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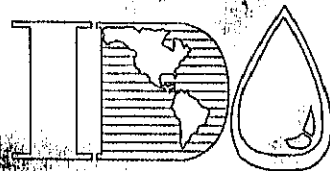
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INTER AMERICAN DIALOGUE ON WATER MANAGEMENT 2°

INTEGRATED WATER RESOURCES MANAGEMENT FOR SUSTAINABLE DEVELOPMENT IN THE AMERICAS



INTERAMERICAN DIALOGUE ON WATER MANAGEMENT II

*INTEGRATED MANAGEMENT OF WATER RESOURCES FOR THE SUSTAINABLE
DEVELOPMENT OF THE AMERICAS*

SEPTEMBER 1996

BUENOS AIRES, ARGENTINA

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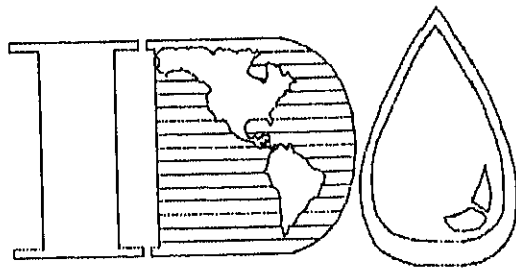
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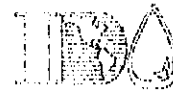
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INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.1

Perri STANDISHLEE
Brown and Caldwell, USA

ACTION STATEMENT:

Basin management requires a global look at coordination of all resources quality, quantity, groundwater as well as surface water. Assessment and planning need to balance resources through a program of source control, best management practices, local participation, economic, financial and regulatory structures and realistic goal setting.

RATIONALE:

Basin management requires a global look at coordination of water quality and quantity. Too little attention has been paid to protecting the water quality of both surface water as well as ground water reservoirs or to manage for quantity. As our cities grow, more concrete and asphalt are being poured changing flow patterns, reducing percolation to recharge ground water basins, and causing flooding. Urban and rural activities generate pollutants, which without proper source control and best management practices, reach the waterways and ground water basins contaminating them. World wide rivers, lakes, ground water basins, bays, and estuaries have been impacted and their beneficial use reduced. Population growth is increasingly putting pressure on limited resources and causing deterioration of quality of the existing resources. Planning needs to take into account balancing available resources, protecting and improving quality through the use of source control, best management practices, public education and participation, economic and financial structures, and realistic goal setting.

- * A watershed management approach provides the most effective framework to accomplish improvement in water quality and in managing quantity.
- * A watershed approach shifts priorities so that management processes move outside political boundaries and become inclusive and all encompassing.
- * The task of cleaning some of the major river basins, bays, and estuaries can be overwhelming unless it is phased and long-term goals are set.
- * Watersheds can be divided into microwatersheds or sub-basins, priorities set based on risk level and economic feasibility, and a step-by-step approach established to reaching the goal of full beneficial use of the basin.
- * To achieve management goals, regulatory programs based on sound science and economic feasibility need to be in-place and uniformly enforced.
- * Basin management requires long-term locally supported programs with all interests represented in defining solutions.
- * Treatment processes cannot removal all pollutants and their costs can be prohibitive. Source control and good planning for basin restoration can reduce waterborne diseases, and has to become an integral part of a multi-barrier approach for achieving economic solutions to water quality improvements.
- * A case study demonstrating such an approach is the Dock Sud project. Most industries at Dock Sud discharge industrial effluents and cleaning waters to surface water drainage channels which empty into the Rio De La Plata. The feasibility study focuses on defining technology for control of industrial discharges in that microwatershed. These solutions can be taken to other areas as economics allow. The improvement in water quality will occur when projects are implemented and enforcement procedures are in-place to monitor compliance with basin protection standards.

A.2 **Integrated Water Resources Management Plan for the City of Junction City, Kansas**
John BRUMMER and Samuel RAMIREZ
Burns & McDonnell International, USA

ACTION STATEMENT:

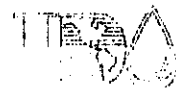
Integrated resource planning can be utilized by municipalities, utilities and cities to closely analyze current water resources and develop a strategy to meet future water demand. An integrated plan is prepared to make economical, environmentally sound decisions regarding use of existing water supply sources using conventional or non-conventional approaches and technologies.

RATIONALE:

The City of Junction City recognized a problem with their ground water supply source when declining well field yields were unable to meet demands during a mildly severe drought. This motivated the city to begin development of an Integrated Water Management Plan (IWMP). The objective of the Integrated Water Management Plan was to assure adequate water supply (quantity and quality) for present and future water demand. A plan was developed by studying many combinations of surface and ground water alternatives.

Yield from the City's well field has been declining since 1960 because of degradation and erosion in an adjacent, hydraulically-connected river. The river bed degradation has been draining the aquifer, reducing the available saturated thickness and threatening the City's sole water source. The well field location could not be abandoned because of potential loss of senior water rights.

Several Alternatives were evaluated for economic and environmental impacts. As part of the Integrated Water Management Plan, a recommendation was made to install additional low capacity wells which would have the lowest economical, regulatory and social impacts. Other potential alternatives include use of surface water from a nearby reservoir, artificially raising river surface levels near the well field area by constructing a downstream weir to back up water and increase aquifer saturated thickness, and installing shallow lateral screens in the river bed.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.3 Integrated Water Resources Planning at Wichita, Kansas Jeffrey KLEIN, Frank SHORNEY, David WARREN and Jerry BLAIN Burns & McDonnell International, USA

ACTION STATEMENT:

Integrated resource planning is utilized by municipalities, utilities, districts and cities to closely examine current water resources and to provide for future water demand. An integrated plan is developed to conserve existing water resources for both water quality and quantity by utilizing conventional or non-conventional approaches and technologies. The selected water supply plan should be environmentally, socially and economically acceptable to all entities that form the community and should be supported by federal, state and local regulatory agencies.

RATIONALE:

Since the 1980s, Wichita, Kansas has recognized that its current water resources would not adequately meet the City's water needs beyond 2010. The City explored using an existing water reservoir located over 100 miles away. Because of high, front-end economic impact and social, environmental and political opposition, the City decided to re-evaluate using locally available water resources. That evaluation led the City to develop a more holistic approach to water resource planning and development. In using this approach, Wichita developed an integrated resource plan (IRP) that is environmentally, socially and economically acceptable to the community. The City believes these efforts represent a model for successful integrated water resource planning and development.

The primary elements of the IRP include water conservation, optimization of the six available local supplies when available to enhance productivity and protect water quality, conjunctive water use permitting and communication with regulatory agencies, other water users and the public. The key to the IRP is the recharge of the City's Equus Beds Well Field area. This area has experienced extensive groundwater drawdown since the 1950s due to pumping by irrigators, municipalities and industries and the dewatered volume of water is capable of storing up to 100 billion gallons of water.

The City has worked closely with local, state and federal agencies throughout the development of the IRP. For the IRP to be feasible, the issuance of a conjunctive use water permit by the Kansas State Board of Agriculture is necessary. The conjunctive use permit will allow the City to use its excess river and bank storage water, groundwater, and reservoir water to maximize water supply during wet and dry hydrologic cycles. This will optimize and maximize the beneficial use of the area's water resources for water supply, as well as create greater operating flexibility.

A.4 **Users' Participation in Decentralized Water Administration The case of Mendoza**
Jorge CHAMBOULEYRON
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

1. *Redefine the management area in order to incorporate economies of scale.*
2. *Include all water uses, not just agriculture, within the scope of Water Users' Associations.*

RATIONALE:

Water administration in the Province of Mendoza has been decentralized and participatory for over a century. The Provincial Constitution in force stipulated the creation of the Department of Irrigation to administer rivers, dams and primary canals while users assumed responsibility for the distribution system. For every irrigation canal there is a Water Users' Association made up of the farmers, who manage and maintain the system and self-finance their expenditures. Such an organization operated efficiently for as long as society was predominantly agricultural. Nowadays, as society turned agricultural-urban-industrial, canal management has been greatly complicated because, in addition to serving agricultural purposes, canals now serve a complex variety of uses. The traditional participatory structures, based on an agricultural model, are no longer efficient.

Some years ago, the irrigation system basically supplied water to agriculture and water treatment plants. As the main economic activity was agriculture, the system was organized and managed only by the farmers. At present, the irrigation system not only supplies water for recreation, public use and power generation but it also helps to drain the cities' floodwaters. In addition, the drainage system is used to discharge wastewater. Problems related to water pollution, environmental protection and land distribution show that the traditional agricultural participatory structure is unable to cope with all the responsibilities and, if it is not resized, the oasis may be confronted with serious environmental problems. Since the most efficient water resources administration is participatory, all users should be incorporated into the new water management structures.

To this end, the following recommendations are made:

- * Water Users' Associations should be made up of representatives from public, recreational, urban, hydropower, agricultural and industrial uses.
- * The size of the area to be managed should be taken into account so that enough capital is accrued from water rates collection that will permit the construction and financing of infrastructure works.
- * The number of votes for each use should be in proportion to the flow each use receives (Mendoza's Water Law stipulates 1 l/s/ha for agricultural uses).
- * Given the allocation according to area and if the law in force is not amended, all water uses should be related.

This should make it possible to adequately organize water distribution and the way Water Users' Associations undertake different activities.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.5 Integrated Management of Local Water Services
Carlos GONZÁLEZ-Antón ALVAREZ
Universidad de León, SPAIN

ACTION STATEMENT:

To promote the integrated management of all water supply and sanitation services at the city or town level.

RATIONALE:

We advocate the convenience or --rather-- the need of a global management of water resources at all administrative levels. Legislators and local authorities should definitely opt for this solution. This idea, already included in European Community regulations and programs as well as in the recent Spanish state water legislation and in some autonomous laws, has not been uniformly adopted at the local level. There, due to the inertia of practices existing until recently, concern about water quality has been circumscribed to water supply, with no regard for its pollution after it has been used.

That attitude is still prevalent in management systems in which water supply and sanitation services are the responsibility of different agencies. To render better services to the community and to attain used waters of a better quality, integrated management is called for. Municipalities or autonomous units should either directly or indirectly manage the "integrated water cycle".

On the other hand, it is a well-known fact that municipal water services are disrupted. That is, municipalities are responsible for the provision of a public service, yet other public agencies are competent to make decisions on important aspects of the service, such as the water itself. If this dislocation poses important problems to service management, the internal disruption of municipal hydraulic services is just as negative.

A.6

B. G. APPELGREN and Wulf KLOHN
Land and Water Development Division, FAO, Rome, ITALY

Need to strengthen the co-operation for management, development and conservation of transboundary and inter-jurisdictional water resources.

ACTION STATEMENT:

- (a) *Identify priority inter-jurisdictional water issues at international and national level.*
- (b) *Establish appropriate international forums, at politically accountable levels, authorized to review and address these issues; and*
- (c) *Develop co-operative and water-sharing frameworks based on state practice experience.*

RATIONALE:

Major portions of the world's unused water resources are shared between countries and new independent states and jurisdictions depend to a large extent on water resources that have only recently become international. Individual states are therefore getting increasingly aware of the importance and motivated to reach agreements on water-sharing and river basin co-operation as water is getting scarce and water competition and conflict is perceived as a constraint to development and a threat to social and societal security. A basic condition for international dialogue is that the basin states appreciate the benefits of co-operation and therefore capacity-building programmes are critical components of the process. While bi-lateral water-sharing and co-operative agreements between developing countries reflect the political realities of bi-lateral relations, the experience has shown that exposure to world public opinions has often been positive to assist in moderating the positions of the parties.

A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A7 The watershed approach

Janet PAWLUKIEWICZ
Office of Wetlands, Oceans and Watersheds,
US Environmental Protection Agency, USA

ACTION STATEMENT:

Future environmental progress requires an holistic approach to integrated water resource management. Strategies for effectively coordinating the actions of many stakeholders are needed.

RATIONALE:

The US Environmental Protection Agency (USEPA) endorses the watershed approach as a strategy to integrate water resource management for several reasons:

- (1) problems manifested in the water often result from actions taken on land;
- (2) actions upstream are felt downstream;
- (3) many programs exist to address specific water resource issues, e.g, point source pollution, non point source pollution, habitat protection, drinking water protection; and
- (4) many jurisdictions hold responsibility for various aspects of water management because watersheds cross political boundaries.

The watershed approach is based on three guiding principles.

