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**TRAINING IN WATER RESOURCES MANAGEMENT
IN LATIN AMERICA AND THE CARIBBEAN:
ANALYSIS AND PROPOSALS */**

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CONTENTS

	<u>Page</u>
Summary	v
I. BACKGROUND, OBJECTIVES AND METHODOLOGICAL ASPECTS OF THE STUDY	1
1. Background	1
2. Basis and objectives of the study	2
3. Methodological aspects	2
II. NATURE OF WATER RESOURCES MANAGEMENT IN THE REGION	4
Structural characteristics of water resources management institutions in the region	4
III. SUPPLY OF TRAINING	5
1. Characteristics of training supplied	5
2. Institutions that offer training	14
3. The current situation with respect to the supply of training	14
IV. DEMAND FOR TRAINING	16
1. Characteristics of demand	34
2. Current situation with respect to the supply of training	35
V. CONCLUSIONS AND RECOMMENDATIONS OF THE NATIONAL STUDIES. . .	37
1. Conclusions	37
2. Recommendations	38
Notes	41
Annex - SPECIFIC ASPECTS OF INSTITUTIONAL STRUCTURES IN THE COUNTRIES COVERED BY THE STUDY	43

Summary

This document is a summary of various studies that were carried out in 1988 to assess the supply of and demand for training in water resources management in Latin America and the Caribbean. The countries studied were Argentina, Bolivia, Brazil, Costa Rica, Guatemala, Nicaragua, Peru and Venezuela. These country studies are, the outcome of activities carried out under the project entitled "Training in the Management of Water Resources Projects and Systems" sponsored by the Government of the Federal Republic of Germany and implemented by the Water Resources Unit of the ECLAC Division of Natural Resources and Energy.

Chapter I deals with the background to and justification for the implementation of the study, explains its objectives and describes its most relevant methodological aspects. Chapter II makes some general comments on the nature of water resources management in the region, and describes the main institutional characteristics of each country. Chapters III and IV contain the main observations made in the analysis of the supply of and demand for training. Chapter V highlights the main conclusions and the consultants recommendations.

I. BACKGROUND, OBJECTIVES AND METHODOLOGICAL ASPECTS OF THE STUDY

1. Background

As part of their efforts to stimulate economic growth and provide higher incomes and standards of living for their people, Latin American and Caribbean countries have stepped up the regulation and control of rivers. In that regard, in most countries of the region, the efficiency of management of water control systems has been criticized as has the fact that the alternative environmental opportunities lost as a result of the implementation of many river control projects far outweigh actual benefits.

In response to those concerns, ECLAC has been studying the status of water resources management in the region focusing on the need to improve the quality of such management independently of the manner in which water resources utilization projects or systems are administered. In that connection, ECLAC has concluded that any change in the current status of management requires much more than an analysis of the problem and recommendations on institutional change. There is a general administrative shortcoming in the management of water resources which cannot be corrected through individual reforms; those responsible for administering water projects and systems have to make much broader changes in the perception of tasks.

ECLAC has reached the conclusion that in order to improve the management of water resources in general and of the large water systems in particular and at the same time to achieve greater co-operation between management institutions of the Latin American and Caribbean countries, efforts must be made at the regional level to improve training for the various groups involved in the management of water resources.1/

As a result of the recommendations, various activities have been initiated to assess the supply of and demand for training in water resources management; such assessment could be used to prepare an appropriate programme for the region designed to promote training as well as to formulate an action strategy for implementing a training programme on the management of water resources in the region.

2. Basis and objectives of the study

One of the basic conclusions arrived at by ECLAC following lengthy studies of the main subject areas related to the management of water in Latin America and the Caribbean is that the quality of management needs to be improved since management might help to overcome much of the current inefficiency. Therefore, attaining and maintaining management of good quality is very important to reducing the number of major problems and difficulties encountered in the management process. In that connection, it can be deduced from all the information collected by ECLAC over the years that one of the key requirements for improving the quality of water management in Latin America and the Caribbean is the establishment of a training system for the officials of agencies connected with the management of water resources.

This study aims at improving the management of water resources in general and of the major water systems in particular through better staff training. Specifically, it uses the training courses that are offered or demanded in the countries covered by the study to make an assessment of the options that could improve the system of formal training in water resources management in the region.

It is understood that the countries will have to make considerable efforts to establish a training system for the management of water resources and that the expansion of international activities in that field will also require considerable resources.

The next moves after this study should focus on: establishing a training programme for the management of water resources to meet the region's needs; designing a regional training system and developing an implementation strategy for the programme.

3. Methodological aspects

This survey of the supply of and demand for training in water resources management in eight countries of the region: Argentina, Bolivia, Brazil, Costa Rica, Guatemala, Nicaragua, Peru and Venezuela was conducted on the basis of correspondence or interviews; it focused on the major institutions or bodies connected with the planning and management of water resources and on institutions that offered courses on management or administration. A clear difference was made between the analysis of the availability or supply of training and the study on requests for training so that they could be compared later.

Before the country studies were conducted, the authors met to discuss and agree on a common framework for work covering the following:

a) Using the criteria and questionnaires discussed and agreed upon at the meeting in the country studies;

b) Making a survey of institutions that offer training courses on water resources management including internal courses of the major institutions that do some work in the area of water resources in their respective countries or subregions;

c) Making an inventory of the courses offered as regards content, frequency and characteristic of participants;

d) Assessing the courses from the information compiled with respect to course content quality and level of teaching;

e) Studying potential demand for training in management at various levels from interviews and/or questionnaires sent to managers/administrators of the major institutions responsible for water resources;

f) Making a comparison between potential supply and demand;

g) Making recommendations with a view to establishing a strategy to improve current systems focusing on identifying areas where ECLAC could help to strengthen and supplement such systems.

II. NATURE OF WATER RESOURCES MANAGEMENT IN THE REGION

Structural characteristics of water resources management institutions in the region

The case studies show that there are very many similarities in the way that water resource management and utilization institutions are run in the various countries. However, the differences observed stem from clearly different contexts and policies. Since water management institutions are the biggest source of demand and are major sources of training, the way they are organized and their characteristics should be analysed in some detail.

There is a considerable variety of water resources management models in the countries studied (see annex).

Generally, water management institutions are operated on the legal basis that water is public property hence in all the countries, water is managed by state bodies. However, there are considerable differences in emphasis between national, federal and local water management institutions from country to country.

All the countries have institutions that specialize in various uses of water; the institutions that deal with drinking water are clearly separated from those dealing with irrigation, energy and navigation.

The studies also show that there is an overlap of responsibilities between various organizations in each sector and between the national, federal and local levels of government.

The studies also show that there are common problems with respect to the overall planning of water resources, investments, authorizations of water use and co-ordination between institutions.

III. SUPPLY OF TRAINING

The analysis of the supply of training was based on the criterion used to determine training activities carried out in the last three years by various institutions of the sector. Activities were classified by subject area, frequency, level of target officials and academic level.

The information obtained for the various countries is summarized in table 1.

1. Characteristics of training supplied

All the country studies show that training activities in water resource management-related subject areas are provided by universities, public training agencies, science and technology institutes, institutes that provide services or other assistance as well as some private institutions and international organizations. Usually, the courses offered are external although there have been some rare cases where training courses have been set up by the requesting agencies themselves. Venezuela is the most notable exception; institutions of the country's water sector have their own training units and human resources development units.^{2/}

The studies also show that, except for the Centro de Economía, Legislación y Administración del Agua of Argentina's Instituto Nacional de Ciencia y Técnicas Hídricas (CEIA-INCYTH) none of the countries have institutions that offer comprehensive courses on water resources management. The country studies have identified various institutions that offer training courses of varying lengths in administration and general management at different levels. There are also institutions that confer academic degrees and/or provide training in water resources related technical subjects.

The analysis of the various studies shows that there are well organized, mature and experienced institutions in all the countries that could, with external assistance and within the framework of a Latin American programme, be developed to the appropriate level to offer courses on water resources management; they would use and strengthen existing infrastructure. Finally, the analysis gives an interesting regional profile of training institutions.

