigation mosaic that facilitates farming.
- + An extensive programme of small-scale hydraulic-engineering works that provides for the use of water for many purposes within the State.

The system of integrated water resources management implemented in Ceará is in keeping with the approach of the proposed federal system.

In the first place, the system consists of a corporate committee, called the Ceará Water Resources Council, in a consultative capacity, and whose aims are to coordinate the implementation of state policy; to formulate and negotiate policies with respect to the use of water supply and the conservation of water resources; to promote linkages between state, federal and municipal agencies and community organizations; and to deliberate on matters related to water resources. This Council is presided over by the Secretary of Water Resources for Ceará, and has representatives from different government agencies.

Second, there is the Water Resources Secretariat, the supreme executive agency responsible for the Department of Water Resources Management, and which coordinates activities with the Ceará Foundation for Meteorology and Water Resources and the Hydraulic-Engineering Works Superintendency.

Third, the system involves a State Water Resources Committee, headed by the Director of the Department of Water Resources Management, with participants from different superintendencies, foundations and State enterprises.

A financial fund is available as the primary tool for action. The managers of this fund are responsible for applying water use charges, exchanging resources with the federal Government, paying for water received with shared funds, charging for administrative expenses, and cooperating with other sources of revenue of the State and federal Government.

As has been mentioned, the bill envisages the setting up of riverbasin committees. The configuration of each committee will depend on the specific characteristics of each riverbasin, but it is recommended that it be made up of public services and the users of water resources. In addition, a set of criteria has been established for setting up these committees.

2. The Doce River Project (Minas Gerais and Espírito Santo)

The Ministry of Mines and Energy, acting through the National Department for Water Resources and Electric Energy (DNAEE), initiated a project in the Doce River basin in June 1989. The task was conducted in four main phases.

In the first phase of the project, which was completed in 1990, a detailed assessment was produced of the quality of the water and the causes of its degradation. At the same time, a survey of the sources of pollution was formulated and water quality objectives were defined, based on the most critical use for man, the supply of drinking water. These elements facilitated the design of an integrated management programme for the riverbasin.

The second phase involving the formulation of a master plan was developed, which defined priorities for integrated riverbasin initiatives that would make it possible to attain the quality targets set for the rivers. Thus, a programme of action to be spread out over 17 years was prepared, involving an initial phase of two years and three five-year plans, whose activities are to be determined on a yearly basis. The total cost was estimated at US\$ 2.2 billion.

The purpose of the third phase of the project was to study financing mechanisms based on the user-pays, polluter-pays principle. In this respect, it was realized that the creation of a committee and a riverbasin agency would make it possible to guarantee financial participation of the users that would generate resources equivalent to 50% of the required investment. The development of these entities in the way conceived in the Doce River project depends on the institutional procedures outlined in the proposed water bill currently in the pipeline. In the meantime, activity can begin through the Special Commission for the Doce River, which is backed by the federal Government through the Ministry of Mines and Energy, as well as the State Governments of Minas Gerais and Espírito Santo.

The fourth phase of the Doce River project will involve the transfer of technologies used to other key riverbasins throughout the country, starting with the basin of the Paraíba Do Sul river.

Both the Doce River project and that of the Paraíba Do Sul River have been carried out within the framework of technical cooperation between Brazil and France.

It is worthy of note that in this project, considerable progress has been made with respect both to technical and financial aspects that would provide for at least partial financing of the project. Nevertheless, the delay in enacting the water resources law has prevented effective progress from being made in setting up the institutional structure, a key element for integrated water resources management.

3. The case of Paraná

In the state of Paraná, the State Secretariat for Agriculture and Supply is developing a programme known as "Paraná Rural". This programme focuses on soil management and conservation and control of water erosion, in an effort to reverse the degradation of the natural resources, using alternative technologies to increase crop yields and, as a consequence, farm productivity and incomes.

The programme is based on the incorporation of techniques for increasing vegetation cover, improving the permeability of the soil profile and hence the soil's capacity for water storage, and decreasing erosion by run-off. Locally, the aim is to control surface run-off and water pollution, which is basically farm-related.

Although the programme does not focus specifically on water resources, it is, however, directed at the combination of water resources and soils that sustains the agriculture in the State. The programme encompasses an area of 6 million hectares, involving 2,100 small riverbasins. Some 165,000 rural landowners stand to benefit from the project.

All the technical activities are applied with the focus on small riverbasins, since these are the most easily adapted to the planning objectives developed. A Municipal Commission undertakes the selection of the small riverbasins in each municipality, according to criteria established beforehand.

The agencies in charge of executing the project are the State Secretariat for Agriculture and Supply and the companies linked to the State Government; management responsibilities have been given to the producer cooperatives, the agricultural planning enterprises and the prefectures, in accordance with established procedures. The financial agents, producer associations, and the municipal, regional and State commissions related to soil and water resources management all play an important role as support agencies.

