

**A PROPOSED STRATEGY
TO ENCOURAGE AND FACILITATE
IMPROVED WATER RESOURCE MANAGEMENT
IN
LATIN AMERICA AND THE CARIBBEAN**

by

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TABLE OF CONTENTS

List of Acronyms.....	v
PART 1 INTRODUCTION.....	1
1.1 Purpose.....	1
1.2 Organization.....	2
1.3 ACKNOWLEDGMENTS.....	3
PART 2 STATE OF THE ART OF WATER RESOURCES MANAGEMENT.....	4
2.1 Introduction.....	4
2.2 Ends And Means In Water Resource Management.....	5
2.2.1 Objectives and Constraints.....	6
2.2.2 Goals of Sustainability, Alleviation of Poverty, and Environmental Protection.....	6
2.3 Action Situations.....	7
2.3.1 Actors.....	8
2.3.2 Environments.....	8
2.3.3 Institutions.....	
10	
2.3.3.1 Scope.....	
10	
2.3.3.2 Participation.....	
11	
2.3.3.3 Powers.....	
13	
2.3.3.4 Information.....	
15	
2.3.3.5 Decision making.....	
15	
2.3.3.6 Benefits and costs.....	
17	
2.4 Levels Of Action.....	
18	
2.4.1 Water Use Level.....	
18	

2.4.2 Water Resource Management Level.....	21
2.4.3 Water Policy and Law Level.....	21
2.5 The Problem Solving Approach.....	22
2.5.1 General Principles.....	23
2.5.2 Water Use Problems.....	26
2.5.2.1 Externality problems.....	26
2.5.2.2 Open access problems.....	26
2.5.2.3 Public goods problems.....	27
2.5.2.4 Scarcity problems.....	27
2.5.3 Means for Achieving Water Resource Management Goals and Objectives.....	27
2.6 Summary.....	28

PART 3 AN ASSESSMENT OF WATER RESOURCES MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN.....

	30
3.1 Introduction.....	30
3.2 State of Water Resources Management in Latin America and the Caribbean.....	31
3.2.1 Recent Advances In Water Resource Management.....	31
3.2.1.1 Improved Water Supply and Sanitation Coverage.....	32

3.2.1.2 Increased Opportunities to Experiment.....	32
3.2.2 Short-Comings in Water Resources Management.....	35
3.2.2.1 Fragmented and Diffused Water Resources Management.	36
3.2.2.2 Inadequate and Poorly Maintained Infrastructure....	38
3.2.2.3 Insufficient and Poor Quality Data.....	39
3.2.2.4 Inadequate Enforcement of Legislation.....	40
3.2.2.5 Inadequate Consideration of Environmental Impacts..	42
3.2.2.6 Minimal Stakeholder Participation.....	43
3.3 Management Responses to Current Problems.....	44
3.3.1 Legislative Reform.....	45
3.3.2 River Basin Management.....	47
3.3.3 Privatization of Water Services.....	49
3.3.3.1 Concessions for Urban Water Supply and Sanitation Services	49
3.3.3.2 Transferring Ownership of Irrigation Infrastructure	51
3.3.4 Water Markets.....	52
3.3.5 National Water Planing.....	54
3.3.6 Environmental Planning.....	55
3.3.7 Improvements in Cost Recovery.....	57

3.4 Some Observations on Current Water Resource Management.	
58	
3.4.1 Implementation issues.....	
58	
3.4.2 Sequencing Problems.....	
60	
3.4.3 Striking a balance in management.....	
60	
3.4.4 Stakeholder Participation is a Multi-Disciplinary task	61
3.4.5 Crises can be positive.....	
62	
3.5 Perceived needs for improving water resources management in LAC.....	
63	
3.5.1 Infrastructure projects.....	
63	
3.5.2 Improved legal and institutional framework.....	
64	
3.5.3 Expansion and modernization of data systems.....	
64	
3.5.4 Demand management programs.....	
65	
3.5.5 Capacity Building.....	
66	
3.5.6 Improved coordination among international lending agencies.....	
67	
3.5.7 Empirical studies and dissemination of information...	
67	
3.6 Summary.....	
68	

PART 4 IMPROVING WATER RESOURCE MANAGEMENT IN LAC COUNTRIES

70	
4.1 Introduction.....	
70	

4.2 Solving Water Use Problems Through Institutional Innovation.....	72
4.2.1 Water pollution (Externality problems).....	72
4.2.2 Overexploitation of ground water supplies (open access problem).....	74
4.2.3 Urban flood damages (public goods problem).....	76
4.2.4 Inadequate supplies of potable water (scarcity problem)	77
4.3 Adoption and implementation issues.....	78
4.3.1 Emphasis on institutional innovation.....	79
4.3.2 Attention to socio-cultural considerations.....	80
4.3.3 Education in many dimensions.....	80
4.4 Summary.....	81

PART 5 WATER RESOURCE MANAGEMENT STRATEGIES FOR DONOR AGENCIES.....

82	
5.1 Introduction.....	82
5.2 Principles for donor agency strategy selection.....	82
5.2.1 Distinguish between long run and short run efforts...	82
5.2.2 Conformity to international water resource management goals	83
5.2.3 Experimentation with new kinds of incentives.....	84

5.2.4 Cooperative and coordinated programs.....	85
5.3 Elements of a Suggested Strategy.....	85
5.3.1 An international institute for analysis and training.	87
5.3.2 Development of comprehensive national strategies.....	88
5.3.3 Encouragement of regional water resource management..	88
5.3.4 Enforcement of consistency requirements as loan conditions.....	89
5.3.5 Loans for analysis, planning, and institution building	90
5.3.6 Credits for institutional innovations.....	91
5.3.7 Research to develop guidelines and standards.....	92
5.4 Summary.....	93

LIST OF FIGURES

Figure 1 - Components of and Action Situation	9
Figure 2 - Levels of Water Policy and Management.....	19

APPENDICES

Appendix 1 - References
Appendix 2 - Literature Review and Annotated Bibliography
Appendix 3 - List of People Interviewed

ACRONYMS

Argentina (AR)	Barbados (BA)	Chile (CH)
Costa Rica (CR)	Mexico (ME)	Peru (PE)
AyA (CR)	Instituto Costarricense de Acueductos y Alcantarillados	
BWA	Barbados Water Authority (BA)	
CAAR	Comité de Administración de Acueductos Rurales (CR)	
CEHI	Caribbean Environmental Health Institute (BA)	
CNA	Comisión Nacional del Agua (ME)	
CONAM	Consejo Nacional de Medio Ambiente (PE)	
CONAMA	Comisión Nacional del Medio Ambiente (CH)	
CRRH	Comité Regional de Recursos Hidráulicos (CR)	
DGA	Dirección General de Aguas (CH)	
DGA	Dirección General Ambiental (PE)	
DGI	Departamento General de Irrigación (AR)	
DNRH	Dirección Nacional de Recursos Hídricos (AR)	
EIR	Environmental Impact Report	
EMOS	Empresa Metropolitana de Obras Sanitarias (CH)	
ICE	Instituto Costarricense de Electricidad (CR)	
IDB	Interamerican Development Bank	
LAC	Latin America and the Caribbean	
LDC	Less developed countries	
MIRENEM	Ministerio de Recursos Naturales, Energía, y Minas (CR)	
MOP	Ministerio de Obras Públicas	
NWP	National Water Plan	
O&M	Operation and maintenance	
PRONAPAC	Programa Nacional de Optimización, Rehabilitación y Ampliación de los Servicios de Agua Potable y Alcantarillado Cloacal (AR)	
RBM	River basin management	
RBO	River basin organization	
SAL	Sociedad Anónima Laboral (CR)	
SENDOS	Servicio Nacional de Obras Sanitarias (CH)	
SNE	Servicio Nacional de Electricidad (CR)	

WHO World Health Organization

WSS Water supply and sanitation

PART 1

INTRODUCTION

PURPOSE

Over the past two decades international aid and lending organizations have developed a substantial literature on needed changes in water resources management, as they have struggled to respond to their own experience of failed projects and to outside criticism of the negative economic and environmental impacts of their programs. Technology transfer had occurred initially with too little attention to the cultural, economic, and political differences between the developed countries and those they sought to assist. Consequently, water resource development projects, while facing the same problems of high cost and adverse environmental impact already seen in the developed countries, also encountered new and different problems which all too often resulted in poor performance, even for those limited purposes which the projects were intended to accomplish. By the last quarter of the twentieth century, the international aid and lending agencies had begun to reappraise the experience of the early years, and to search for more promising development strategies.

Inter-American Development Bank (IDB) lending for water resources development in Latin America and the Caribbean (LAC) from 1989-1994 totaled more than \$4.3 billion, approximately 15% of total IDB lending for this period (Figueroa 1995). It is anticipated that a similarly substantial percentage of the \$40 billion of the Eighth Replenishment will be for operations in the water sector. The Eighth Replenishment identifies key objectives for IDB operations in the coming years, including poverty alleviation, environmental protection and sustainability in resource use. Water projects will be an integral component of IDB strategies in achieving these goals. This study provides some background for the formulation of water resources development

guidelines that are based firmly on existing conditions in LAC countries, while drawing from the valuable experience gained in water resources management in the United States and Europe.

Numerous instruments for water resources management have been identified as potentially useful in meeting these objectives, including privatization of services, establishment of river basin management organizations, increased demand management, mechanisms to improve cost recovery, and increased stakeholder participation. These instruments are not a panacea and are not suitable to all problems in all situations. Successful implementation of any instrument requires the existence of certain conditions, including (1) the countries themselves must be in a position to accept the implications and effects of the new policies; (2) the desire and need to use these instruments must be internally motivated; and (3) the instrument must fit the problem, which requires that the cause be properly identified and understood.

Improving water resources management anywhere, most would now agree, is largely a matter of institutional change. Institutions are specific to individual countries, and institutional change must take place within the cultural and political contexts of those countries. What can be achieved, how it can be achieved, and how it will work if implemented is quite different in Mexico than it is in Bolivia, just as it is quite different in France than in the U.S. We have tried to emphasize the importance of cultural and political context, and to provide some suggestions as to how they may be taken into account.

International lending agencies can have considerable influence upon the improvement of water resources management in LAC. But this is only influence, of course, and often it is quite limited. Internal factors will always be far more influential in determining what happens, and this is how it should be. But we also believe that there is great room for improvement in how lending agencies use their limited leverage, and how effectively they work in concert with in-country entities and with each other.

ORGANIZATION

Part 2 of this study presents key elements which should be part of a water resources management strategy: namely, goals, instruments, and a conceptual framework for evaluating and analyzing water resources management needs and opportunities. A distinction is drawn between ends and means in water resources management, and a structured problem solving approach is discussed. Various options for water management including: building and maintaining infrastructure, changing water management institutions, and augmenting human capital are presented.

Part 3 presents findings from country visits. Recent advances and existing short-comings in water resources management in LAC are discussed, and an evaluation of some of the measures being taken to address water resource problems is provided. Part 3 draws heavily from interviews conducted in each country and is supported by supplementary documentation received during the visits and a brief review of current literature.

In Part 4 the conceptual framework of Part 2 is applied to the findings of Part 3. From this stem some possible strategies for improving water resources management in Latin America and the Caribbean to be developed by the countries themselves and international donor organizations. Part 5 suggests some specific elements which might be included in such strategies.

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PART 2

STATE OF THE ART OF WATER RESOURCES MANAGEMENT

INTRODUCTION

Throughout the history of civilization, but especially since the beginning of the twentieth century, the development of water resources has been seen as an engine for economic development. The heyday for water resources development occurred in the developed countries in the first half of the twentieth century. By the end of that period most of the best sites had been developed, development costs were rising rapidly, and awareness of the environmental impacts of development was spreading. Political opposition to water resources development projects increased greatly.

Ironically, at this same time transfer of water resource development technology from the developed countries to the less developed countries (LDC) became a prominent part of resulting international development aid programs. Technology transfer occurred initially with too little attention to the cultural, economic, and political differences between the developed countries and the LDC's. Consequently, water resource development projects, while facing the same problems of high cost and adverse environmental impact seen earlier in the developed countries, also encountered new and different problems which resulted all too often in poor performance, even for those limited purposes which the projects were intended to accomplish. By the last quarter of the twentieth century, the international aid and lending agencies had begun to reappraise the experience of the early years, and to search for more promising development strategies.

It was at this same time that regulatory programs aimed at arresting the deterioration of surface water quality became prominent in the developed countries. These programs employed a quite different policy approach, and were largely unrelated to older water supply augmentation programs), leading to uncoordinated management of surface waters for the two broad and

inescapably related purposes of water supply and water quality control. Attempts to control the degradation of ground water quality have been even more recent, due to the limited knowledge about this phenomenon, and despite the fact that ground water provides domestic water supply in virtually all countries.

Historically, water resources development has been concerned primarily with facilitating single purpose water uses, such as irrigation and navigation. But the increase in kinds of use, the increase in numbers of users and, above all, the increase in scale and technological sophistication of water resources development, have led to greater concern over the efficiency and equity of such development.

The perceived limitations of structural water supply augmentation measures, the need for protecting environmental quality, and the growing recognition of the desirability of demand management are some of the trends which have supported the current emphasis upon water resources management, rather than water resources development, and upon the goal of sustainability. This emphasis is evident in the developed countries and, to a lesser degree, in the LDC's.

In this context, water resources management means not only manipulation and management of the physical resource but also influencing the ways in which people use scarce water resources. Not only water, but also human behavior, must be managed. The goal of such management is sustainability, which may be defined variously from maximizing the present value of the well-being of all future humans to maintaining the viability of all existing natural systems. Each of these concepts captures important considerations which go far beyond the traditional goals of water resources development; goals now universally regarded as too short-sighted. A modern view of sustainability attempts to strike a balance between these two concepts.

ENDS AND MEANS IN WATER RESOURCE MANAGEMENT

The distinction between ends, or what is intended to be accomplished, and means, or the instruments used to attain those ends, is a fundamental one. Still, in practice, there is a great deal of confusion between ends and means. Higher farm income, for example, may be an end, in the analysis of an irrigation project proposal, or one of several means to alleviate poverty (a higher end) in a national policy analysis.

One may refer to an ends-means continuum, with the most general and abstract goals at one end and the most specific and detailed instruments at the other. In between are several different levels of measures which may serve as ends in some analyses and means in others. Sustainability, poverty alleviation, and environmental protection lie far towards the ends side of the continuum. Building dams, zoning flood plains, and installing wells for potable water supplies lie far towards the means side. In between lie solving scarcity, externality, open access, and public goods problems (these problems will be defined and discussed in section 2.5.2). They are not ultimate or distant ends, but neither are they unambiguous means. They may be called "ends-in-view", which are provisionally accepted as ends for practical purposes, but which ultimately must be justified in terms of higher ends, such as sustainability, poverty alleviation, and environmental protection.

1 OBJECTIVES AND CONSTRAINTS

Ends-in-view are chosen as objectives to guide planning and decision making because they are concrete enough to be defined clearly and because they are specific enough to be attained through only a limited range of means. This makes planning and decision making a practical and practicable activity. Such ultimate ends as sustainability, poverty alleviation, and environmental protection are not good planning objectives because they are so general and abstract as to be difficult to measure. Just as bad, there are many means for pursuing them; too many means to be described, quantified, evaluated, and compared in any practical analysis. However, these broad ends, perhaps best called

goals, are ultimately important, and an analysis which leaves them unconsidered will be too narrow and will lack perspective.

While the objectives used to evaluate water resource management projects and programs may be ends-in-view, the higher goals can be used as constraints in the search for options. For example, benefit-cost analysis is an analytical procedure for evaluating options in terms of the broad goal of improved economic well-being for all. It is a poor planning objective because there are infinitely many options (water-related and non water-related) to examine and evaluate, and thus one cannot tell what the best option might be. But a benefit-cost ratio greater than unity or an internal rate of return greater than the social time preference rate is an excellent constraint on the search for options. Ruling out possible water resource development projects which fail to meet this test is a good way to constrain consideration of options for, say, solving a water scarcity problem, in the interest of maintaining national fiscal responsibility.

2 GOALS OF SUSTAINABILITY, ALLEVIATION OF POVERTY, AND ENVIRONMENTAL PROTECTION

Proposed water resource management activities in LAC should be designed and evaluated using situation-specific objectives, such as resolving particular scarcity, externality, open access, or public goods problems. Solving such local problems, however, is not enough, for local objectives must not conflict with national or international goals. To this end, each country should specify the national goals which are important to it. The U.S. has chosen national economic development (NED) and environmental quality (EQ) as the two national goals which constrain the formulation of federal water resource development projects. Some LDC's would add foreign or hard-currency earnings and/or poverty alleviation. Each country will and should have its own short list of such goals, but there will be great similarities between these lists because the goals are so broad and general.

International aid and lending organizations should and do formulate their own goals for their water resource management

assistance programs. Again, the details may differ between organizations, but there will be great similarities among them, if for no other reasons than that they all share the same basic mission, they are all subject to the same criticisms and pressures, and they all participate in the international conferences in which these matters are discussed at length. IDB has proclaimed its own goals for the eighth replenishment period to be sustainability, poverty alleviation, and environmental protection. These three goals should be made operational by defining them as constraints to be observed by all projects and programs proposed for IDB funding (this notion is pursued further in Part 5).

ACTION SITUATIONS

The broader range of considerations which are now involved in the call to move from water resource development to water resource management requires the use of a similarly broader analytical or conceptual framework. Such a framework must be based upon a systems concept which includes institutions as well as infrastructure, and it must recognize environmental and social variables as well as hydrologic and economic ones. It should also focus upon decision making and action, as well as the more usual scientific cause and effect. In other words, it must comprehend far more than the hydrologic system (now, subsystem) so familiar to water planners. It must include other sub-system models of ecosystems, economies, political organization, and individual behavior. It must also relate these sub-systems to each other, into an integrated model (possibly, but not necessarily, computerized).

One such conceptual framework is based upon the notion of an action situation (Ostrom, 1986). The action situation is composed of three broad classes of elements. The first is the actors themselves, whether individuals or groups. Their actions are shaped by the other two elements, as well as by their own innate characteristics. One of those shaping forces is the environment,

the natural and man-made elements (e.g., land, water, and physical infrastructure) which support human activities. The other is the rules (institutions) which order the interrelationships among people as they use environmental resources to further their well-being. Figure 1 is a diagram of such an action situation. Public programs can attempt to change elements of any of these three types.

1 ACTORS

The actors are the persons or homogeneous groups of persons which affect, or are affected by, what occurs in an action situation. In water resource-related situations, actors are commonly those who use water, those who are directly affected by those uses, those who regulate water use, and those who make water policies and laws. These actors behave in ways which are determined by their environments, by the institutions or rules to which they are subject, and by their own biological and psychological (organizational, in the case of groups) characteristics. A model of the actors behavior provides the means for predicting how they will respond to changes in the environment or in institutions.

Predicting how people will respond to water pricing as a demand management tool, for example, requires the use of some behavioral model of those actors. Economists use a model which says that water users will use less water if its price goes up, and more if the price goes down. Water managers have sometimes denied the validity of this model, but empirical research has supported it very strongly.

2 ENVIRONMENTS

The environment in the action situation is a catch-all term for all of the important variables other than actors and rules. It is useful to distinguish between the natural environment and the man-made, or built environment. The natural environment includes all elements of the atmosphere, hydrosphere, and lithosphere, and all of the flora and fauna, which may affect, or may be affected

by, the actions which can be taken. Physical infrastructure is a part of the man-made environment, but it also contains such artifacts as shovels, pencils, clothing, and computers. All of these environmental variables can affect the outcomes of an action situation, because they determine in part what the actors can and cannot do, and what happens as a consequence when they do. A model of the environment will normally encompass the essential hydrology of the geographic region of

interest, and it should also encompass whatever elements of the lithosphere, hydrosphere, atmosphere, flora, and fauna depend upon or affect water resources.

3 INSTITUTIONS

By institutions we mean the rules which liberate and constrain the actors. These rules may be formally codified, as are laws and regulations, or they may be informal and understood, as are customs and mores. All, however, are created by human actions and can be changed by human action. Institutional innovation, so important in the water resource management, is exactly the process of changing these rules. An institutional model expresses the relationships among these rules and the actors and environmental variables which they may influence.

We may think of seven different types of rules within the institutional set. Often called scope, position, boundary, authority, information, aggregation, and payoff rules, they address the six issues of scope, participation, powers, information, decision making, and benefits and costs. This section is devoted to the definition and discussion of these six issues.