Table 1

CHARACTERISTICS OF TRAINING ACTIVITIES OFFERED BY EXTERNAL INSTITUTIONS
TO THE WATER RESOURCES SECTOR, 1985-1987

Country	Institutions	Subject Areas	Frequency	Level of participants
Argentina	<u>Academic</u>			
	Faculty of Law and Social Sciences, Universidad de Buenos Aires	Multidisciplinary specialization in natural resources	Permanent	Middle-level management
	Faculty of Law and Social and Political Sciences, Universidad Nacional del Nordeste (UNN)	Basic guidelines for the integrated development of river basins	Permanent	Middle-level management
	Faculty of Economics, Universidad Nacional de Cuyo	Integrated management of natural resources	Permanent	Top and middle-level management
	Faculty of Law, Universidad Nacional de Rosario (UNR)	Environmental law	Annual	Top and middle-level management
	Faculty of Law and Political Science, Universidad Católica Argentina, "Santa María de los Buenos Aires" (UCA)	Natural resources and environmental law	n/d	Middle-level management
	Facultad de Ciencias Hídricas, Universidad Nacional de San Luis (UNL)	Water resources engineering	n/d	Operational staff
	<u>Non-academic</u>			
	Centro de Economía, Legislación y Administración del Agua/Instituto Nacional de Ciencia y Técnicas Hídricas (CELA-INCYTH)	Integrated management of water resources	n/d	Top and middle-level management

Table 1 (cont.1)

Country	Institutions	Subject Areas	Frequency	Level of participants
Bolivia	Servicio nacional de agua potable y saneamiento	Plant operators and systems design	Three courses	Operational staff
	Comité nacional para el programa hidrológico internacional (CONAPHI)	International Course on Hydrology	Biannual	Middle-level management and operational staff
	<u>Academic</u>			
	Instituto de hidráulica e hidrología, Universidad Mayor de "San Andrés"	Hydraulics, hydrology and hydraulic laboratories	n/d	Operational staff
	Universidad Católica Boliviana	Development planning	n/d	Operational staff
Brazil	<u>Non-academic</u>	Land economics, business and agribusiness administration	n/d	Operational staff
	Instituto Superior de Administración Pública (ISAP)	Administration, projects, financing, planning	n/d	Operational staff
	Asociación nacional de empresas de servicios de agua potable y alcantarillado	Organizing matters to make it easier for civil servants or professionals to attend external courses	n/d	Operational staff
	<u>Academic</u>			
	Institute of Hydraulic Research, Universidade Federal do Rio Grande do Sul	Masters degree in water resources and sewerage	Annual	n/i
		Techniques in hydrology	n/d	n/i

Table 1 (cont.2)

Country	Institutions	Subject Areas	Frequency	Level of participants
	Centro de hidráulica e hidrologia Universidade Federal do Paraná	Hydraulic engineering	Annual	n/i
	Universidade Estadual Paulista "Julio de Mesquita Filho"	Doctorate degree in irrigation and drainage	Annual	n/i
		Masters degree in irrigation and drainage	Annual	n/i
	Universidade Federal do Ceará, Instituto de saneamiento ambiental	Masters degree in water resources	Annual	n/i
		Drainage and control of urban erosion	n/d	n/i
	Universidade Federal de Pernambuco	Specialization in water resources engineering	n/d	n/i
	<u>Non-academic</u>			
	Companhia de desenvolvimento do vale do Rio São Francisco Ministério Extraordinário da Irrigação	Courses on the integrated management of water resources, water planning, irrigation and drainage	n/d	n/i
	Departamento Nacional de Aguas e Energia Eléctrica, Ministério das Minas e Energia	Courses and seminars on the integrated management of water resources, hydrometeorology, hydraulic engineering and computer programming with respect to hydrometeorology	n/d	n/i
	Departamento nacional de obras contra assecas, Ministério Extraordinário da Irrigação	Courses on Fishing and Fish Breeding	n/d	n/i

Table 1 (cont.3)

Country	Institutions	Subject Areas	Frequency	Level of participants
	Superintendencia do Desenvolvimento do Nordeste, Ministério do Interior	Courses on Irrigation and on Environmental Protection	n/d	n/i
	Companhia paraense de electricidade	Course on impact assessment	n/d	n/i
	Secretaria Especial do Meio Ambiente, Ministério para urbanismo, habitação, e meio ambiente	Courses on the administration and management of water resources and on hydrology	n/d	n/i
	Programa de Irrigação do Nordeste, Ministério Extraordinário da Irrigação	Courses on the formulation and assessment of irrigation and drainage projects	n/d	n/i
	National Irrigation Programme, Ministério Extraordinário da Irrigação	Courses on irrigation	n/d	n/i
Costa Rica	<u>Non-academic</u>			
	Tropical Agricultural Research and Training Centre (CATIE)			
	Central American Institute of Business Management (INCAE)			
	Central American Institute of Public Administration (ICAP)			

Table 1 (cont.4)

Country	Institutions	Subject Areas	Frequency	Level of participants
Guatemala	<u>Academic</u>			
	Escuela regional de ingeniería sanitaria, Universidad de San Carlos de Guatemala			
	<u>Non-academic</u>			
	Central American Institute of Business Management (INCAE)			
Nicaragua	<u>Academic</u>			
	Programa de maestría en ingeniería ambiental, Universidad Nacional Autónoma de Nicaragua			
	<u>Non-academic</u>			
	Central American Institute of Business Management (INCAE)			
Peru	<u>Academic</u>			
	Universidad de Lima	Administration	n/i	n/i
	Universidad del Pacífico	Administration	n/i	n/i
	Universidad Nacional de Ingeniería	Sanitary engineering	n/i	n/i
	Universidad Nacional Agraria	Agricultural and related engineering	n/i	n/i

Table 1 (cont.5)

Country	Institutions	Subject Areas	Frequency	Level of participants
	Universidad de Lima	Geography	n/i	n/i
	Universidad Nacional Mayor de San Marcos de Lima	Geography	n/i	n/i
	Pontificia Universidad Católica del Perú	Economics	n/i	n/i
	Universidad del Pacífico	Economics	n/i	n/i
	Universidad Nacional de Ingeniería	Environmental engineering	n/i	n/i
	<u>Non-academic</u>			
	Graduate School of Business (ESAN)	Administration, finance, marketing techniques, logistics, operation, production, project formulation and evaluation	n/i	Top and middle-level management and operational staff
	Escuela superior de administración pública	Public administration	n/i	Top and middle-level management and operational staff
	National Planning Institute (INP)	Project planning	n/i	Top and middle-level management and operational staff
	Pan-American Center for Sanitary Engineering and Environmental Sciences (CEPIS)	Administration and management of drinking water enterprises	n/i	Operational staff

Table 1 (cont.6)

Country	Institutions	Subject Areas	Frequency	Level of participants
Venezuela	<u>Academic</u>			
	Universidad Simón Bolívar	Water resources planning and engineering	Bimonthly	Operational staff
	Instituto de estudios superiores de administración	Training in management	Annual	Middle-level management
	<u>Non-academic</u>			
	Inter-American Center for the Integral Development of Water and Land Resources (CIDIAT)	Postgraduate course on water resources planning and development	Annual and biannual	Middle-level management and operational staff
		Postgraduate course on irrigation and drainage engineering Postgraduate course on water works, methods of irrigation, project formulation and evaluation, operation of irrigation systems, aquifer simulation models, etc.		
	Fundación Instituto de Mejoramiento Profesional del Colegio de Ingeniería de Venezuela	Various technical and administrative subjects	Annual and quarterly	Middle-level management
	Ministerio del Ambiente y Recursos Naturales Renovables	Training in management	Annual	Middle-level management and operational staff
	National Institute of Sanitation Works (INOS)	Various technical systems	Annual	Operational staff

Table 1 (concl.)

Country	Institutions	Subject Areas	Frequency	Level of participants
	Compañía Anónima de Administración y Fomento Eléctrico (CADAFE)	Training in management	n/i	Operational staff
	Electrificación del Caroní, CA. (ENDELCA)	Management techniques	n/i	Operational staff
	Instituto Nacional de Canalizaciones (INC)	Refresher courses in management	Annual	Operational staff

2. Institutions that offer training

In line with the foregoing, universities are the institutions that offer the greatest number of graduate courses in water resources management; in some cases, the academic level is exceptional. It can be concluded that only a few universities can be used as backstops for the development of a regional training strategy.