1. **Partnerships.** Those people most affected by management decisions are involved throughout and shape key decisions.
2. **Geographic Focus.** Activities are directed within specific geographic areas, typically the areas that drain to surface water bodies or that recharge or overlay ground waters or a combination of both.
3. **Sound Management Techniques based on Strong Science and Data.** Collectively, watershed stakeholders employ sound scientific data, tools, and techniques in an iterative decision making process. This includes:
 - * assessment and characterization of the natural resources;
 - * goal setting and identification of environmental objectives;
 - * identification of priority problems;
 - * development of specific management options and action plans;
 - * implementation; and
 - * evaluation of effectiveness and revision of plans, as needed.

USEPA works with public and private sector stakeholders at all levels to promote and support integrated watershed approaches. Please share strategies used to improve coordination and communication among diverse programs and across jurisdictional lines. More information on Use's Watershed Approach is available on the internet: <http://www.epa.gov/OWOWOW>

A.8 Cooperative Management of Shared Water Resources
Thomas T. ANKERSEN and Richard HAMANN
Mesoamerican Environmental Law Program
Center for Governmental Responsibility, University of Florida College of Law, USA
Elisa COLOM de MORAN
Instituto de Derecho Ambiental y Desarrollo Sostenible (IDEADS) Guatemala, GUATEMALA
Ignacio MARCH
El Colegio de la Frontera Sur (ECOSUR), San Cristobal de las Casas, Chiapas, MEXICO

ACTION STATEMENT:

Efforts to cooperatively manage shared water resources should be strongly encouraged with financial, technical and diplomatic support.

RATIONALE:

Every country in the Americas shares responsibility for the management of a body of water with one or more other nations. There are 58 shared basins in Latin America. These basins are often areas that have been economically and politically marginalized. The United States and Canada also have extensive shared water resources. Unless there is effective cooperation in the management of these resources, ecological degradation will continue, sustainable development cannot be achieved and international conflict can result.

There have been numerous efforts to address issues in the management of shared basins. The United States and Canada, for example, jointly manage the Great Lakes. Mexico and the United States have devoted considerable attention to the management of rivers along Mexico's northern border. There has been much less attention to the development of effective institutions in the remainder of Latin America.

During the first Interamerican Dialogue on Water Management, the Mesoamerican Environmental Law Program sponsored a round table concerning how to improve management of the San Juan River Basin, shared by Costa Rica and Nicaragua. A similar round table process has now begun to discuss how management of the Usumacinta River, shared by Mexico and Guatemala, can be improved. Similar efforts should be encouraged and supported throughout the region. Those who manage basins have an urgent need for financial assistance, technical support and diplomatic encouragement of transboundary cooperation. One of the most important contributions that could be made would be to evaluate existing efforts at multijurisdictional management of shared water resources, determine the factors influencing success or failure, and provide recommendations for successful cooperation.

A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.9 Modular Systems for Water, Electricity and Waste Disposal
Daniel J. DALY
Energy & Environmental Research Center (EERC), USA

ACTION STATEMENT:

Development and demonstration of small, integrated, multiple-function, modular support systems to provide clean water, electricity, and waste disposal for rural areas.

RATIONALE:

Sustainable development will be supported in rural areas through the application of efficient, cost-effective, and environmentally sound modular technologies that address the multiple needs of power generation, water treatment, and waste disposal. The use of modular technologies allows systems to be tailored to the needs of the community in terms of appropriate size and use of indigenous fuels and raw materials, including utilization of waste materials. Some remote rural areas are currently without electric power, use impure water, and discard waste without environmentally sound disposal facilities.

Small-scale fluid-bed combustion, as traditionally applied on a larger scale by electric utilities and manufacturing industries, can be used to dispose of agricultural and municipal solid wastes and sludges while utilizing these carbon sources for the production of heat and electric power.

Other technology such as hybrid wind power and fuel cells can be used when local conditions are appropriate. Implementation of this action will require:

- 1) Development of partnerships between vendors, developers, funding agencies, and stakeholders in the region;
- 2) Selection of technology packages for local conditions;
- 3) Site demonstration and assessment; and
- 4) Development of partnerships with regional stakeholders for financing and implementing replicate projects and providing manufacturing, marketing, and support services.

A.10 The fragmentation of water management between sectors and institutions.
Basil FERNANDEZ
Water Resources Authority
Ministry of Public Utilities and Transport, JAMAICA

ACTION STATEMENT:

Water must be treated systemically. Management must recognize the interaction of the hydrologic basin while allowing for the incorporation of cross sectoral and environmental considerations.

RATIONALE:

Water resources planning on a basin and national level is necessary to move forward in an integrated, inclusive and sustainable manner. The hydrologic basin is the management unit which offers the best opportunity for balancing different interests.

Emphasis should be place on:

- (a) The development of an integrated land/water oriented plan, to achieve a balanced development of the hydrologic basin taking into account all the relevant factors (demographic changes, ecological, socio-economic, hydrologic, hydraulic factor and spatial and agronomic potentials of the basin) while ensuring attention to urban/rural and upgradient (upstream) /down-gradient (downstream) competition for water.
- (b) Stimulating environmental awareness and institutional strengthening to obtain support for such an integrated water plan.

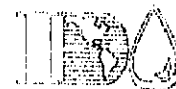
The plan must include:

- (a) Objectives and time frame;
- (b) The systems influencing the objectives e.g. environmental, socio-economic;
- (c) the disciplines needed to formulate and implement the plan as well as monitor progress;
- (d) Inventory of all resources and relevant factors
- (e) Indicators to monitor progress;
- (f) Actions and who will carry out these actions to ensure successful implementation.

There must be a balance between conflicting objectives. The allocation of water to competing users within a basin must be based on their positive or negative contribution to the plans objectives.

Sustainable water resources development requires a new approach to water management. Work has begun on the policy framework that is necessary to move forward in an integrated, inclusive and sustainable manner. Key components of a comprehensive framework are:

- (1) quantity and quality concerns must be addressed in an integrated approach;
- (2) land use management must linked directly to sustainable water management;
- (3) hydrologic basins should be used as the management unit;
- (4) water must be recognized as an economic good and interventions must be cost-effective and sustainable;
- (5) stakeholders must participate; and
- (6) action must focus on activities that improve the lives of people and the quality of their environment.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.11

Basil FERNANDEZ
Water Resources Authority
Ministry of Public Utilities and Transport, JAMAICA

ISSUE:

While Jamaica has adequate water to meet its future demands, the deterioration in water quality can quickly reduce this availability with serious effects on health, economy and development.

ACTION STATEMENT:

Develop and implement policies and programs for:

- (a) *Better land use*
- (b) *Protection and pollution prevention.*

Strengthen institutional and technical capabilities to monitor effectiveness.

RATIONALE:

The deterioration in water quality is the result of the poor handling of the waste that attends human activities. A finite resource with escalating demands make the degradation of water quality the major challenge in water resources management. While government seeks to push economic development and make land available to the landless, the linkage between land and water must be recognized. There needs to be developed a strategy aimed at non-undermining land/water management. Waste producing land use that deteriorate water quality must be avoided.

A water pollution prevention programme must be formulated based on an appropriate mixture of pollution reduction at source strategy, environmental impact assessment and enforceable standards.

The development and application for clean technology (tertiary treatment systems and reuse of water) can also significantly reduce pollution.

The programs and policies for reduction of pollution will require monitoring to determine effectiveness, through the surveillance of the resource. Water quality surveillance and monitoring networks must be established to determine changes and to ensure compliance with standards.

The "polluter pays" principle must be enforced through strong regulations. The use of groundwater must be adapted to the aquifer sustainable yield to prevent undermining and long term decline of the economy. In coastal aquifers, as in Jamaica, this is particularly important to ensure that ground-water does not become unusable due to irreversible intrusion of saline water.

Training to increase technical capability to implement and monitor the progress will be imperative. This can be achieved through short term subject specific courses. Support will be needed from international funding and training agencies.

A.12

Basil FERNANDEZ
Water Resources Authority
Ministry of Public Utilities and Transport, JAMAICA

Significant investments in the water sector are being made without any recent assessment of water resources. Assessment of resources is necessary for integrated management.

ACTION STATEMENT:

If sustainable development is to be achieved, a knowledge of the resource is an absolute necessity. The Water Resources Assessment is one of the key tools in assessing what will happen. More financial resources and better cooperation between water agencies are needed.

RATIONALE:

A Water Resources Assessment is the determination of the sources, extent, dependability and quality of water resources on which is based an evaluation of the possibilities for their utilization and control. The starting point is the determination of the available water supply, its variability and quality.

Both surface and ground water must be considered. The existing and future uses of the water resources must be determined giving due concern for water quality and the aquatic environment. Alternatives for balancing supply and demand needs to be evaluated, assessing alternatives that reduce demand as well as ones that increase the available supply.

As scarcity increases and conflicts develop, alternative uses must be considered and trade-offs made between intensive uses such as agriculture and high value uses such as tourism or industrial use. The Water Resources Assessment will often identify the need for new coordinating and integrating mechanisms, the need for new legislation and regulation, the need for strategies and policy that deal with priority of uses and resolution of conflicts. The lack of critical skills and data base requirements will be identified as well. It must also be recognized that an assessment is only a tool and part of the decision making process that must involve the political, public and key stakeholder levels throughout the process.

The Water Resources Assessment can be conducted at a number of levels including national, regional and local. The hydrologic basin is recognized interconnected areas separately so that remedial action plans can be developed and future problems averted.

Several limitations have been identified as to why water resources assessments are not carried out more regularly.

The limitations for Jamaica are:

- (a) Lack of financial resources assigned to water resources assessment at the national level.
- (b) Lack of coordination and integration between agencies and between data producers and users;
- (c) Poorly developed assessment practices despite the availability of guidelines.

A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.13 Integrated Water Management: Ecosystem Planning as the Foundation
David L. HARRISON
Moses, Wittermyer, Harrison and Woodruff, P.C., USA

ACTION STATEMENT:

Compatibility with ecosystem integrity is fundamental to long-term sustainability of water development. With good fundamental ecosystem science that compatibility can be designed or restored.

RATIONALE:

Lost channel capacity, intensified flood regimes, deterioration of water quality, salinization and loss of ground water all have been experienced from water development. The rapidly mounting concern over loss of species and habitats, particularly aquatic, has produced increasing political and social pressure. This is forcing redesign of projects or operations and is impacting the yields and performance of water management systems. Achieving stable and reliable water management for human uses requires compatibility with ecosystems and basic ecological processes.

River basin management must proceed on the basis of solid information and understanding of basic hydrological and ecological processes within each basin.

Some key natural characteristics that must be understood and managed include:

- * Patterns of occurrence of biological diversity, particularly in aquatic and riparian ecosystems, including life stage pathways and food chains of aquatic organisms
- * Geomorphological processes
- * Magnitudes and variations in the natural hydrograph -- protection of the greatest degree possible of that variation is critical in maintaining aquatic and riparian ecosystems
- * Flood magnitude and routing; flood plain characteristics; natural hydroperiod for wetlands and flooded forests.
- * Water quality including sediment and temperature regimes

Water development that can fit into and tolerate those natural processes and variations will be the most stable. Extreme events - the most difficult for human uses - are extremely important attributes of intact river systems. They often perform the greatest part of the work of maintaining the ecosystem. The good news is that within these constraints, a great deal of water use opportunity exists for urban communities and other human uses.

A.14 Basic Concept of Integrated Management: Water A Factor of the Environment
Jorge R. SARAVIA
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

For the integrated water resources and river basin management as well as for the strategies for sharing and exchanging experiences and expertise in water technologies, the considerations that follow should be borne in mind. (1) Water should be considered as a physical factor of the environment and, as such, it is closely connected and in dynamic equilibrium with all the other environmental factors, both physical and biological. (2) The alteration of water characteristics --quantity, opportunity, quality and energy-- modifies relationships and the equilibrium among environmental factors. (3) Evaluation, control, management and use interventions should take into account the principal points of the physical, chemical and biological behavior of environmental factors by reproducing and combining natural responses in accordance with (within the proposed objectives) its balanced behavior.

RATIONALE:

The factors involved in the formation and evolution of the environment are changing climatic, mineral and organic components which can be classified into physical and biological.

Water, a determinant element in the definition of a water system or river basin, is a factor of the environment and participates in its formation and evolution.

Within the complex environment, water (life determinant and condition) is a physical factor that plays a central role in the phenomena and processes that take place in it, a fact that becomes manifest in the interaction of all environmental factors (physical and biological).

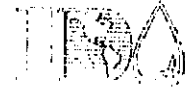
This leads us to point out the relationship that the simple water concept has with the real and complex formation and evolution of environmental factors.