2.3.3.1 Scope

By the scope of a policy, program, or project is meant the range of effects upon human and environmental systems which that policy, program, or project affects, either now or in the potential future. In other words, the scope of an activity consists of all of the significant foreseeable consequences of carrying out that activity.

The scope of any public program should include both the primary and secondary effects of that program. Water resource management itself includes both the management of physical resources, most notably (but not solely) ground water and surface waters. It also includes managing the human activities which affect and depend upon those hydrologic resources.

The direct effects of water resource management activities are of three types. The first is the provision of water for

consumptive uses (in which water is withdrawn from the environment and at least partially depleted), such as municipal and industrial water supply and irrigation. The second type of direct effect is maintenance or enhancement of water flows for such non-consumptive instream uses (in which no withdrawal or depletion occurs) as hydroelectric power generation, fisheries, navigation, recreation, the protection of aquatic, estuarine, and related environmental resources, and the minimization of natural hazards such as flooding and poor drainage associated with the presence of too much water. The third type of direct effect is the preservation and enhancement of water quality, both surface and sub-surface. The ordering of these three types of effects carries no implication as to their relative importance (and, indeed, water quality is a significant aspect of both types of water uses).

The indirect effects of water resource management are manifold. They include the amount and distribution of monetary income, the non-monetary implications for peoples' lives, such as the amount and kinds of work they do and, perhaps most important of all, their health. They include impacts upon the national economy, such as the production of foreign currency-generating export goods and services, demands for health-related and educational services, for transportation and other infrastructure, and the provision of subsidies or the generation of revenue through user charges.

Most fundamentally, water resources management activities help to determine the long-term sustainability of the socio-economic and environmental system of the river basin and of the nation as a whole. Of course, the state of our knowledge at any time severely limits our ability to recognize, measure, and appropriately consider all of these secondary effects, so the scope of water resource management is not static, but is continually expanding.

2.3.3.2 Participation

At one time the participants in water resource management were often narrowly-defined to include only water management

technicians, their political superiors, and the people directly affected by what were then largely structural water resource development activities. That day has passed in all countries, with a broadening of the scope of water resource management to include demand management as well as supply enhancement, and resource preservation as well as resource exploitation. With that broadening of scope, which also includes recognition of an increasingly wide range of secondary effects, has come the need to admit a far greater array of participants into water resource management activities.

Today, it is essential that all major stakeholder groups be represented in some way in the water resource management decisions which will affect them. This does not mean that the institutions for managing water resources must be general-purpose governments. In fact, the charters of such institutions must limit them to their primary purposes, as indicated by the primary effects which they produce. Otherwise, they will duplicate and compete with other resource management institutions and with general-purpose governments, a sure route to institutional extinction.

Water resource management institutions, then, should provide for the direct participation of stakeholder groups which experience the direct impacts of their activities. Such participation can be organized through a variety of means. The most decentralized of these means is the use of market institutions for distributing costs and benefits. Market institutions provide efficient ways of registering the true preferences of participants, of rationing scarce goods and services, and of drawing upon all available information. They are practical, however, only when the ability to organize participants into functioning markets exists, or can be created. This occurs only when property rights in water, including the right to buy and sell, are well-defined. It may not occur even then, if high transactions costs exist and cannot be reduced. In addition, market institutions are desirable only when the existing distribution of power to command resources, as represented by

monetary income and wealth, are distributed in patterns which reasonably approximate a society's norms of fairness and equity.

When the above conditions are not met it may be preferable to use political institutions as avenues for stakeholder participation. Such institutions normally incorporate centralized means, such as the use of hierarchically organized government bureaus and agencies for policy implementation, coupled with decentralized ones, such as the use of representative governing boards, advisory committees, and similar institutions of representative government, for policy adoption.

The participation of stakeholder groups which experience the secondary effects of water resource management activities is usually more difficult to achieve than is effective participation of primary stakeholder groups. The somewhat marginal importance of the effects experienced by individual members of such groups often leads to little motivation to expend the effort needed to participate fully in collective decision making. And, if participation does occur, it sometimes takes the form of the kind of vote trading and log rolling which can lead to poor collective decisions. For these reasons, the participation of secondary stakeholder groups is usually achieved indirectly, through coordinating mechanisms and through the use of existing general-purpose governments. One way of doing this is to form coordinating councils, upon which sit representatives of substantive agencies within whose domains the anticipated secondary effects fall. These representatives should have the power and the duty to review proposed water resource management activities, and to recommend positively or negatively upon them to higher authority. In this way, potential difficulties can be worked out at the interagency level, or can be referred upwards for resolution at the upper executive or legislative level. Similar mechanisms may be useful for interbasin coordination and dispute resolution. Finally, all proposed water resource management activities should be reviewed at the national level for consistency with national policies and objectives (these, in turn, should be disseminated to water

resource management authorities, to forestall inconsistencies in the first instance).

2.3.3.3 Powers

The organizations which are assigned the responsibilities for water resource management must have authorities commensurate with their responsibilities. Water resource management organizations may be assigned responsibilities for water allocation, for water resource development, and/or for water quality control. These three functions are closely interrelated, thus, it is preferable that all three be assigned to the same organization. If this is not done, special efforts should be made to coordinate the decision making and implementation activities of the several agencies involved.

Where water allocation is based upon a system of transferable water rights, and consequent market allocation, water resources management organizations may administer the system of water rights, although it is more common for courts to do so, as they administer other property rights. Water is usually considered to be a public resource, however, and even private rights are only usufructuary. Where water allocation is by administrative allocation, e.g., through the issuance of water use permits, the responsibility and authority should be lodged in the water resource management organizations. Seldom will the responsibilities of these organizations extend to consumptive uses of the water, although they may often assume responsibility for such non-consumptive uses as hydroelectric power generation, fishery management, and recreation management.

Where water resource development is entrusted to the private sector, the responsibilities of water resource management organizations may be limited to administering property rights in water and regulating private activity in the interests of controlling external costs imposed upon others and protecting the public interest in environmental quality. Far more commonly, however, water resource development is either a public activity or is publicly supported, because many of the benefits of such

development are thought to be public goods which cannot be marketed. Additionally, assembling private capital in amounts sufficient to undertake major development projects is difficult in industrialized countries and nearly impossible in non-industrialized ones. In these cases, the water resource management organization is a logical choice for locating development responsibility, and this has been the primary role for many of the world's existing water resources management organizations.

Responsibility for water quality control is particularly difficult to assign to the private sector, because water quality degradation is an external cost. Generators of pollution do not bear most of the costs of that pollution. For private sector market allocation to work efficiently in such cases, the right to pollute must become a transferable property right, and government action will generally be necessary to monitor and enforce that right. Every effort also must be made to reduce avoidable transactions costs. Reducing transactions costs will often require governmental action to facilitate the organization of cost-bearers into effective bargaining units, and the creation of pollution rights will inevitably depend upon government action, as will the initial assignment of those rights, whether to polluters or to externality-bearers. One great advantage of the market allocation route, if it can be organized successfully, is that it reduces the need for government to acquire costly and sometimes jealously-guarded proprietary information. The crucial initial distribution of rights to pollute must be in accord with societal norms of fairness and equity.

A simpler and more usual, if less efficient, solution to the water quality problem is to assign responsibility and commensurate authority to a public sector entity. This entity then functions in a regulatory capacity, establishing and enforcing rules which limit the right to pollute. Such rules can take the form of either regulations (ambient water quality or effluent standards) or incentives (effluent taxes, fees, or charges). The technical capacity to establish appropriate ambient water quality standards, to set effluent standards consistent with them, and to monitor and

enforce compliance is often lacking, even in the most industrialized nations, hence regulatory programs of this kind should be viewed as evolutionary processes. Early regulatory attempts will be awkward and initial standards will be highly approximate. Those who regulate and those who are regulated will be engaged in a learning process which, over time, should approach the goal of optimal pollution control.

2.3.3.4 Information

The information requirements for effective water resource management can be quite forbidding, even for the most industrialized nations. For example, the conjunctive management of ground and surface water resources requires both sophisticated ground water models and a sufficient data base for calibrating those models. Ground water data can only be obtained from numerous and costly wells, over substantial periods of time. Few places on earth can be characterized by such a data base. Furthermore, advanced geological and mathematical knowledge, together with powerful computers, are needed for the modeling effort. Water quality models and data can be described in similar terms. Even such conceptually less complex tasks as flood forecasting and early warning require costly electronic monitoring networks which are only now being put in place in selected locations in industrialized countries.

Experience has shown that water resources data collection can become a bottomless pit, into which any amount of money can disappear without yielding concomitant benefits. Water resource management organizations must obtain sufficient data to discharge their responsibilities, but they must also guard against indulging a technical urge to seek data which are too costly or which are not critical for decision making. Institutional innovation, to make the most of readily available data and to deal wisely with unavoidable uncertainty, is often a better investment than is protracted data collection. Avoiding costly and irreversible commitments is frequently the best strategy for dealing with high uncertainty.

It is also important that residual uncertainty be recognized and dealt with appropriately in water resource planning. Human beings are often uncomfortable with uncertainty and deal with it poorly, hence it is all too easy to work with single planning scenarios, rather than a range of plausible ones. Both water supply planning and flood control planning are particularly vulnerable to extreme events, and probability analysis and/or sensitivity analysis should be basic techniques in such planning.

2.3.3.5 Decision making

There are three basic methods of making decisions about public policies and programs. They are bargaining, command, and representation. Bargaining is a non-hierarchical method in which equals voluntarily exchange goods and services to the benefit of both parties. It is a decentralized method which occurs prominently in market institutions, but also in legislatures, committees, and many other forms of organization.

Command is a centralized hierarchical decision method, in which entities at the top of the hierarchy (often the central government, but also sometimes upper elements of a bureaucracy, corporation, or association) make decisions which affect, and are carried out by, entities lower down in the hierarchy.

Representation is a decentralized hierarchical method by which entities low in the hierarchy control leaders higher in the hierarchy. Electoral processes for choosing legislators and executives in a democratic political system and worker participation in industrial decision making are examples of this method.

Any successful water resource management system will rely in part on each of the three decision making methods. Bargaining is the method by which competing interests find common ground, command is the method by which society articulates and pursues common purpose, and representation is the method by which hierarchies are constrained to seek the common interest.

Water resource management will be directed in part from above, as national authorities use command to ensure that local

and regional programs do not work against national objectives while pursuing their individual purposes. Within basins, the command method will be used to ensure that certain purposes, such as control of toxic substances and other hazards to public well-being, are attained unfailingly. It may be used for additional purposes, even though strict accommodation to the public purpose may not be imperative, when employing the more permissive bargaining method (as in the use of economic incentives) is impractical.

An important feature of water resource management is responsiveness to regional needs and objectives. Achievement of this ideal requires use of the representative method. Decision making bodies, such as regional boards or commissions, are composed of representatives of general-purpose governments within the region. They provide the channels through which the goals and policies of these units can shape water resource management decisions. Advisory boards or committees, made up of representatives of stakeholder interest groups affected by water resource management, are often used to ensure that the views and desires of such stakeholders are not overlooked. Coordinating committees of representatives of agencies whose responsibilities overlap those of the water resource management organization are customarily used to assure that interrelated programs are not in conflict with each other.

2.3.3.6 Benefits and costs

Water resource management decisions always involve benefits and costs. Consideration of benefits and costs should not be limited to those affecting the budgets of water resources authorities. They should include all of the material consequences, to whomsoever they may accrue, and whether measurable in monetary terms or not, which are expected to result from implementing water resource management decisions.

Three aspects of these benefits and costs are important for water resource management. First, the magnitudes of benefits and costs influence whether proposed programs or projects are

economically efficient. Benefit-cost analysis is the analytical tool most often used to assess economic efficiency. These magnitudes also determine financial feasibility (not all economically efficient projects are financially feasible, and not all feasible projects are efficient!). Generally speaking, only efficient and feasible projects should be pursued, because to do otherwise diverts scarce resources from more productive uses. However, economic efficiency is not the only goal, and occasionally modestly inefficient projects may be justified for their distributional, environmental, or other non-efficiency attributes.

The second important aspect of water-related benefits and costs lies in their incidence. Water resource management programs are likely to enjoy public acceptance and support when the incidence of benefits and costs is consistent with prevailing social norms of fairness and equity. Otherwise, they may be perceived as unjust, and their implementation resisted and thwarted. Patently inequitable projects should no more be pursued than should highly inefficient ones. It should be noted that estimates of the magnitudes of benefits and costs are not unrelated to the distribution of those benefits and costs. Willingness to pay is the accepted measure, but willingness to pay depends upon ability to pay, which may be very unequally distributed.

The third important aspect of water-related benefits and costs lies in their influence upon behavior. They may be thought of not only as outcomes of water resource management activities but also as instrumental elements of such activities. Properly designed cost (and benefit) allocations can create the incentives which motivate persons and groups to work towards the attainment of water resource management objectives. Effluent charges and water pricing are examples of the use of such incentives. But it is important to think broadly about the aspect of incidence. All of the effects of basin management activities are experienced by persons and groups, and all will affect the behavior of these persons and groups. It is important that the behavior which is so

influenced be consistent with water resource management objectives, else it is likely to frustrate them. Perhaps the best example of this is the subsidization of water supplies, for irrigation, industrial, or domestic uses, in an attempt to encourage development. Water which is underpriced will be overused, and in a water-short environment this will ultimately constrain development rather than advance it, because it will not be sustainable in the long term.

LEVELS OF ACTION

The other essential portion of the conceptual framework is the notion of levels of action or decision making. There are three such levels, which are termed variously in the literature as operational, institutional, and policy or operational, collective choice, and constitutional. Figure 2 is a diagram of the levels of action concept. With specific reference to water resources management, these three levels will be referred to henceforth as the water use, water resource management, and water resource policy and law levels.

1 WATER USE LEVEL

Water may be used for municipal, domestic, and industrial purposes, for irrigation, for generating electricity, for waste or residuals disposal, for fisheries, for navigation, for recreation, and for maintaining aquatic, terrestrial, and marine environments. The maintenance of adequate water quality is important for all of these uses. Terrestrial land uses may depend upon a reliable water supply and upon protection from such natural water hazards as floods and poor drainage.

Actions at the water use (operational) level are those taken to manipulate the environment. These actions directly determine the well-being of humans and ecosystems. Most action at this level is performed by individuals or private groups, as they attempt to make the environment work for their well-being. These actions are the objects which programs attempt to influence. Examples include

diverting water for irrigation, discharging wastes into a stream, exploiting the potential energy of a river for generating hydroelectric power, using a lake for commercial, subsistence, or recreational fishing and, perversely, suffering the damage caused by a flood or tsunami.

Rules are always necessary to facilitate water use. These water use institutions may take such forms as quantitative allocations to withdraw and consume water, waste discharge limitations, navigation rules of the road, and reservoir rule curves,

Figure 2

to name but a few examples. They may be established by custom, by market transactions, by statute, by court decisions, or by administrative proceedings.

There are many ways in which these water use institutions may be less than effective in dealing with changing conditions. A few examples are given below, but they are only examples. The number of possibilities is virtually unlimited, and could not be completely cataloged.

A common institutional problem at the water use level is a lack of coordination between surface water rights and ground water rights (if any). In many countries, the laws governing the allocation of surface waters were established before modern hydrology had clarified the interrelationships between surface water and ground water. Ground water withdrawal was a prerogative of land ownership, and was not governed by water laws. Consequently, conjunctive management of surface water and ground water, although economically and ecologically desirable, was difficult or impossible to achieve. This problem continues to exist in many countries to this day. It is an example of defective scope rules. The uses of closely interrelated resources are governed by separate, narrow, and uncoordinated institutions.

Another common institutional problem at the water use level is the lack of participation by stakeholders other than consumptive water users. Water rights laws often require diversion and beneficial (consumptive) use as a condition of obtaining a water right, with few or no instream uses defined to be beneficial. There is no such thing as a right to instream flow. Such a position rule deficiency discriminates against whole classes of stakeholders, creates both inequity and inefficiency, and invites environmental degradation.

A third example of an institutional problem at the water use level occurs when a consumptive water user is exposed to water quality degradation produced by upstream users, but lacks the right to be protected against such impacts. This is a defect in authority rules, especially if there exists no right to buy relief on the part of the downstream party or to sell it, on the part of

the polluter (normally, the polluter pays principle would suggest that the right to be free of pollution would inhere in the downstream party and the upstream party would have a duty to respect that right).

The foregoing illustrations are only three of many types of common water use rule deficiencies which can cause inefficiency, inequity, and/or environmental degradation. The function of activity at the higher water resource management level is to identify and resolve such problems.

2 WATER RESOURCE MANAGEMENT LEVEL

The purpose of water resources management is to correct problems at the water use level through changing these institutions, or through changing environmental or social conditions other than rules. The essence of the water resources management process to determine which water use rules ought to be changed, and in what ways, in each site-specific situation. That determination begins with a diagnosis of the problems caused by the existing water use institutions.

Actions at the water resource management (institutional) level are those aimed at influencing water uses and users. Such actions attempt to affect the states of humans and ecosystems indirectly, by creating the rules or institutions which shape behavior at the water use level. The design, adoption, and implementation of public programs occurs at the institutional level. Water resources planning, as ordinarily understood, is an example of action at this level. Water resources management is another, and broader, example, because it includes not only the design of plans and programs but also their adoption and implementation. More general examples might include legislating, adjudicating, and administrative rule-making.

Water resource management activities are themselves subject to rules. The scope of the decision making process, who participates and how, what information is considered and how it is collected and distributed, how collective choices are made, and

how costs are shared are all governed by the rules at this institutional level.

3 WATER POLICY AND LAW LEVEL

Actions at the water resource policy and law (constitutional) level determine the rules for actions taken at the water resource management level. They have provided the basic context within which programs operate, and the constraints which must be observed in program design, adoption, and implementation. Normally, as we look at institutional level activities such as water resources management, higher level policies and laws may be regarded as fixed and immutable. Analytical concern for the water resource policy level goes no further than understanding how institutional level rules may be formulated at that level, a necessary understanding if workable water resource management programs are to be devised. For purposes of this report, however, water policies and laws are taken to be open to change, as well, because improperly structured laws and policies can frustrate even the best water resource management activities at the river basin or regional level.

Developing a comprehensive strategy for water resource management in any country is a high level process which defines the rules which water resource management processes at the basin and regional level must follow. It sets laws and policies. Ideally, developing a comprehensive strategy should precede, and provide the institutional basis for, the development of water resource management strategies for individual river basins or regions. Such a process will not require building formal hydrologic-environmental-economic-institutional models of the type referred to earlier, and again below. However, less formal and less detailed understanding of the complex systems to be managed are essential.

A comprehensive water resource management strategy, whether at the national or the regional or basin level, is not to be confused with what has traditionally been termed a national water plan. Such plans have often taken the form of a set of water

resource development projects to be built at some future time. Although they have usually included institutional descriptions and, perhaps, economic and/or environmental impact projections, they have not focused upon non-structural options. A comprehensive strategy has a very different focus, and will not normally include plans for individual development projects.

THE PROBLEM SOLVING APPROACH

Water resources management can be seen as the process of ensuring that water is used in ways which provide the greatest benefit to society and which resolve conflicts between water uses and users as effectively, efficiently, and equitably as possible. This means that the rules which govern water uses and water users must be structured so as to avoid conflicts or to resolve them expeditiously. Whereas water resources development programs have been characterized by a focus primarily upon the operational issues of facilitating single water use purposes, and much less upon the institutional issues of controlling and coordinating water uses and users, that focus must now be reversed.

Water resources development is supply-oriented. It is concerned with largely structural measures for increasing water availability. Water resources management is both supply and demand-oriented. It is concerned with managing both supplies of water and the demands for those supplies, to achieve the best use of limited resources. Managing demand involves influencing the behavior of people, the users of water (so may supply management, although it has not often been seen in this light).

There is no need for water resources management when all present and prospective users of water for these several purposes are able to meet their needs without difficulty. This is rarely the case, as demands for water services increase and as the interrelationships among uses become ever more obvious. This does not mean that resolving overt conflicts among water users is all there is to water resource management, although it can certainly be an important element. Rather, it means that the multiple uses

which are served by water resources, and the finite nature of those resources, indicate that making choices and analyzing tradeoffs lies at the core of what we mean by management.