Usually, universities offer academic courses on the physical and operational aspects of water systems. In the whole of the region, institutions that offer integral water resources management courses are few. For example in Brazil, 80% of the topics treated in academic courses related to the management of water resources are in the physical and operational field. Many universities of the region have business administration training centres that offer courses on certain aspects of management which could be used to upgrade the skills of administrators/managers of water resources systems and projects. However, apart from universities, such institutions and other similar institutions in the public and private sectors can handle only aspects relating to providing support for training in the integral management of water resources systems and projects. The courses that are offered at different academic levels can meet training requirements in specific aspects depending on the subject area or the location of the institution.

In the region, there are a few institutions that specialize in offering courses on management in general and on the water resources sector in particular, especially, specific aspects of water management. Such institutions provide postgraduate, specialization, practical and field training. Such institutions meet the requirements for organizing a training programme on the integrated management of water resources. They include CELA-INCYTH of Mendoza, Argentina; the Getulio Vargas Foundation in Rio de Janeiro; the Inter-American Center for the Integral Development of Water and Land Resources (CIDIAT), in Mérida, Venezuela; the Graduate School of Business (ESAN), in Lima and the Central American Institute of Business Management (INCAE) in San José.

There are also other public and private institutions that focus their training on more marginal subjects such as consumer organization and training in management. Although such courses are of mixed academic quality, they could cover specific aspects depending on the subject area or where the institutions are located. The experience of such institutions could be very valuable in preparing a training programme.

3. The current situation with respect to the supply of training

Although there are academic and non-academic institutions that offer water resource management-related courses, the current situation is far from ideal if the desired aim is to offer training in integral water management. Virtually no training in integral water management is offered. For example, the study identified only one institution in the sector in Central America that had conducted a training programme on the principles of administration for its professionals. Only one of the countries studied, Venezuela, has a national training system which covers all aspects of water resources

management; however, even in this case, no courses are offered on integral management.

In order to achieve the objective of promoting the establishment of a training system on integral water management in the region, support would have to be provided to institutions that already offer courses in related areas or have expressed interest in such problems. Such training institutions, together with institutions of the sector, could be used as the basis for establishing a regional structure capable of offering courses on the integral management of water resources. The studies demonstrate that co-operation with respect to training can be established without creating new institutions; such co-operation could actually be set up by adapting current programmes and, if need be, adding new courses. The appropriate infrastructure exists for organizing courses for the executive staff of institutions and for middle-level and operational staff.

IV. DEMAND FOR TRAINING

The study on the demand for training of water management institutions was carried out in two phases:

- a) Analysis of training activities implemented over the past three years which shows explicit demand;
- b) Identification of future training needs with a view to working out the approximate potential demand.

Training activities were treated in the same way as training offered in order to harmonize them; interviews or surveys were used to compile information on each country for the period 1985-1987 on training policies, the level of officials trained, frequency, subject areas and types of activity organized (internal or external) in each one of the institutions consulted. The information obtained is set out in table 2.

The subject areas were classified as follows:

- a) Integral management which looks at water as a component part of all management activities;
- b) Management of subsystems which includes courses on one or more specific aspects of the management process such as project assessment, planning and financial management;
- c) Technical courses on any subject related to water management;
- d) Other types of courses on subjects such as human behaviour in groups and others.

The same method was used to analyse future training needs: the reports presented by each consultant were based on the statements of the institutions themselves (see table 3). In this case, the variables for each country and for each institution are the following: subject area required, level of officials, level of activity and organization of training in the institution.

Table 2

SURVEY OF TRAINING IN WATER RESOURCES MANAGEMENT: CHARACTERISTICS OF TRAINING
ACTIVITIES CONDUCTED BY WATER RESOURCES INSTITUTIONS (1985-1987)

Institution	Type	Training policy	Level of participants	Frequency	Subject area of the course	External or internal
<u>Argentina</u>						
<u>Planning</u>						
Servicio Nacional de Agua Potable		Incentives for professionals	Middle-level management	Annual	Management and techniques	E
Secretaría de Recursos Hídricos		Incentives for managers and professionals	Top and middle-level management	Annual	Integral management	I
Secretaría de Obras y Servicios Públicos, San Luis		Incentives for professionals	Middle-level management	Annual	Integral management, management and techniques	E and I
<u>Drinking water</u>						
National Sanitation Works		Incentives for technicians and professionals	Top and middle-level management and operational staff	Annual	Integral management, management and techniques	E and I
Obras sanitarias, Catamarca		Incentives for technicians and professionals	Middle-level management and operational staff	Annual	Management and techniques	E and I

Table 2 (cont.1)

Institution	Type	Training policy	Level of participants	Frequency	Subject area of the course	External or internal
Agua potable y saneamiento, Formosa		Promoting the internal transfer of know-how. Also sends technicians on courses outside the institution				
Obras sanitarias, Mendoza		Incentives for professionals and technicians	Top and middle-level management and operational staff	Annual	Integral management, management and techniques	E and I
Departamento provincial del agua, Río Negro		Incentives for professionals	Middle-level management	Annual	Integral management and management	E and I
Obras sanitarias, San Juan		Incentives for professionals	Middle-level management	Annual	Integral management and management	E
Servicios públicos, Santa Cruz		Incentives for professionals	Middle-level management and operational staff	Annual	Management	E
Obras sanitarias, Santiago del Estero		Incentives for professionals	Middle-level management	Annual	Integral management and management	E
Obras sanitarias, Municipality of San Luis		Incentives for professionals	Middle-level management	Annual	Techniques	E
Obras sanitarias, Mar del Plata		Incentives for professionals	Middle-level management	Annual	Techniques	E
Saneamiento ambiental, Entre Ríos		Incentives for professionals	Operational staff	Annual	Techniques	E

Table 2 (cont.2)

Institution	Type	Training policy	Level of participants	Frequency	Subject area of the course	External or internal
<u>Irrigation</u>						
Depto. general de irrigaciones, Mendoza		Incentives for professionals	Middle-level management	Annual	Management	E
Dirección provincial del agua, La Pampa		Incentives for professionals	Middle-level management	Annual	Management	E
Adm. provincial de recursos hídricos, Santiago del Estero		Incentives for professionals	Top and middle-level management	Annual	Management and techniques	E
Dirección general agua subterránea, La Rioja		Incentives for professionals	Middle-level management	Annual	Management	E
Dirección del agua, San Luis		Incentives for professionals	Middle-level management and operational staff	Annual	Management and techniques	E
<u>Other</u>						
Centro de geociencias aplicadas, Chaco		Incentives for professionals	Middle-level management	Annual	Management and techniques	I
HIDRONOR (Hidroeléctrica norpatagónica, S.A.)		Incentives for professionals and technicians	Top and middle-level management and operational staff	Annual	Management and techniques	E and I
Federal Investors Council (CFI)		Incentives for professionals and technicians	Middle-level management and operational staff	Annual	Management and techniques	E
Agua y Energía Eléctrica, Empresa del Estado		Incentives for professionals and technicians	Middle-level management and operational staff	Annual	Management and techniques	E and I

Table 2 (cont.3)

Institution	Type	Training policy	Level of participants	Frequency	Subject area of the course	External or internal
<u>Brazil</u>						
The study did not include information on this topic						
<u>Costa Rica</u>						
Dirección General Forestal (DGF)	04	Positive but lacks resources	Operational staff	Annual	Technical	E
Sec. Ejec. Planif. Nac. del Sector Agropecuario Ministry of Health	04					
National Electricity Company (SNE)		Does not have a permanent training programme. Provides support to professionals	Operational staff	Annual	Technical	E
Instituto Costarricense de Acueductos y Alcantarillados (ICAA) Costarrican Electricity Institute	04	Has a constructive policy that focusses on electricity and telecommunications systems and on administration	Top and middle-level management	Annual	Management of subsystems and techniques	E
Servicio Nacional de Aguas Subterráneas (SENAS)	03	Has a training policy which is severely restricted by limited financial resources	Operational staff	Annual	Technical	E