In view of the reciprocal nature of these interactions, the central role of water should be considered taking due account of its inevitable relationship with its associated factors. This, in turn, leads us to a transdisciplinary approach to water resources management and research with a view to their evaluation, conservation, control, management and use.

Water conservation, monitoring, management and use actions are carried out by man, a FACTOR of the environment that affects the other factors either directly or indirectly.

Man's inevitable intervention of man is due to his primary need to use natural resources not only for survival but also for his present and future evolution.

In principle, anthropic action would not be negative if it were conducted in line with the basic physical, chemical and biological point of environmental behavior.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.15 Integrated Management of Flood Plains

Carlos PAOLI

Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

Preparation of a paper describing experiences and providing recommendations on the technical, administrative and legal tools required for integrated management.

RATIONALE:

Floods are basically environmental and social phenomena since they occur in a hybrid system (natural and man-made), the effects are felt by the community (damages), and the interventions or solutions provided affect other natural resources (flora, fauna, soils). The problems to be solved are not only technical, or ecological, economic, social, legal or institutional, but a complex interaction of all of them, so solutions should be offered from an interdisciplinary standpoint.

The objectives of integrated flood plains management are to reduce flood damages, to preserve and increase natural values, and to promote the optimum use of lands and waters in these areas. To fulfill these objectives it is necessary to devise schemes that involve land owners, all government levels and the public in general with a view to striking a balance between the benefits to accrue from the development and use of flood plains, on the one hand, and the potential flood losses and destruction of natural values, on the other. Such a balance should be established for both the present and future generations.

The availability of a paper containing objectives, approaches, procedures and methodologies to be followed should prove most useful not only to governments but also to individuals, who must assume their own responsibilities.

A.16 Use of "Partnership Agreements" as Mechanism for Integrated Water Management Planning
Charlotte M. HAYNES
Wisconsin Department of Natural Resources, USA

ACTION STATEMENT:

A Partnership Agreement model is recommended as a means of solidifying the contributions of those who have a stake in the future of the natural, social, cultural and/or economic resources of a watershed. The model calls for the integration of people, programs and resources around the common goal of long-term protection and sustainable management of watersheds and provides a mechanism for achieving such integration.

RATIONALE:

In Wisconsin, the most critical water management problem is the pollution of streams, lakes, rivers and groundwater by nonpoint sources of pollution. The pervasiveness of this pollution source and the wide range of its origins requires innovative and inclusive strategies.

In Wisconsin, we have a Priority Watershed Program which has been in existence since 1978. The program has traditionally addressed urban and agricultural watersheds with problems being identified and quantified through technical pollutant load modeling which culminates in the subsequent development of management strategies. While citizen involvement has been an element of this program, the use of partnership agreements is being piloted as a way to systematically involve a wider range of interests and individuals in addressing nonpoint source pollution control in priority watershed projects.

The partnership agreement model is especially useful in watersheds where protection (as opposed to remediation of polluted water bodies) is the major focus . . . watersheds where growth management is a top concern, and in regions where there are complex resource problems.

Partnership agreements are pacts between citizen, agency, economic development, natural resource, and local government groups who seek to balance, in many instances, increasing development pressures with the need to preserve high quality resources essential to tourism and recreational industries. These pacts are embodied in a concise document that unifies diverse groups around a common cause or project. The document is meant to affirm that the high quality natural resources of the watershed region are critical to its ecological and economic future and therefore must be maintained, protected or restored.

Partnership agreements set a tone of balance between economic growth and ecological integrity, often between agricultural, forestry, recreational and development uses.

Structure of Partnership Agreements: Typically there are representatives (partners) from all the groups with a stake in the health of the watershed. These signatories to the agreement are represented on a steering committee. Subcommittees are formed to implement the initiatives goals. While partnership agreements are not meant to be legally or financially binding, the process still tend to instill a significant sense of commitment, and perhaps peer pressure.

Benefits: Often overlapping projects and grant proposals are consolidated through the use of a partnership agreement. Communication is also greatly enhanced by using this model. The model provides a mechanism for developing long-term goals for a 10 - 20- year span and beyond. Partnerships provide strength in numbers that is critical to leveraging technical, political, and financial assistance.

The regional nature of water resources requires that diverse interests and a large number of local jurisdictions (townships, counties, villages, school districts, etc.) all have a voice in and responsibility for resource management. The organization, legal, and financial strategy for watershed management must be a locally driven process.

A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.17 Institutional Arrangements to Promote Integrated Water Management on a Watershed Basis (Government Model)

Charlotte M. HAYNES

Wisconsin Department of Natural Resources, USA

ACTION STATEMENT:

Governments are encouraged to consider doing the difficult but critical work of structuring agencies and departments with water management program areas around the boundaries of major river basins and developing tangible mechanisms for involving stakeholders in water management (letting stakeholders drive water management programming).

Governments need to strive to:

- (1) *reduce institutional barriers in agencies with jurisdiction over water management, and*
- (2) *reorganize around integrated water management principles, moving towards the ideals of ecosystem management.*

RATIONALE:

The experiences of the Wisconsin Department of Natural Resources (WDNR) follow: Wisconsin has 15,000 lakes, nearly 60,000 miles of rivers and streams, the Great Lakes Michigan and Superior, the Mississippi River, groundwater, and associated bird, fish and wildlife habitats. In order to better protect and manage these highly valued natural resources, resource managers and citizens in Wisconsin are realizing that effective resource management must include active stakeholder involvement, and an institutional structure which supports integration and coordination. The WDNR is in the midst of better accommodating these needs through a departmental reorganization and an evolving interest and belief in watershed and ecosystem management approaches.

Wisconsin's watershed approach emphasizes integrating management through two main concepts: first, stakeholders are central to decision making and implementation, and second, solutions are geographically based and reflect an array of factors affecting an area.

Stakeholder groups are being created to advise WDNR resource management teams in each of 23 newly delineated geographical management units. (GMUs) The GMUs will be staffed by interdisciplinary land and water resource management teams. Whereas past efforts have focused separately on point sources or nonpoint sources of surface water pollution, groundwater protection, site remediation, or fisheries management, this basin approach considers the combined impacts of these and of other resource management actions.

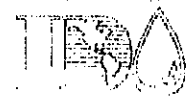
The ongoing departmental reorganization has introduced a fundamental shift in WDNR management structure. Wisconsin created the nation's first super-agency for natural resource management in 1969 by combining environmental quality and resource management functions into a single Department of Natural Resources with more than 3000 employees. Over the past two years, the WDNR has gone through a comprehensive self assessment and restructuring. The new structure organizes the Department by media --land, air, and water. All water resource management activities are being joined into a single Water Division to enhance decision-making, integration, and ultimately to better protect and manage the state's water resources.

In summary, we are in the midst of refining our vision of a watershed approach, how that approach fits in (drives) with other Department management schemes, and how to implement this integrated approach to include targeted efforts and broad stakeholder involvement. We are currently working through a series of pilot projects to address several continuing challenges including developing new tools for working with permittees, empowering stakeholders in targeted geographic areas, sharing responsibilities for monitoring and management decisions, promoting intergovernmental partnerships, incorporating ecosystem management principles at the field level, and developing mechanisms for financial assistance to support interactive management through a watershed approach.

WDNR is moving away from its separate treatment of water resource management activities and towards an integrated management approach encompassing both land and water resources. WDNR's new approach places

great emphasis on the stakeholder role in identifying and prioritizing goals and in implementing management strategies.

Sustained protection of Wisconsin's aquatic resources depends on our ability to move forward in this direction.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.18 Water Management under Conditions of Climatic Change
Omar A. LUCERO
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

Recommend that water management agencies, both at the national and provincial levels, promote studies to identify and quantify climatic change in their jurisdictions and develop projections of its effects on water availability. The findings should be used in when planning water use, irrigation, control and distribution works.

RATIONALE:

Climatic change is taking place in many regions worldwide. It is observable --inter alia-- in the statistical characteristics of air temperature near the surface and of rainfall in different periods. Climatic change is due to natural and anthropogenic causes. The international community agrees on the importance of its effects on natural resources and the quality of life. This agreement has become manifest in the signing of the United Nations Convention on Climatic Change.

Some UN agencies, such as UNESCO's International Hydrologic Programme and WHO, are implementing plans to further knowledge on the subject and on its impact on natural resources.

Since climatic change affects water availability and demand levels (by modifying the statistical characteristics of air temperature near the surface), and given the fact that for water management to be effective the said impacts should be taken into account, it is deemed convenient to implement the recommendation formulated in the action statement.

A.19 **A New Approach to Water in Ecuador**
Juan B. CARCELEN F.
Consejo Nacional de Recursos Hídricos, ECUADOR

ACTION STATEMENT:

Enactment of a new Water Law for the political-legal reinforcement and institutional strengthening of the Consejo Nacional de Recursos Hídricos - CNRH.

RATIONALE:

The State must supply water to all inhabitants and promote sustainable economic development within equitable and environmental preservation parameters. The legal and institutional framework currently in force in Ecuador, which dates back to the 60s and 70s, reflects the political situation that prevailed at that time.

The CNRH was set up in 1994 as the national authority on water management in charge of implementing a policy based on the following:

- * integrated management of all other natural resources
- * sustainable river basin development
- * water conservation, optimal use, and quality protection
- * use of appropriate technology
- * harmonious multi-sectoral approach
- * inventory of water uses and quality
- * community's capacity to solve problems
- * transfer of functions to regional agencies and to the community with the participation of all the actors involved
- * legal security concerning water use rights, on the provision that an effective and beneficial use be made of the resource, with clear rules to promote self-management
- * rates of rights of use and services that will make it possible to defray administrative costs and recover investments
- * priority to marginal social groups
- * water saving and water quality protection
- * power to protect, control and penalize wastewater quality



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A. 20 Integrated Water Resources Management
José A. FEBRILLET HUERTAS
Instituto Nacional de Recursos Hídricos, REPÚBLICA DOMINICANA

ACTION STATEMENT:

To ensure water sustainability by implementing a National Water Plan.

RATIONALE:

Current increasing water demand and pollution levels have led to conflicts spreading all over the country.

It is an acknowledged fact that problems concerning water shortages, pollution, the inadequate control of water surpluses, and conflicts originate, in turn, in water management problems such as:

- * Dispersion of functions and authority among the main water use sectors (drinking water supply, agriculture, hydropower generation, industry), especially as regards water quantity and quality;
- * Diminishing financial resources for hydraulic development, and for the conservation, rehabilitation or direct replacement of infrastructure.

A.21 Multisectoral Integration
José F. FEBRILLET HUERTAS
Instituto Nacional de Recursos Hídricos, REPÚBLICA DOMINICANA

ACTION STATEMENT:

To promote the solution of multisectoral problems concerning water use, protection and allocation in rural and urban areas.

RATIONALE:

Current increasing water demand and pollution levels have led to conflicts spreading all over the country.

It is an acknowledged fact that problems concerning water shortages, pollution, the inadequate control of water surpluses, and conflicts originate, in turn, in water management problems such as:

- * Dispersion of functions and authority among the main water use sectors (drinking water supply, agriculture, hydropower generation, industry), especially as regards water quantity and quality;
- * Little social awareness of the urgent need to use water efficiently and control protect its quality due to an erroneous appraisal of the resource.

A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.22 Water Code
José F. FEBRILLET HUERTAS
Instituto Nacional de Recursos Hídricos, REPÚBLICA DOMINICANA

ACTION STATEMENT:

To eliminate present legislation incongruities arising from the existence of multiple water sector agencies with the approval and enforcement of a Water Code.

RATIONALE:

Current increasing water demand and pollution levels have led to conflicts spreading all over the country.

It is an acknowledged fact that problems concerning water shortages, pollution, the inadequate control of water surpluses, and conflicts originate, in turn, in water management problems such as:

- * Dispersion of functions and authority among the main water use sectors (drinking water supply, agriculture, hydropower generation, industry), especially as regards water quantity and quality;
- * Inadequate legal framework to deal with conflicts arising from competing water uses.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.24 Users' Organizations
José F. FEBRILLET HUERTAS
Instituto Nacional de Recursos Hídricos, REPÚBLICA DOMINICANA

ACTION STATEMENT:

To promote the development of financially sound and administratively autonomous users' organizations with decentralization objectives.

RATIONALE:

Current increasing water demand and pollution levels have led to conflicts spreading all over the country.

It is an acknowledged fact that problems concerning water shortages, pollution, the inadequate control of water surpluses, and conflicts originate, in turn, in water management problems such as:

- * Excessively centralized government intervention
- * Inadequate rates to cover maintenance, conservation and protection of both infrastructure and water quality
- * Negligible or in-existent users' participation in the search for solutions to meet water and sanitation needs.