1 GENERAL PRINCIPLES

Water resources management is a problem-solving process. As such, it must proceed in an appropriate sequence of tasks if it is to succeed. These tasks are well-known, but curiously little followed. Le Moigne et al. (1994a) refer to two phases of the process, assessment and formulating options. In slightly greater detail, they are to identify the symptoms which are causing, or will cause, dissatisfaction, to diagnose the possible causes of these symptoms (defining the problems), to identify potential remedies (listing alternatives), and to analyze and compare those options in order to determine those which should be adopted (evaluating alternatives). Decision making (adopting solutions) and action (implementing solutions) may be added to this list of tasks.

It would be impossible, and undesirable if it were possible, to provide a set of recipes for institutional change in water resources management. The subject is too complex to be reduced to such a "cookbook" approach. Furthermore, institutional change is a process of social learning which cannot be imposed from outside or from above. Each situation is in some respects unique, and each demands a situation-specific approach. Certain broad principles do apply, however, and concern of this section of the report is to enunciate them.

1. Water resource management is fundamentally a matter of finding and implementing changes in the "rules of the game"; the rules which govern how people use water and how they interact with each other and the natural environment in so doing. Some, but not all, of those rules have to do with the creation and operation of infrastructure, such as dams and water treatment facilities. Others of them have to do with pricing, property rights, and regulations.

2. Rules of these kinds exist to help people make the best possible use of available water resources (which sometimes means no use whatsoever). Therefore, the kinds of rule changes which may be appropriate will depend upon the nature of the water resource, the characteristics of possible uses of it, and the potential impacts of such uses upon humans and their environment. This point cannot be made too strongly. Institutions should be designed as carefully and as objectively as are engineering works, for they have little chance of succeeding if they are not responsive to, and derived in part from, the water use situation which they are to influence. Ideologically-based preferences for particular institutions, whether of the right or left, are commonly held but should be guarded against. The values which underlie ideological preferences must play an important role in guiding decision making, but any technical or factual judgments about how institutions might perform should not be based upon ideology.

3. The water resource management process, then, must begin with an adequate understanding of the entire situation at the water use level. This should involve building integrated models of the hydrology, economics, and other aspects of the water use situation. There are now several tools available for modeling hydrologic-economic-environmental-institutional systems which are user-friendly, graphically-oriented for clear presentation of results, and which incorporate sensitivity analysis capabilities (particularly important in LDC's where lack of data poses a serious barrier to modeling). One example of such a tool is STELLA II (©High Performance Systems, Inc.), a difference equation-based simulation program with pre-defined elements representing stocks, flows, connectors, and converters, a repertoire of pre-defined mathematical functions, the capabilities to import and export data, to represent systems graphically and to employ sensitivity analyses.

4. A key part of such an integrated model is the inclusion of, and emphasis upon, the rules by which the behaviors of resources, facilities, and water users are shaped. The use of hydrologic models in water resources management has long been commonplace. No

engineer would think of designing a dam without such a model. More recently, the integration and use of economic models has become common, as the reliance on forecasts of projected water needs or requirements (point estimates) has given way to more useful projections of water demands as a function of prices, for example. Rarely, however, is an explicit institutional model included in an integrated water resources management model. Such integration is essential for adequate evaluation of institutional issues.

5. Existing water resource management rules should first be evaluated by using the integrated model to project possible outcomes under a range of scenarios which specify plausible values of key uncontrollable explanatory variables, such as weather, international markets, and population. This evaluation, in which the outcome variables are chosen to represent key system attributes which are valued by stakeholders, then provides a diagnosis of the problems to be solved by water resources planning and management. As one example, separate and uncoordinated institutions governing water quantity and quality may cause problems if model runs show water quantity and quality to be interrelated, as is usually the case. And, sensitivity analyses can indicate the importance of various kinds of missing information, thereby directing future monitoring and other data collection efforts, and avoiding large expenditures devoted to collecting non-essential data.

6. Alternative institutions, or rule sets, should then be evaluated in the same way as are physical alternatives, by projecting the outcomes of their implementation under a range of plausible scenarios. This makes the tradeoffs involved explicit and facilitates informed choice. It may not make such choices easy, however, as when an evaluation of free water marketing discloses impressive gains in water use efficiency, increased environmental degradation, and increased concentration of income and wealth (in this situation it may not lead to rejection of water marketing, but to additional rule changes needed to address adverse outcomes).

The important point here is that prescriptions for changes in institutions should be just as situation-specific as are prescriptions for controlling water flows. There are generic kinds of institutions, just as there are generic kinds of dams, but each situation deserves and requires an institutional prescription derived from an analysis of that situation. One-size-fits-all prescriptions are unlikely to succeed.

7. Not all water use problems can be solved at the next higher (water management) level. Water management rules themselves may be inadequate for solving all water use problems. In such cases it is usual for dissatisfied stakeholders to carry the unresolved issue to a higher level, such as to a court or legislature. In interstate water allocation conflicts in the U.S., for example, the decision making rule which requires unanimous agreement among the participating states in order for them to make any changes in water allocations virtually precludes such water use changes. Consequently, resolution of such conflicts almost never occurs until a disgruntled party takes the issue to the Supreme Court or to the federal legislature.

8. Many water resource conflicts are especially difficult to resolve because the fugitive nature of the resource itself makes them asymmetric. Upstream water users can and do impose costs upon those downstream. They have little incentive to reduce those external costs because all of the benefits of doing so accrue to those downstream. And, because downstream water use has no effect upon upstream users, in the absence of rules like those of appropriation doctrine, those downstream have no ability to shift costs upstream. Upstream parties are unlikely to bargain over rule changes which would benefit those downstream, and thus the stage is set for moving such issues to higher levels, and out of the water management bargaining arena.

2 WATER USE PROBLEMS

The problems which interrelationships among water uses and users spawn, and which are exacerbated by increasing demands of all types, may be categorized as externality problems, open access

problems, scarcity problems, and public goods problems. Other types of water use problems may also exist, but these four are common and will serve to illustrate the analytical approach.

2.5.2.1 Externality problems

An externality, whether cost or benefit, is said to exist when the actions of one party affect the well-being of a second party, and the first party cannot itself gain by considering this effect and modifying its behavior accordingly. A classic example of an external cost, usually referred to simply as an externality, is that of the upstream paper mill which discharges wastes into a river, thereby reducing downstream fish populations upon which others depend. An externality is thus a purely asymmetric situation. There is nothing which the bearer of the externality can do directly to lessen the impact.

2.5.2.2 Open access problems

An open access problem is said to exist when access to the use of a resource is open to all, and when the rate of use of that resource affects the amount that can be used. A classic example of an open access problem is that of the ocean fishery, in which excess fishing effort drives down the stock of the resource, eventually reducing yields or, in the extreme, causing the extinction of the species. Another example is the familiar "tragedy of the commons". An open access problem is a symmetric one, because each user creates a cost which is spread over all users, including himself. However, the cost which a single user bears is minor in relation to the total cost imposed upon all, and thus no user takes into account the full implications of his actions.

2.5.2.3 Public goods problems

A public goods problem is said to exist when a particular good must be provided to all in equal amounts. No one can be excluded from consuming it, and the cost of providing it to one is as great as the cost of providing it to all. National defense is

the classic example of a public good, but endangered species provide another. The problem, in this case, is that public goods are likely to be undersupplied because no one will undertake to produce them, since they cannot be withheld from others, thus cannot be sold to make profit. Public goods thus must always be provided by government, but in this case it is impossible to determine how much should be produced because no one must pay, and thus disclose what the good is worth to him.

Problems such as these are present in almost all water resource use situations, although few such situations are confronted with all of them, especially simultaneously. In the usual case, problems are recognized and dealt with sequentially, with the solution of one problem revealing, if not resulting in, another. Indeed, the process of responding to, diagnosing, and resolving these water resource use problems is exactly what is meant by water resources management.

2.5.2.4 Scarcity problems

A scarcity problem may be said to exist when the users desire more of a good than the quantity available. This is the most common of all operational level problems. In fact, the phenomenon of scarcity is so general that some may object to calling it a problem at all. Virtually all resources are scarce in some sense, and those things which are not scarce are often not considered to be resources, or they may go completely unnoticed. Economic markets handle scarcity by allowing competition, in which those with the most purchasing power, and to whom the resource is most valuable, will bid it away from others. But scarcity is also commonly dealt with by non-market institutions, a frequent situation in the water resources field.

3 MEANS FOR ACHIEVING WATER RESOURCE MANAGEMENT GOALS AND OBJECTIVES

The water resource management literature contains frequent references to such measures as privatization, decentralization, water marketing, public participation, improving human capital,

institutional innovation, river basin management, full cost recovery, demand management, and integrated water and environmental (or land and water) management as means for improving water resource management. All of these means are appropriate, in some forms and in some situations. All can be inappropriate as well. What is needed is the ability to describe and prescribe more clearly than these very general terms permit.

We suggest that use of the analytical framework which has just been presented is one way of achieving the requisite clarity. Privatization, for example, can be characterized as the adoption of position and authority rules which stipulate that non-governmental actors may assume the roles of owners and managers of certain resources. But to begin down this path raises immediately such questions as scope (what is the range of ownership rights created?), entry and exit (how are private rights assigned, and how may they be transferred?), information (how are private actions monitored, and by whom?), decision making (how do the multiple decisions of multiple private owners interact to become collective actions?), benefits and costs (how are the benefits, especially monopolistic rents, distributed?), and at what level is privatization occurring (water use, which is already largely private in many situations, water resource management, through creation of market institutions, or water policy and law, such as the nationalization of water resources and facilities?). The use of a systematic analytical framework improves the clarity of discussion and helps to assure consideration of all relevant aspects of the situation. A definitive analysis requires not only this analytical framework but also the application within it of models of all of the important sub-systems involved.

SUMMARY

It will be obvious that the kind of water resources management process just described is not often seen, in LAC or elsewhere. The reasons why this is so are many, but the most important, from the perspective of this report, are themselves

institutional in nature. It is institutions, or rules, at higher levels than that of water resources management which shape the extent to which the kind of process just described can be carried out. There is little chance of implementing water marketing in a country in which the English common law system of riparian water rights prevails, for example. Replacing such a system with one more congenial to water marketing, while not impossible, is a major undertaking which goes beyond the alternatives available in a single river basin. Similarly, concentration of income and wealth, of political power, and of control over water resources (not an uncommon situation in Latin America) may make the adoption and implementation of broad stakeholder participation difficult to achieve. Part 3 of this report deals extensively with the institutional context, or preconditions, which now exist in LAC, and which condition what may be expected and what may be achieved in the way of improving water resources management there.

PART 3
AN ASSESSMENT OF WATER RESOURCES MANAGEMENT IN LATIN
AMERICA AND THE CARIBBEAN

INTRODUCTION

This section of the report presents a preliminary assessment of water resources management conditions in Latin America and the Caribbean (LAC). The assessment is based on interviews with water resources managers and policy makers in six countries - Mexico, Costa Rica, Barbados, Argentina, Chile, and Peru - and is supported by supplementary documentation received during the visits. Over ninety people were interviewed for this study, individually or in groups. The overwhelming majority of those interviewed were public employees with significant responsibility for water management or formulation of water policy. Very few individuals were from the private sector, academic institutions, or non-governmental organizations. Most were engineers, others were economists, lawyers, or planners. A list of those interviewed is presented in Appendix 3.

Neither time nor budget permitted visits to as many countries as would have been desirable. The six countries visited were selected because it was believed they could provide an adequate representation of water resources management issues in their respective sub-regions. A second consideration in the selection process was whether any of the countries had unique experiences in water resource management. A final consideration was whether or not there were people in the individual countries with experience in other LAC countries who could provide a broader perspective on water resource management issues. According to IDB's country classification based on relative state of development, the countries visited represent three of the four groups: Argentina and Mexico (Group A - highest); Chile and Peru (Group B); and Costa Rica and Barbados (Group C). No countries from Group D (lowest) were included, a fact that must be considered in

interpreting the findings of this assessment since these are the poorer, less developed countries in the region.

Part 3 is organized as follows. Recent advances and accomplishments in water management and a discussion of the more critical issues facing water planners and managers are presented in Section 3.2. Some measures being taken to address water resource management problems are documented in Section 3.3, and general observations on the countries' efforts are provided in Section 3.4. Part 3 concludes with some perceived needs for improving water resources management in LAC countries and some thoughts on sub-regional water issues.

STATE OF WATER RESOURCES MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN

"There is no crisis in water resource administration in Latin America and the Caribbean...Water resource administration has made and continues to make progress...However, the present state of water management is far from optimum and many issues inherent to water system operation are often poorly handled or even ignored by those running the systems (Lee, 1990:199)." Lee makes this observation near the end of his appraisal of conditions in Latin America and the Caribbean. The observation also makes an interesting point of departure for the current appraisal. Is there crisis in water resource management in Latin America and the Caribbean? There are problems to be sure, some of which are rather formidable, such as inadequate access to potable water supply and sanitation, environmental deterioration, water pollution, and salination of ground water aquifers. There has been and continues to be progress in addressing and overcoming these problems and towards developing a more efficient and responsive water management system. However, despite these efforts, many of which are quite localized, the overall impression of those interviewed for this study is that water resources management in LAC is indeed facing a crisis.

Existing water resource institutions and infrastructure have evolved in response to local conditions, local forms of government (e.g., federal or unitary), local scarcities of water, and the rate at which resource problems have arisen. Thus, it is not surprising to find a wide range of institutional forms and tremendous differences in the level of infrastructure development and technical, economic, and financial capabilities among the various countries. The recent advances and critical issues facing water managers are a function of these conditions, and, thus, also vary considerably between countries and regions within countries. This section addresses some of these advances and critical issues in broad terms.

1 RECENT ADVANCES IN WATER RESOURCE MANAGEMENT

Recent advances in water resources management in LAC can be attributed to numerous factors, two of which are briefly discussed here: (1) the impetus provided by the International Drinking Water Supply and Sanitation Decade, and (2) the changing role of the State in the past 10-15 years. The latter, and to some extent the first, is an example of what Lee (1990) describes as external factors influencing water resources management, i.e., factors over which in-country water planners and managers have no direct control.

3.2.1.1 Improved Water Supply and Sanitation Coverage

The International Drinking Water Supply and Sanitation Decade in the 1980s and the concomitant support of international financial institutions provided impetus for the improvement of water supply and sanitation systems throughout the world. In LAC, the Water Supply and Sanitation Decade coincided with what has been termed "the lost decade", a period of prolonged recession during which most countries in LAC suffered from excessively large foreign debts which, among other things, resulted in very little public investment in infrastructure. As such, advances during the Decade were less than had been anticipated. Nonetheless, significant strides were made in the provision of water supply and

sanitation services, particularly to the rural sector (Munasinghe, 1992). The percentage of total rural population in LAC with access to safe drinking water supply increased from 47 per cent in 1980 to 62 per cent in 1990. The increase in the provision of sanitation services in this period was from 22 to 37 per cent. Numbers for the urban sector, while higher overall, did not change significantly during the Decade. Access to safe drinking water increased from 82 to 87 per cent, while the provision of sanitation services was basically unchanged, increasing slightly from 78 to 79 per cent. These improvements vary considerably across various LAC countries (Reid, 1994). However, the fact that coverage has improved is not to say that the sector as a whole is in good shape. In many cases infrastructure is insufficient to keep pace with expanding urban populations and, generally, is in poor condition.

3.2.1.2 Increased Opportunities to Experiment

The changes in political and economic policies which have taken hold in many countries in response to the conditions of the "lost decade" have had a noticeable impact on water resources management. The central government's role is being redefined through a series of structural reforms (e.g., expansion of market principles and privatization of state run enterprises) aimed at reducing direct government intervention in the economy. The decentralizing and liberalizing policies have given water managers room to experiment and test new options, including many market-oriented, incentive-based measures. In terms of the conceptual framework presented in Part 2, this change is an illustration of action at the constitutional level that broadens the range of options and possibilities at the water management level.

The range of incentive-based instruments available to water managers and policy makers is vast, as noted in Part 2, and many of these have been contemplated or implemented in LAC. (See Russell and Powell (1995) for a summary of the use of these instruments for environmental policy management.) Though the switch from centralized control of water resources management has

not been complete - nor should it be - and the experiences have not always been positive, it is encouraging that new policies and strategies are being tried. The adoption of these measures is likely to increase in coming years as local experiences accumulate and because these policies are strongly encouraged and supported by international lending institutions.

Three examples - decentralization of water related services, privatization of water supply and sanitation (WSS) services, and the creation of water markets - are briefly mentioned below. These and other instruments sought by water managers in LAC are discussed in more detail in subsequent sections.

Decentralization. In seeking alternatives to the public provision of water related services, many governments are decentralizing administrative and decision-making responsibilities. Decentralization is most prominent in the agricultural and water supply sectors. All the countries visited had in place programs to transfer operating and maintenance responsibilities for, if not outright ownership of, irrigation facilities to local user groups. Many governments have decentralized the administration of water supply and sanitation services. For example, in 1980 Obras Sanitarias de la Nación (OSN), which had been responsible for providing WSS services throughout Argentina, was decentralized and responsibility for these services was transferred to the provinces. Some provinces furthered the process by transferring responsibility to individual municipalities. In rural areas of Argentina, cooperatives were formed to provide these services. As a result of this decentralization, there are approximately 1,500 organizations throughout Argentina involved in water supply and sanitation. Similarly, in Chile in 1989, the Servicio Nacional de Obras Sanitarias (SENDOS) transferred responsibility for WSS services to the regions, and thirteen regional, semi-autonomous entities were formed to provide WSS services.

Privatization. Privatization of state-owned enterprises has been a mainstay of recent government structural reforms. Hydropower generating facilities were among the first water

related services to be privatized in many countries. Whereas privatization of hydroelectric services generally has been well planned and implemented, the same cannot be said of privatization efforts for WSS services. Though, arguably more complicated to privatize because of its unique characteristics, e.g., natural monopoly, public good, economies of scale, several countries are actively pursuing the privatization of some components of WSS services, including Mexico (Casasús, 1994), Argentina (Idelovitch and Ringskog, 1995), Chile, and Peru. The privatization models vary considerably, ranging from full concessions for WSS services, as in Buenos Aires and Lima, to concessions for the provision of selected services, such as meter reading, billing, or treatment plant operation, as in some Caribbean nations. These incipient efforts with private sector participation have not been without difficulty, yet they are providing valuable lessons and experience for future efforts (Richard and Triche, 1994).

Water Markets. Water markets are sought as a means of allowing society to allocate water to its most highly valued uses. Chile was the first, and to date the only, country in LAC to make water rights freely transferable private property. It was envisioned by the authors of the 1981 Chilean Water Code that, following the initial allocation of rights, the State would cease to have authority in this area, and future distribution of rights and, thus, water allocation among users and uses would be left to market forces. The Chilean experience has spurred much interest among water managers in LAC and international lending agencies, and has generated a fair amount of discussion (Bauer, 1993; Rosegrant and Gazmuri, 1995; Ríos and Quiroz, 1995). However, Chile is not alone in this experiment. Water transfers are supported by the 1992 Ley de Aguas in Mexico (Garduño, 1995), though very few transactions have taken place and water rights are not considered private property. Also in Peru, proposed reforms to the existing Código de Aguas seek to establish conditions for the creation of a water market. Although experiences with water markets in LAC are limited and the few transactions that have occurred are mostly within the agriculture sector, it is likely

that interest will spread because of the strong academic and theoretical support.

Some government policies, such as decentralization, privatization, and creation of water markets can have direct bearing on water resources management. However, water resources and water users also can be impacted indirectly by overall economic forces and through specific government sectoral policies, most noticeably agricultural policies. For instance, in water scarce areas, increased water use efficiency by the agricultural sector is often primarily motivated by the increased availability of markets and improved prices for agricultural products, not by government efforts to improve water resource use directly. A case in point is the improved irrigation efficiency in Chile in the past two decades, spurred in large part by macro-economic policies in the agricultural sector. Another example related to agricultural policies but also involving pressures from the international community is improvements in the quality of irrigation water used for export crops. For public health reasons, nations importing some agricultural products required that irrigation water for these crops be of good quality. This occurred in Chile and Mexico, two countries in which large portions of agricultural lands are irrigated with untreated municipal wastewater. Some regions are now irrigating with ground water. These policies, to some extent, have also motivated the planning and construction of wastewater treatment plants in Santiago and Mexico City.