Table 2 (cont. 4)

Institution	Type	Training policy	Level of participants	Frequency	Subject area of the course	External or internal
<u>Guatemala</u>						
Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología	04	The staff frequently take part in courses abroad and in the country	n/i	n/i	n/i	
Instituto Nacional de Electrificación (INDE)	04	Activities are sporadic and concentrate on hydraulics	Operational staff	Annual	Technical	n/i
Empresa Municipal de Agua Potable (EMPAGUA)	02	Gives priority to the training needs of junior staff	Operational staff	Annual	Technical	n/i
Municipal Development Institute	02	Has conducted limited training activities	Operational staff	Annual	Technical	E
Dirección técnica de riego y avenamiento	03	Has provided technical training for professionals	Operational staff	Annual	Technical	E
Unidad ejecutora del programa de acueductos rurales	02	Has implemented technical training programmes	Operational staff	Annual	Miscellaneous	
Departamento de acueductos y alcantarillados	02	Has trained sanitary engineers	Operational staff	Annual	Technical	E
<u>Nicaragua</u>						
Dirección de los recursos naturales y del ambiente	04	Training policy affected by the lack of appropriate resources	n/i	n/i	n/i	n/i
Nicaraguan Institute of Territorial Studies	04	Does not offer training activities due to a lack of resources	n/i	n/i	n/i	n/i

Table 2 (concl.)

Institution	Type	Training policy	Level of participants	Frequency	Subject area of the course	External or internal
Nicaraguan Energy Institute	04	Has all types of training programmes	Top and middle-level management and operational staff	Annual	Management of subsystems, technical and operational	E
Instituto nicaraguense de acueductos y alcantarillados	02	The organization has a masters programme in sanitary and environmental engineering	Middle-level management and operational staff	Annual	Technical and operational	
Ministerio de Desarrollo Agropecuario y Reforma Agraria	03	Frequently supports technical and managerial training activities	Middle-level management and operational staff	Annual	Management of subsystems, technical and operational	

Note: In table 2 and 3 of this document, country training activities are analysed on the basis of the following variables:

a) Institutions are classified by type into those responsible for national, regional or provincial planning (01); drinking water and sanitation (02); irrigation and drainage (03); others, hydroelectricity, navigation, etc. (04).

b) The institution's training policy.

n/1 = no information; n/d = no date.

Table 3

SURVEY OF DEMAND FOR TRAINING IN WATER RESOURCES MANAGEMENT:
CHARACTERISTICS OF OVERALL FUTURE TRAINING NEEDS

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
<u>Argentina</u>				
Servicio nacional de agua potable	01	Integral management, management of subsystems and techniques	Top and middle-level management and operational staff	E & I
Secretaría de Recursos Hídricos	01	Integral management, and management of subsystems	Top and middle-level management	E & I
Secretaría de Obras y Servicios Públicos	01	Integral management and management of subsystems	Top and middle-level management	E & I
National Sanitation Works	02	Integral management, management of subsystems and techniques	Top and middle-level management and operational staff	E & I
Obras sanitarias, Catamarca	02	Integral management, management of subsystems and techniques	Top and middle-level management and operational staff	E

Table 3 (cont.1)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
Agua potable y saneamiento, Formosa	02	Integral management, management of subsystems and techniques	Top and middle-level management and operational staff	E
Obras sanitarias, Mendoza	02	Integral management, and management of subsystems	Top and middle-level management and operational staff	E
Departamento provincial de agua, Río Negro	02	Integral management and management of subsystems	Top and middle-level management	
Obras sanitarias, San Juan	02	Integral management and management of subsystems	Top and middle-level management	
Servicios públicos, Santa Cruz	02	Integral management and management of subsystems	Top and middle-level management	
Obras sanitarias, Santiago del Estero	02	Integral management and management of subsystems	Top and middle-level management	E
Obras sanitarias, Municipalidad de San Luis	02	Integral management and management of subsystems	Top and middle-level management	E
Obras sanitarias, Mar del Plata	02	Integral management and management of subsystems	Top and middle-level management	E

Table 3 (cont.2)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
Saneamiento ambiental, Entre Ríos	02	Management of subsystems and techniques	Middle-level management and operational staff	E
Depto. general de irrigación, Mendoza	03	Integral management and management of subsystems	Top and middle-level management	E
Dirección provincial de aguas, La Pampa	03	Integral management and management of subsystems	Top and middle-level management	E
Dirección provincial de recursos hídricos, Santiago del Estero	03	Integral management and management of subsystems	Top and middle-level management	E
Dirección agua subterránea, La Rioja	03	Integral management and management of subsystems	Top and middle-level management	E
Dirección del agua, San Luis	03	Integral management and management of subsystems	Top and middle-level management	E
Centro geociencias aplicadas, Chaco	04	Management of subsystems	Middle-level management	I
Hidroeléctrica norpatagónica, S.A. (HIDRONOR)	04	Integral management and management of subsystems	Top and middle-level management	E
Federal Investors Council (CFI)	04	Integral management and management of subsystems	Top and middle-level management	E
Agua y Energía Eléctrica, Empresa del Estado	04	Integral management and management of subsystems	Top and middle-level management	E & I

Table 3 (cont.3)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
<u>Bolivia</u>				
Ministerio de Planeamiento y Coordinación	01	Integral management, management of subsystems and techniques	Top and middle-level management and operational staff	E
Ministerio de Asuntos Campesinos y Agropecuarios	01	Integral management, management of subsystems and techniques	Top and middle-level management and operational staff	E
Ministerio de Energía e Hidrocarburos	01	Management of subsystems	Top and middle-level management	E
Ministerio de Minería y Metalurgia	01	Integral management and management of subsystems	Top and middle-level management	E
Subsecretarías de Urbanismo y de Vivienda	02	Integral management and management of subsystems	Top and middle-level management	E
Ministerio de Previsión Social y Salud Pública	02	Integral management and management of subsystems	Top and middle-level management	E
Regional Corporations	04	Integral management and management of subsystems	Top and middle-level management	E
Municipalities	02			
Instituto nacional de riego	03	Integral management and management of subsystems	Top and middle-level management	E
Dirección de cuencas hidrográficas	03	Integral management and management of subsystems	Senior management	E

Table 3 (cont.4)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
<u>Brazil</u>				
Presentation by regions and subdivided into State and Federal levels without identifying any institutions				
State level	n/i	Integral management of subsystems	Top and middle-level management	E
Federal level	n/i	Integral management and management of subsystems	Top and middle-level management	E
<u>Costa Rica</u>				
National Electricity Company	04	n/i	n/i	
Costa Rican Electricity Institute	04	n/i	n/i	
Instituto Costarricense de Acueductos y Alcantarillado (ICAA)	02	Management of subsystems and techniques	Top and middle-level management	E & I
Servicio Nacional de Aguas Subterráneas (SENAS)	03	Management of subsystems and techniques	Top management	E
Dirección General Forestal (DGF)	04	Integral management	Senior management	E
<u>Guatemala</u>				
Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología	04	Integral management	Senior management	E

Table 3 (cont.5)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
Instituto Nacional de Electrificación (INDE)	04	Integral management, management of subsystems and techniques	Top and middle-level management and operational staff	E
Empresa Municipal de Agua Potable (EMPAGUA)	02	Techniques	Operation staff	E
Municipal Development Institute	02	n/i	n/i	n/i
Dirección Técnica de Riego y Avenamiento	03	Integral management	Top management	E
<u>Nicaragua</u>				
Dirección de recursos naturales y del ambiente	04	n/i	n/i	n/i
Nicaraguan Energy Institute	04	Integral management and management of subsystems	Top and middle-level management	E
Instituto Nicaragüense de Acueductos y Alcantarillados	02	Integral management and management of subsystems	Top and middle-level management	E
<u>Peru</u>				
National government:				
National Planning Institute:				
Dirección de planificación regional	01	Integral management and management of subsystems	Top and middle-level management	E
Dirección de inversiones	01	Integral management and management subsystems		