A.25 Integrated Use
José F. FEBRILLET HUERTAS
Instituto Nacional de Recursos Hídricos, REPÚBLICA DOMINCANA

ACTION STATEMENT:

To reconcile the fulfillment of the water demands posed by all sectors with efficiency and equity objectives.

RATIONALE:

Current increasing water demand and pollution levels have led to conflicts spreading all over the country.

It is an acknowledged fact that problems concerning water shortages, pollution, the inadequate control of water surpluses, and conflicts originate, in turn, in water management problems such as:

- * Lack of mechanisms and clear incentives to implement effective water quality and quantity control programs
- * Lack of interinstitutional coordination due to incongruities in the legislation
- * Lack of an adequate water management policy.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.26 Water Resources Information
José F. FEBRILLET HUERTAS
Instituto Nacional de Recursos Hídricos, REPÚBLICA DOMINICANA

ACTION STATEMENT:

To establish and/or improve water information services.

RATIONALE:

Current increasing water demand and pollution levels have led to conflicts spreading all over the country.

It is an acknowledged fact that problems concerning water shortages, pollution, the inadequate control of water surpluses, and conflicts originate, in turn, in water management problems such as:

- * Little social awareness of the urgent need to use water efficiently and control protect its quality due to an erroneous appraisal of the resource;
- * Incomplete and inadequate information on water resources due to a lack of systematic data collection, a fact which makes it difficult to formulate new sectoral development projects.

A.27 Development of Institutional Structures for Integrated Water Resources Management
Armando LLOP
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To create an organizational system for the integrated management of water resources based on two key instances: a) a forum (Council) to convene the main actors and interests involved in a given water system's management and use; and b) an "ad hoc" advisory group, of flexible structure and composition, capable of summoning the most qualified experts and technicians to facilitate the Council's decisions.

RATIONALE:

Latin America and the Caribbean countries lack an institutional arrangement that will make the integrated management of water resources possible. Environmental ministries or agencies have been set up to fulfill that role but they have not yet been able to attain the objective.

In most cases, it is still necessary to achieve adequate interinstitutional coordination.

The worst consequence of a lack of integrated management is its impact on the less protected component: the water-related environment. This is generally the jurisdiction of a large number of management agencies which do not consider the issue as one of their priorities. The situation often leads to the setting up of non-governmental organizations but, as long as there is no adequate institutional development, the environment will undergo an irreversible process of degradation.

There are neither general rules nor recipes to design the most appropriate agency for the integrated management of a given water system. However, what we hereby propose is a general organizational structure that may be applicable to many cases in Latin America and the Caribbean. The central idea of this proposal is that the two above-mentioned instances should complement each other so as to develop an "intelligence" that will make it possible to choose the best course of action and to design the best organizational and institutional structures capable of attaining the effective sustainable development of the system.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.28 Strategic Planning and Project Management for Water Resources and River Basin Management
Armando LLOP
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To use strategic planning as a means to identify and develop strategic action projects at the water system or basin levels; i.e., the application of the "think globally, act locally" principle.

RATIONALE:

At present there is broad consensus on the need for integrated water resources management or for basin management, which --to a certain extent-- are similar concepts. However, there are discrepancies on what is understood by the integrated management of water resources or river basins. There is a tendency to think that the concept implies the management of each and every one of the resources in a given geographic area. Although conceptually an acceptable idea, it is very difficult to make it operative since the simultaneous handling of so many elements requires efforts, operators, etc., which are not available as a rule.

It is then proposed to "think globally", a means to systemically understand the context in which the hydrologic cycle, water use, environmental impacts, etc. take place. Analyzing this context calls for an interdisciplinary, intersectoral and interinstitutional approach. This means that the workings of the system should be perfectly understood so that, when one acts on one of its components, it is possible to foresee the impacts on the others. An appropriate methodology to do this is that of strategic planning performed in cooperation with the main operators and users of the water system or basin.

Once the main lines of strategic planning are defined, it is proposed to "act locally" by defining specific action projects that can be implemented through the project cycle.

An iterative planning-action project mechanism will make it possible to achieve an integrated water resources or basin management system.

A.29 Caution Against Using the Market as a Water Allocation Mechanism In Developing Countries
Armando LLOP
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

Before legally instituting the market mechanism as water allocator, it is necessary to undertake a detailed evaluation of its impacts on the sustainability of rural communities and minority groups, and to consider which related mechanisms can be implemented to control environmental impacts.

RATIONALE:

Latin America and the Caribbean have recently shown a marked tendency to promulgate water laws that incorporate, without major restrictions, the market mechanism as water allocator. Apparently, this tendency stems from the Chilean experience, whose water legislation incorporated it more than ten years ago. Also, from an ideological point of view, many professionals who are not economists hold the idea that, just by assigning property rights to water resources, all water allocation conflicts will be automatically solved (principle known as Coase's theorem). Unfortunately, the dysfunctions and inefficiencies resulting from the enforcement of the Chilean Water Law and the inapplicability of "Coase's Theorem" are not known.

It is important to recall an old paradigm of economic sciences which states that the market can be an effective tool to solve many problems, but that it will never be able to solve extreme poverty or environmental problems. This is why, when incorporating the market mechanism in water allocation --water being considered an ordinary asset-- it is necessary to establish other mechanisms to protect rural communities, aboriginal inhabitants, minority groups, communities deprived of information or with a low level of instruction, etc., and to provide them with sustainable conditions for the use of water resources. Likewise, mechanisms should be devised to permit the internalization of the externalities that occur naturally in any water system or basin and which are not taken into account by the market. This can be done by incorporating appropriate mechanisms to obtain genuine funds.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.30 Decentralized and Autarchic Regulatory Agencies for Water Resources Control
Elsa CORREA de PAVÓN
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

Within the State Reform process, it is necessary to separate clearly regulation and control roles from policy-making and management roles, whether at the national, local or regional level. In order to be able to perform the regulation and control role, decentralized and autarchic agencies should be set up at the said levels.

RATIONALE:

The proposal is based on a classification of the roles of the State, historically confused and --in many cases-- performed at the same level. All countries are rethinking the State's functions, a good opportunity to discuss how to improve the integrated management of water resources and the environment while ensuring the system's manageability and sustainability.

In the field of water resources, a modern State can perform its functions at three levels:

1. A strategic-political level, at which medium- and long-term strategies are outlined, goals and objectives defined, projects and programs promoted and financed, and the strategic control of such programs is implemented. The appropriate organizational structure is made up of political public officials at a high level in the Central State.
2. A regulatory and management control level, which analyzes and recommends the legal and regulatory framework which is to determine the rights and obligations of each of the system's actors, enforces regulations (technical, economic and legal), and solves conflicts of interests among sectors. Public officials at this level should have autonomy and decision-making capacity, free from the political contingencies of the administration in office. The most appropriate organizational figure is autarchic, the appointment of officials being independent from the interests of party politics, and with the participation of representatives of the different private and public actors of the water system.
3. A management level proper, at which material and human resources are combined to achieve specific objectives for the basin or water system under consideration. In every case, the most suitable organization depends on the characteristics of the water development system, which may be private, semi-public or public.

By separating roles, each organization can have well-defined and specific objectives, responsible parties can be identified, results can be measured, and cross-controls can be used. All this contributes to the system's long-term manageability and enhances the transparency of public management.

In federal countries, like Argentina, it is highly recommended that the regulatory and control role be performed at the national level with the participation of areas or regions within a common legal system.

A.31 Community Participation In River Basin Management
Graciela FASCIOLO, Amelia SIMONE and Oscar ZOIA
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To foster leaders' and community participation in river basin management through educational campaigns to raise environmental awareness.

RATIONALE:

One of the key factors for environmental socio-economic development is participation and the commitment of the different actors of the basin or water system being managed. In this context, community participation is essential.

Community participation consists in a communication process between managers and citizens that makes it possible to learn about their respective and mutual interests and viewpoints.

A formal mechanism for participation is public hearings, provided for in many current environmental laws. This and other types of participation should be encouraged through education facilitated with group practice and organizational development exercises in a continuous training-action-participation process. In these processes, information and communication components, for which there are modern communication systems available, are essential.

Environmental research agencies should be active facilitators in the education process, contributing to the identification of critical environmental problems and to the development of group activities.

Environmental education is an essential element in river basin management for communities --and their leaders-- to participate in a critical and conscious manner in defense of nature and of their own interests.

A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.32 Strategies for Protecting Surface and Groundwater Sources by Means of Management Mechanisms

Patricia PUEBLA
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To design and apply management systems in order to prevent the degradation of surface and groundwater sources through the adoption of regulations and an efficient organizational scheme.

RATIONALE:

In Latin America and the Caribbean there are numerous cases of increasingly polluted water sources which feed systems used for the provision of drinking water supply services, for example. There are cases of groundwater which has been salinized or polluted with different contaminants, such as nitrates discharged by treatment plants or septic tanks. In like manner, surface water systems also undergo quality degradation processes due to land use, deforestation, etc. in the upper basins.

In view of the above, it is necessary to set up an organizational management and preventive control model to help avoid such degradation processes.

An adequate management model should provide for the creation of protected areas according to the pollution risk for the different water bodies, whether they be surface or groundwater. Water quality standards should be determined for each one of the activities authorized in a given area and a monitoring system should be adopted to follow the pollution process. Such a monitoring and control system should be simple and effective so that non-compliance with the regulations in force can be quickly detected.

Adequate coordination among the sector agencies, the enterprises subject to use restrictions, and the users and beneficiaries of the control system will contribute to its effective operation.

A.33 Socio-Cultural Aspects of Organizations Engaged in Environmental Management Improvement
Amella SIMONE de MASAGLI
Instituto Nacional de Ciencia y Técnica Hídricas

ACTION STATEMENT:

- * *To analyze the psycho-social system of organizations as a step prior to their transformation.*
- * *To implement a human resources development program to accompany the organizational change and capacity-building processes.*

RATIONALE:

Recent megatrends in water and environmental issues show that current emphasis lies on management. The subject has been dealt with at all the regional meetings that have been held lately, which have assigned great importance to the recent deregulation, decentralization and privatization processes. These processes have brought about a deep transformation in water, energy and environmental management, as well as a drastic change in the role of the State.

Most state agencies are imbued with a bureaucratic culture which is necessary to transform. In the first place, the situation calls for a diagnosis that will make it possible to uncover the internal cultural elements which hinder the development and efficient management of the organizations and limit the State's de-bureaucratization and modernization processes.

The cultural diagnosis, which helps detect the factors that restrict or foster changes, should provide the basis on which to design an institutional training program that takes those elements into account. It should be borne in mind that the quality of management depends on the nature of the organizations and on their human and technological components since, to a large extent, results and products depend on the quality of their people. If, when implementing changes, the people are not taken into consideration, the changes will be merely cosmetic.

The search for new management methods does not admit of the simple copy of ready-made models as the contingency approach is already a paradigm of administrative sciences. This means acknowledging the fact that organizations have socio-cultural specificity and develop within given contexts, use different technologies, and are the product of the particular institutional histories which have shaped their identities. It is then dysfunctional to attempt to transfer appropriate models and methodologies to other contexts.

A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.34 Towards Integrated Water Resources Management in Colombia

Claudia Inés MESA B.

Unidad de Política Ambiental,

Departamento Nacional de Planeación, COLOMBIA

ACTION STATEMENT:

To undertake varied parallel actions ranging from the formulation of a research and assessment program to the summoning of the different organized actors that exert an impact on water resources at the national, regional and local levels.

RATIONALE:

Almost 1000 rivers flow through the country; there are more than 2.5 million hectares of wetland areas, the average water yield is 58 l/km² with marked interregional and intertemporal variations due to the hydrologic cycles. Despite the abundance of water, alterations in the ecosystems that regulate water have given rise to problems such as water shortages, water over-exploitation and pollution, and signs of desertification in different areas of the national territory. In fact, the serious social and political problems affecting the country have allowed disorganized population settlements and an excessive or wrong use of the environment. Little experience in public management participation together with the traditional scheme of water management have further contributed to this situation.

In accordance with the participatory and decentralized democracy principles held in the new Colombian Constitution, our country is in the process of formulating and developing an integrated water management policy that incorporates the new international concepts and scenarios for sustainable water management.

Global water assessment, consensus among the different actors interacting with water resources, and generation of adequate and efficient technologies constitute essential action lines.

The objective is to ensure the long term supply of water throughout the country in terms of distribution, quantity and quality so as to equitably meet socio-economic needs within the framework of sustainable development. There are eight action lines: a. water resources research and assessment programs; b. an institutional scheme within the framework of the National Environmental System; c. organization and planning; d. technology transfer; e. strategies for citizens' participation; f. environmental education strategies; g. financial strategies design; h. binational coordination.