2 SHORT-COMINGS IN WATER RESOURCES MANAGEMENT

The problems and short-comings discussed in this section are those that appeared to be most important and critical to the individuals interviewed. In this sense, the listing of problems should be regarded as a set of preliminary observations, and in some instances, uncorroborated by more detailed investigations of water resources management conditions in the various countries. Likewise, most of the examples used herein are drawn from the personal experiences of those interviewed, and, thus, may reflect

personal opinion more than objective analysis. This discussion is not meant as a critique of conditions and practices in individual countries or by individual institutions. It merely serves as a reminder of situations and conditions that previously have been identified in the LAC region as a whole. Certainly, the list of problems mentioned herein is not exhaustive. Other issues such as inadequate funding and improper or incomplete project evaluation procedures are certainly critical and need to be recognized in efforts to improve water resources management. Furthermore, the short-coming discussed below should not surprise anyone because they are not new. Recent studies on water resource conditions in LAC, and LDCs in general, present similar findings (World Bank, 1993; Brookshire and Whittington, 1993; Anton, 1993; Lee, 1990; OECD, 1989; ECLAC, 1980).

Water resources planning and management in LAC can best be described as reactionary, acting primarily in response to crises, such as floods, droughts, emergency public health concerns, main breaks, or to special interests, e.g., political. Emergency contingency plans and long-term planning rarely exist and, typically, responsibilities are loosely defined. Under these conditions, responses and water resources management in general tend to be myopic and narrowly focused. In some way, the problems discussed in this section all serve to perpetuate this syndrome. The problems discussed are the following:

- _ Fragmented and Diffused Water Resources Management
- _ Inadequate and Poorly Maintained Infrastructure
- _ Insufficient and Poor Quality Data
- _ Inadequate Enforcement of Legislation
- _ Inadequate Consideration of Environmental Impacts
- _ Minimal Stakeholder Participation

3.2.2.1 Fragmented and Diffused Water Resources Management

Water resources management in LAC tends to be highly fragmented, with responsibilities for planning, development, and management typically dispersed along sectoral lines among a multitude of ministries, agencies, secretariats and autonomous and

semi-autonomous entities. The strong sectoral division found in most countries stems from the historic in-country development of water resources, from the power struggles among sectors, and their conflicting and competing objectives. This administrative structure has been reinforced through the project and sector specific lending practices of external donor agencies. Few formal mechanisms exist for disseminating information across sectors or fostering cooperation and coordination. Some informal coordination and cooperation exists among the various water agencies at a regional or municipal level, or at a national level in smaller, highly centralized countries, simply because the people at these levels know one another. But this is more the exception than a rule. The problem is one of fragmentation and diffusion with inadequate coordinating mechanisms.

The fragmentation, diffusion of power, and poor coordination obscure channels of responsibility and authority. The conflicting and contradictory information acquired in interviews in some countries suggests that misinterpretation and misinformation are common, and that agency staff may not always be clear on what they can and cannot do. In some countries there was disagreement among personnel from different agencies over issues such as the level of water quality standards, the definition of water rights, or who has responsibility for monitoring and enforcement; issues for which there should be clear and definitive information. The lack of clearly defined, transparent, and credible lines of authority and responsibility has obvious consequences for water resources management.

The fragmented condition of water resources management not only gives rise to inconsistencies in governing legislation, prioritization, and management approach, but also creates an environment that facilitates duplication and redundancy in some responsibilities and duties, while others are omitted or overlooked. For example, in one of the countries visited, each water using sector, e.g., agriculture, mines, industry, municipal, has an internal environmental committee responsible for establishing regulations for sectoral development and performing

project environmental impact assessments. These environmental committees are very heterogeneous across sectors and their technical capabilities and regulatory frameworks vary substantially. In another country, one ministry has jurisdiction over the planning, design, and construction of sanitary sewers and wastewater treatment plants, while another entity is responsible for administrating, operating, and maintaining these facilities. This division of responsibilities has the potential of generating conflict and rivalry among agencies that have different requirements and objectives.

The strong sectoralization of water administration has created a situation in many countries in which an agency charged with providing services is also charged with regulatory and enforcement responsibilities. This is a major problem in the water supply and sanitation sectors. In many LAC countries, the agency responsible for the provision of municipal water supply and sanitation services both establishes drinking water standards and enforces them (See also Blanlot, 1995). Again, the sectoral environmental committees cited above serve as an example in that they both establish criteria for project development and oversee compliance. Incentives to be lax or look the other way abound.

A major consequence of the inadequate coordination among administrative entities is the lack of an integrated approach to water resources management and inefficient use of water resources. Even in countries with highly centralized governments the fragmentation of power and responsibility interferes with the formulation of a coherent national water policy. The multiple agencies involved may fail to recognize existing inter-relationships and may not fully address externalities of their individual actions. Inefficient use of water resources is reflected in various ways, but two manifestations are the virtual non-existence of multi-purpose water projects and the lack of surface and ground water conjunctive use projects. Management approaches are still very supply-sided with a strong focus on single-purpose projects. Irrigation, water supply, or hydroelectric projects are typically planned and constructed with

the single purpose in mind and little consideration of other uses. For instance, in one of the countries visited a new reservoir is currently being considered for irrigation use only; a reservoir that some studies have shown to be unsound on economic grounds and which may have detrimental environmental impacts. Also, the hydrologic connection between surface and ground waters is often poorly reflected in technical and planning studies, laws, and water use regulations. There are cities and regions that rely on both surface and ground water sources, but typically the uses are not coordinated in any manner.

3.2.2.2 Inadequate and Poorly Maintained Infrastructure

In several of the countries visited there appears to be minimal commitment on behalf of governments or responsible agencies for maintenance of existing infrastructure. Because of limited financial resources, absence of competition for the agencies providing these services, poor accountability, low priority (new projects are still more desirable than rehabilitation and maintenance of existing systems), and a lack of skilled personnel, much of the infrastructure, from pipelines to treatment plants to irrigation systems, is in poor condition. A main objective of recent efforts to decentralize the provision of water related services was to improve the quality of those services. However, the regional or municipal entities charged with these duties many times suffer from the same structural and administrative maladies as the central government and the desired local accountability may not materialize.

Delivery of drinking water in many cities and towns is subject to intermittent supply, frequent outages, poor pressure, and poor quality. Per capita consumption in most major cities in LAC is between 300-500 liters per day. This excessively high consumption rate is attributed to illegal connections (unaccounted for water) and inefficient use by consumers, but primarily to very large losses from poorly maintained urban water systems. Losses from water delivery systems in major LAC cities range from 30-50% (World Bank, 1993). Also, in one major city, the poor condition

of the water delivery system is blamed for the poor quality water available to consumers at the tap. Water leaving the treatment plants is said to be potable, but it is contaminated in the delivery system, which is subject to substantial infiltration, is corroded, and, in regions where distribution mains are not pressurized, subject to contamination from illegal access.

In general, wastewater treatment facilities are scarce throughout the LAC region, and often are in states of ill-repair or not functioning at all. Most major urban centers discharge untreated wastewater directly into the receiving waters. Often these same waters are used downstream for irrigation.

The use of a separate drainage system for the evacuation of urban storm water is limited (ECLAC, 1990). With the exception of the central areas of some larger cities which have some form of drainage, storm water is typically channeled to the natural drainage system. Natural drainages, from gullies to major rivers passing through urban areas are routinely used as open dumps. The systems generally are in a state of ill-repair, often clog, and commonly have insufficient capacity to handle the quantity of flow generated by even modest rain storms. Exacerbating the problem of urban flooding are the expanding urban populations that are encroaching on the floodplain areas, paving them and reducing their natural carrying capacity. Frequent and costly floods are often the result. Urban drainage is one aspect of water management that seems to go unnoticed, until a flood occurs. Responsibility for maintaining these systems generally falls to the municipal public works department. But, as noted above, low priority and lack of funds prevent them from performing their tasks adequately.

3.2.2.3 Insufficient and Poor Quality Data

Water resources managers in LAC must routinely contend with insufficient and often unreliable data, particularly data on ground water resources and water quality. In many countries, there is not enough information to establish baseline conditions for water quality studies or to make significant use of planning

and operations models. Many hydrologic and meteorologic monitoring stations and networks throughout LAC are in poor condition and tend to provide insufficient coverage of most country's water resources. Even information on the location of system components, e.g., pipes and valves in a distribution system, is often missing or inaccurate. A comprehensive analysis of data related problems in Central America is provided in Arteaga (1994).

Responsibility for data collection is usually divided among numerous agencies, typically is collected along sectoral lines, and is poorly disseminated. For example, in one country a single agency operates over 95 per cent of the country's hydrologic stations and about 50 per cent of the meteorologic stations. The agency collects data only in areas it considers potential sites for hydroelectric generation. Though this data is available to other agencies, its value may be limited since its is purpose-specific.

Ground water resources are poorly monitored. Even in regions or cities that rely exclusively on ground water, there appears to be very little information about the quantity and quality of the ground water resources. For example, one city is beginning to have problems with salinity intrusion into the ground water lens underlying the city. Though ground water is the principal supply source for the city, little has been done in the way of monitoring or ameliorating the situation.

Collection of water quality data has only recently become a concern in most countries. As such there is insufficient information to establish trends for demonstrating changing conditions. Furthermore, available water quality data is often unreliable because of poor sampling techniques, improper handling, or faulty laboratory work. In one country, all water quality data samples collected, regardless of the institution doing the monitoring or the purpose for which they were collected, are analyzed by a central laboratory. The majority of those interviewed expressed dissatisfaction with the technical and analytical capabilities of the central laboratory, raising

concerns about the validity of the results due to poorly trained personnel and lack of analytical equipment.

Socio-economic data necessary for water resources management is also inadequate, possibly more so than the "engineering" data referred to above. Little reliable information is available for preparing demand forecasts and planning studies. Water users and uses are poorly documented, particularly agricultural and ground water users. In most countries visited, poor records of ground water users are kept and, in fact, few governments have an accurate estimate of how much water is actually being pumped from agricultural wells. In some countries, regional offices can grant water rights or use permits, but information on newly granted rights does not always reach the central office responsible for planning.

3.2.2.4 Inadequate Enforcement of Legislation

In many countries legislation for the administration and management of water resources includes provisions which are no longer relevant and actually may serve to constrain new management initiatives. Though existing legislation may be inadequate in certain areas, a more significant concern is the lack of rules and regulations for monitoring and enforcing existing legislation. Without proper monitoring and enforcement, the standards "...do little other than clutter documents and lead to false confidence (Frederiksen, 1992)." Three areas in which enforcement is perceived to be especially inadequate are: 1) administration of water rights; 2) water quality standards, if they exist; and 3) collection of tariffs.

Water Rights. In most LAC countries, water is a public good owned and controlled by the State. Overall water use priorities are determined by the State, but often conditions for allocation under water short conditions do not exist. Water rights or permission to use water is administered differently in each country. In Chile, for example, water rights are private property, separate from land, and can be transferred, sold, or mortgaged. However, in the majority of countries, the central

government, in theory at least, retains much tighter control on water use.

In most countries surface water rights for a specified quantity are granted to applicants for a specific use and duration. Typically, the water rights are granted for a period ranging from five to fifty years, and should be renewed upon expiration. However, since administration is fairly lax, a poor registry of users is maintained, and monitoring for compliance is rare, applicants rarely petition for renewal and simply continue use. In several countries, water rights are subject to forfeiture for lack of use or for not complying with the conditions of the water right. Again, these regulations are rarely enforced. In some cases, water rights are granted on a first come, first serve basis, based in large part on studies submitted by the applicant. However, the technical components of applications are not routinely reviewed or verified, nor is much attention given to the cumulative impacts of water development.

Even when water rights and allocation priorities and mechanisms are well established in the legislation, monitoring and enforcement is usually lacking. This is particularly true of ground water. One such case is that of an agency that has had the authority to regulate ground water users for two decades. But it was not until 1991 that they began to require the registration of new ground water users. Up to this time, ground water use was not monitored.

Water Quality. Historically, little importance has been given to protecting ambient water quality of surface and subsurface supplies. In fact, water pollution may be the greatest problem facing water resource managers in LAC. Industrial wastes containing heavy metals and agricultural drainage laden with pesticides, fertilizers and other chemicals routinely are discharged without any treatment or are permitted to leach into ground water aquifers. Few countries have legislation supporting ambient water quality standards; most follow World Health Organization (WHO) guidelines. In one country visited, WHO quality guidelines are used for controlling and permitting

wastewater discharges. Although it is a criminal offense to discharge in excess of the established guidelines, the responsible agency has little power to enforce them. The existing standards are not viewed favorably by the courts because they are not backed by legislation. Polluters taken to court for non-compliance have been able to win by citing the lack of legislation and by challenging the methods employed for monitoring, data collection, and analysis. A similar situation occurs in another of the countries visited in which the entity responsible for monitoring and enforcing water quality standards nation wide, only has five employees assigned to this task.

Tariffs. There is widespread consensus among those interviewed that water use efficiency starts with the collection of fees. Yet, collection records are notoriously poor, if water is charged for at all. Also, with the possible exception of a nominal administrative fee, water rights themselves are free. Only Costa Rica imposes a surcharge based on the quantity of the right, which is independent of intended use. Routinely, there are disagreements between water managers who are pushing for the establishment of more reasonable tariffs (e.g., tariffs that would cover O&M cost), and some politicians backed by public attitude that water should be a free good, subsidized by the government, if necessary.

Inadequate tariffs do not provide the correct incentives for the conservation of water, but rather encourage overuse and inefficiency. The agriculture sector in most countries rarely pays for water. The fact that in most countries water costs are estimated to comprise less than one per cent of total agricultural production costs, contributes to poor irrigation practices and low water use efficiency. Similarly, lack of proper control and inappropriate tariffs for the use of ground water has resulted in many regions in the overexploitation of aquifers and severe environmental problems, such as salination and contamination.

Of the countries visited, only Chile had tariffs for urban water use that approximated the marginal cost of providing service. More typically, tariffs rarely cover operating costs.

In some cases, lack of metered water service prevents the use of more efficient tariff structures. Meter coverage in major urban areas typically ranges between 10 and 50 percent of connections, and only a percentage of those metered are actually read and billed.

3.2.2.5 Inadequate Consideration of Environmental Impacts

Water resources planning and management in LAC does not adequately address environmental issues. Often the relationships between water development, and development in general, and the environment are not well understood, or are overlooked in the planning, design, construction, and operation of projects. In addressing conflicts between environmental objectives and water-use demands (i.e., economic objectives), the predominant pattern is for the latter to take precedence. Even in the few cases in which environmental impact studies are required, typically as a condition of international financing, the studies tend to be loosely done and the recommendations rarely incorporated in project design. It seems that environmental concerns become an issue only when international pressures are applied.

Water quality issues do not appear to be a primary consideration in the planning and implementation of water use projects, nor in the allocation of use permits. In fact, water rights in most LAC countries are not conditioned on their potential environmental impacts, nor can they be amended to ameliorate environmental threats (Solanes, 1995). Also, existing water legislation does not account for the allocation of water specifically for environmental purposes, such as instream flow for preserving habitat. When Chile privatized water rights in 1981, little consideration was given to possible impacts this action could have on the environment. By not retaining water rights specifically for environmental purposes, the government will most likely have to revert to the market to purchase such rights, if in the future it wishes to set aside water for environmental uses. It is unlikely that the market, without government intervention, will provide for such purposes for the time being.

A consequence of the fragmentation in water management is that responsibility for water quality and water quantity related functions are assigned to different entities. Water quality responsibilities typically lie with the Ministry of Health or an equivalent agency, while water quantity responsibilities are dispersed among numerous water use entities, such as the Ministry of Agriculture or Industry. There is little contact between the sectoral water agencies and environmental agencies, if they exist. Also, as noted above, few countries have established water quality standards for drinking water and for effluent discharge that are backed by legislation, which further complicates and makes more difficult the process of environmental planning and protection.

3.2.2.6 Minimal Stakeholder Participation

Public participation in project planning and implementation has not been considered a necessary part of past water resources management in LAC, where typically a centralized agency administered all aspects of a project. Although new management strategies include the idea of directly incorporating stakeholder participation in project activities, the notion has been slow to take hold. Many water managers are reluctant to incorporate or consider the opinions of an "uneducated" public or be subjected to public oversight or approval of their decisions. Water managers are not altogether wrong in their assessment of the public, for there is a general lack of consciousness among the public regarding water resources and its efficient use. However, the water agencies do not appear to be proactive in soliciting increased stakeholder participation, particularly in the urban sector, and they sponsor few campaigns to booster public awareness, except during periods of crisis, such as droughts or public health emergencies.

Traditionally, stakeholder participation has been strongest in rural water supply and sanitation projects, where local operation and maintenance is routinely sought. However, according to an IDB summary of ex-post evaluations of rural potable water projects (IDB, 1990), local participation efforts have not been

entirely successful for several reasons, including: lack of a permanent system for training local operators and administrators; infrequent contact with members of the executing agency; and, community promotion efforts that are limited to pre- and during construction phases, but die out quickly once the project is finished. Special emphasis has been placed on increasing the role of women in rural water and sanitation projects, but these efforts, too, have not been overly successful.

MANAGEMENT RESPONSES TO CURRENT PROBLEMS

Local, regional, and national water authorities are responding to many of the problems and challenges they are facing. In many countries the focus of solution strategies has started to shift from the provision of basic services to the quality and management of those services, that is, from supply expansion programs to programs of demand management. Traditional engineering solutions, such as construction of new facilities or the unobstructed expansion of existing infrastructure, are no longer seen by many as sufficient to solve current water resource management problems. Planners, managers, and policy makers are resorting to less traditional, non-structural measures for alleviating problems. The requirements for implementing these new measures can be quite different than those required for the more traditional approaches. Many water agencies are seeking the assistance of international agencies and consulting firms to compensate for little experience they may have in these new areas. Those interviewed also expressed interest in what other countries in the region have done and what experiences they may have gained.

The following measures are discussed in this section:

- _ Legislative Reform
- _ River Basin Management
- _ Privatization of Water Services
- _ Water Markets
- _ National Water Planning
- _ Environmental Planning

– Improved Cost Recovery Criteria

The individual approaches and program details vary considerably by country or even by regions within a country. Some measures, such as legislative reform and privatization, are being widely implemented. Others, such as the establishment of water markets receive much attention, but are less frequently implemented. Three of the measures - privatization, water markets, and river basin management - were identified in conversations with IDB staff, as being of special interest to water managers in LAC. A fourth, national water plans, was consistently referred to by many of those interviewed as an important component in the development of a water resources management strategy. Much has been written elsewhere about the pros and cons of the measures presented here, in general and specifically as they relate to LAC. The following observations are based primarily on the country visits and reflect general tendencies in the region.

1 LEGISLATIVE REFORM

Projects for legislative reform in the water sector are ubiquitous, ranging from the formulation of new water codes, as in Peru, to minor modifications, as is occurring in most countries. The legal reform projects are being pursued in great part to support implementation of a broader range of management strategies, such as privatization and the creation of river basin organizations. In fact most of the measures discussed in subsequent sections will require some form of legislative support. In Mexico, for example, the new water code and additional legislative reforms have permitted the CNA to implement numerous changes. The 1992 Ley de Aguas includes provisions for the promulgation of self-financing urban water supply and sanitation services, including privatization of these services, and, encourages the formation of water markets and the transferring of irrigation facilities to local user groups (Garduño, 1995; Casasús, 1994).

In Peru, the central theme of proposed reforms to the Water Code is privatization of water rights. As in Chile, water right owners would be free to sell or transfer their rights at will, and the rights would be taxed as private property. The proposed modifications are being spearheaded by the Ministry of Agriculture, whose primary motivation seems to be to provide small-scale farmers certainty over their water supplies. Some argue that the proposed changes motivated by this desire to bolster agriculture in the coastal zone where irrigation is necessary, give inadequate consideration to conditions in the rest of the country where irrigated agriculture is of lesser importance.

The move towards the private ownership of water rights is viewed with skepticism in some countries and openly opposed in others. For example, in Guatemala where water rights have been private for some time, the government is attempting to regain authority over the distribution and allocation of water, citing too many conflicts among users, including fights and armed attacks. In fact, a recent study of water resources management in Central America makes the specific recommendation that water rights not be granted as private property (PARLACEN, 1994).