Table 3 (cont. 6)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
COTERNALES				
	01	Integral management	Senior management	E
Proyectos microrregionales	01	Integral management	Senior management	E
Ministerio de la Presidencia: Programa multisectorial de riego	03	Management of subsystems	Middle level-management	E
Programa especial selva	04	Integral management and management of subsystems	Top and middle-level management	E
Ministerio de Agricultura: Dirección de Aguas de Regadío (DAR)	01	Integral management and management of subsystems	Top and middle-level management	E
Direcciones regionales	01	Integral management and management of subsystems	Top and middle-level management	E
Autoridad de riego	03	Integral management and management of subsystems	Top and middle-level management	E
Dirección de irrigación	03	Management of subsystems	Middle-level management	E
Ministerio de Pesquería: Dirección de aguas continentales	04	Management of subsystems	Middle-level management	E
Ministerio de Energía y Minas: Oficina de Planificación	01	Integral management and management of subsystems	Top and middle-level management	E

Table 3 (cont.7)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
Dirección de medio ambiente	01	Integral management and management of subsystems	Top and middle-level management	E
Empresas mineras	04	Management of subsystems	Middle-level management	E
Empresas de electricidad	04	Integral management and management of subsystems	Top and middle-level management	E
Empresas de servicio eléctrico	04	Management of subsystems	Middle-level management	E
Ministerio de Vivienda y Construcción:				
Servicio nacional de agua potable y alcantarillado	03	Integral management and management of subsystems	Top and middle-level management	E
Empresas de servicios de agua	02	Management of subsystems	Middle-level management	E
Dirección de saneamiento	02	Management of subsystems	Middle-level management	E
Ministerio de Salud:				
Dirección de ingeniería sanitaria	02	Management of subsystems and techniques	Middle-level management and operational staff	E
Regional government:				
National Planning Institute	01	Integral management and management of subsystems	Top and middle-level management	E

Table 3 (cont.8)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
Secretaría de producción	n/i	Management of subsystems	Top management and operational staff	
Secretaría de infraestructura	n/i	Management of subsystems	Middle-level management	E
Secretaría social	n/i	Management of subsystems	Middle-level management	E
Local governments: Water Division	n/i	Management of subsystems	Middle-level management	E
Energy Division	04	Management of subsystems	Middle-level management	E
Consejo nacional de cuencas	01	Management of subsystems	Middle-level management	E
Consejo regional de cuencas	01	Management of subsystems	Middle-level management	E
Autoridad de cuencas	01	Management of subsystems	Middle-level management	
<u>Venezuela</u>				
Ministerio del Ambiente y Recursos Naturales Renovables	01	Integral management and management of subsystems and techniques	Top and middle-level management and operational staff	E

Table 3 (cont.9)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
National Institute of Sanitation Works (INOS)	02	Integral management, management of subsystems and techniques	Top management and operational staff	E & I
Ministerio de Agricultura y Cría	03	Management of subsystems and techniques	Middle-level management and operational staff	E
Compañía Anónima de Administración y Fomento Eléctrico (CADAFE)	04	Management of subsystems and techniques	Middle-level management and operational staff	E
Instituto Nacional de Canalizaciones (INC)	04	Integral management and management of subsystems	Middle-level management and operational staff	E
Electrificación del Caroní, C.A. (ENDELCA)	04	Management of subsystems and techniques	Middle-level management and operational staff	E

Table 3 (concl.)

Institution	Activity Code	Subject area required	Level of staff for whom training is organized	External or internal
Ministerio de Sanidad y Asistencia Social	04	n/i	n/i	n/i
Corporación de los Andes (CORPOANDES)	03	Technical management	Operational staff	E

Note: In tables 2 and 3 of this study, country training activities are analysed on the basis of the following variables:

- a) institutions are classified by type into those responsible for national, regional or provincial planning (01); drinking water and sanitation (02); irrigation and drainage (03); other, hydroelectricity, navigation, etc. (04).
- b) the institution's training policy.

n/i = no information; n/d = no dates.

1. Characteristics of demand

It is clear that training is part and parcel of the activities of the vast majority of the institutions that were surveyed; the volume of training is directly proportional to how developed the institutions of any specific sector are. Thus, sanitation agencies in Argentina, Bolivia and Peru and irrigation agencies in Brazil had a relatively greater demand for training.

Similarly, there is a direct relationship between training requirements and the size of institutions: the bigger the institution is, the greater seems to be the amount of training it requires.

Training activities conducted over the past three years in all the countries and institutions surveyed focused on subsystem management or on purely technical aspects. In the context of this study, subsystem management means the study of specific subjects or aspects of subjects such as project evaluation, planning and financial management. Such study is always done on a subject-by-subject basis.

In the case of Peru, an adequate level of training is provided for officials of the technical category and this apparently makes it easy for them to quickly understand integral management. Nevertheless, given the mobility of staff as a result of low salaries, the level of training must be maintained.

In the case of Bolivia, the potential demand for training in integral management that appears on the surveys is almost nil; this is because Bolivia does not have a legal or administrative framework to facilitate such training. Although there are no training activities on integral water resources management in Argentina, Brazil and Venezuela, various institutions consulted revealed that there was a great need for courses on the subject.

In Costa Rica, Guatemala and Nicaragua, future demands, other than a few exceptions, were for technical training courses and programmes. The study attributes this to the low priority that the professionals of water resource institutions assigned to administrative duties.

The analysis of the relationship between the level of officials who are trained and the subject area shows that historical demand stresses training in subsystem management and technical aspects at all levels. On the other hand, as far as future demand is concerned, there is an emphasis on the training of top and middle-level managerial staff in integral management.

On the organization of training over the period considered, the study shows that in most of the institutions, such training is carried out by government bodies external to the institutions; more often than not, such bodies provide services within the framework of agreements such as the one signed with CIDIAT in Venezuela or with CELA-INCYTH in Argentina.

Some quantitative estimates of demand were made from the scanty information available. The quantitative estimates are set out in table 4; in all cases, they are based more on projections than on actual statistics.

2. Current situation with respect to the supply of training

The surveys carried out in the countries covered by the study indicated that institutions in the various sectors needed training in integral water resources management. The study itself used both the written replies to questionnaires and material from interviews to clearly state the need for such training.

As the subject requirements differed from sector to sector, demand was accordingly segmented.

As far as training in subsystem management is concerned, the subjects in greatest demand are related to areas such as administration, finance, economics, tariffs, project evaluation and organizational analysis.

Although there was clearly a need for technical training, technical training is not analysed in the study because it does not fall under the project's main objective.

In general, institutions mostly opt for training courses that are tailored to their own needs and are offered on their premises because they feel that such an approach yields greater practical benefits. This means that the courses proposed must be highly pragmatic in order to train civil officials to take decisions in the context of many disciplines.

The training costs for each participant for the whole region cannot be assessed from the data available. Nevertheless, it could be inferred from internationally calculated costs, that many institutions could offer training. Other institutions obviously also require specific financing to be able to offer training courses.

Table 4

ESTIMATE OF THE POTENTIAL NUMBER OF OFFICIALS WHO REQUIRE TRAINING
IN INTEGRAL WATER RESOURCES MANAGEMENT FOR EACH COUNTRY

Country	Sector	Level of officials			
		Top management	Middle-level management	Operational staff	Grand total
Argentina	Planning and policy making	48	72		
	Drinking water and sewerage	64	192	320	
	Irrigation	36	108	180	
	Other	24	72	120	
	<u>Subtotal</u>	<u>172</u>	<u>444</u>	<u>620</u>	<u>1 236</u>
Bolivia	National government	4	20	n/i	24
	<u>Subtotal</u>	<u>4</u>	<u>20</u>	<u>n/i</u>	<u>24</u>
Brazil	State level	190	1 141		
	Federal level	86	602		
	<u>Subtotal</u>	<u>276</u>	<u>1 743</u>		<u>2 019</u>
Costa Rica		20	28 +	22	64 134
Guatemala		16	30 +	18	62 124
Nicaragua		16	26 +	18	52 112
	<u>Subtotal</u>	<u>178</u>	<u>84 +</u>	<u>58</u>	<u>52 372</u>
Peru	National government	19	53	n/i	72
	Regional governments	12	36	n/i	48
	Future national council on river basins	3	n/i	n/i	3
	<u>Subtotal</u>	<u>34</u>	<u>89</u>	<u>n/i</u>	<u>123</u>
Venezuela		n/i	n/i	n/i	

V. CONCLUSIONS AND RECOMMENDATIONS OF THE NATIONAL STUDIES

The main conclusions and recommendations of the country study reports have been summarized in this chapter. The conclusions are a general summary while the recommendations have been taken directly from each country study.