A.35 Integrating Belize's Water Resources Management, Policies, Planning and Organizations.
Rudolph S. WILLIAMS Jr.
National Hydrological Service
Ministry of Energy, Science, Technology & Transportation, BELIZE

ACTION STATEMENT:

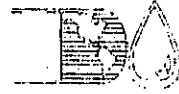
The adoption of the Water Resources Management report, the enactment of the Water Resources Commission Bill, ensuring the development, conservation and protection of Belize's water resources.

RATIONALE:

Legal provisions regulating the use, development and protection of water resources are scattered in numerous enactments, some of which date back to when Belize was a British colony. These enactments covered, directly or indirectly, sectorial aspects of water resources management, e.g., water supply and sewerage, fishing, hydro-power, sanitation, pollution, etc., separately. Each legal text provides for its own implementing institution, so that several government departments and agencies are responsible for the management of water resources within their respective sectors, without any coordination being sought. Important aspects of water resources management, such as those relating to groundwater, are not handled.

Each sector has been regarded as a tight compartment, and apparently, during the process of assigning management functions relating to a given sector to one institution, no efforts have been made to ascertain whether other institutions were vested with such functions under legislation in force and whether such legislation was obsolete. Thus, there is inconsistency among legal provisions and a number of institutions perform the same functions.

Aware of the need to overcome fragmentation in the existing system of water resources management the Government of Belize is presently reviewing the reports and proposed legislations prepared with the assistance of the Food and Agriculture Organization of the United Nations (FAO). The implementation of these proposals will eliminate confusion, duplication of functions and responsibilities and potential conflicts among implementing sectorial institutions. It will also enable the adoption of clear-cut water resources management strategies, and facilitate the planned allocation of water use rights, the conservation, and protection of water resources against pollution.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.36 Strategies to Ensure the Integrated Management of Water Resources through the Implementation of Data and Information Collection Programs

Julio C. de Lio, Carlos A. Angelaccio and Raul A. Lopardo
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To establish, with multinational assistance, water data collection programs for the systematic monitoring of surface and groundwater quantity, quality and uses. Special emphasis should be laid on areas exerting great water demands, undergoing marked development, and posing human health hazards.

RATIONALE:

The collection of water resources data in Latin America has historically been deficient on account of the time and efforts it requires, which are incompatible with the political conjuncture. Thus, the well-known lack of investments in the field in Latin America.

Since the current privatization of water utilities has further deteriorated this situation, it is necessary to carry out a survey of present conditions that will make it possible to advance solution proposals appropriate to local circumstances. This calls for the involvement of the private firms taking over the utilities and the promotion of multinational assistance.

Basic information is essential for efficient decision-making water resources management.

On the other hand, the creation of national data bases calls for the support of adequate financing and cooperation programs as well as for awareness on the part the private, national, provincial, and regional actors. Water use must be optimized and the many conflicts which in the past prevented the exchange of data can today be overcome by means of information network technologies.

A.37 **Interinstitutional Coordination for Environmental Risk Warning in Transboundary Basins and the Littoral**
Carlos A. Angelaccio and Julio C. De Lio
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To establish communications and coordination schemes in order to provide effective technical responses to transboundary environmental emergencies in river basins and the littoral.

RATIONALE:

In the continent there are extremely important basins in which downstream countries receive their river waters without previous knowledge of their quality. These rivers are sources for important consumptive uses by large populations. Under these circumstances, in view of future increases in river transport and in case of potential situations of environmental emergencies due to uncontrolled discharges, modifications in sediment rates by anthropic actions, over-saturation of dissolved gases, or any other special circumstance, there is no communication among technical agencies to provide an answer concerning the evolution of such phenomena or to furnish remedial actions.

This action statement aims at establishing effective communications among the environmental monitoring agencies of co-basin countries in order to exchange specific information, analyze emergency scenarios, carry out joint simulation exercises, and develop adequate technical responses to undesirable situations.

The proposal is applicable to similar situations in the littoral, especially when the discharge of hydrocarbons can migrate down the littoral and out of the jurisdictional waters of each country of the region.



A. INTEGRATED WATER RESOURCES AND RIVER BASIN MANAGEMENT

A.38 Assessing the Institutional Structure of Research and Training Centers in order to Establish Strategies that will Ensure the Integrated Management of Water Resources

Julio C. DE LIO, Carlos A. ANGELACCIO and Raúl A. LOPARDO
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

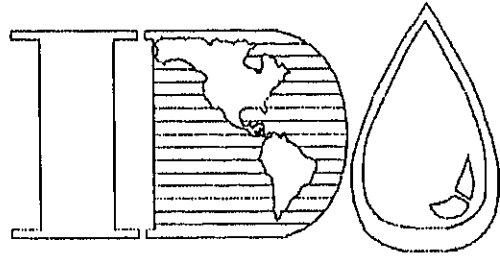
To promote the creation of national committees that will be entrusted with the responsibility of surveying the institutions engaged in research, development, technical assistance, and professional training activities with a view to assessing their respective institutional capacity for improving water resources management and facilitating decision-making.

RATIONALE:

All the countries of the region have a large number of institutions --whether international, national, provincial or regional-- engaged in different aspects (usually partial) of water resources research, development and training. In Argentina, most of these institutions belong to the sphere of the state, often with conflicting interests, and compete among themselves and with the private sector.

In the case of Argentina, for instance, it has been estimated that a commission made up of specialists from the Dirección Nacional de Recursos Hídricos and INCYTH could submit a complete report within a reasonable period. The report would yield objective information on the activities performed and on the human and material resources available at each of the institutions surveyed.

The findings of such a report could be especially relevant for both the local and regional agencies which finance and support research and training activities on water resources management. The information could be used to eventually orientate the centers towards appropriate lines of research and training and to establish priorities for a better



**LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE
DEVELOPMENT**

B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.1 Regional water supply development in South Florida- planning for existing and future human and environmental needs.

Irene KENNEDY QUINCEY

Pavese, Garner, Haverfield, Et Al., USA

ACTION STATEMENT:

Immediate institution of a regional water supply development program to include scientific evaluation, feasibility analysis, reasonable and affordable alternatives and timely implementation.

RATIONALE:

Florida has long since recognized the need for water supply development. At least 25 commissions have provided recommendations on water since 1971. The common theme was that water supply development cannot be accomplished through regulation. Future water supply sources must not only be identified, but must be funded. Regardless, there continues to be discord over implementation to the extent that parochial interests threaten the very nature of Florida's water law. To focus discussion and arrive at action-oriented results, Florida must develop a four-step process for regional water supply development.

Supply augmentation as opposed to regulation is needed. First, there must be a technical evaluation for the water resource needs of natural systems, the population, urban and agricultural needs. Questions over restoration goals, or future land use must be resolved early. The second step must be the development of specific alternatives including the feasibility and economic analysis. Important to this step is a fair evaluation of whether the alternative provides for water development in a timely manner so to meet the needs of the users without a drop in the level of certainty for water use. The third phase involves the selection of a balanced alternative(s) with public input and scientific review. Any additional regulations, responsibilities or funding requirements must be identified.

Implementation is the final phase; which includes financing, land acquisition, public works, and regulation. Retrofitting of existing permitted systems should be shared by public and private sources. Interim plans should be proposed, if necessary.

B.2 Wastewater Reuse to Prevent Water Pollution
Carlos GONZÁLEZ-Antón ALVAREZ
Universidad de León, SPAIN

ACTION STATEMENT:

Hydraulic regulations should not only permit but also promote wastewater reuse as a means of saving water resources and minimizing pollution.

RATIONALE:

Wastewater reuse can be carried out by the users themselves, by local governments or by third parties.

We understand that state legislation should promote the reuse as it entails water saving.

However, it should be pointed out that a legal problem may arise with concession systems: returns are calculated to grant excess waters to downstream users. Reuse, in this case, might imply that no resources will be available for later concessions, as flows would be kept within a closed circuit. Yet, we understand that through reuse upstream users can save water, thus allowing for a continuous water supply to downstream users.

As regards reuse by the users themselves --usually of the industrial type-- promotion policies should be adopted for the installation of water saving and recycling devices.

Water reuse by local administrations should consist in the use of duly treated wastewater for watering lawns and streets and for other uses that do not require high quality water. High-level administrations should encourage local administrations to install the systems that permit these uses.

Reuse by third parties entails greater legal problems; regulations should be made flexible so as to allow participating users (municipalities, irrigators' associations, industrial parks) to negotiate quality and quantity requirements among themselves.

This policy will not only promote water resources saving but also a reduction of pollution levels.



B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.3 Link the water sector with the national economy, to address water scarcity, environmental degradation and unequal access to water resources.

B. G. APPELGREN and Wulf KLOHN

Land and Water Development Division, FAO, Rome, ITALY

ACTION STATEMENT:

Enunciate policy and mechanisms at national level for:

- (a) *integrated water and land resources and physical, landuse planning ;*
- (b) *integration of water sector policy with macro- and sectoral social, economic and environmental policy and national economic planning; and*
- (c) *strategy for implementing integration: (e.g. water scarcity, water pollution, versus e.g., growth, equity, food security...)*

RATIONALE:

As water resources are getting scarce there is the need for broader management measures which goes beyond specific policy measures, such as water allocation, water pricing and water markets restricted to the water sector. For example there might be the need to adjust agricultural and food self-sufficiency policy, review current fiscal policy and the impact on water demand and water conservation and appraise the regional development and urbanization policies. These form important and long term considerations for economies, and where water, as a critical, often scarce and always necessary resource would play a strategic role for sustainable national development. These are time-consuming measures, that need to be well planned and initiated in a timely manner to address issues for future water security.

B.4 Water Use and Economic Incentives for River Basin Conservation
Guillermo RUDAS LLERAS
Ministerio del Medio Ambiente/Universidad Javeriana, COLOMBIA

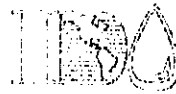
ACTION STATEMENT:

A method to estimate the value of economic incentives for river basin conservation that are attractive to water users (beneficiaries) and to those in charge of river basin conservation.

RATIONALE:

Of the various functions performed by a forest ecosystem (biodiversity conservation, CO₂ capture and retention, landscape, etc.), water flow regulation has direct beneficiaries: water users (aqueducts, irrigation districts, etc.).

The benefits derived from river basin conservation can be estimated on the basis of the costs that users do not have to pay when they have a regular water supply. In order to obtain this kind of supply, the forest in the upper basin should be protected, which implies that landowners should bear the opportunity cost. If this cost function is related to the benefits, it is possible to estimate a value for the incentives that is attractive to both actors: the water users and the landowners responsible for river basin conservation.



B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.5 Water Pollution Rates: Funding Mechanism or Economic Instrument?

Guillermo RUDAS LLERAS

Ministerio del Medio Ambiente/Universidad Javeriana, COLOMBIA

ACTION STATEMENT:

Mechanisms for the application of the "polluter pays" principle in Colombia as a means to reduce water pollution.

RATIONALE:

Originally, Colombia set water pollution rates in order to obtain revenues to finance environmental activities. At present, the rates are conceived of as economic instruments to induce changes in the behavior of those who pollute waters. Although the law that establishes these rates imposes some restrictions (for instance, they can only be charged to those who are within the pollution ranges authorized by environmental standards), an application mechanism is being designed to make them effective as an economic instrument. Besides, the law conceives of them as a strictly Pigouvian tax; however, at a first stage they are being designed as a cost-effectiveness instrument, aimed at enforcing water quality objectives at a minimum cost. An interpretation of the mechanisms that are designed to apply this tool and an analysis of its scope and limitations will be presented.

B.6 Using revenues of urban water utilities to fund protection and conservation of their watersheds
Willam RHOADS
The Nature Conservancy, Virginia, USA

ACTION STATEMENT:

To protect the quality of the water that urban water utilities get from nearby watersheds, these utilities should finance the protection of their watersheds.

RATIONALE:

Many urban areas collect water from watersheds that are rich in biodiversity. These watersheds are often natural parks or reserves, yet they are not being adequately funded to protect, conserve and restore the watersheds and their biodiversity. If this is not done, the quality of the water they yield, and/or their minimum flow in dry seasons, may be degraded, thus forcing water utilities to take expensive measures to offset this deterioration. Modest expenditures now to protect and conserve watersheds can avoid expensive projects in the future.