Through a series of reforms, the Costa Rican government is attempting to consolidate some of the responsibilities for water resources management. The Ley de Reforma del Servicio Nacional de Electricidad (SNE) would make the Ministerio de Recursos Naturales, Energía, y Minas (MIRENEM) an umbrella agency for water resources management. MIRENEM would absorb some of the powers of the SNE and other agencies, including the administration of water rights and the setting of tariffs. MIRENEM, it is argued, can provide a more integrated and disinterested perspective on water resources management and environmental concerns because it does not represent a specific water user. Some note that, even though the law contemplates the transfer of personnel, MIRENEM is not adequately staffed to handle the additional responsibilities. Others comment that although the proposed laws are a move in the right direction, they do not go far enough in consolidating

responsibilities. Similarly, the proposed Peruvian code considers the formation of a Consejo Nacional de Aguas to oversee all aspects of water resources management.

An issue that is routinely overlooked in the legislative reform projects in LAC is protection of indigenous water rights (Solanes, 1995). Current government efforts to register water rights and water users tend to be very rigid and to allow short-time periods for individuals to present their claims. The penalty for not doing so is forfeiture of the water rights. Solanes notes that these policies may discriminate against indigenous peoples who may be unable to respond in a timely manner. Furthermore, legislation rarely considers that water uses for indigenous peoples include not only water diversions for agriculture, but also instream uses, which are not considered valid water uses in most countries.

2 RIVER BASIN MANAGEMENT

Although the concept of water resources management at the basin level appears to be generally accepted, the manner and extent with which it is pursued varies substantially, and, thus, experiences with river basin management (RBM) in LAC are mixed. River basin organizations (RBO) can be coordinating or authoritative. Coordinating RBOs may be less efficient, but typically are easier and cheaper to establish and maintain. On the other hand, authoritative RBOs are more difficult and expensive to set-up and may require legislative support because they wrest control from existing agencies. Successful and unsuccessful examples of both kinds exist. ECLAC has been investigating this issue for some time (e.g., ECLAC, 1994, 1988)

In Mexico, RBM has been promulgated for decades and was a major component of the 1975 National Water Plan. However, implementation has been slow. Although the CNA has identified fourteen river basins as "priority basins", only three RBOs have been formally organized: río Lerma-Chapala, río Bravo, and the Valle de México. All have been motivated by water scarcity or contaminated supplies. The RBOs provide a mechanism for

coordinating the activities of the CNA, local, state, and federal entities, and local user groups to improve overall water management, the provision of water-related services, and water use efficiency in the basin. These RBOs have, or will have, an advisory role; they will help ensure that the values and concerns of the stakeholders are known and considered in planning, and they provide a forum for conflict resolution.

In 1980s the Secretaría de Manejo de Cuencas spearheaded a national project to establish river basin management councils in Costa Rica. However, under subsequent political administrations, the Secretaría was dissolved and the priority for RBM was reduced. Nonetheless, water managers are still supporting efforts to establish RBOs. As in Mexico, the idea is for RBOs to have an advisory role and to serve as mechanisms for conflict resolution among stakeholders. Four RBOs exist, including the río Tárcoles and río Tempisque. The río Tárcoles RBO was formed in response to water pollution problems in the basin, but support for the project has suffered because of the changing political priorities.

Several observations on the implementation of RBOs in the countries visited are provided. First, numerous difficulties exist for the establishment of RBOs, including, diffuse administrative duties, lack of a national organization to induce cooperation, and laws suppressing local authority.

Second, the initial functions and responsibilities of RBOs must be very well defined and limited in scope. It is a mistake, we believe, to be overly ambitious with the definition of RBM and the powers granted to the RBOs. For this reason, it appears that RBM will have a better chance of succeeding if the process is structured about a common theme or problem perceived by users in the basin to be affecting them and their use of the resource. Water pollution is such a problem. The Lerma-Chapala RBO in Mexico has centered on the clean-up of the basin's major rivers and Lake Chapala. Though this effort in Mexico is led by the CNA, local participation has been a key factor in its success. Similarly, efforts to form an RBO for the Bio-Bio River in Chile have focused on the impacts of poor water quality on the region's

growth potential. Once established, the scope of activities encompassed by the RBO can be broadened, if necessary and desirable.

Third, local support and participation is necessary for the formation of a RBO, but must be complemented by proper government incentives (historically the incentives have been financial, such as construction of infrastructure). Stakeholders should feel they are gaining by participating, not that another level of authority is being imposed on them. This requires education of users, creation of relevant institutions, and mutual adjustment of users and existing management institutions.

Fourth, RBOs may be easier to implement in basins which have established user groups and some experience with cooperation and coordination in the operation and management of systems, e.g., agricultural user groups in charge of secondary or tertiary irrigation canals. Such groups may be more willing to accept and cooperate with others in the basin, than would individuals without an existing structure.

A final comment on RBM pertains to international river basins and watersheds. Internationally-shared water resources, such as Río de la Plata, Lake Titicaca, the border rivers in Central America, and possibly ground water aquifers, can be important elements in regional integration and development processes. However, as noted by several of those interviewed (many of whom did not seem overly concerned with international water issues) and supported by Lee (1995), "...there are few examples in the region [LAC] of institutions actively engaged in the joint management of shared resources." This can be attributed in large part to the "...marginal significance of the shared water resources to most Latin American economies." Even if the economic value of some of these shared resources is of marginal significance, their environmental value and the need to protect them will necessitate international cooperation and coordination. In this regard, the external, unbiased support provided by international lending agencies can be instrumental in establishing treaties or international RBOs, facilitating the continued operation of

existing agreements, and forging cooperation among the numerous public, private, and non-governmental entities that may be involved.

3 PRIVATIZATION OF WATER SERVICES

The privatization of water related services is the focus of many governments' efforts to find alternatives to the public provision of these services. The reasons for privatizing are numerous, including, for example, alleviating a public agency of financial responsibility or generating a competitive environment for improving the quality of services. Likewise, many privatization strategies are available, each with various requirements (Idelovitch and Ringskog, 1995; Richard and Triche, 1994; Israel, 1992). This section addresses the privatization of water supply and sanitation (WSS) services and the transference of irrigation infrastructure to local user groups. However, opportunities for privatization are not limited to these two areas. Opportunities exist in other water areas and will continue to increase as the number and types of uses increase, e.g., aquaculture, recreation, and tourism.

3.3.3.1 Concessions for Urban Water Supply and Sanitation Services

Urban water supply and sanitation services in all countries visited were being privatized to some extent, and in all cases the strategies for privatization were different. In Argentina, the hyperinflation of the 1980s provided a strong impetus for the privatization of most publicly owned enterprises, including WSS services. Water managers interviewed anticipate that eventually all WSS services in Argentina will be privatized. With assistance from the World Bank, Obras Sanitarias de la Nación, providers of WSS for greater Buenos Aires and thirteen neighboring jurisdictions, was privatized in 1993. Other privatization activities in Argentina are supported by PRONAPAC (Programa Nacional de Optimización, Rehabilitación y Ampliación de los Servicios de Agua Potable y Alcantarillado Cloacal), a program co-

financed by the IDB and the World Bank. Mendoza is currently soliciting bids for the privatization of their WSS services. Those involved in the privatization process disagree with the manner in which services in Buenos Aires were privatized (Del Frari, 1995). They argue that privatization in Buenos Aires was not well planned, noting that the regulatory agency was not functioning until six months after the concessionaire started operation. And, because the regulatory agency was not adequately prepared for its new responsibilities, conflicts arose between it and the concessionaire. In Mendoza, the regulatory agency is already functioning, several months before the concession will be granted.

In Mexico, the CNA is encouraging municipalities to carefully assess the granting of concessions for the administration of WSS services, in whole or in part. The CNA is providing interested municipalities general guidelines on privatization, including information on financing strategies, contract preparation, bidding procedures, bid evaluation, and so forth. Privatization strategies are being developed for cities of different sizes. Municipalities are being classified according to existing efficiency, level of service, and profitability to determine attractiveness for private sector participation. In some instances, municipalities of varying "attractiveness" levels will be grouped to ensure that the less attractive are not excluded. Though encouraged by CNA, the decision to seek private sector participation rests with the municipalities. Approximately twenty municipalities are doing so. Two - Cancún and Aguas Calientes - recently granted full concessions (the Cancún concession includes sanitation services), and Mexico City has undertaken a phased approach to privatizing water supply services (Casasús, 1994). León, Querétaro, and Toluca recently granted concessions for the operation of wastewater treatment plants.

In Costa Rica, municipalities of approximately 3,000 or so inhabitants may be eligible to participate in a program known as the Comité de Administración de Acueductos Rurales (CAAR). In these cases, Acueductos y Alcantarillados (AyA) assists the

community by providing materials, training and assistance in the construction of WSS infrastructure. Following construction the systems are turned over for local administration. Although CAARs are a local initiative, ultimate responsibility for WSS services still rests with AyA. AyA and other public agencies are also privatizing by encouraging the formation of Sociedades Autónomas Laborales (SAL). Groups of public employees possessing certain skills are encouraged to leave public service and form SALs, which then assume responsibility for services such as meter reading, trench digging, and leak detection and repair. This reduces public financial burden by reducing public payroll while providing incentives for private sector participation.

Opportunities for private sector participation in water resources management in the Caribbean nations are more limited than in South or Central American countries. Because water is such a scarce commodity in most Caribbean nations, the feeling among water managers is that the government should retain responsibility for supply, distribution, and quality. Government preference is to buy and own new facilities, even though they may be constructed and operated under a concessionary agreement with the private sector. Nonetheless, there is a role for the private sector in the provision of specific services, including maintenance contracts, sludge hauling, meter reading, bill collection, and construction of capital projects. Much of the recent experience with private sector participation in Caribbean nations has been fee-for-service contracts in the areas cited above (Pemberton, 1994). For example, in Barbados, developers can dig their own trenches for water service, but the BWA installs the pipes and retains ownership. Desalination is another area for potential private sector participation which has been pursued in several Caribbean nations.

3.3.3.2 Transferring Ownership of Irrigation Infrastructure

Most countries visited are in the process of transferring irrigation systems to user groups. They are at different stages

and are taking different paths, but in all cases the ultimate objective is to transfer, if not ownership outright, at least full operating and maintenance responsibilities. Since in most LAC countries, the central government built, owns and has operated major irrigation infrastructure, local farmers have grown overly dependent on government services. Therefore, not all user groups are in a position to assume responsibilities for system management. The user groups, in addition to taking on the important role in the distribution and allocation of irrigation water, also can function in a variety of capacities ranging from advisory to managerial and from coordinating to quasi-judicial. The experiences in Mexico and Chile are illustrated.

Although the 1972 Ley Federal de Aguas permitted the Mexican government to grant concessions to user groups for the operation, maintenance, and administration of water infrastructure, including irrigation works, the first transfers were not initiated until 1989. To date responsibility for operation and maintenance of 36 of the 79 irrigation districts in Mexico has been transferred to user groups, representing approximately 70 per cent of irrigated lands (CNA, 1994). This effort has been supported by a joint World Bank/Inter-American Development Bank Drainage and Irrigation Investment program. The program, which began with those districts that appeared to be better off, signified a radical shift in irrigation policy away from the highly centralized control that existed previously. The CNA maintains some oversight for O&M, but the local user groups assume all responsibilities for allocation, distribution, and bill collection. Internal organization is left to the user groups. The groups establish objectives, administrative hierarchy, and enforcement mechanisms. The CNA has assisted by establishing guidelines and reserves the right to interfere if internal problems arise. In addition, the CNA has initiated programs to train local user groups in technical, financial, and administrative matters.

In Chile, water user associations (juntas de vigilancia, asociaciones de canalistas, and comunidades de aguas) have responsibility for the maintenance and administration of

irrigation infrastructure, including the collection of fees, but ownership has rested with the government. Recently legislation has also been enacted to permit the transfer of ownership, administration, and operation of publicly built irrigation projects to the private sector. Several pieces of legislation also have been enacted in the past decade to encourage private investment in irrigation and drainage works. Often private investments for repair or construction of new facilities are subsidized up to 75 per cent by the government. In addition, new irrigation facilities built by the government must be co-financed by future users, who must also agree to assume ownership of the project upon completion (Anguita, 1995).

4 WATER MARKETS

Water markets, in theory, hold the promise of encouraging water conservation and providing a stimulus for technological innovation. In addition, water markets can defer or delay the need for and expense of developing new supply sources. However, barriers to the formation of a well functioning water market are numerous (Howe *et al.*, 1986), and the potential for water markets, as with all policy, must be evaluated in light of local institutional and economic conditions. A basic consideration for the establishment of a water market, or any market, is whether a legitimate need and desire exists. High valued water uses must exist, there must be a willingness to purchase water, and these uses must be located within a "transferable" distance from low valued uses willing to sell. Water markets can be advantageous in situations of water scarcity, but are not needed under normal conditions of water supply, when there is little or no competition for water.

As noted earlier, experiences with water markets, especially in LAC, are quite limited. The right to transfer water rights currently exists in Chile and Mexico, and Peru is advancing legislation to foster the creation of water markets. The Chilean experience with water markets continues to be scrutinized and the jury is still out (Bauer, 1993; Rosegrant and Gazmuri, 1995; Ríos

and Quiroz, 1995; Hearne, 1995). In Chile, the low number of water right transactions separate from land in many regions of the country has been explained in part by the underlying lack of demand. Those needing additional supplies have been able to secure them from other sources at lesser cost without resorting to the market. There have been very few transfers from low-valued to high-valued uses, i.e., from agriculture to municipalities or industry. Also, there are no documented cases of farmers improving water use efficiency to sell the conserved water, as might be expected in a well-functioning market. In fact, the expected increase in private sector investment in irrigation never fully materialized and subsequent legislation was needed to encourage it. Farmers appear to be satisfied with having secure property rights to their water, and have not shown a keen interest to participate in a market, possibly because conditions, including price, have not been to their liking or institutions have not been well established to facilitate market activities. Additional concerns about water market activity in Chile relate to the adequacy of the 1981 Water Code, which among others things, does not include a beneficial use clause, does not give downstream users firm rights for return flows, and does not adequately protect third-parties (see the above citations for additional information.) As noted later, the government is attempting to correct some of these inadequacies through legislative reform projects.

Nascent water market activity exists in several regions of Mexico. Most transfers have involved agricultural buyers and sellers. However, a few transfers from agricultural users to industrial and municipal users have occurred. Though water markets are fully supported by the 1992 Ley de Aguas, numerous regulatory and technical impediments hinder their potential success. Foremost is the strong authority of the CNA in water matters: 1) the CNA must approve all transfers, but conditions and requirements for evaluating potential transfers are not clearly identified; 2) the quantity of water rights and the amount available for transfer is controlled by the CNA; and, 3) no

transfers are permitted from the urban sector to other sectors. There is a feeling among some at CNA that water markets are ineffective and that government involvement in the prioritization and allocation of water will always be necessary; that this responsibility cannot be left to the private sector. The City of Querétaro, Mexico, has invested in improving the efficiency of local irrigation wells and on-farm irrigation practices, with the conserved water going to the city for municipal and industrial uses. This type of innovative arrangement is rare in LAC, but ought to be encouraged.

The notion of a water *market* solely as the buying and selling of water rights should be expanded to include the numerous other forms that water *transfers* can take (Lund and Israel, 1995). These other forms include long and short-term leasing arrangements, contingent or dry-year-options, and wheeling arrangements. Some of these alternative forms may be more suitable to existing conditions in LAC. It certainly could provide water managers more flexibility in planning and operating their systems.

5 NATIONAL WATER PLANING

Water managers in many countries are contemplating the formulation of national water plans (NWP) as a means of overcoming the fragmented and uncoordinated management of water resources. This view is supported by ECLAC (1990), noting that "...there is a clear trend in all countries towards the formulation of increasingly complete and long-term plans." Of the countries visited, Argentina, Mexico, and Barbados are actively involved in preparing NWP. Argentina's Dirección Nacional de Recursos Hídricos (DNRH) is formulating a NWP that would integrate all agencies involved in water resources management, supposedly without compromising their individual agendas. The idea is to develop a master plan and let the provinces or their assignees implement plan components. The effort is self-financed and being undertaken internally by DNRH. Seminars have been held across the country soliciting input from provincial governments, with the

hope that representatives from the provincial governments would be able to express local user concerns. However, no mechanism to include municipalities and end users directly has been established. However, a NWP does not have full support of all the provinces. Without this support it would appear that DNRH may be taking an overly centralized approach to a problem that has been greatly decentralized and privatized in recent years. If the NWP is completed, it will have to tread a fine line between offering recommendations and suggestions for national water policy and interfering in provincial politics.

In Mexico, CNA is preparing an update to the national water plan. Previous NWPs in 1975 and 1982 were prepared by CNA without input from regional offices, but the intent is that the new plan will be a bottom-up effort. Regional CNA offices are being asked to develop local plans, all of which will be coordinated by the central CNA office into a National Plan. The regional plans are being developed with very limited participation by users and local interests. As in Argentina, it is assumed that the local CNA officials know and understand local conditions and can represent local user concerns. The process in Barbados is somewhat different in that the national water plan is being developed, not by a public entity, but as part of a larger, more comprehensive water resources management project contracted to a consulting firm.

A concerted government effort to develop a NWP can be an indication that water resources are viewed as an important element in regional and national development and that resolving conflicts in water resource management is important. However, the utility of a NWP will depend on how it is used in the decision-making process, and in the formulation of water policy. Thus, the value of a NWP may not be so much the plan itself, but the process of developing it. Preparing a NWP requires, among other things, gathering relevant information from a multitude of sources, analyzing existing conditions and preparing forecasts about future conditions, consulting and cooperating with diverse and disparate groups, and analyzing options for improving operation of existing

water systems, as well as how to best incorporate new components. The question then arises, if a major benefit of developing NWP is the acquisition and analysis of information, is a NWP the best and most efficient way to go about this?

6 ENVIRONMENTAL PLANNING

There is growing awareness of the extent to which environmental problems are impacting development in LAC countries. Many countries are slowly starting to integrate environmental concerns in the development and management of water resources. Commissions to address environmental problems are being formed, as are ministries or secretariats of environment and natural resources. Much is being done at the urging and with the assistance of international agencies.

In Peru, the Consejo Nacional de Medio Ambiente (CONAM) was recently formed to foster inter-sectoral cooperation and consistency in environmental matters. As noted earlier, each functional sector has a separate environmental entity known as Dirección General Ambiental (DGA), which is responsible for seeing to environmental issues associated with sectoral development. As a result of this separation, environmental policy across sectors is quite inconsistent and poorly enforced. The intent of CONAM, which will have inter-sectoral jurisdiction, is not to replace the DGAs entirely, but to provide technical assistance and clear guidelines for establishing more uniform environmental regulations, including those related to water. CONAM will be involved in three principal areas: pursuing sustainable use of natural resources, preserving environmental quality (initially by targeting industrial pollution and having industries internalize the cost of water in production), and fostering public education programs. A similar agency, the Comité Nacional de Medio Ambiente, also was recently formed in Chile.

The Secretaría de Recursos Naturales y Ambiente Humano in Argentina, which was formed in 1991, soon will be reorganized as the Ministry of the Environment and will assume planning and regulatory functions for environmental protection. According to

the 1994 Constitutional reforms, the national government has the authority to establish minimum standards (e.g., water quality) for resource management to which the provinces, who are autonomous in most matters, must adhere. However, the national government has not acted on this and no minimum standards have been set in any area.

The transfer of the CNA in Mexico from the Ministry of Agriculture and Water Resources to the Ministry of Environment, Natural Resources and Fisheries has given the CNA greater liberty to pursue its objectives of sustainable water resources development through decentralization and more integrated project management. The strong tendency and favoritism towards capital investment projects (primarily agricultural) prevalent in the CNA in the past has diminished somewhat with this restructuring. In addition, the strong economic development focus in project planning and evaluation can be reduced somewhat and social and environmental factors can be increasingly emphasized. For example, funds which historically have been used to finance irrigation projects can now more freely be used to foster water quality improvement and public education programs and to reinforce local administration of projects. Furthermore, the 1992 Ley de Aguas Nacionales establishes "ecological preservation" as a beneficial use, which reserves the right to maintain minimum instream flows in rivers and streams (Garduño, 1995). No action has yet been taken in this area.

In Costa Rica, water resource managers have realized that the cost of finding alternatives to contaminated water supplies is prohibitive. While programs to protect ground water recharge areas have existed for some time (primarily land zoning regulations), they are now being more strictly enforced. In addition, AyA plans to place a surcharge on urban water tariffs to cover costs of conservation programs, including public education. Studies to determine what the proper surcharges ought to be are presently under way.