1. Conclusions

The studies in individual countries of the offer for and supply of training show that there are many aspects and circumstances common to all water resources management institutions that are highly representative of the management situation in Latin America and the Caribbean.

a) There are a number of external and internal characteristics of water management institutions that recur systematically. As far as the external context is concerned, it is obvious that the economic situation is one of the main factors that affect for the development and performance of institutions. In addition, the external institutional context is normally characterized by considerable overlaps in the jurisdictions of institutions, a lack of co-ordination between the different institutions in the sector and unsuitable laws and regulations. Another significant factor is that, as a result of centralized administrative decision-making in many of the countries, decisions are not taken in the areas where problems arise. This hampers the performance and development of institutions. As far as the internal context is concerned, the institutions suffer from excessive bureaucracy, have failed to adopt modern managerial practices, are unable to retain most of the qualified staff and use unsuitable management instruments. As far as the physical and operational aspects are concerned, services offered have been unable to meet a growing demand in various sectors, domestic and industrial wastes have not been properly treated and eliminated and this has generated considerable environmental problems and a considerable decline in the quality of life.

b) There are virtually no institutions in the region that provide training in integral water resources management. With the exception of CELA that has been providing such training since 1985 and of CIDIAT which will begin to offer such training in 1989, the training offered in the countries has tended to focus on technical and operational subjects or on the administration of public or private institutions in general. This means that training in integral water resources management can be described as scattered and unsystematic.

c) The subject areas covered by training activities respond by and large to the relative emphasis of prevailing water policies. Thus, for example, in Argentina, Bolivia, Costa Rica and Peru training has focused on the drinking water and sewerage sector while in Brazil it has focused on irrigation; such focus which fits in with the priorities established by the governments as reflected in the budget allocations. This conclusion is relevant because in designing future training activities, water policy priorities have to be reflected in the allocation of financial resources.

d) The demand for training in integral water resources management has a common characteristic in all the countries considered: it is largely a latent demand since no solid budgetary provisions have yet been made to satisfy it. When officials of various levels are offered the prospect of integral and interdisciplinary training in water resources management they show a marked interest in such training. This is because such training is a new product with which most of the Latin American and Caribbean institutions are not familiar; they are still unaware of its usefulness and potential contribution to improving the management of water resources.

e) Although, generally speaking, institutions in the region are not yet familiar with training in integral water resources management, it can be inferred from the surveys that there is a considerable gap between the current supply of and potential demand for such training; that considerable efforts need to be made in terms of defining a training programme on integral management and organizing the region's existing resources so as to provide such training with maximum efficiency.

2. Recommendations

The main recommendations of the country studies on future training activities are as follows:

a) In the study on Argentina, it is proposed that a permanent programme on integral water resources management based in educational institutions with previous experience such as CELA in Mendoza be promoted so as to develop the relationship between countries with similar problems. It is proposed that such activity be co-ordinated by ECLAC. It is recommended that the courses should use an approach based on modern management concepts which reflect the social context of the students. To carry out the above-mentioned activities, it is suggested that a team be established to prepare a detailed training programme in line with the objectives for the whole region and to prepare support with bibliographical material. The team should be composed of representatives of the whole region.

b) The study on Brazil stresses the fact that the Brazilian authorities have to be alerted to the need for training water resources managers and recommends that the authorities should make efforts to organize, promote and implement such activities. Priority should be given to training of a general nature so that the physical and operational aspects of the multiple uses of water could be integrated into interinstitutional management relations and processes. Priority should also be given to offering a wide range of training since different levels of management have to be catered for:

strategic and institutional and managerial. In designing the system of training, due account should be taken of the fact that there are regional dissimilarities between countries and within each country. It is also suggested that educational activities should be developed in such a way that they not only transmit but also generate know-how. With respect to institutions, it is suggested that the authorities support the establishment of a pilot water resources training network at the national level that has regional connections and is composed of training and research bodies of proven excellence. In Brazil, this pilot network could be made up, at the regional level, of the Institute of Hydraulic Research of the Universidade Federal do Rio Grande do Sul (IPH/UFRGS) and the Centre for Studies and Research on Hydraulics and Hydrology of the Universidad Federal do Paraná (CEPHH/UFDR) in the south; in the south-east, its components could be some of the centres that are under the universities of São Paulo and Rio de Janeiro and in the north-east the federal universities of Paraíba and Ceará. All these universities have centres that specialize in water and would be co-ordinated during the pilot phase by the Inter-American School of Public Administration of the Getúlio Vargas Foundation.

c) In the study on Costa Rica, Guatemala and Nicaragua it is recommended that a training programme be established which would be targeted at the higher authorities of the various institutions in order to achieve greater acceptance of the programme; this would reverse the current tendency to give very low priority to the subject of management. The programme's objectives should be clearly set out and widely disseminated. The activities that are suggested in connection with the launching of the programme should include the preparation and wide dissemination of special brochures; visits by staff members of ECLAC or of the appropriate institution to the various countries in order to secure the support of governments and of staff working in the water sector; and finally, a meeting of leaders of the water sector also aimed at securing government support where some aspects of the style of training planned would be demonstrated. The programme's main characteristic should be a clear-cut orientation towards managerial training; it should not overlook the fact that inclusion of the basic elements of training in management could be creative. Its approach should be integrative and interdisciplinary in order to promote the exchange of experiences through group analysis and participative discussions. All currently available modern educational and training instruments should also be used. The programme should be set up within a national context; its objectives should be to bring about a change in behaviour and develop the skills of its participants; it should include bodies to evaluate the contents of the programme and the efficiency of instruction. The programme should be implemented in appropriate areas away from the work environment; moreover, it should be conducted as three- to five-day modules presented intermittently or sequentially. The courses should be organized for the various managerial categories already defined, i.e., professionals and specialists.

d) The studies on Bolivia and Peru recommend the organization of two types of courses. The first type, courses on integral management, should last for no less than six months since what they would attempt to teach would be an integral concept of development and planning and the multiple uses of water as a resource. The second type, courses on the management of water use, would be meant for specific sectors that utilize resources. Such courses

should be itinerant and last for at least three months; the technical, physical, natural and administrative subjects covered must include systems approaches, group dynamics and organization design, decision-making and the theory of sets. In Peru, such courses can be designed and organized in a short space of time because the infrastructure, organizational capacity, and adequate pool of lecturers for the various administrative subjects and teaching experience are available although adequate financing is lacking. In Peru, the appropriate institution to offer such courses would be the Graduate School of Business Administration (ESAN).

Bolivia, currently has greater difficulties in organizing and conducting courses on the integral management and use of water resources. The most appropriate institution for implementing such activities would be the Institute of Hydraulics and Hydrology of the Universidad Mayor de San Andrés; the Institute has experience in the application of water to various purposes. The report, however, does not make any proposals with respect to organizations at the regional or international level.

e) The study on Venezuela recommends the preparation of a national plan on training in water resources management addressed to managers/directors and operational/technical staff of various public agencies connected with the sector. The plan should be based on the experience of national and regional institutions or centres that offer training activities in water resources-related subjects. It is recommended that such activities be carried out at the regional or subregional level and be co-ordinated by ECLAC; given the experience of the Centro de Economía, Legislación y Administración del Agua (CELA) in Mendoza, Argentina and the Inter-American Center for the Integral Development of Water and Land Resources (CIDIAT) in Mérida, Venezuela, in the development of training programmes on water resources at the inter-american level, they should be used as focal points. It is recommended also that ECLAC be given a co-ordinating role with respect to training plans at the inter-american level and that the Commission should also be given the responsibility of securing financing for the activities including a fellowship programme for professionals of the water sector in Latin America and the Caribbean. It is recommended that CIDIAT should consider, under its inter-american programme, training activities on economic, legal and administrative aspects in order to satisfy the needs of the countries of the region. CIDIAT and CELA could be made responsible for implementing such activities. It is further that a system of co-operation between Latin American and Caribbean countries with respect to water resources management be established to develop training and technical assistance activities and exchange experiences in the region; the system would be co-ordinated by ECLAC. Such a system would help to develop senior and middle-level specialists and optimize the overall use of the region's specialized professional resources. Finally, it is stressed that in order to develop such a system of regional collaboration and solidarity, new structures or institutions do not have to be established but rather that the desired progress could be achieved simply by co-ordinating and actively co-operating in the use of existing resources; however, some additional financial resources would be required.