The project has the following components: agricultural research, rural extension, a fund for soil management and conservation and pollution control, revamping of municipal structures, the development of railroad terminals for the distribution of critical inputs, forest development, monitoring and inspection of the uses of the soil, and training.

Annex II

FEDERAL WATER LAW OF MEXICO

The national water law regulates the administration of water and the water programme. It describes procedures for allocating water use or development rights, defines criteria for establishing areas designated as prohibited or as reserves and establishes the criteria for water use. The law also deals with the prevention and control of water pollution, as well as guidelines for investment in water control works, and establishes the offences, penalties and resources for the execution of the law.

1. Description of the Law

In general terms, this law represents a considerable modernization of water resources management, as it specifically incorporates aspects such as the planning and programming of water management and the rational and efficient use of the resource. It reaffirms federal ownership of water resources as inalienable and imprescriptible, on the basis of article 27 of the National Constitution.

It reflects modern thinking concerning the efficient use of natural resources and the preservation of their quality, and also alludes to integrated water management, characterized by greater user participation and streamlining of water programmes. It reaffirms the National Water Commission as the only federal authority for the administration of the resource.

2. Objectives and management tools: The National Water Commission (CNA) and the Riverbasin Councils

The objectives of the law are to regulate the development, use and exploitation of water resources, their distribution and control, as well as the preservation of their quantity and quality, so as to achieve their sustainable integrated development. This constitutes in essence what could be called integrated water resources management.

The law reaffirms the National Water Commission (CNA) as the national administrative authority with respect to waters under federal jurisdiction; the CNA is a decentralized agency of the Ministry for Agriculture and Water Resources.

Article 13 states that the CNA will set up riverbasin councils, defined as bodies for coordination and consensus-building between the commission, the offices and units of federal, state or municipal agencies and representatives of the users of each particular riverbasin, in order to develop and carry out programmes and initiatives for improved water administration, development of water control works and the respective services and the preservation of resources in the riverbasin.

Consequently, the riverbasin councils constitute the primary tool for integrated water resources management. Article 14 stipulates that the Commission will accredit, encourage and support the setting up of organizations by users in order to improve the use of the water and the preservation of its quality.

The law also specifies in article 15 that it will formulate, install and assess a water resources development programme.

3. The concessions

Any use or development of the water resource will be in the form of a concession granted by the Commission.

Article 29 specifies that, in addition to executing projects and development works, concessionaires must make their share of payments as provided for in the revenue laws in force.

Water for urban or public use will be allocated to the municipal or state water supply and sanitation systems, and this activity is the responsibility of the Commission. In all cases, the form of guaranteeing payment of contributions, products and uses provided for by tax legislation, will be applied.

With respect to agricultural use, the law states that owners or occupants of agricultural land, whatever their legal status, will have the right to exploit, use or develop the water resources granted to them by the Commission in the form of a concession. The Commission may authorize the development of water resources in ways different from those indicated in the concession, when the new owner so wishes and no damage is caused to third parties.

Water exploitation, use or development rights, for agricultural use, will be transferrable.

The concession may be granted to individuals or legal entities for exploitation by them or to legal entities for the administration or operation of irrigation systems or for the shared exploitation, use or development of waters under federal jurisdiction for agricultural purposes.

For the administration of systems, legal entities must have a set of regulations defining the forms and conditions of operation, distribution, and other actions. The law provides the irrigation districts with the flexibility to partially or totally alter the use of the water resource, in conformity with their own bylaws.

The exploitation, use or development of water in the case of communal land ("ejidos") and human settlements or on land held in common, will obey the regulations of the communal land or the community. When the general assembly of the ejido resolves that the holder of a share in the ejido may become the full owner of his landholding, the right to exploit, use or develop the water resources necessary for the irrigation of his plot will be considered to have been transferred, and the respective sources or volumes will be specified, taking into account the rights enjoyed.

The producers or farmers are free to form associations, in order to constitute legal entities, with the aim of forming systems for the provision of agricultural irrigation services. In such cases, the concession will be made to the legal entities which group together these users, who will receive freely transferable certificates, in accordance with the regulations issued under the law.

4. Water for the irrigation districts

Article 64 defines the criteria for irrigation districts. In cases where the federal Government has participated in the financing, construction, operation and administration of the works for necessary for the functioning of the district, the Commission will, in a set time-limit, proceed to hand over the administration and operation of the district to the users, in accordance with the terms stipulated by the law and its regulations. The districts will then be operated, preserved and maintained by the users themselves, who will organize in accordance with the criteria for association defined by the law.

Each irrigation district will establish a water committee, which will formulate regulations for the district and will act as the body for building consensus for the appropriate management of the water resource and of the infrastructure. In using the water and services, the users of the irrigation districts are obliged to conform to their regulations and pay charges for the irrigation service which have been set by the users themselves, and which will need to cover at least the administrative and operational costs of the service as well as the costs of conservation and maintenance of the works. These charges will be submitted to the Commission for its approval; approval may be denied if the charges do not comply with the above-mentioned requirements.