Environmental legislation is being passed and environmental agencies of one type or another are springing up throughout LAC.

However, this is only a first step in recognizing the value of environmental protection. True recognition of the long-term benefits of environmental protection will come when the inter-relationships between water quantity and water quality and between land-use management and water resources management are incorporated in planning and management activities, when monitoring and enforcement activities are encouraged and financed, and when water managers are trained on the use of new technologies and models.

7 IMPROVEMENTS IN COST RECOVERY

Cost recovery problems due to poor bill collection and inadequate tariff structures are major impediments to improving water resources management. Several countries, including Mexico, Chile, and Barbados have completed or are currently conducting rate studies to be used as the basis for modifying current tariff structures. These studies, some conducted by public agencies others by private consultants, are assessing the value of water in different uses, to different users, and in various regions of a country.

The installation of water meters in urban areas will help both the process of recovering costs and achieve the management objective of decreasing excessive consumption. With meters, water agencies can charge based on volumetric use employing a variety of rate structures, instead of relying on a flat-fee or no fee as is the case in many cities. Most major cities have meter installation programs underway, often as part of the privatization package. For example, in Buenos Aires a project is underway to install 80,000 meters annually, but it will take years to be effective, since Buenos Aires has about one million unmetered connections. In Jujuy, Argentina, economic incentives are provided by the provincial government for the installation of residential and commercial meters, but the final decision is up to the individual customers. In addition to water meters, many urban water agencies are installing automated monitoring and leak

detection systems in an effort to control distribution system losses.

Cost recovery programs in agricultural areas meet greater resistance since traditionally agricultural users have not been charged for water. In Peru, a 1990 Presidential Decree established tariffs for agricultural users. The tariffs are earmarked for system operation and maintenance. Collection has been problematic due in large part to high inflation rates, which can render tariffs meaningless in a short time. In many countries responsibilities for billing agricultural users are being given to local user groups.

Water agencies throughout LAC are making a concerted effort to identify and register water users. The focus is primarily on agricultural users for which there is typically little information, particularly on water consumption. Information from the registration process is useful for planning purposes everywhere, but in Chile, Mexico, and Peru these efforts are also aimed at improving the atmosphere for the establishment of water markets. In Mexico, the CNA established a subsidized well efficiency improvement program aimed at reducing electricity and water use. The intent was that by providing subsidies, small irrigators would present themselves to CNA, which is taking the opportunity to register agricultural users and install well meters.

SOME OBSERVATIONS ON CURRENT WATER RESOURCE MANAGEMENT

The overall experiences of the countries in responding to their individual water resource problems, as noted in the previous section, must surely be viewed in a positive light. There have been and will continue to be difficulties and impediments to the implementation of the measures and policies discussed. However, much can be gained by critically analyzing these individual experiences. This section presents some observations on country experiences in responding to water resource problems, which, if properly considered, can potentially facilitate future

implementation of these and other measures and possibly suggest new avenues for action. Again the reader should bear in mind that these observations were drawn from the six countries visited. Nonetheless, the observations should be adequate as a foundation for further study, analysis, and dialogue. The following observations are discussed:

- _ Implementation issues need to be better considered in policy or program design
- _ Sequencing of program components must be better coordinated
- _ A balance in water management is needed
- _ Improving stakeholder participation is a multi-disciplinary endeavor
- _ Crises can have positive effects on water resources management

1 IMPLEMENTATION ISSUES

Water resources management in Latin America and the Caribbean is undergoing a paradigm shift. The incentive-based policies and measures being discussed and implemented in most countries represent a dramatic change from the traditional sector-specific, capital investment projects. However, water managers and policy makers in LAC have limited practical experience with some of the new measures. In some instances, this lack of experience may have resulted in inadequately prepared and haphazardly implemented projects in which implementation issues may not have been properly addressed, including, for example, inadequate definition of authority, poorly structured payoffs or incentives, and inadequate information. This seems to have been the case even when international lending agencies are involved.

One of the lessons from recent experience in the countries of Eastern Europe, and in LAC to a lesser extent, is that market-based reforms, such as privatization and water marketing, can easily cause more problems than they solve if pursued without care. The advantages of market mechanisms are undeniable, but their limitations in the case of resources like water, with many

public goods aspects, frequent common pool resource characteristics, and high transactions costs involved in addressing externality problems have been inadequately recognized. Furthermore, market-based reforms can work only if a supporting infrastructure of well-defined property rights exists and if the distribution of economic power to command resources is widely perceived to be reasonably equitable. These conditions are often not met in LAC countries.

Policy and project planning must assess how local political, legal, institutional, technical, and economic conditions match the requirements of the policy instruments under consideration. Designs need to be adapted to these conditions, as necessary. (During the interviews, IDB project planning was criticized as weak in this aspect, being insensitive to local conditions, particularly social and cultural characteristics, and over-reliant on least-cost decision making.) In some instances, it may be premature to implement certain measures until some of these necessary conditions are fulfilled. It is one thing to privatize water rights through legislation and permit market transactions, but quite another to educate the rural, possibly illiterate farmers on what their new rights signify. For example, decentralization requires, among other things, that the proper institutional infrastructure be in place at the local level to absorb the increased duties. With the tremendous urban-rural split in most LAC nations, the next level down in decentralization can be quite rural and disperse without the capacity to absorb these duties. Also, in Costa Rica, for instance, there is little if any executive power at the local or municipal levels. In these cases, decentralization needs to be very well planned with sufficient training and empowerment programs.

Lastly, repercussions of individual instruments need to be evaluated in a broader context, to include possible impacts on other measures. For example, how will decentralization of water and sanitation services affect the desire to have integrated planning at a regional level? what additional cooperation and coordination requirements will decentralization impose?

Decentralization reduces central government burden and increases local participation and potentially the burden on local governments, but it may also reduce the central government's ability to provide a unified approach to planning and sector development.

2 SEQUENCING PROBLEMS

An important component of program design and implementation is the sequencing of proposed activities, that is, the pace and order in which program components are implemented, if they are implemented at all. People must be trained before they are charged with new duties; a regulatory or oversight agency should be functioning before services are privatized; and in general projects or programs must have time to mature before the next step is taken. For example, it was noted in the interviews that the "provincialization" of water supply and sanitation services in Argentina was hastily done and many of the provinces and municipalities were not fully prepared to assume their new duties. Many lacked manpower, technical know-how, financial resources, and other necessary skills to carry out the duties and responsibilities entrusted to them.

Incentive-based policies can take time to come to fruition as both policy makers and water users become accustomed to and aware of new possibilities. For example, water rights in Chile were privatized in 1981 and the potential for developing a free market in water rights has existed since then. Nonetheless, it has only been in the past few years that people have shown interest in or have participated in actual transfers of water rights. It has taken 15 years and a host of parallel policies, many not directly related to water resources development, and still markets are not functioning as originally intended.

3 STRIKING A BALANCE IN MANAGEMENT

A major objective of water resources management in LAC should be to strike a balance between private and public sector functions and responsibilities, between centrally administered programs,

locally administered programs, and market-oriented strategies, and between supply expansion and demand management measures. A result of the rapid implementation of market-based policies in many LAC countries may be to bypass the equilibrium point. Some restraint must be shown in suggesting and implementing market-based policies. Analysts and planners should not be swept away by the enthusiasm of incentive-based policies, nor should theoretical results be used to establish the expectations of implementing these measures in LAC. The potential success or benefits of these types of policies should be measured relative to existing conditions and the possible long-term impact they could have on water resources development and management.

Left to their own devices, institutions typically are slow to change, but once changed may be even harder to re-assemble. Some governments, it seems, are trying to regain or re-centralize some of the authority lost through previous measures. Through legislative reforms, it appears that Chile is attempting to reclaim some control over water rights privatized in 1981.

In addition to overcoming the social consequences of abolishing established institutions or creating new ones, planners must be wary that if done too quickly or improperly, policy changes may interrupt on-going projects resulting in possible loss of credibility, information, experience, personnel, and funding.

4 STAKEHOLDER PARTICIPATION IS A MULTI-DISCIPLINARY TASK

The incentive-based measures being considered by water managers in LAC, such as water rationing, pricing mechanisms, water markets, and privatization, by their very nature involve the public directly, and their success depends on adequate stakeholder participation. Therefore, there is a need to incorporate the stakeholders in the decision-making and planning processes, and as a minimum educate the public. Decentralization efforts in agriculture have bolstered user participation, but more needs to be done, particularly in urban fringe areas where water service is marginal at best. Stakeholder participation is often viewed as the result of government agencies wanting to reduce some of their

responsibilities and costs. However, community and stakeholder initiatives can also arise as a response to government inactivity or inefficiency in the provision of services.

Establishing public participation programs and increasing stakeholder participation could require skills that water agencies may not have. As demonstrated by the efforts to provide water and sanitation services to the favelas in Sao Paulo (Watson, 1992), water agencies may not be prepared, trained, or willing to initiate and follow through with a public participation program. Success in bringing water to the marginal sectors of Sao Paulo was due, in large part, to the participation of several more socially oriented agencies, such as housing, health, and community services. When these agencies took on the issue of water supply and sanitation they were able to mobilize the population using methods more suited to their specialization and achieve what the water agencies could not.

It should be recognized, however, that as stakeholder and public participation in project planning increases, so does the possibility of judicial intervention and project delay. This has certainly been the experience in the United States and Europe, where environmental groups and adversely affected parties have repeatedly resorted to the courts to alter, delay, and sometimes cancel projects. The success achieved by these groups through increased judicial scrutiny and the judicial overturning or modification of project plans in the past years indicate that individuals and groups affected by existing or proposed projects will continue to use the courts to test the propriety and application of administrative measures. Public participation in LAC has yet to become a major component in project planning. However, as public involvement increases either through individual initiatives or government sponsored programs, the role of the courts in project development, legislative reform, etc. should not be underestimated.

Water resources management in LAC is in effect crisis management. Responding to crisis as *modus operandi* can distract the attention and resources of water managers from more productive endeavors. To the extent that crisis management diverts efforts from good planning and operational studies, the frequency and severity of crises is increased and the operational flexibility to manage them is diminished. However, crisis situations do provide opportunities and can serve several functions, such as: 1) raise newly relevant concerns; 2) present the opportunity for timely study of critical issues; 3) provide the opportunity to apply innovative and novel operating and management techniques and strategies; 4) provide high-level attention to the particular issue; and, 5) generate much needed funding. In short, there can be positive aspects to crisis situations, and the astute manager must know how to turn them to his advantage, placing them within the context of integrated long-term development plans. This requires breaking with the traditional, sector specific, short-term outlook that often prevails in most water management systems.

Political support for certain types of programs or specific projects may be less than enthusiastic, and may remain so until a crisis occurs. At this juncture, a program or project may receive full political support for as long as the crisis persists. The challenge for water managers, and to some extent international lending agencies, becomes how to capture and maintain this interest. For example, most public education programs are initiated as a result of a crisis. The cholera epidemic of the early nineties prompted a spree of public health warnings in Peru and Chile, and the recent drought in Barbados prompted efficient water use campaigns. These crisis situations should serve as the bases for establishing long-term support for such programs.

PERCEIVED NEEDS FOR IMPROVING WATER RESOURCES MANAGEMENT IN LAC

This assessment of water resources management in LAC reinforces many of the policies, investment programs, and

priorities currently supported by international financial institutions, and demonstrates a need for their continued support. However, the current analysis also provides some insights to how these policies and programs may be re-oriented to better serve the needs of the individual countries and the LAC region as a whole. This section presents a list of what we have termed perceived needs for improving water resources management in LAC.

1 INFRASTRUCTURE PROJECTS

The primary focus of this report is the institutional aspects of water resources management. Indeed this is an area in which much needs to be and can be accomplished in the coming years. However, it is quite clear that the region as a whole is in dire need of support for improving and extending coverage of water-related services. As such, investment at the water use level in infrastructure projects should continue to form a solid part of assistance programs. These projects should focus on the maintenance, rehabilitation, or replacement of existing infrastructure, as necessary. Expansion of services and provision of adequate water supply and sanitation coverage is still a concern in many countries, but improving and maintaining existing systems is critical. As noted by Ingram and Kessides (1994:18) "...the adequacy of a country's infrastructure helps determine its success or failure in diversifying production, expanding trade, coping with population growth, reducing poverty, or protecting the environment. Good infrastructure also raises productivity, lowers production costs, and improves living standards." To the extent that water resources management can be improved and supply problems resolved through infrastructure projects, the planning and design of these projects and programs should focus on the integration of sector-specific projects within a multi-sectoral, multi-purpose framework and be supported by proper institutional analysis and development.

2 IMPROVED LEGAL AND INSTITUTIONAL FRAMEWORK

There appears to be some misunderstanding by LAC water managers and staff regarding the legal and institutional frameworks for water management. Studies are needed to identify areas of legislative and institutional weakness, conflict and overlap, and areas that are poorly represented by the existing frameworks. Such a review would identify and clarify responsibilities, rights, and privileges granted to the various actors involved in the management of water resources, including the private sector and non-governmental organizations.

These studies would form the basis for projects of legislative and institutional reform, the overall aim of which would be to improve the quality and consistency of water management legislation and regulation. One of the principal issues is to ensure that nascent efforts in the formulation of policy for environmental protection are properly integrated with water resources management legislation and responsibilities are properly assigned within the institutional framework. An additional item would be the separation of regulatory and operational responsibilities, which in many countries rest within the same ministry or agency. This "wolf guarding the henhouse" approach has obvious drawbacks. Self-enforcement generally does not work, especially in systems with few checks and balances and with a tendency towards corruption and abuse of power and privileges.

3 EXPANSION AND MODERNIZATION OF DATA SYSTEMS

Lack of basic data is a problem throughout LAC. This includes both technical and socio-economic data as discussed earlier. Efforts need to continue for expanding and modernizing not just data collection systems, but also the capabilities for processing, storing, retrieving, and disseminating data. This would include continued support for government programs to gather socio-economic data, e.g., registration of water users, preparation of rate studies. Just as important is the need to coordinate the efforts of the multiple agencies collecting data and to make them aware of what the others are doing. Many

incentive-based measures require a minimum level of information and monitoring that many countries do not currently possess and may not for a fairly long time unless data collection programs are expanded and integrated with planning and management programs so the right type and amount of data is collected, including socio-economic and environmental data. (See Arteaga (1994) for some specific recommendations for overcoming data-related concerns in Central America.)

Investment in real-time data collection systems may not be in the best interest of many countries. Real-time data is useful for forecasting purposes and more efficient operation of water systems, both worthy objectives. However, if this is done at the expense of proving a wider, but perhaps a less sophisticated monitoring system, the benefits may not be worthwhile. Data needs may be better served by focusing on the expansion of traditional monitoring networks for hydrologic and water quality data, including training for data collection, and on the storage and distribution of this data.

4 DEMAND MANAGEMENT PROGRAMS

As the scarcity of good quality water increases, the competition among users intensifies, and the availability of new supply sources dwindles, water planners and managers will necessarily have to rely more heavily on demand management measures, including water conservation, water rationing, public information, pricing mechanisms, and water reuse. Water managers in all the countries visited recognize the importance of properly pricing water services and are actively restructuring tariff systems to reflect the value of water. However, substantially less effort is being placed on instilling the public with a consciousness of water use efficiency, or on other demand management measures, such as modifying plumbing codes to incorporate more water efficient fixtures. A first priority of demand management should be to educate the public; to make the public aware of the extent and severity of the problem. This can be complemented by programs to teach water conservation practices,

which will be very different for rural and urban users, and for agricultural and industrial users.

Demand management, of course, is nothing new in water resource management. It is often the preferred approach to controlling flooding and other water-related natural hazards. It is usually more effective and less costly in the long-run to exclude vulnerable human activities from hazard zones than to construct structural hazard control facilities. The reason is that structural measures which augment the supply of protected land, encourage new encroachment, which, in an extreme event exceeding the design capacity of the structural measures, will result in increased damages.

Likewise, virtually all water quality maintenance and improvement programs are based on demand management. Access to assimilative capacity of the aquatic environment is controlled by regulations or, less frequently, by pricing, both are demand management approaches. Supply augmentation, which in this case is water treatment, is generally the last resort, used only when demand management programs are too difficult or costly to implement. Demand management can effectively control a wide range of the many external costs of water pollution.

5 CAPACITY BUILDING

Capacity building here refers both to the development of human capital and the strengthening of institutions. The rampant decentralization efforts underway throughout LAC have drawn attention to the scarcity of well-trained, qualified personnel. This lack of human resources has hampered the progress of many decentralization programs, whether for water supply and sanitation or irrigation infrastructure. The training programs that accompany decentralization efforts have been non-existent or have been insufficient to adequately prepare those who are to assume new responsibilities. As most countries intend to increase stakeholder participation in planning and management of water projects, the importance of these training programs should not be overlooked. However, with insufficient in-country expertise to

develop and implement the necessary programs, assistance from international lending institutions is necessary. These programs should include a component that addresses the flight of human resources from the regions to the capital and/or overseas.

Capacity building programs (e.g., training programs, reorganization, administrative improvements, legislative reform) are now a requisite of most all infrastructure or sectoral improvement projects. Institutional strengthening of water resources management programs, however, have different staffing needs and expertise requirements, and cannot be held to a "construction" schedule of the infrastructure project. Furthermore, institutional strengthening through infrastructure projects may provide a limited perspective and a limited time frame for implementation. They also tend to miss the cross-sectoral components that are becoming increasingly important for management of water resources. Should institutional strengthening and capacity building programs be considered independently of the infrastructure development projects, or at least can some components of institutional strengthening be implemented independently? The investment programs and projects often serve as leverage for the implementation of institutional strengthening programs. In separating the two programs, this leverage is lost. Other means should be sought for replacing this lost leverage.

6 IMPROVED COORDINATION AMONG INTERNATIONAL LENDING AGENCIES

The fragmentation and poor coordination that describes many local water agencies in LAC also might be used to describe the participation of international lending and development agencies. The Inter-American Development Bank, the World Bank, the Caribbean Development Bank (which is currently reviewing their water resources management policy for the Caribbean nations, much as IDB is doing for LAC), the Organization of American States, and a host of U.N. agencies are active in LAC water resource issues, and, with few exceptions, their activities are quite independent and uncoordinated. International lending agencies also have often competed for the chance to finance water resource development

projects. This situation is antithetical to achieving better water management, where coordination, consistency, and improved system-wide efficiency are essential. There needs to be improved coordination and cooperation among these agencies.

Also, there are several multi-national regional agencies, such as Comité Regional de Recursos Hidráulicos (CRRH) in Central America and Caribbean Environmental Health Institute (CEHI), that have been and continue to be quite active in certain areas of water resource management. ECLAC in Santiago, Chile, has also been active in this area for many years and has amassed a wealth of information on the subject. The cumulative local experiences of these groups can be valuable to improving water resources management. Well planned and coordinated initiatives by and with non-governmental organizations, though rare in LAC, also can be advantageous and should be sought.

7 EMPIRICAL STUDIES AND DISSEMINATION OF INFORMATION

As discussed, there is little experience in LAC with many of the incentive-based measures and others measures that are sought to improve conditions in water resources management. Furthermore, little of the available experience is disseminated to interested parties in the region. Lessons and experiences from projects such as the water market in Chile, which attracts so much interest in the international community and is the target of numerous studies, are not readily available to water managers in many countries. They may have heard of the projects, but know little about the specifics. There is a need to study further the experiences of the various countries with issues such as privatization, river basin management, cost recovery, legislative reform, stakeholder participation, and to make these lessons learned widely available. IDB and other international lending agencies can be instrumental in providing external, unbiased and impartial project analysis and expertise, and also can provide a medium for disseminating information on country experiences, good and bad, through seminars, project summaries, and so forth.

SUMMARY

Water managers, planners, and policy makers in LAC face numerous challenges in the coming years as they seek to improve the provision of water related services. Among the characteristics of current water resources management that could hinder progress are: fragmented institutional structure and diffused responsibilities; inadequate and poorly maintained infrastructure; insufficient or poor quality data to support project planning and decision-making; inadequate enforcement of legislation; minimal stakeholder participation; and, inadequate consideration of environmental concerns in project planning, design, and implementation. The responses of water managers to these problems are varied, reflecting differences in local conditions, and in some instances have been spurred by recent changes in political and economic policies which have provided an opportunity to test new management strategies, such as privatization, water markets, and decentralization.