Finally, the various country studies indicate very dissimilar details about what the courses should cover and put forward very dissimilar proposals with respect to other course characteristics such as duration and orientation. Therefore, it is recommended that additional activities be carried out to define a training programme tailored to the needs of the region which should be co-ordinated by ECLAC. In this connection, the recommendations of the various consultants concord in various fundamental aspects. First, they indicate the need to organize and conduct training activities in integral water resources management; secondly, such activities should be carried out within a regional framework making use of the experience of the various countries in the region and; finally, they recommend that ECLAC should be the agency to co-ordinate all activities at the regional level.

Notes

1/ Economic Commission for Latin America and the Caribbean (ECLAC), Report of the meeting of experts on horizontal co-operation in water resources management in Latin America and the Caribbean (LC/G.1468(Sem.38/3)), 27 August 1987.

2/ Tomás A. Bades, Estudio sobre oferta y demanda de capacitación en gestión de recursos hídricos en Venezuela, CEPAL (LC/R.732), Santiago, 6 January 1989.

Annex

SPECIFIC ASPECTS OF INSTITUTIONAL STRUCTURES IN THE
COUNTRIES COVERED BY THE STUDY1. Argentina

Argentina has a network of different national, provincial and municipal organizations responsible for the planning and management of various uses of water resources.

The administrative decentralization determined by the federal structure has developed into specialization by sector of water uses and a process of decentralization on the basis of hydrological boundaries is beginning such as river basin committees, regional development programmes and others.

a) Institutions responsible for planning and assessing water resources

At the federal level the body responsible for establishing water policy is the Secretaría de Estado de Recursos Hídricos which is under the Ministerio de Obras y Servicios Públicos.

This secretariat, through autonomous agencies, carries out research, compiles information, and provides technical assistance and training in almost all sectors connected with water resources.

b) Institutions responsible for drinking water supply

At the federal level, among the sectoral service-providing bodies is Obras Sanitarias de la Nación which supplies the federal capital with drinking water.

Outside the federal capital, the provision of drinking water comes under provincial and sometimes municipal jurisdiction; various bodies, mainly public companies, are responsible for drinking water supply.

Since water resources have a public character, the institutions that administer them are also public; there are, however, parastatal and private institutions such as drinking water supply co-operatives and electricity supply co-operatives that are involved in the management of water resources.

c) Institutions responsible for using water to generate electricity

The State company, Agua y Energía Eléctrica is the body responsible for the production and distribution of electricity throughout the country. Another State company, Hidroeléctrica Norpatagónica, S.A. (HIDRONOR), is responsible for the generation and supply of electricity in northern Patagonia. These two enterprises and other smaller agencies are organized as federal state companies. At the same time, the provinces manage smaller enterprises responsible for the distribution and marketing of energy.

d) Institutions responsible for irrigation

There are highly-developed irrigation institutions in the provinces (in Argentina, irrigation authorities are usually provincial) which in some cases were established before the federal irrigation authorities. The provinces of Mendoza and San Juan, for example, administer irrigated areas that are larger than the total irrigated surface area under the control of the federal administration.

In many provinces various associations of users are involved in the administration of irrigation.

At the international level, the Government of Argentina is a member of institutions that are directly responsible for the development of shared rivers through institutions with an international legal status such as the Comisión Técnica Mixta Argentina y Uruguay de Salto Grande and the Comisión Argentino-Paraguaya del río Paraná; the Government also participates in bilateral bodies such as the Yacyretá hydroelectric power plant on the Paraná river.

e) Water quality control institutions

Water quality control is under the jurisdiction of provincial and municipal governments. There are no federal agencies empowered to control water quality.

2. Bolivia

Traditionally, Bolivia has had two levels of government, national and local; however, recently, intermediate decentralized bodies such as regional development corporations have been developed.

Although water resources come under the public domain, the State does not have a single body responsible for issuing licenses for water use. Currently, a general law on water resources has been submitted for approval which covers among other aspects the multiple and priority uses of water and establishes a national irrigation institute.

Generally, in each sector that utilizes water for any purpose, there is an institution that takes the water and grants authorization for it to be utilized for private or public purposes.

a) Institutions responsible for planning and compiling information on water resources

Bolivia does not have a principal institution responsible for integral planning although at the national level the Ministerio de Planeamiento y Coordinación is formally responsible for this.

b) Institutions responsible for drinking water supply

As far as domestic or urban use is concerned, water supply is managed by self-financed municipal enterprises in the capital cities of departments. In smaller cities, water is managed by co-operatives. In such cities, once the infrastructure has been put in place, the Dirección de Saneamiento Ambiental of the Ministerio de Previsión Social y Salud Pública and the Potable Water and Sewerage Corporation of the Subsecretaría de Vivienda organize the population into co-operatives, give them training in managerial skills so that they can administer on their own.

c) Institutions responsible for irrigation

Generally speaking, irrigation schemes are managed by the users in co-operatives, since there are no significant state bodies that administer irrigation projects.

d) Institutions responsible for other uses

There are virtually no restrictions on the use of water for other purposes (industrial, fishing, mining and energy) except in the case of mining which has priority for any exploitation or transformation activity in water use.

3. Brazil

The assignment of responsibilities over water resources Brazil is complicated and cannot be classified in the same manner as in other countries. Only a brief description is presented here of the general characteristic of current institutional structure. Brazil has four levels of government: national, state, regional and local.

At the national level, there are institutions responsible for the management of water resources. In fact, the institution that has been assigned the major jurisdiction over water resources by law and by actual activities is the Departamento Nacional de Aguas y Energía Eléctrica (DNAEE) under the Ministerio de Minas y Energía. Also, the Secretaría de Planeamiento de la Presidencia de la República (SEPLAN) has a section which deals with the production and distribution of electricity, the environment and natural resources.

The recently created Ministerio Extraordinario para Asuntos de Riego shows the political importance that Brazil, through the establishment of a national irrigation plan and other regional plans, has assigned to the development of irrigation infrastructure.

The Ministerio de Urbanismo, Vivienda y Medio Ambiente is also involved in the preparation of integral plans on the conservation of the environment and natural resources.

At the federal level, the development of research and compilation of information is under the jurisdiction of the Ministerio de Ciencia y Tecnología in co-operation with the Instituto Nacional de Meteorología (INEMET) under the Ministry of Agriculture.

The federal agencies responsible for water resources at the regional level include the development agencies for the southern (SUDESUL), north-eastern (SUDENE), central-west (SUDECO) and Amazon (SUDAM) regions.

The supply of drinking water is entirely under state and municipal jurisdiction and it is generally the responsibility of public companies.

4. Costa Rica

Although Costa Rica has a well-developed system of water resources management institutions, it is badly integrated and its subsectors operate in such a way that each institution covers only one particular use of water.

There are two levels of government: national and local. There are three main types of institutions at the national level:

a) Institutions responsible for the use of water to generate energy and other multiple uses

Apart from regulating electricity services, the National Electricity Service (SNE) is the institution responsible for enforcing the water law (area of public water resources and waterways). It controls electricity, drinking water and sewerage tariffs, etc. There are problems with respect to how this authority manages water resources and consequently in the new draft law on water, its jurisdiction over water has been removed.