Some urban water utilities are now making, or plan to make, payments to conservation organizations to protect and conserve their watersheds that are in parks or reserves. All urban water projects and programs should include elements to protect the future quality of water supply by funding now the conservation and restoration of their current and future watersheds. Non- governmental conservation agencies now assisting governments in conservation of parks and reserves can also assist water utilities in protecting, conserving and restoring their watersheds.

The following statement should be included in the measures concerning water for the upcoming Summit Conference for Sustainable Development in Bolivia this December:

"Implement the principle and practice of using water utility revenues to fund watershed protection and biodiversity conservation, including the establishment of appropriate funding mechanisms."



B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.7 International Pollution Prevention Declaration
Natalie ROY and Ken ZARKER
Regulatory Integration Workgroup
U.S. National Pollution Prevention Roundtable, USA

ACTION STATEMENT:

Pollution prevention has been recognized as a preferable and cost-effective environmental management tool. Partnerships with member nations and indigenous peoples are needed to develop an International Pollution Prevention Declaration to support pollution prevention and cleaner production principles by all nations.

RATIONALE:

Pollution prevention is the reduction or elimination of pollution at the source. Pollution prevention results have "bottom line" benefits including: reduced waste treatment and disposal costs, reduced potential liability costs of pollution cleanup, cheaper raw materials, higher quality products, better environmental compliance, lower government fees, improved worker health and safety and a holistic environmental improvement.

The purpose of this Issues statement is to provide an opportunity to review the draft Pollution Prevention International Protocol developed by the National Pollution Prevention Roundtable for consideration by countries of the Western Hemisphere. This protocol seeks to direct resources to the study, development and implementation of pollution prevention approaches in the Americas.

The protocol includes a Plan of Action to work cooperatively with fellow colleagues from around the world to solve pollution problems, focus on multi-media solutions, and commit resources to pollution prevention and cleaner production programs.

The National Pollution Prevention Roundtable is the largest membership organization in the world devoted solely to pollution prevention. The Roundtable provides a national forum for promoting the development, implementation and evaluation of efforts to avoid, eliminate, or reduce pollution at the source.

B.8 Water Resources Regulation in South America
María Luisa BALTRA VERGARA
Instituto de Derecho de Minas y Aguas,
Universidad de Atacama, CHILE

ACTION STATEMENT:

In order to improve water distribution, use and management, it is necessary to undertake studies that will make it possible to achieve an effective water development not only at national but also at regional levels.

RATIONALE:

Water is a scarce, depletable natural resource.

Water cannot be comprehended in isolation; it must be considered as part of nature, interacting with other natural resources, which influence to a greater or lesser degree the development of various activities, such as agriculture, industry, mining, and electricity, which have a bearing on the economic, social, and cultural development of every country.

For a better use of the resource, it is convenient to conduct climatic, morphological, geological and geographical studies that will permit to assess the current condition of the resource in its liquid, gaseous and solid states, and thus plan its better use and disposal. Once the first conclusions have been drawn, it is suggested that the experiences of every country be projected to South America so as to bring into uniformity basic water concepts, and to capitalize on the experience of other countries, such as Mexico, Spain and the United States, in this as well as in related fields. This should facilitate the planning of water use and management policies first at a regional and, later on, at a national level.

These studies become more relevant in the case of transboundary watersheds, as co-basin states are likely to face different legal and economic conditions.

The establishment of regional criteria that will permit to adapt national legislation will contribute not only to an effective water management but also to the growth of all economic, political, social and cultural sectors in South America.



B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.9

Michael POLLEN
Water Environment Federation

ISSUE STATEMENT:

The Water Environment Federation (WEF) is an international association of water environment professionals working to preserve and enhance the global water environment. WEF believes that worldwide too little attention has been paid in the past to the provision of adequate sanitation and the control of water pollution. The consumption of polluted water or sewage-contaminated foods is a principal cause of health problems that result in extensive human suffering. Further, the economic and environmental consequences of failing to protect water resources are devastating and will affect future growth.

WEF is pledged to lend support to all constructive efforts that contribute to the protection of water quality.

It is believed that the following are important issues that should be addressed:

- The true cost of poor sanitation in the hemisphere has many elements, including the cost of treating enteric diseases and the impact of these illnesses on economic productivity. This must be recognized so that the investments required to develop environmental infrastructure can be compared to the real cost of failing to provide these systems.
- The public must be made fully aware of the consequences of water quality degradation and of the true cost of providing high quality waters to protect public health. Only in this way, will the public recognize its role in the protection and enhancement of water quality and be prepared to support sound water quality protection measures.
- Rational regulatory programs, based on sound science, should be supported and enforced. To the maximum extent feasible, water quality programs should be designed, prioritized, and implemented in the context of watershed units.
- The proper management and operation of wastewater treatment facilities must be emphasized in terms of facilities design, maintenance, and training.
- The beneficial recycling/reuse of appropriately generated and treated residuals from wastewater treatment (biosolids) should be encouraged.
- Pollution prevention should be promoted - whenever possible, the control of toxic chemicals should be directed towards eliminating these at source. To this end, governments could consider the use of economic incentives for the introduction of cleaner technologies or for other pollution prevention achievements. The active support and participation of community representatives and leaders in pollution prevention programs should be sought. This will help create support for water quality protection and sustainable development programs.
- Water conservation, reclamation and reuse should be promoted. Wastewater must be treated adequately to remove harmful contaminants or decrease these to a level at which human health and the quality of receiving waters are protected.

B.10 Warnings and Recommendations Concerning the Sustainable Expansion of the Rice Frontier in South America
Héctor M. CURRIE
Facultad de Ciencias Agrarias
Universidad Nacional del Nordeste, ARGENTINA

ACTION STATEMENT:

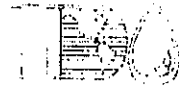
The expansion of rice farming through the conjunctive use of surface and groundwater calls for the application of sustainable policies in South America.

RATIONALE:

Rice farming in South America has greatly increased as regards both spatial expansion and productivity. The countries involved are Uruguay, Brazil and Argentina. Uruguay is expanding towards the Argentine littoral while the traditional cropping areas in the other two countries are pushing south.

From the turn of the century and up the 70s, rice was irrigated with surface and groundwater. On account of its genetic characteristics, rice production took place in more active heliophanic regions, a situation which called for new water use methods, such as deriving water from reservoirs, and which created conflicts between upstream and downstream users. Excessive pressure on groundwater in areas lacking adequate topography for the construction of dams led to their collapse.

Warning: It should be borne in mind that the critical situation of groundwater and the use of reservoirs affect sustainable development.



B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.11 Support Methodologies for Decision-Making Concerning Water or Basin Systems Characterized by Multisectoral Water Use and Hypercomplexity
Valeria MENDOZA and Patricia PUEBLA
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To summon university science and technology organizations to collaborate in the development of models for the multi-attribute assessment of different water resources strategies, investment policies and development actions.

RATIONALE:

Until now, water use has been poorly planned and based on the policies and capabilities of each water use sector. This results in great inefficiencies and undesirable environmental impacts which have to be remedied.

In order to understand the overall water system and devise quantitative elements that will allow decision-makers to foresee the consequences of each of their decisions, a multi-attribute assessment method (trade-off analysis) is recommended. The methodology consists in the use of simple assessment methods so as to know the most important attributes of each potential decision, such as a given action's profitability, its quantitative impact on other sectors (water savings, reduced salinization rate, toxic gas emissions, rate of depletion of non-renewable natural resources, etc.).

B.12 Water Management Turnover to Users as a Mechanism to Promote an Efficient and Integrated Surface and Groundwater Use
Oscar ZOIA and Patricia PUEBLA
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To establish mechanisms to educate and raise awareness among surface and groundwater users of the degradation processes affecting the resource, and to promote the formulation of management and control strategies and instruments. To this end, the participation of all motivation agents should be ensured so as to facilitate organizational development for the integrated management of surface and groundwaters.

RATIONALE:

Up to the present, the cases in which users have achieved a rational Integrated management of surface and groundwaters management that fulfils the objectives of water use efficiency, equity and quality conservation are rare. Water management agencies have generally focused on surface water while groundwaters experience the so-called "tragedy of common goods". It is then necessary that users attain an organizational development that permits the harmonious and integrated management of sources according to their origin.

In order to achieve such an organizational development, existing agencies should undergo important institutional and cultural changes. This includes a transfer of roles from the public to the private sector, and an increase in the number of functions performed by water users' organizations. Besides expanding their participation in the operation of the system, water users' organizations must devise a strategy for the integrated management of surface and groundwaters that will make the sustainability of natural resources possible.



B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.13 "Clear Waters" Generated in Dams and their Impact on Hydraulic Infrastructures and Downstream Irrigated Areas

María E. QUILES and Silvia M. SAURINA

Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

The environmental impacts of large dams in the Argentine west point to the need for alternative structural measures and for the design of mitigation strategies before undertaking this type of constructions.

RATIONALE:

On the basis of empirical evidence from the experience with dams built in the provinces of San Juan, Mendoza, Neuquén and Río Negro a number of downstream environmental impacts can be identified:

- (a) water table rise or water-logging in the irrigated areas, which brings about changes in cropping patterns and the abandonment of lands;
- (b) salinization of agricultural soils, which leads to a drastic drop in productivity;
- (c) erosion of downstream river beds and banks;
- (d) proliferation of algae;
- (e) weakened and unusable hydraulic infrastructures downstream due to the greater erosiveness of water;
- (f) increase in the frequency and intensity of floods in urban and agro-industrial areas located in irrigated regions;
- (g) damages caused by water-logging in basements and septic tanks.
- (h) etc.

In addition to the above, a marked reduction in water conveyance efficiency calls for zonal and plot drainage systems to eliminate infiltration.

The El Carrizal Dam on the Tunuyán River and the dams on the Diamante and Atuel rivers (Agua del Toro, Los Reyunos, Valle Grande, and El Nihuil) --all of them in the province of Mendoza-- are examples of negative impacts. Another example is the Ullúm Dam, upstream of the "viejo derivador Ignacio de la Rosa" in the province of San Juan.

As sediments are left behind in a dam, "clear waters" become very erosive and cause the above-mentioned problems downstream. This is common in arid and semi-arid regions, where waters carry high sediment loads. The impacts produced were not foreseen when the works were designed, but they are felt many years after their construction.

The objective of this proposal is to identify the impacts produced and formulate mitigation or control policies and measures in order to attain sustainable development.

B.14 Develop Programs to Build Capacity and Educate Decision Makers, Professionals, and the Public About Water Issues

Raúl LOPARDO, Julio C. DE LIO and Carlos A. ANGELACCIO
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

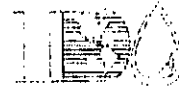
ACTION STATEMENT:

1. *Support the development and use of modular educational materials which describe the importance of water resources to society and the environment, public health issues, general water issues, and specific actions that individuals can take to protect water resources from depletion and pollution. Training modules should be targeted for primary and secondary school students up to and including decision makers and the general public, with special attention to the needs of women and indigenous peoples. Hemispheric materials should be prepared with support from the United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Institute for Training and Research (UNITAR), UNEP, IDB, and the World Bank using existing and hemispheric material and local expertise which should be made available to national educational systems.*
2. *Request IDB, World Bank, GEF, and other multilateral organizations to support the development and use of training programs for technicians and operators of facilities and operations that can affect water resources and the environment and to raise their awareness of the possible impacts of their actions unless proper procedures are followed.*
3. *Implement capacity.-building programs that include: creating an enabling environment with appropriate policy and legal frameworks; promoting institutional development, including community participation; and fostering human resources development and strengthening managerial systems with the support of intergovernmental organizations, such as UNDP, UNEP, and OAS..*
4. *Request that organizations, such as UNEP and OAS, promote the full utilization of existing regional training centers, programs, and institutions to provide both centralized and on-site training of water resource managers from the public and private sectors in the Americas.*
5. *Promote horizontal technical aid strategies for the transfer of experience and appropriate technologies for water collection and treatment, distribution, and protection among countries of the region.*
6. *Request IDB, World Bank and other multilateral organizations to require that information about project plans, project social and environmental impacts, and project costs to be made available to the general public in a timely fashion as part of a public information system. This program should be part of each project and project funds should be dedicated to the training of nationals.*

RATIONALE:

The training of managers, professionals and of an informed public is critical to the successful implementation of integrated water resources management.

Technicians and operators can exert an impact on water resources and the environment and they should be informed of the possible effects that their actions can have unless adequate procedures are followed.



B. LEGAL AND ECONOMIC WATER POLICES TO SUPPORT SUSTAINABLE DEVELOPMENT

B.15 The cost of water in Ceara, Brazil.
José Carlos DE ARAÚJO and Francisco LOPES VIANA
Companhia de Gestao de Recursos Hídricos do Estado do Ceará, BRAZIL

ACTION STATEMENT:

The semi-arid state of Ceara needs urgently a rational management of its waters, for whose purpose the water tariff is an important instrument.