One goal of this study, and a primary consideration in selecting the countries that were visited, was to potentially use the in-country assessments to make some observations about the condition of water resources management in the countries' respective sub-regions. However, the only country assessments with which it seems feasible to extend the analysis to the respective sub-regions are Barbados (the Caribbean nations) and Costa Rica (Central America). It is more difficult to extrapolate or generalize from the assessments of Peru, Chile, and Argentina because the situation in each is so unique.

The basic problem faced by water managers in the Caribbean island nations is inadequate water supply, regardless of whether the primary supply source is surface or ground water. Measures such as decentralization and privatization (though there is room for some privatization activity) should be less of an issue than is protecting supply sources from overexploitation and contamination. Demand management measures, water conservation and public education, for example, will be an important recourse for

water managers. The countries of Central America appear to be coordinating water resource management activities through entities such as Comité Regional de Recursos Hidráulicos (CRRH) and the Parlamento Centroamericano (PARLACEN). There have been coordinated efforts to identify and offer solutions to the problems facing water managers in this region.

The following section of the report analyzes the findings of this assessment in terms of the framework presented in Part 2 to suggest possible avenues for action by the countries themselves and by international lending agencies.

PART 4

IMPROVING WATER RESOURCE MANAGEMENT IN LAC COUNTRIES

INTRODUCTION

Conversations with water resource officials in Latin America and the Caribbean produced the listing of problems discussed in section 3.2.2. This and similarly compiled lists can provide much information and useful insights. However, such lists generally tend to be prescriptions, rather than descriptions of symptoms, or even diagnoses of the problems which greater coordination, more data, better enforcement of legislation, increased integration, or maximum stakeholder participation might be expected to resolve. Consequently, one cannot analyze or critique these items. They can only be accepted or rejected on faith. A similar difficulty arises with the identification of perceived needs in that they contain no direct references to the problems which they are intended to solve. The perceived needs identified in the previous section all refer to changes which might be instituted at the water resource management or water policy and law levels. But the primary justification for making institutional changes at these higher levels is to address problems at the water use level, and there is no indication of just what water use problems might motivate these higher level institutional changes.

A better way to proceed is to identify existing dissatisfactions or problem symptoms, use the best analytical methods available to pinpoint the sources of these difficulties, and then to prescribe changes which could be expected to improve matters. The intent of this section of the report, then, is to illustrate how the conceptual framework and problem solving approach presented in Part 2 might be used to more critically analyze the "raw data" presented in Part 3 and to offer some suggestions on what LAC countries may do to achieve improvements in water resource management. A full illustrative analysis is not possible, of course, because we lack the necessary empirical information about the problem situations, and because we cannot

hope to select or present all of the needed sub-system models (hydrologic, environmental, economic, political, etc.), even if we did possess the necessary facts of the case.

To review briefly, the framework separates water resource management actions or activities into three levels: the operation or water use level, the institutional or water management level, and the constitutional or water policy and law level. The basic problems to be solved by better water management occur at the water use level, whether they be scarcity, externality, open access, or public goods problems. Solving them requires changes in water use rules, which must occur at the higher water resource management level. But, actions taken at this higher level also are subject to rules, and these water resource management rules can be just as problematic as can water use rules. It may be impossible, given the water resource management rules in place, to adopt and implement the water use rules which could effectively address scarcity, externality, open access, and public goods problems. Even as water use rules may be problematic, because they fail to solve water use problems, so water resource management rules may be problematic because they do not foster effective rule making. There are several problems at the water management level which can be responsible for such ineffectiveness. Among them are free riders, excessive transactions costs, inequity, and uncertainty. All point to specific rule deficiencies at this level.

Creating an effective set of water resource management rules requires action at the even higher level of water policy and law. These higher level actions can be critically important, because an ineffective set of water resource management rules virtually assures that basic water use problems cannot be solved. Exactly the same institutional problems which can characterize the water resource management level can also characterize the water policy and law level, because the activity which occurs at each of these levels is rule making.

Among the problems identified in the assessment of water resources management in LAC are four at the water use level. They are (1) contaminated surface and ground water supplies due to

poorly controlled pollution, (2) shortage of potable water supplies, (3) saltwater intrusion and/or excessive pumping costs due to aquifer mining, and (4) excessive urban flood damages. Section 4.2 examines what and how changes in water use rules might resolve these four water use problems. Section 4.3 turns to how such changes in water use rules might be made. This, in effect, is an examination of water resource management institutions, the function of which is to make and change water use rules. Existing institutions may be judged inadequate if they cannot facilitate indicated changes in water use rules. Then, it is necessary to ask whether water resource management institutions themselves can be modified to function more effectively, given the higher legal and socio-political arrangements which exist in the country(ies) in question.

SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION

Most problematic water use situations will be found to include aspects of more than one of the four general water use problem types (externality, scarcity, open access, and public good). For example, aquifer mining can produce an open access problem for ground water users and an externality problem for surface water users through stream dewatering. However, for simplicity of presentation, each of the four common LAC water use problems is examined as if this were not the case; in other words, as if there were a one-to-one correspondence between water use problems and general operational level problem types. The analysis is complicated, but not changed in any fundamental way, by more realistically including all relevant problem types. This is the course which should be followed in practice.

1 WATER POLLUTION (EXTERNALITY PROBLEMS)

The most common water resource-related externality in Latin America and the Caribbean is the adverse effect on the quality of water supplies of downstream users resulting from the untreated discharges of upstream parties. This is an example of an

externality problem, in which the effects of actions by some parties are felt, usually as costs, by other parties, but at no cost to the instigating party. Such externalities are asymmetric, in the sense that the upstream parties affect the well-being of downstream parties, but not vice versa. Absent institutional change, there is usually little or no incentive for polluters to abate their pollution and improve the well-being of externality bearers, even when the benefits of such pollution abatement may far exceed their costs. Other externality problems, stream dewatering resulting from ground water mining, for example, should be addressed in the same general way as pollution externalities.

Asymmetric externality problems may be resolved through three general kinds of institutional changes. The first, and most common, is to adopt and implement regulations, in this case discharge standards which limit the rights of polluters while reducing the liabilities of others. The second is to create incentives, such as effluent fees or taxes, which discourage undesirable activities by making them costly, and which encourage polluters in this case to find inexpensive ways of abating pollution. The third is to change the structure of property rights, in this case making the use of water for waste disposal a marketable right, which may be assigned initially to either upstream or downstream parties, but which then permits the parties which value those rights most highly, whether polluters or sufferers, to purchase them. Polluters can purchase rights to pollute, if the economic gains of doing so outweigh the benefits of clean water. Alternatively, those who value clean water can purchase the right to it, if its value outweighs the value of the water body for waste disposal purposes.

Implementing any of these three approaches requires adjustments in most of the seven kinds of rules identified in Part 2. It is not enough to adopt a regulation and then assume that it will be followed. Monitoring (information rules) and enforcement (authority rules) will be required as well. In most countries, including those of LAC, regulation is the most common of the three approaches for dealing with water pollution, but inadequacies in

monitoring and enforcement and a lack of information on polluters and stream water quality impede efforts to solve the problem. Similarly, it is not enough to levy pollution taxes (payoff rules). Monitoring, collection, and enforcement will be required. It is not enough to create a structure of property rights (authority rules). Again, monitoring and enforcement will be necessary to make them meaningful (monitoring may be accomplished by affected property owners, who can bring suit for violation of rights of others), as will enforcement of contracts and possibly government action to reduce transactions costs.

When LAC water managers cite inadequate enforcement of legislation, they may mean enforcement of regulations, of taxes and tariffs, or of property rights. Somewhat different enforcement activities may be involved in each. When they cite inadequate data, they may refer similarly to any of the three approaches, for effective monitoring is a requisite for all. When they mention inadequate consideration of environmental impacts they may refer to weak or non-existent environmental protection regulations, to ineffective incentives to control pollution, or to lack of property rights to a clean environment.

Water resource management organizations at the river basin or other sub-national level in most LAC countries possess limited powers to effect rule changes of the three types which are appropriate to addressing externality problems. They may adopt and enforce discharge standards, but only if national legislation permits them to do so. In some countries there is no legislation which provides for water pollution control regulations at any level, while in some other countries such legislation exists but it does not allow the delegation of standard setting, monitoring, and enforcement to sub-national levels. The lack of any water quality control legislation must be addressed at the national level, through changes in national water policies and laws before anything can be accomplished at the regional or river basin level. Water quality control legislation which provides uniform national water quality standards is frequently too inflexible to allow the adoption of standards which are appropriate to site-specific

conditions. Sometimes such inflexibility is desirable, such as for ensuring safe drinking water supplies or keeping highly toxic compounds out of all water bodies. At other times it is undesirable, as when fishery-based standards are imposed upon water bodies which do not and cannot support fish populations (ephemeral streams, for example).

Providing water resource management organizations at the regional or river basin level with the authority to establish water quality standards may remove the national obstacle to improved water quality management, but it does not guarantee that effective action can be taken at the sub-national level. Appropriate standards are unlikely to be adopted if the decision making authority lies largely in the hands of the polluters. Participation of externality bearers is also required, and their participation must be accompanied by sufficient power over the process that the "polluter pays principle" can be implemented, something which the polluters will naturally resist strongly (this provided that there exists higher level agreement upon the appropriateness of the ethical principle involved).

2 OVEREXPLOITATION OF GROUND WATER SUPPLIES (OPEN ACCESS PROBLEM)

Ground water is an example of an open access resource, in which the "race to the bottom of the aquifer" often causes problems of salt water intrusion and/or water level decline which renders remaining supplies useless in the first instance or more expensive in the second. Overexploitation of ground water supplies, often resulting in mining of the aquifer, is a common problem in many LAC countries.

Open access problems like aquifer mining are said to exist when multiple users rely on a resource, and none can be excluded from its use. Furthermore, the character of the resource is such that the flow of goods or services which it yields can be diminished by overuse, sometimes to the point of exhaustion, but more often only to an uneconomically low level. Yet each user continues to pursue his own pattern of exploitation so long as his

out-of-pocket costs do not exceed his short run benefits. Not to do so is not to save the resource, but only to give up benefits to others, for others will deplete it anyway.

Open access problems cannot be resolved through the same three general kinds of institutional changes which can be applied to externality problems. The regulatory approach is sometimes used to limit the rate of use, the level of effort, or the technology employed by resource users. None of these work, however, because the number of users is not constrained. The result is only more numerous, smaller (and less efficient) users. The incentives approach has also been tried, but if the resource is truly open access, then user fees cannot be imposed effectively because they cannot be made a condition of access. Restructuring property rights offers the only solution to the open access problem.

Property rights to an open access resource may be restructured in several ways. One way is to institute government ownership of the resource, with access then restricted to those who are so permitted by the government (ocean fisheries are an unowned and thus open access resource, but the fisheries within the continental limits of nations are "owned" by those nations, who try, often successfully, to control access to them, thus the limits of national "ownership" is sometimes a contested international issue). A second, and less frequently tried approach is privatization, in this case the assignment of ownership rights, hence control, to a single private owner. The third, and quite common, approach is to assign ownership rights to a defined user group, such as a cooperative or association. All three property rights approaches achieve the essential condition of restricted access, so that overexploitation and attendant rent dissipation can be avoided, at least in principle. Each has other drawbacks, however. Government ownership brings the usual difficulties of bureaucratic inefficiency and possible unresponsiveness to public desires. Privatization brings the usual difficulties of monopoly control, inefficiency, and inequity. Common property or collective ownership brings problems of monitoring and enforcement in order

to minimize free rider problems (each user must be assured that all other users will observe limitations or he will not do so either).

Water resource management institutions at the river basin or other sub-national level often have limited authority to change property rights. And, any such changes must accord with national policies and laws, which may forbid them. On the other hand, the right to withdraw and use water is often granted by permitting at the regional level, if national laws permit and encourage it. As before, the exercise of powers to change property rights is often highly controversial, and may be effectively resisted by those with vested interests in the status quo. Strong national action at the water policy level may be necessary to support such changes, and often even this is not enough.

3 URBAN FLOOD DAMAGES (PUBLIC GOODS PROBLEM)

Urban flooding is a common problem in many LAC countries, and many believe that the damages caused by such flooding considerably exceed the costs of avoiding at least part of them through more effective flood control measures. Such measures can be structural (storm drainage, dams, levees, and channelization) or non-structural (flood plain zoning and flood insurance), but it appears that all are underutilized in most LAC countries. Urban flood control has many public good characteristics, and so it is often underprovided.

The problem is that of determining how much of a public good to produce since there is no direct evidence of the value of such goods, i.e., how much flood protection to provide or how much maintenance to perform on existing flood control structures if the value of the flood protection is uncertain. Consequently, public goods often tend to be underprovided, although they may also be overprovided. In either case, determining how much to provide is likely to be a highly contestable political decision. Because they are incapable of generating revenue, public goods will be produced primarily by the government; private profit-making organizations find no reason to produce them. And even private not-for-profit

entities may be reluctant to produce public goods because they can be enjoyed by all, and not just by those who pay for them (this is not a free rider problem, because additional users create no additional costs; it is instead a matter of determining how much to produce and then spreading the cost equitably among all users).

The regulatory and incentives approaches are inapplicable in the case of a public good. Only the property rights approach is useful for controlling the output of a public good, and the property right must be a collective or governmental one. The problem then becomes one of information rules; how to ascertain the value of the public good in order to determine how much of it to produce. Flood damage estimates, which rely upon market prices of that which is damaged, should be used wherever applicable. But many public goods, such as the existence value of endangered species whose habitat may be threatened by flood waters, are not bought and sold, and thus have no market values. There are several techniques for eliciting from the public how much they value non-marketed goods and services, of which public goods are one type. Contingent valuation is one such technique.

If the provision urban flood control protection is deemed to be the responsibility of the government, the question then arises of how to allocate this responsibility among the various governmental levels and how to best coordinate the actions at these different levels. In the more decentralized countries, municipal or regional governments are more likely to provide urban storm drainage and stream channelization projects or flood plain zoning programs than is the national government. On the other hand, municipal governments rarely have the resources necessary to provide larger works such as dams and levees. Adequate flood protection, however defined, will require a mix of these measures. However, the coordination necessary to plan and carry out this task is often lacking in LAC countries.

4 INADEQUATE SUPPLIES OF POTABLE WATER (SCARCITY PROBLEM)

Inadequate supplies of potable water constitutes a problem so common throughout the world that it needs little description.

There are two contrasting ways of dealing with such scarcity problems. The first is supply augmentation (or water resources development), which has long been a key aspect of the programs of international aid and lending organizations. The second is demand management, which has been applied much less frequently, except in periods of drought or other instances of temporarily increased scarcity. Supply augmentation is structurally oriented and often takes the form of surface water storage and subsequent delivery, although diversion and transport is common as well. Even more common in LDC's is drilling additional wells to tap ground water supplies, which in many regions are likely to be of higher quality than surface water.

Demand management can be accomplished through a variety of methods. Many think first of the regulatory approach, which embodies water rationing or similar enforced quotas. However, the incentives method, embodying water pricing, is often preferable because it is less heavy-handed and because it has favorable revenue implications. The regulatory approach is better suited to short emergency situations, and it is more easily accepted by the public in such situations. Pricing is the superior long term method, provided that it does not raise equity and hardship difficulties for low income people.

Incentives-based pricing as a demand management tool can be utilized by either private or public water providers. The heavy capital requirements of many water supply technologies, together with the economic inefficiency of duplicative systems, creates a naturally monopolistic situation. There are dangers in implementing either private or public ownership in such situations. Uncontrolled private monopolies have both the motivation and the opportunity to restrict production, raise prices above average costs, and thus reap excessive profits. Public utility regulation has been the means most often employed to control monopoly pricing. However, regulators in such situations too often become virtual captives of the regulated monopolies. If private ownership tends to unduly restrict provision of goods and services, public ownership, by contrast, is

apt to be characterized by underpricing and overproduction. Public managers are often guilty of overspending upon excess capacity, because they hope to avoid the political consequences of raising tariffs and/or rationing uses when occasional shortages occur.

ADOPTION AND IMPLEMENTATION ISSUES

Institutional change, by which we mean the adoption of new water use rules to solve problems of the kinds just discussed, is the result of actions taken at the water resource management level. Organizationally, such rule making has occurred in LAC countries mostly in centralized government agencies, and with limited participation by stakeholders. Regulatory approaches have been favored over marketing and other incentive-based approaches. International aid organizations and conferences have called for a shift from a development project orientation for assistance programs to one of basin-wide, and even country-wide, analysis and planning. The need for this shift cannot be overstated, because it is absolutely essential to the achievement of good water management. However, implementing this shift must be translated to specific acts at the two higher action levels of water resource management and water policy and law.

LAC water managers cited the problems of fragmented and diffused water resources management, inadequate and poorly maintained infrastructure, insufficient and poor quality data, inadequate enforcement, inadequate consideration of environmental impacts, and minimal stakeholder participation, as reported in Part 3. Much of the literature on water resource management advocates such measures as privatization, water marketing, decentralization, unified river basin management, public participation, and demand management to solve these sorts problems and others. While it is true that each of these measures has been underutilized, it is also true that none is a panacea. Each is feasible in some situations and infeasible in others. Each is a promising solution to some problems, and is likely to be ineffective in solving others. And, each is really a general term,

within which considerable variation may occur. What is too often absent in the literature is a discussion about how and in what contexts to adopt and implement these changes, and in what specific forms. What is crucial for successful water resource management is not uncritical adoption of any particular measure, but a careful analysis of site-specific conditions and problems, and then an analysis of all of the measures which may be regarded as available options for solving those problems. This is true whether the problems in question occur at the water use level or at one of the higher levels of water resource management and water policy and law.

Changing water policies and laws, which determine the rules under which water resource management actions are taken, calls for country-wide action at the highest political levels. Changing water use rules, on the other hand, is often best accomplished at the individual basin level, where greater specificity is possible and where stakeholder involvement is more easily accomplished (decentralization). Attempts to improve water management, at the basin level, however, may be frustrated by inappropriate water laws and policies at the national level. These higher-level constraints should be identified and addressed before major expenditures of scarce resources are devoted to making water resource management changes at the decentralized basin level.

Below we briefly touch on three issues which should be considered in the evaluation of rule changes, regardless of the level at which they occur, but which appear to be overlooked or superficially treated by the current water resource management activities in LAC.

1 EMPHASIS ON INSTITUTIONAL INNOVATION

Priority must be given to institutional analysis and change, over building physical infrastructure. Many of the activities involved in water resources management (demand management, for example) have little to do with building projects, and a continued focus upon projects will fail to identify the needed institutional changes which comprise much of what is meant by good water

management. Nevertheless, this shift will not be easy for LAC countries to make. Custom, habit, organizational structure, bureaucratic inertia, professional specialization, and political advantage all weigh in on the side of business as usual. Difficult or not, this shift in focus is the first essential step for improving water resource management.

Not only does management consist mostly of institutional design and implementation, but even the successful operation of projects depends upon putting appropriate institutions in place. However, professional water resources staffs, within both the LAC countries and the lending agencies, are dominated by engineering personnel with little training or familiarity with institutional analysis and action. The message that water resource management is now the order of the day must be articulated at the highest organizational levels, and reinforced by organizational policies and operating procedures. Hiring practices must be revamped to ensure that a proper mix of disciplines is attained. All of this means that water use institutions must be inventoried, characterized, and analyzed just as explicitly, comprehensively, and carefully as are hydrologic and economic conditions.

2 ATTENTION TO SOCIO-CULTURAL CONSIDERATIONS

The LDC landscape is littered with water resource development projects which lie in states varying from misuse to non-use. A major reason is that such projects were designed and built with technical expertise, but without allowance for local cultural conditions and traditions. The same thing can occur if water resource management institutions are not crafted with these conditions in mind. Migratory herdsman cannot be turned into irrigation farmers simply by giving them irrigable land and irrigation water. Neither can water markets be established and function if not integrated with local laws, customs, and economies. Such integration must be a cornerstone of water resource management activities. A part of the integration which is needed can be achieved by expanding the disciplinary mix of

professionals who are involved in water resource management activities, as we have noted above.

3 EDUCATION IN MANY DIMENSIONS

Institutional change of the kind which is needed is a process of social learning, not just a matter of putting new rules in place. In fact, the new rules to be put in place cannot be found in any manual or "cookbook". They must be developed over time through a process of analysis and experimentation which takes full cognizance of local conditions, be they environmental, cultural, political, or economic. Such a process depends upon the effective involvement of stakeholder groups and of knowledgeable specialists interacting with each other in a properly structured situation. Such situations are scarce to non-existent in most LAC countries. They must be created, and the essence of doing so is education. The need for additional specialist training is widely appreciated (and is reemphasized here), but all participants must learn how to interact with each other productively.