The Costa Rican Electricity Institute is an autonomous state body responsible for the generation of energy, and it operates all the country's hydroelectric power supply stations.

b) Institutions responsible for drinking water and sewerage

The Instituto Costarricense de Acueductos y Alcantarillados (ICAA) is an autonomous body responsible for supplying drinking water and collecting and disposing of waste and it is also responsible for setting standards for rain water evacuation systems in urban areas. It is also responsible for water quality control. Fifty percent of the drinking water supply systems are the responsibility of ICAA and the rest is the responsibility of municipalities, although ICAA also advises and gives technical support to them.

c) Institutions responsible for irrigation

The Servicio Nacional de Aguas Subterráneas (SENAS) is an autonomous body that is responsible for the establishment of irrigation, drainage and flood protection systems and for the allocation of water for agricultural purposes.

The Dirección General Forestal (DGF) is an agency of the Ministerio de Agricultura y Ganadería, although recently (1986) it was transferred to the Ministerio de Energía y Minas which still lacks any structure. The DGF is specifically responsible for water conservation mechanisms and the physical management of watersheds, through the establishment of protection zones on state lands, the implementation of surveys for the integrated management of watersheds and the establishment and co-ordination of the activities of a regulatory interinstitutional committee.

d) Institutions responsible for compiling information on water resources

The compilation of information on water resources is the responsibility of the Instituto Hidrometeorológico of the Ministerio de Agricultura y Ganadería. It operates 60% of the meteorological network while the other 40% is operated by the Costa Rican Electricity Institute. Planning is centralized within the Ministerio de Planificación; with special emphasis on activities of the agricultural sector related to water resources. The Ministry of Health is also authorized to control pollution. Recently, an interinstitutional agreement on the integral management of river basins was approved; it proposes a specific programme of activities and gives priority to the preparation of pilot plans for various river basins.

5. Guatemala

A characteristic of Guatemala's water sector is that many institutions have been established each to deal with a specific problem.

In many cases, responsibilities are assigned to institutions that had previously been assigned to others. Although there are some 30 institutions responsible for the evaluation, utilization and conservation of water, none of them have the authority to define integral management policies nor is there any legal instrument for regulating and co-ordinating the utilization of water resources.

The main institutions of this sector are:

a) Institutions responsible for irrigation and drainage

The Dirección Técnica de Avenamiento y Riego is a national agency under the Ministerio de Agricultura, Ganadería y Alimentación. Its purpose is to develop the utilization of surface water for irrigation and it has the authority to grant concessions. However, its objectives do not include the regulation of underground water.

b) Institutions responsible for drinking water supply

The Empresa Municipal de Agua Potable (EMPAGUA) of Guatemala City supplies drinking water to the largest city (120 000 users). The Departamento de Acueductos y Alcantarillados of the Ministerio de Comunicaciones, Transportes y Obras Públicas supplies drinking water to other urban areas.

The Instituto de Fomento de Hipotecas Aseguradas (FHA) is responsible for designing and building water supply and sewerage systems.

Finally, the unit responsible for the implementation of the rural water network under the Ministerio de Salud Pública y Asistencia Social supplies water to villages and the División de saneamiento del medio of the same ministry supplies water to hamlets in the rural areas.

c) Institutions responsible for energy

The Instituto Nacional de Electrificación (INDE) is the national body authorized to develop electricity generation systems in the country. There are also municipal enterprises that supply electricity at the local level.

d) Institutions responsible for compiling information on water resources

The Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología (INSIVUMEH) is responsible for carrying out basic studies to enable various users to make the best use of water resources. The Institute has recently prepared the initial draft of a law on water resources.

6. Nicaragua

Nicaragua does not have a law on water, but a draft law is currently in the process of study.

The main national level institutions connected with water resources are listed as follows:

a) Institutions responsible for regulating and conserving water resources

The aim of the Dirección de Recursos Naturales y del Ambiente (DIRENA) is to exploit and monitor the conservation of the country's natural resources including water resources. It has focused its activities on establishing comprehensive mechanisms for regulating and safeguarding natural resources covering land, water and soils.

b) Institutions responsible for compiling information on water resources

The Nicaraguan Institute for Territorial Studies is the body responsible for carrying out basic surveys to assess water resources.

A considerable number of the components of the national meteorological network are controlled by the Institute.

c) Institutions responsible for energy

The Instituto Nicaragüense de Energía (INE) is the main agency in Nicaragua's energy sector since the petroleum enterprise was attached to it in 1982. It is responsible for the generation and distribution of hydroelectricity and is also responsible for drinking water supply and sanitation.

d) Institutions responsible for drinking water supply

The Instituto Nicaragüense de Acueductos y Alcantarillados (INNA) is responsible for the supply of drinking water and for sewerage in Managua as well as the rest of the country.

e) Institutions responsible for irrigation and drainage

The Ministerio de Desarrollo Agropecuario y Reforma Agraria is responsible for harnessing water resources especially from underground sources for irrigation.

The Alcaldía de Managua deals with problems relating to flooding of the city, land slides and storm water drainage from the city. Finally, the Ministerio de Salud Pública is responsible for monitoring the quality of water for domestic use in collaboration with INAA.

7. Peru

In Peru, water management takes different legal forms at the national, regional and local levels.

a) Institutions responsible for water resources planning

The integral planning of water resources for various purposes is carried out by the Dirección de planificación regional which is under the Instituto de Planificación Nacional. It should be noted that a national water resources plan was prepared some years ago.

There is a beginning to the development of river basin authorities, and the establishment of a national council on river basin development has been proposed.

b) Institutions responsible for irrigation

In line with the general law on water and the organic law on agriculture, it is the responsibility of agriculture to authorize the use of water. The Dirección general de aguas y suelos of the Ministry of Agriculture is the main body responsible for such authorizations.

As far as irrigation is concerned, the supreme authority in the Government is the technical administrator of the irrigation district; the technical administrator has responsibility for planning agricultural production in consultation with the committees of users.

c) Institutions responsible for water supply and sewerage

Public companies cater for general domestic or urban water and sewerage services in large cities and operative units of the housing sector and the municipalities cater for such services in smaller cities.

The general water law and the organic law of the Ministry of Health give responsibility for water quality to the health sector through the Dirección técnica de salud ambiental in co-ordination with the División de Saneamiento Ambiental and the Servicio Nacional de Agua Potable y Alcantarillado (SENAPA), which are under the Ministerio de Vivienda y Construcción.

d) Institutes responsible for compiling information on water

The Servicio Nacional de Meteorología e Hidrología (SENAMHI) and the Oficina Nacional de Evaluación de Recursos Naturales (ONERN) compile information on water.

8. Venezuela

In Venezuela, the management of water resources is highly centralized under the Ministerio de Ambiente y Recursos Naturales Renovables (MARNR), which is the national authority responsible for the planning, administration, utilization, regulation and control of water resources.

Currently, a draft law on water designed to legally consolidate very important concepts such as planning and integral administration of water resources has been submitted for legislative approval.

a) Institutions responsible for water supply

The administration of water supply is the responsibility of the National Institute of Sanitation Works (INOS), an autonomous body that provides services throughout the country to towns of over 1 000 inhabitants. The Ministerio de Sanidad y Asistencia Social (MSAS) deals with any matters related to water and sewerage systems in smaller towns.

b) Institutions responsible for irrigation and drainage

Water for irrigation and drainage is the responsibility of the Ministerio de Agricultura y Cría in co-ordination with MARNR.

c) Institutions responsible for energy and other multiple uses of water

MARNR is not responsible for harnessing water to generate electricity which has been considerably developed. Water used to generate electricity is managed by a variety of bodies including the Ministerio de Energía y Minas, the Consejo Nacional de la Energía (CNE), the Compañía Anónima de Administración y Fomento Eléctrico (CADAFE), the Corporación Venezolana de Guayana (CVG) and the Empresa Electrificación del Caroní (ENDELCA).

Parallel to the national government, there are regional intermediate bodies that are responsible for water resources; they include the Corporación de los Andes (CORPOANDES), which is responsible for the conservation and development of natural resources and the development of irrigation and hydroelectric systems.

d) Institutions responsible for compiling information on water resources

MARNR is responsible for hydrometeorological services throughout Venezuela. There are also other national bodies such as the Instituto Nacional de Canalizaciones (INC) that are responsible for the use of navigable rivers.