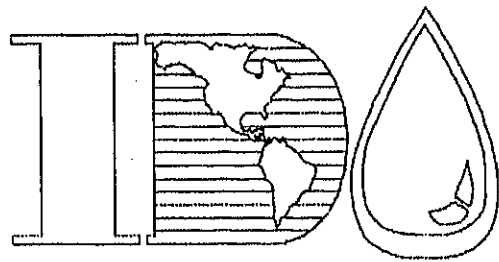
RATIONALE:

The Water Resources Management Company of Ceara (COGERH), created in 1993, started its action by organizing the users of the water system (specially the irrigators); operating twenty dams (capacities from 20 hm³ to 2.100 hm³); and collecting processing data, water tariff studies included.

The implementation of water tariff in Ceara, whose history is deeply related to severe and frequent droughts, must overcome serious difficulties, such as cultural resistance, absence of a clear water allocation policy and lack of technical data, among with its cost and social and economical impacts of the tariff.

Recent investigations on water cost were performed by means of three different methods; the historical investments and maintenance costs; the investments needed for further improvement of the system; and the costs of operating and maintaining the present system.

The results show historical cost of water of about 0.030 US\$/m³. New investments, divided by the increase of water offered, range from 0.014 US\$/m³ to over 10.00 US\$/m³. The last was verified for planned action upstream Orós dam, due to negative hydrological impact of new reservoirs. Yet, other advantages are brought up by the action, but are not accounted in the calculations, such as better spatial distribution of water and its social and economical impacts. Except for the extreme high value, the costs range from 0.014 to 0.140 US\$/m³. The cost for operating and maintaining the present system, depending on the basin in the state, range from about 0.010 US\$/m³ to 0.025 US\$/m³, investments not included.



**STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND
EXPERTISE WITH WATER TECHNOLOGIES**



C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.1 The Vital Issues Process... an Effective Strategic Planning Tool to Integrate Stakeholders' Spectrum of Objectives

Jorge I. VELEZ AROCHO, Dennis ENGI, Nestor Ortiz, William FREY
University of Puerto Rico at Mayaguez, PUERTO RICO

ACTION STATEMENT

Decision makers need a structured mechanism for identifying and prioritizing a portfolio of strategic issues, programmatic areas, and responses to effectively manage water resources.

RATIONALE:

Decision makers need information and, in fact, knowledge --not just raw data--to effectively manage water resources. This information is of two kinds: geophysical and socio-economic. The Vital Issues Process (VIP) has demonstrated its capability to provide input that is useful to sponsoring organizations. Stakeholder participation in the strategic planning and decision making processes can also stimulate buy-in on the part of the broader constituent community and generate a climate that will promote the successful implementation of programs for effectively managing water resources. This process is being implemented in Puerto Rico to develop a decision support system (dss) which facilitates the means whereby the raw data is collected, analyzed, and synthesized into information and knowledge which can be used effectively by a decision maker to manage water resources. This process is composed of three stages.

- (1) An initial stage in which a panel of water resources stakeholders agree upon an objective statement and a set of criteria for issue prioritization.
- (2) A second stage in which a different panel of stakeholders identify, define, and prioritize issues for information gathering on the basis of the first panel's objective statement and issues criteria.
- (3) A third panel which identifies the information needs required to address the issues selected by the 2nd panel. The resulting product is a proposal for a decision support system, an information collection, analysis, and synthesis system which provides the decision maker with refined information to facilitate decision making. This proposal will be submitted to the appropriate sponsoring organizations for funding.

There are three considerations that recommend this process as a means of addressing the problems in Puerto Rico with water resource management. First, the process is cumulative: each panel builds upon the work of earlier panels. The first panel started with the results of the Rio Grande vital issue process carried out in New Mexico in April 1995. They debated these results and generated their own objective statement and issue selection and ranking criteria which are being summarized in this report and will be made available to the second panel. Then the results of the second panel will be made available to the third panel. Such a cumulative process provides a means of involving as many stakeholders as possible.

This brings out the second consideration: careful attention is given to identifying the important stakeholders and enabling them to participate in the panels. Water resource management stakeholders are those who impact or are impacted by the management of water resources in Puerto Rico. The organizers of these panels identified some 36 stakeholders which they then divided into four generic groups: government, private industry, the public and academia.

Third, the process is designed to refine and integrate stakeholder fragmentary and partial interests. A past VIP panelist put it well, if not bluntly: the VIP process will walk talented people through a maze; it's tedious but, one would add, necessary.

The necessity, again, comes from the function of the process: it takes partial, fragmentary, and individual stakeholder interests and hopefully integrates them together into something of common value to all participants. By agreeing to the process on the basis of its objectivity and impartiality, the panelists commit themselves to the results even if these don't exactly coincide with their particular interests. Thus the vital issues process is a means of producing stakeholder consensus on difficult issues. Our sense is that this process has the potential to be of great value throughout other parts of the world where water resources management is of vital importance.

C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.2 Information Systems on Groundwater Hydrology Adolfo E. FERNÁNDEZ Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To set up a Latin American geohydrological information network and promote the development of regional systems.

RATIONALE:

Over 95% of the world's drinking water is stored in the sub-soil.

The economic and social value of groundwater arises from its vast geographical distribution and accessibility, major engineering works not being required for its use. This very fact makes it highly vulnerable to level and quality variations, especially in urban areas.

Some countries, such as the United States, have increased groundwater consumption by as much as 65% during the last decade.

Groundwater studies follow a specific methodology, which both calls for and generates a great bulk of information.

Until very recently, commercial software for scientific analysis was very limited. Research findings were recorded on paper as reports, tables, maps and graphs. The management of this type of information (filling, retrieving, consulting, displaying, comparing, synthesizing) was expensive and inefficient due to its obsolescence.

The development of computer display technology has rendered hardware and software more and more accessible every day.

Geohydrological information systems facilitate groundwater management and planning activities. The constant display of groundwater operation and results, which favors intuitive understanding, constitutes a very helpful device for public education in the sustainable use of the resource.

Basically, geohydrological information systems are made up of three main parts: a powerful Data Base; a software package --an Expert System-- designed for groundwater planning and management functions; and another program package, Interphases, that facilitates data input and results display.

Expert Systems operate on the conceptual hydrogeological model for which they were designed and should be re-designed if they are to be used in a different hydrogeological region.

Groundwater reservoirs are not defined by political and jurisdictional boundaries, so it is highly recommended that each geohydrological information system comprises all the countries sharing the geohydrological unit of interest.

In favoring the exchange of experiences and knowledge of groundwater, the setting up of a Latin American network made up of regional geohydrological information systems will exert an immediate positive impact on the sustainable use of the resource. By facilitating fluid communications and exchanges with the sectors engaged in the generation, processing and use of groundwater data, it will be an essential contribution to the constant updating not only of the geohydrological data banks but also of the respective retrieval systems.

C.3 Enhanced awareness of water issues at political and public level.
B. G. APPELGREN and Wulf Klohn
Land and Water Development Division, FAO, Rome, ITALY

ACTION STATEMENT:

Awareness-raising among: politicians, decision makers and senior advisor introducing water conservation issues under political programmes; and the public through public media and primary and secondary education.

RATIONALE:

Successful water management to address immediate issues and secure supplies for different water uses depends on:

- (a) commitment and participation of decision makers; and
- (b) awareness, understanding and appreciation of water users.

While the current attention to water conservation issues in public media is growing rapidly in industrialised countries the level of information activities for understanding and appreciation is low in developing countries. This results in a general indifference and non-appreciation of water values which often used as pretexts for delaying improvements. This leads to careless and wasteful use, over-exploitation and environmental degradation and high water costs.



C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.4 Utilizing Professional Associations for Sharing Water Resource Experiences and Expertise
Bret D. HAMMELL
Blo-Services, Inc., Florida, USA

ACTION STATEMENT:

Professional associations provide a wealth of information and assistance for their members which could be utilized by OAS member states in search of water resource expertise.

RATIONALE:

Western hemisphere governments, industries and private citizens have an informational resources and a ready source of expertise available. Professional associations exist to assist their members via libraries, technical programs, certifications, governmental lobbying, and professional networking. As an example, the Air & Waste Management Association alone has over 17,000 environmental professional members in 65 countries. A new tool, the Internet, provides a means of sharing these assets world-wide at minimal cost.

Most environmental professional associations are putting a great deal of effort in an attempt to expand their membership into Latin America and the Caribbean and have placed an emphasis to creating national, state, and local chapters. Public and private organizations need only contact the particular association active in a certain environmental area to receive assistance.

A recommendation is made that a series of Internet webpages be created at the OAS that will act as a networking tool for public and private organizations in member states, and water resource professional organizations. Professional organizations will list their potential services and points of contact. Also, the Inter-American Water Resource Network (IWRN) sponsored by the OAS is in existence.

C.5 Surf your watershed --An Internet-based Information Transfer Tool

Janet PAWLUKIEWICZ
Office of Wetlands, Oceans and Watersheds,
US Environmental Protection Agency, USA

ACTION STATEMENT:

To be effective environmental stewards, people need information. Internet offers a tremendous opportunity to share water resources and related information.

RATIONALE:

SURF YOUR WATERSHED is a new site on the World Wide Web that allows users in the United States to access environmental information and maps for their community, watershed, or state within the United States. It is under construction by the US Environmental Protection Agency in collaboration with numerous federal, state, local and private partners.

Five primary actions will be available to users of Surf Your Watershed:

1. Locate a Watershed--Search by state name, stream name, zip code or by using a map to determine the US Geological Survey hydrologic unit code for the watershed of interest.
2. Search for information--Access water quality and other environmental data as well as information on demographics, political boundaries, land use and land cover, natural features and organizations at work in the watershed.
3. Link Information--Add information on users' activities.
4. Create Maps--Design a map and request that it be sent by email to the user.
5. Give Feedback--Provide comments and suggestion on line.

Surf Your Watershed is under construction and can be found at <http://www.epa.gov/surf>. We welcome your comments and suggestions. Others interested in developing similar information tools should contact Karen Klima by telephone (202.260-7087) or by E-MAIL (Surf-Link@epamail.epa.gov).



C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.6 A Cooperative Training Program in Water Resource Technologies

Deb J. HALEY

Energy & Environmental Research Center (EERC), USA

ACTION STATEMENT:

Strengthen technical and institutional capabilities for applying cutting edge solutions to water resource problems through a cooperative program of training courses, workshops, and personnel exchanges.

RATIONALE:

Based on the experience of the EERC as a privatized research center transferred from the U.S. Department of Energy to the University of North Dakota in 1983, effective partnerships between government, industry, and academia are the key to resolving complex energy and environmental problems, including water quality and supply problems. Goal-oriented education and training needed to secure future water supplies, to preserve water quality, to control contaminant discharge, and to protect ecosystems should be a multidisciplinary effort that integrates regulatory policy, economics, science, and technology in ways that address the needs of many different stakeholders.

In order to be effective, technology transfer must lead to the commercialization of cutting edge solutions that can be economically implemented in the marketplace. The EERC has a proven track record for implementing technology transfer that leads to commercial application under joint venture arrangements with government and industry.

Based on proven principles, the EERC proposes a series of jointly planned and sponsored policy seminars, short courses, workshops, and personnel exchanges to address water resource needs from the perspective of effective implementation of remedies. Training would be focused on resource assessment, watershed management and rehabilitation, the policy framework for water allocation including model water laws, standards for pollution control and waste management, water conservation and reuse, pollution prevention, economic incentives for pollution control, water cleanup technologies, risk-based methods for setting cleanup priorities, reduction in water-borne illness, low-cost water treatment methods for rural areas, and project financing options.

C.7 Barriers to Pollution Prevention by Waste Utilization
Everett A. SONDRAL
Energy & Environmental Research Center (EERC), USA

ACTION STATEMENT:

Perform a multinational hemispheric study to identify barriers to the utilization of waste materials for the purpose of pollution prevention and devise offsetting economic incentives.

RATIONALE:

Increasing costs and heightened environmental concern are making the casual disposal of municipal, agricultural, industrial, and mining solid wastes an undesirable option. The prevention of such pollution at its source can make an immense contribution to the improvement of water quality. Problems that can be remediated or minimized include mercury contamination from extraction mining practices; toxic metals released from metal refining and plating and chemicals production; polycyclic aromatic hydrocarbons and halogenated hydrocarbons from petroleum and petrochemical refining; nitrate and pesticide or herbicide residues from agriculture; a broad range of organic and inorganic pollutants leached from municipal waste dumps; and the accumulation of nonbiodegradable plastics that is becoming the legacy of modern society.