Too often, water resource management conflicts are characterized by protracted disputes over the "facts" of the situation, without sufficient attention given to the value aspects. The result is often one of stakeholders making factual judgments about which they are less well informed than are the specialists, and specialists making implicit value judgments which reflect only their professional biases, and not the values of the real stakeholders. Both groups must be educated as to their legitimate and necessary roles, and how to participate effectively in the decision making process.

SUMMARY

The conceptual framework based on the three levels of decision making and action (water use, water resources management, and water policy and law) can be a powerful and insightful tool for problem solving and institutional innovation. Though more information on the three action levels is necessary to provide a

more thorough analysis of water resources management in the individual LAC countries, the limited application presented in this section of the report provides a glimpse of the usefulness of the framework for classifying problems and identifying potential solutions and possible constraints to their implementation.

PART 5

WATER RESOURCE MANAGEMENT STRATEGIES FOR DONOR AGENCIES

INTRODUCTION

The problem-solving approach to institutional innovation presented in Part 2 and illustrated in Part 4 is a recipe that each country could follow in its attempts to improve water resource management within its borders. The role of international aid institutions is different, of course. That role is to encourage and facilitate institutional innovation to improve water resource management within the recipient countries, but not to directly control or manage that process. However, these international institutions can, and we believe should, follow an analogous problem-solving approach in devising their own strategies for improving water resource management in Latin America and the Caribbean. The problems which the international agencies face are derivative from the problems within the countries.

The aim of the international aid organizations should be first and foremost to encourage the kind of analysis and planning which will lead countries to adopt improved institutions at each of the three levels of decision making and action. Lender support for projects intended to improve water use runs a grave risk of repeating the failures of the past if it is not founded upon an understanding of the higher-level rules, whether explicit statutes or uncodified customs and mores, which condition the behavior of participants. The next section identifies some principles which should guide international lender agencies' strategies for improving water resource management in the LAC countries. Section 5.3 then offers some suggestions for embodying these principles in IDB and other donor agencies' own programs.

PRINCIPLES FOR DONOR AGENCY STRATEGY SELECTION

The principles for donor agency strategy formulation discussed in this section are to distinguish between long- and short-run efforts, to maintain conformity with international water resource management goals, to experiment with new kinds of incentives, and to cooperate and coordinate programs among the lending agencies.

1 DISTINGUISH BETWEEN LONG RUN AND SHORT RUN EFFORTS

Developing an institutional structure at all three levels of decision making which will lead to good water resources management in any country, including those of Latin America and the Caribbean, is a long run (indeed, never-ending) process of experimentation, adaptation, learning, and improvement. To expect immediate success is naive. Public and private decision makers need time to change ways of thinking and acting that have been long established. Likewise, the water users themselves need time to adapt to changing water management measures and practices. Furthermore, enacting far-reaching changes in national water policies and laws is not something that should be done in haste, without full analysis and informed debate by representatives of all major stakeholder groups. One of the cornerstones of donor agency programs should be to encourage and facilitate this long term process of institutional analysis and innovation in the LAC countries. Funding individual development projects should not be a concern in these long term programs, because to do so only diverts attention from the higher level institutional reexamination which is required.

However, short term response to pressing current water use problems is no less important than is long term institutional review and revision. Many problems are urgent and effective responses to them are obvious and necessary. Widespread lack of functioning municipal wastewater treatment facilities is one such problem in the LAC countries. It would be both irresponsible and unnecessary to defer action in addressing this problem until a new comprehensive national water resources strategy had been developed and implemented. Therefore, international donor agencies should,

as they certainly will, continue to fund short term, or quick response, projects to solve immediate and pressing water use problems. However, current knowledge concerning what constitutes good water resource management should play an increasing role in the generation and evaluation of proposals for such projects. International donor agencies can help recipient countries to accomplish this and can institute increasingly stringent requirements for compliance with standards of good water resource management. Eventually, conformity with a comprehensive national water resource management strategy should be a condition of all loans for water projects, but interim requirements short of that standard can increase the pace of needed change prior to the time when a comprehensive national strategy is in place.

2 CONFORMITY TO INTERNATIONAL WATER RESOURCE MANAGEMENT GOALS

The goals of sustainability, poverty alleviation, and environmental protection advanced by the international water resources community, and adopted by IDB, should be stressed as constraints upon the selection of options for improving water management. The institutional problems which are identified in the strategy design process directly drive the search for options, and these will be to some extent unique to each country. The IDB goals are more general - too general to drive the problem solving process. However, they are important constraints which must be observed as a condition of obtaining IDB assistance. For example, identification of a water scarcity problem in a national assessment could lead to a recommendation for institutional changes to facilitate water marketing, and, thus, allow scarce water resources to flow to their economically most valuable uses. IDB might then require that the changes in water resource management rules which would permit water marketing also contain provisions for long term viability, for avoiding environmental degradation, and for assuring maintenance of adequate potable water supplies for the poorest users; goals which unconstrained free markets might fail to achieve.

3 EXPERIMENTATION WITH NEW KINDS OF INCENTIVES

The promise of a new and large water resource development project has offered a powerful incentive to politicians in LDC's to cooperate with international aid and lending agencies. Most water resource management measures offer no such immediate and obvious political advantage. Institutional change can even be politically unpalatable because it carries the potential to threaten existing power structures. Lending agencies will have to exercise considerable ingenuity in devising water resource management programs which can accomplish needed institutional change, but which will also be acceptable and desirable to those whose cooperation is essential to their success. Lessons may be learned from the Coastal Zone Management Program in the United States, a program in which the federal government, whose powers to control land use were as limited as are the lending agencies powers to control water resource management in LAC, used a combination of technical assistance and financial incentives to substantially upgrade protection of the vulnerable coastal environment. One key to the success of this program is that it is not solely "top down". Coastal states which elect to participate are able to gain a measure of decision making power over federal programs and projects. A similar participatory spirit might be used in international donor programs.

4 COOPERATIVE AND COORDINATED PROGRAMS

The twin tools of technical assistance and financial incentives which are available to international aid agencies can be most effective if used in a cooperative and coordinated manner. Unlike the case of the U.S. National Water Commission, most of whose recommendations were not followed, the recommendations of the proposed national assessment (section 5.3.2) could become the basis of a cooperative lending program by the several international lending agencies involved. This would provide real impetus for adoption and implementation of comprehensive national strategies to improve water resources management. However, if international agencies do not cooperate and coordinate their

efforts, it will be easy for recipient countries to continue to "cherry pick" desired water resource development projects and to avoid undertaking the difficult job of institutional innovation at the national level. There is little hope for achieving effective water resource management under these circumstances.

In the past, the international lending organizations have often acted as though their purposes were primarily to dispose of money, rather than to attain higher ends. And, in believing themselves to be competing with each other to finance development projects, they have set lower standards than each might have preferred, absent the threat of such competition. They have at times failed to attach to loan agreements the conditions which would be needed to ensure that goals such as sustainability, alleviation of poverty, or protection of the environment were advanced by the projects in question.

Only the establishment of firm coordinating agreements among the lending organizations can eliminate this destructive competition. Some cooperative efforts in support of large development projects have occurred in the past. A substantial expansion of such cooperation and coordination is now appropriate in the area of institution-building. IDB should consider taking the lead in proposing a coordinated water resource management approach on the part of all of the major lending agencies involved in LAC. Not only would such a coordinated approach encourage efficiency but it would also remove the ability of country politicians to play one agency against another to secure politically useful but questionable projects.

ELEMENTS OF A SUGGESTED STRATEGY

In this concluding section we suggest elements for a strategy for international lending organizations to consider as they contemplate the most effective approach for encouraging better water resource management in the countries of Latin America and the Caribbean. This suggested strategy is responsive to the commitment of international lending organizations to assist

countries in attaining their goals of sustainable socio-economic development, alleviating poverty, and protecting the environment. In so doing, the strategy incorporates the river basin approach, institutional innovation, stakeholder participation, and increased economic emphasis as tools, and attempts to help fit such tools into the overall socio-political context in which they must be used. It is a problem solving strategy which recognizes the substantial, if limited, leverage which international aid agencies can and should exert over decision making in LAC countries. The suggested strategy is based upon an explicit conceptual framework, which distinguishes levels of decision making and supports institutional classification and analysis.

There is little hope for improved water resource management in LAC countries unless these countries possess national policy and legal environments which are conducive to effective water resource management. Our survey reveals that many countries do not possess such fundamental institutions, or at least that those which they do possess are not structured effectively. Only minor structural changes will be needed in some countries, but more substantial changes will be needed in most.

This is a period of rapid institutional change in LAC, and changes are occurring (and more can be expected) in water policy and law institutions. It is important that these changes be wisely conceived and effectively implemented. However, the U.S. experience with the National Water Commission suggests strongly that this will be a difficult political task, given the powerful interests vested in the status quo. The international aid and lending organizations can and should use their capabilities of making conditional loans and providing technical assistance to encourage what may otherwise be very difficult innovations in water policy and law.

The example of the U.S. Coastal Zone Management Program shows that such resistance (at the state level) can be countered by a coordinated outside effort relying on technical assistance and financial incentives. In that case, coastal zone states have developed and implemented far-reaching changes in land use

planning and land use control, changes which would have been much slower to occur, if they occurred at all, without the encouragement, technical support, and financial assistance, of the federal government. The international organizations can play the same kind of creative and positive role in improving water resource management in LAC that the federal government played in improving coastal zone management among the sovereign states of the United States.

1 AN INTERNATIONAL INSTITUTE FOR ANALYSIS AND TRAINING

International aid and lending organizations could assist the nations of Latin America and the Caribbean in building their capabilities for improving water resource management in two centralized ways. First, they could establish a knowledge base for institutional innovation and, second, they could train country water resource professionals in the need for and methods of institutional analysis. These two functions could be carried out by a number of existing institutes in LAC, some of which have in fact been doing some of this work. Primary responsibility could be assigned to one institute or could be coordinated among regional institutes. Each would have a small permanent staff, supplemented by visiting specialists on short and long term assignments, dedicate to issues of water resources management.

The institutes would be, in part, "think tanks", charged with conducting analyses of water resource management projects in their respective sub-regions. The field of water resource management has seen all to little examination and evaluation of projects and programs which have been tried. We have failed to assess our successes and failures, and thus have been unable to fully learn from experience. There is a fairly large literature on this subject, but most of it is more descriptive than analytical. The dedicated staff would have the analytical skills needed to conduct state of the art *ex post* evaluations of the large experience base which already exists. They could then serve as expert consultants to new programs and projects in water resource management.

Water resource professionals are not normally trained to perform institutional analyses. To address this need and to complement their research focus, the institutes should have a strong educational focus. For instance, a short course could be established which could be attended by water professionals from both lender and recipient country organizations. A course of no more than eight weeks could pay substantial dividends in equipping key technical personnel with the perspective and with some of the tools which they will need. Specialists in institutional analysis will also be needed to complement recipient country staffs. The institutes could consider establishing fellowship programs to provide graduate training in social science disciplines which will provide the experts needed for this work. It could work out cooperative agreements with qualified universities throughout the world to meet this need.

2 DEVELOPMENT OF COMPREHENSIVE NATIONAL STRATEGIES

IDB should consider proposing a series of country-specific national assessments aimed at improving water resources policies and laws. These could be modeled somewhat along the lines of the National Water Commission, which made important and far-reaching recommendations in the U.S. two decades ago. The intended product would be much the same as what the World Bank (1993) calls a "comprehensive national water strategy". It would be intended to provide the high level framework of laws and policies which would enable and facilitate water resource management efforts at the river basin or other sub-national level. It would not be a national water plan, in the sense that a plan has come to mean a collection of proposed water resource development projects, based upon hydrologic, engineering, and economic analyses.

Available resources, both financial and technical, cannot support the simultaneous undertaking of national water resource assessments in each of the LAC countries, nor would every country be equally receptive to undertaking such an assessment. Awareness of the need for action is a resource no less scarce than funds and technical personnel. Consequently, IDB and its collaborators

should press for the initiation of national assessments in those few countries where the sense of need for institutional change is most evident, perhaps in the wake of drought, serious water contamination, or other water use problems. And, undertaking just a few assessments at a time offers the additional advantage of testing and modification of the program as experience with it grows.

3 ENCOURAGEMENT OF REGIONAL WATER RESOURCE MANAGEMENT

The hydrologic reality that water flows down hill makes the river basin an interrelated hydrologic system, largely independent of neighboring systems, and thus an appropriate unit for analyses of many kinds. Organization for water resource management, therefore, starts at the basin level. However, trans-basin diversions and other works of man often compromise the integrity of the self-contained basin, and important non-hydrologic factors, such as animal migration, electric power transmission and, above all, general political organization, may suggest quite different boundaries for decision making. The "problem-shed", rather than the watershed is the appropriate unit of analysis for decision making purposes. Still, the river basin offers a good focus and starting point.

There is a diminished need for international cooperation and coordination within individual river basins, provided that an appropriate national water policy for supporting basin-level water resource management has been created, as envisioned in the preceding section. However, coordination will still be required to ensure that multiple agencies are not competing with each other in such basins. Joint deliberations by country and international agency personnel could assign responsibility uniquely within each basin, so that overlapping and duplication of effort was avoided. Then, country and agency personnel could work effectively with each other within each basin.

Technical and financial assistance in support of basin-level analysis and planning (not just for structures, but for institutional change as well) can then be provided by the

appropriate international agency. Either "centralized" or "networked" models may be appropriate for basin-level water resource management. The centralized model assigns responsibility to a single agency, such as the U.S. TVA or the French basin management boards. The networked model, instead, emphasizes coordination of the efforts of multiple agencies which share the responsibility for water resource management (water supply, water quality control, and water-related hazard management, for example). History shows that either approach can succeed, if properly implemented.

4 ENFORCEMENT OF CONSISTENCY REQUIREMENTS AS LOAN CONDITIONS

A major feature of the basin-level water resource management approach is to require consistency of each new activity or project with the over-all basin plan or program. Whereas technical assistance is more important than financial assistance in the analysis and decision making phases of basin-level water resource management, financial assistance becomes the most important tool for international organizations to use in the implementation phase.

Plans and programs may be out of date before they can be adopted and implemented, so that some flexibility to recognize and adapt to changing conditions will always be necessary. Nevertheless, the consistency requirement is a vital one, and it must be applied firmly, if flexibly. It is, after all, the money of the donor agencies which is to be used, and they should not shrink from assuring that it is used appropriately and effectively.

There is little prospect that country interest in loans for individual water resource development projects in the traditional mold will cease just because the emphasis of the programs of international aid and lending organizations shifts away from such projects and towards water resource management. Nor should there be a hiatus in funding such projects unless and until a comprehensive national water strategy has been adopted and river basin management plans are far enough advanced to produce project

plans. There will be certain projects which are so obviously and quickly needed that no national strategy or river basin management plan will be required to confirm their desirability.

In order to meet this quick response need, and yet ensure a reasonable prospect of ultimate consistency with future comprehensive national strategies and river basin management plans, IDB should consider imposing interim procedural, rather than substantive, consistency requirements for making water project loans. Such consistency requirements could be based upon the conduct of a problem assessment process to assure that the proposed project would be likely to effectively solve a real problem (easily demonstrated in the example of the discharge of untreated municipal wastes). They could also require evaluation of the likely impacts of the proposed project on the goals of sustainability, poverty alleviation, and environmental protection. The environmental impact assessment required in the U.S. by the National Environmental Policy Act, and now required in many other countries as well, can serve as a model of the kind of full disclosure requirement suggested here.

5 LOANS FOR ANALYSIS, PLANNING, AND INSTITUTION BUILDING

Traditional lending practices are oriented to water supply augmentation or water treatment projects which, at their best, generate products which are marketable, at least in principle. The potential for revenue from those products creates confidence on the part of borrowers that repayment is possible and justified. Thus, there is a willingness to borrow for such projects, even though the loans are not directly guaranteed by prospective returns, as in the case of revenue bonds.

Water resource management activities, such as non-price demand management, do not generate a prospective revenue stream. In fact, they often diminish revenue expectations. On the other hand, such measures may be easily justified on the basis of their prospective reductions in cost, primarily in the form of reduced need for capital investment to support augmentation of water supplies. IDB should consider developing an analytical procedure

which reveals the prospective benefits and costs of non-capital projects such as demand management; a procedure which would not only fairly display the long term value of such measures but which could also become the basis for evaluating loan programs. Cost savings should be no less important than benefit production in project and program evaluations. Loans in support of improved water management will have to be associated with programs which are valued locally to the extent that LAC decision makers will undertake the debt burden necessary to pay for them. A conference of lending agencies directed exclusively to this problem (one which they all face) should be considered.

6 CREDITS FOR INSTITUTIONAL INNOVATIONS

Earlier sections of this report have emphasized the utility and importance of properly structured incentives to the achievement of water resource management goals. These discussions were usually couched at the river basin or regional level within the LAC countries. The principle involved is far more general, however, and can be applied at the level of the relationship between international donors and borrowing countries.

IDB and other international lending organizations might explore the development of a system of credits for meritorious and promising water resource management proposals from recipient countries. Proposals for assistance loans could be evaluated for their ability to meet such criteria as problem solving orientation, consistency with substantive and/or procedural standards deemed conducive to effective water resource management, and compatibility with the goals of sustainability, alleviation of poverty, and protection of the environment.

A formal rating scheme could be devised, despite the somewhat subjective nature of some of these criteria. Then, incentives could be linked to the ratings level. One way of doing so would be to key the priority assigned to prospective loans to the merit ranking of the project or program, with particularly deserving proposals receiving a higher priority than those which were less deserving. Other forms of incentives can be envisioned. One would

be to provide assistance grants which would finance some portion of especially innovative and promising features (conventional loans would still finance the larger share of such projects). Another would be to extend the repayment period for proposals which would not generate directly marketable outputs, but which would be expected to improve overall productivity in the longer term. Yet another incentive could be the extension of substantial technical assistance to proposals which required sophisticated institutional analysis capabilities for their success. Different forms of incentives could be developed to be most effective in encouraging different types of improvements in water resource management.

7 RESEARCH TO DEVELOP GUIDELINES AND STANDARDS

IDB should consider developing a set of guidelines and/or procedures for testing new proposals for their implications for sustainability, much as guidelines for conducting benefit-cost analyses have been developed and promulgated in most developed countries and by some of the lending agencies themselves. IDB itself uses an internal rate of return constraint, or lower bound, for assuring the economic efficiency and financial feasibility of proposed projects. Similar standards could be developed and applied for the other two goals of poverty alleviation and sustainability. Economic tools, such as the Gini coefficient, which measures the degree of inequality of income distribution, could form the basis for developing a poverty alleviation standard. A more direct measure could be based upon job creation. Research will be needed to provide the kind of advance which has occurred in the assessment of economic efficiency.

A standard for sustainability presents a more difficult challenge, because there is still no consensus on precisely what this term should mean, despite general agreement that it is desirable. The most common, and most rigorous, definition to date equates sustainability with long term economic efficiency, when all impacts are measured in economic terms. The difficult question which then arises is not non-economic considerations, as many

believe, because a proper concept of such economic considerations goes far beyond those impacts which are valued in monetary terms through the operation of existing markets. Economists have developed several ingenious, if imperfect, tools for estimating the monetary values of non-marketed goods and services (measures of option value and existence value through the use of such techniques as contingent valuation come to mind). Rather, the difficult question is the discount rate to be used in measuring economic efficiency. One might argue that sustainability implies a zero discount rate, which is to say no discounting the importance of events which may occur far in the future as compared to those which are imminent. How the use of such a zero discount rate (or even whether it is appropriate) could be squared with current internal rate of return, benefit-cost, and discounted net benefits criteria, all of which assume a positive discount rate (12% in the IDB case) will be difficult to resolve. IDB and other international lenders could sponsor research on such difficult issues; issues which must be resolved before their own criteria can be applied consistently.

SUMMARY

The strategies employed by the international donor agencies to assist LAC countries improve water resources management are, as are the strategies used by the LAC countries themselves, comprised of three basic elements: goals, instruments, and an analytical framework. In this section we have identified some principles that should be used to guide the development and implementation of international donor strategies to encourage and facilitate the changes required to improve water resources management in LAC countries.

APPENDIX 1

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