Article 71 states that the federal Executive will encourage the organization of producers or farmers and the construction of the necessary infrastructure for setting up the irrigation districts.

5. Use of water in generating electricity

Article 78 stipulates that the Commission will, on the basis of its national resource use studies and plans, be able to grant water rights to the Federal Electricity Company (CFE) without additional red tape; this right will specify the volume to be used for the generation of electricity and for cooling, as well as the grounds on which the right may be terminated.

The Commission will oversee the periodic programme for water extraction from each river, stream, lake, lagoon or any public reservoir and its distribution, so as to coordinate hydroelectric development with the other uses of the water. This situation is very novel in Latin America and the Caribbean, in that the water authority which is empowered to establish the rules governing operation of dams is not the hydroelectricity authority. In most of the countries, it is the hydroelectricity industry which regulates the operation of the dams in accordance with its needs, and without the express intervention of the rest of the users of the water system.

Article 79 states that the Federal Executive will decide on a case by case basis whether it is the National Water Commission or the Federal Electricity Company which will build hydraulic-engineering works.

6. Flood protection and control

The Commission, in coordination with municipal or state Governments, is empowered to build and operate works for flood control and protection of areas susceptible to flooding. With this aim in mind, the Commission will classify areas according to flood risk, and will issue the regulations and

recommendations necessary for enacting operational, control and follow-up measures, and will allocate contingency funds for this purpose.

Similarly, the Commission will intervene when water emergencies occur or in situations caused by exogenous climatological phenomena, always in coordination with the competent authorities.

7. Prevention and control of water pollution

The Commission will be responsible for promoting, building and operating federal infrastructure and the services necessary for the preservation, conservation and improvement of water quality in the riverbasins and aquifers.

It will also design integrated programmes for water resources protection, and will set the specific discharge standards required in the case of waste waters generated by whatever means and monitor their observance. It will be empowered to authorize the dumping of waste waters into the sea, under conditions agreed upon with the Navy Secretariat.

The Commission will also control the quality of the water for human consumption; and will promote the application of disposal methods designed to prevent contamination of underground or surface waters by garbage, toxic waste and materials, sludge, and other substances; and will exercise its responsibilities with respect to the prevention and control of pollution, as well as monitoring and policing activities.

The Commission is the body responsible for setting the standards for discharges, determining the assimilation and dilution capacity of water bodies under federal jurisdiction and the pollution loads that these can receive, as well as quality goals and timetables for their attainment. Both legal entities and individuals will require authorization from the Commission if they discharge waste waters into receiving water bodies, whether intermittently, permanently or accidentally. Prior to granting its authorization, the Commission will have to develop a classification of the water bodies.

In instances where the discharge could potentially affect sources of drinking water supply or public health, the Commission will refuse to grant the relevant permit or will revoke any previously granted permit.

The Commission can order the suspension of activities giving rise to the discharge of waste water in the following situations: lack of a permit; failure to comply with official standards concerning the quality of water discharged; non-payment for use or development rights of federal public goods, such as receiving water bodies; or use of a dilution process on the part of those responsible for the discharge in an effort to meet pre-established standards.

8. Water control works

The law states that the users of water resources are entitled, either by themselves or through third parties, to build the water control works that are required for the development, use or exploitation of these water resources. The administration and operation of such works will be the responsibility of either the users or the executing associations.

The Commission will be empowered to establish regulations or take action to prevent the construction or operation of works that alter the state of the water in a river or endanger people's lives or the safety of their possessions.

It is considered in the public interest to foster and encourage participation by private individuals in the financing, construction and operation of water control works. Accordingly, the Commission will be empowered to negotiate contracts with private individuals to build public works and provide services. The Commission will be empowered to grant a total or partial concession to operate or maintain the water control works built by the federal Government as well as to supply the respective services. The Commission will be empowered to grant a total or partial concession to build, equip and operate the federal water control works and provide the respective service.

In the cases of total or private concession mentioned above, the Commission will set the minimum bases for tendering and for taking the concession. The selection will be made on the basis of the minimum charges that meet the criteria of seriousness, reliability and quality established in the case of each tender.

9. Charges and cost recovery

The minimum charges set must encourage the efficient use of water, discourage excessive use, anticipate any necessary adjustments as a result of the corresponding variable costs, in accordance with known and measurable indicators, and specify a given time period, that at no time can be less than the period required to recover the capital investment.

Lastly, the law refers to the recovery of public investment. Federal investments will be recovered in accordance with the law on betterment levies for federal water control works, through the setting of charges that the beneficiaries of such works will have to pay.

Operating, conservation and maintenance costs will be borne by the users of the services. In the case of irrigation districts or units, land titles or, where holders of a share in communal lands ("ejidatarios") or commune members are concerned, the rights to the use of the plots may be given in guarantee.

Finally, the law states that the exploitation, use or development of water resources under federal jurisdiction, including groundwater, will require payment, by the users, of the charges stipulated by federal legislation on water rights.