Many of these problem wastes can be reused as fuels or raw materials, thereby turning serious environmental liabilities into economic benefits in terms of reduced disposal costs, reduced pressure on virgin raw materials, and reduced primary energy consumption and CO₂ emissions.

A number of interrelated technical, economic, institutional, regulatory, and legal barriers need to be remedied to foster increased waste utilization. A cooperative effort by government and private stakeholders, including industry and environmental interest groups, is needed to devise effective incentives.

Technologies are available to beneficially use waste materials as fuels and raw materials. Examples are fuel-flexible fluidized-bed combustors that convert combustible waste to heat and electrical power and nondestructive thermal treatment units that convert plastics to reusable inorganic chemicals. Applications research is needed to match these technologies to local waste utilization opportunities.



C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.8 Desalination Technologies Matching Local Needs Everett A. SONDREAL Energy & Environmental Research Center (EERC)

ACTION STATEMENT:

Perform a survey of novel, low-cost desalination methods, including augmented membrane technologies and freeze thaw methods, adaptable for local treatment of brackish waters.

RATIONALE:

The EERC has demonstrated the effectiveness of a novel, low-cost freeze thaw method for treating saline waters from a petroleum refinery to produce pure, potable water and a concentrated brine for disposal. Work is in progress at the EERC on a centrifugally augmented membrane filter capable of treating wastewaters containing high levels of both suspended and dissolved solids. Other novel methods have been advanced by research centers around the world for treating saline water at various strengths and to various concentration ratios. There are many regions that have access to saline or brackish water, where development is limited not by the volume of the resource, but by the salt content. The choice of desalination technology depends on the water purity required and the degree to which the brine must be concentrated for disposal. Implementation of projects requires that the technology be matched with local conditions. A survey is proposed to identify and classify regional needs for desalination and to recommend appropriate classes of technology for these identified needs.

C.9 Mercury Decontamination
Everett A. SONDRAL
Energy & Environmental Research Center (EERC), USA

ACTION STATEMENT:

Demonstrate mercury decontamination technologies appropriate to local remediation requirements.

RATIONALE:

Mercury pollution from many different sources is contaminating soil and surface water and slowly finding its way into groundwater and ecosystems. Significant sources in various regions may include municipal waste incineration or landfills, extractive mining practices, oil and gas production and storage facilities, fossil fuel-burning power plants, and certain other industries. Mercury is concentrated in the food chain and can be present in fish at concentrations that are harmful to human health.

The EERC has focused on methods for characterizing mercury pollution and remediating soil contamination and process emissions. Different control technologies based on a combination of extraction, adsorption, amalgamation, and/or thermal treatment are applicable depending on the forms of mercury contamination present, whether in elemental or oxidized form. The EERC has devoted a major effort to remediating mercury contamination in the oil and gas industry, where elemental mercury has been discarded in large quantities at well sites, along pipelines, and at storage facilities. A selective survey of mercury contamination throughout the hemisphere is proposed to generate recommendations for selecting remediation technologies for different classes of contamination. The appropriate technologies should then be demonstrated at selected sites.



C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.10 Education of Hydraulic Engineers in Environmental Topics for the Sustainable Development
Raúl A. LOPARDO and Fabián A. BOMBARDELLI
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

Incorporate environmental topics into all the subjects of the hydraulic engineers' curriculum (undergraduate level)

RATIONALE:

The idea is to discourage current efforts at the university level to create a new career to educate future "specialists in environmental sciences". On the contrary, this action would produce "generalists": professionals without specialization that would have a poor participation in the "transdisciplinary" teams formed for the environmental impact assessments.

Nowadays, hydraulic engineers get the environmental knowledge through post-graduate courses which, on one hand, try to fill the empty space in their skills and, on the other hand, are oriented mainly to the identification and assessment of environmental impacts. It is considered, however, that the environmental concept should be present in all the stages of the engineering projects; specially, in the hydraulic projects. To understand this could be possible only if the student faces it since the beginning of its education (primary and secondary schooling) and deepens it during his university studies.

Indeed, the very idea of "environmental preservation" should be an extra "verification" of every hydraulic project -just as works are tested to determine whether they have the required hydraulic and structural capacity-. It is important to point out that true environmental training will not be attained by the mere addition of only a subject called, for instance, "Ecology" or "Environmental Engineering", unless the need of educating with the sustainable development as a framework is understood. Besides this, it is likely that such subject be taken as a simple complement, which is opposite to its incorporation.

It is considered more effective to have a university department devoted to environmental concerns, related obviously with engineering, to train first in this field the trainers of the hydraulic engineers -that's to say, the professors of all the engineering subjects-. In this way, the learning of the environmental idea should be more profitable, subject to subject.

Thus, future hydraulic engineers will be able to reach the requirements of the society and the challenges of the turn of the century.

C.11 Basic Concept: Water - A Factor of the Environment
Jorge R. SARAVIA
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

Strategies devised for sharing and exchanging experiences and expertise in water technologies should promote studies and research on water relationships and interaction mechanisms with each of the other factors of the environment in order to improve water management and control.

RATIONALE:

In view of the fact that water is a physical factor of the environment and that, as such, it is closely connected with all the processes that develop therein.

And given the interaction of the physical and biological factors which make up the environment in the genesis and evolution of the phenomena that take place.

It is essential to study, develop and apply technologies which, by operating on the physical and biological factors of a system, modify its relationships in order to enhance the control, management and use of water while maintaining its dynamic equilibrium.

C.13 Transfer of environmentally sustainable water technologies within the framework of the Basel Convention

Oscar E. NATALE

Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA/
Secretaría de Recursos Naturales y Ambiente Humano, ARGENTINA

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ACTION STATEMENT:

To incorporate sustainable water technologies in the activities carried out by the South American Training and Technology Transfer Center of the Basel Convention.

RATIONALE:

In order to implement the training and technology transfer system for the hazardous wastes covered by the Basel Convention, it was agreed in 1995 to set up a System of Centers in the Latin American and Caribbean Region with branch offices in Uruguay (Regional Coordination), Argentina (South American), El Salvador (Central American-Mexican) and Trinidad Tobago (Caribbean).

The headquarters of the South American Center will be the National Institute for Water Science and Technology (INCYTH), which belongs to the Natural Resources and Human Environment Secretariat of Argentina. Its missions are:

- a) To coordinate, facilitate and implement training programs on the rational management of hazardous wastes, their sustainable technologies, legislation and control.
- b) To collect and disseminate information on the generation and management of hazardous wastes and on their transboundary transportation.
- c) To transfer and demonstrate environmentally rational technologies, mainly those concerning clean production practices and the reduction of hazardous wastes generation; to develop and implement characterization methodologies and to provide technical assistance.

The objective of this proposal is to implement those aspects of water technologies that will make it possible to minimize the generation and transportation of hazardous wastes and that will ensure water conservation in the Americas.

82 To fulfill this objective, the following actions should be carried out:

- * A census of regional institutions and experts in this field.
- * A census of regional technologies and cases.
- * Preparation of a South American manual and atlas of problem cases and sustainable water technologies for hazardous wastes.
- * Design of a training program.



C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.12 Specialists' Exchange Program

Carlos PAOLI

Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To set up an exchange program on a yearly basis for the leaders of specialists' groups in the field of water resources from interested institutions and organizations.

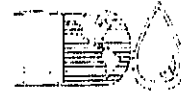
RATIONALE:

In our countries a large number of professionals from different disciplines is confronted with the daily task of leading working groups to find solutions to water use and control problems.

When they have to decide on an approach, on an analysis and calculation methodology, on an alternative evaluation procedure, or on any other issue, they have to resort to all their know-how. But the acquisition of know-how calls for continuous training in specific areas of their professions as well as in water management aspects. There is an aspect, however, which has not always been sufficiently valued: the experience obtained either from direct participation in cases or from an indirect acquisition or "appropriation" of knowledge.

The specialists' exchange program aims at enlarging the appropriable base of case experience through the practice gained when a professional visits another institution. As such, this program is addressed to specialists who lead working groups but who do not hold managerial posts (for those in managerial positions there are more possibilities).

The agreements entered into between INCYTH (Argentina), IMTA (Mexico), IDEAM (Colombia) and many other organizations as well as the Horizontal Cooperation Programs should facilitate the implementation of this proposal.



C. STRATEGIES FOR SHARING AND EXCHANGING EXPERIENCES AND EXPERTISE WITH WATER TECHNOLOGIES

C.14 Develop materials and workshops for inter-institutional exchanges for integrated water resource planning, development and management.

Alberto J. PALOMBO

Florida Center for Environmental Studies
Florida Atlantic University, USA

ACTION STATEMENT:

The IWRN should assist member organizations and stakeholders in the development and/or implementation of inter-institutional exchanges for integrated water resource planning, development and management at local, regional and national levels.

RATIONALE:

There is a considerable amount of information on intergovernmental and community activities to assist in decision making and wide participation in the planning, development and management of water resources at the local, regional and national level among current members of the IWRN. Particular examples include experiences of the Florida Water Management Districts, the Tennessee Valley Authority (in the United States), water user organizations (through World Bank and Inter-American Development Bank-sponsored projects in Peru and Venezuela, for example), training programs developed by the Inter-American for Environmental and Territorial Research (CIDIAT, Venezuela), and other integrated and local efforts to mitigate urban infrastructure impacts, and overall water demand management programs (such as those programs developed at Curitiba, MS, Brazil).

The information should be compiled and summarized to allow specific entities at the local, regional or national level to structure avenues of cooperation at their specific levels. The lessons learned can be analyzed, portrayed and summarized into demonstration projects that could be replicated, emulated, or used as a base for the special local, regional or national needs in water resource planning, development and management. With the advent of information sharing and dissemination technology, this information can be made available through IWRN (or one of the members) sponsored World-Wide-Web sites in the form of interactive workshop conferencing combined with tailored training to maximize throughput and address special local needs.

A demonstration project could be established with as little as US\$100,000 for the compilation of information and basic structure of the training/workshop program. The operational cost of institutional nodes could be as low as US\$6,000 per year plus staffing (usually a 0.5 full-time equivalent plus ancillary help). Other requirements include availability of country internet providers, local/in-country dial-in telephone lines capable of handling 9,600 bps (28.8 Kbps recommended), a personal computer with modem (Pentium 60MHz or higher recommended) and communications software.

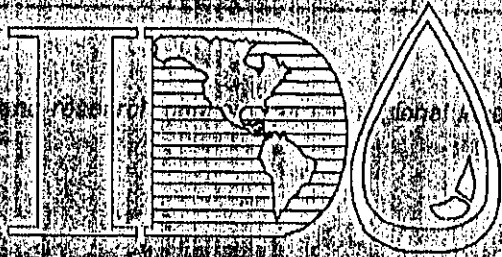
An standard project outline has been prepared by the author and is available for further development.

STRATEGIES FOR FUNDING AND INVESTING IN WATER RESOURCES

Concepts for Planning and Funding Water Projects
Edward W. STEADMAN
Energy & Environmental Research Center, GEORGETOWN, USA

ACTION STATEMENT

Water is a natural resource, an industry, and a business. It is essential for life and health, and it is the basis of many of our most important economic activities.



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STRATEGIES FOR FUNDING AND INVESTING IN WATER RESOURCES

Water is a natural resource, an industry, and a business. It is essential for life and health, and it is the basis of many of our most important economic activities. Water is also a scarce resource, and its efficient use is essential for the well-being of our society. This report discusses the challenges of water resource management and offers strategies for funding and investing in water resources.

The first strategy is to develop a water resource management plan. This plan should take into account the needs of all stakeholders, including farmers, industry, and the general public. The plan should also take into account the environmental impacts of water use. The second strategy is to develop a water resource investment plan. This plan should take into account the costs and benefits of different water resource management options. The third strategy is to develop a water resource financing plan. This plan should take into account the different sources of water resource funding, including government, industry, and the private sector.



D. STRATEGIES FOR FUNDING AND INVESTING IN WATER RESOURCES

D.1 Consortia for Planning and Funding Water Projects
Edward N. STEADMAN
Energy & Environmental Research Center (EERC), USA

ACTION STATEMENT:

Create government, industry, and research consortia at the regional level to plan and fund water resource projects addressing priority issues.

RATIONALE:

Based on experience at the EERC, we propose regional consortia as a mechanism to facilitate planning and funding water projects that integrate the social, economic, and environmental needs of stakeholders over regions from individual watersheds to international water basins. These water management consortia, including cognizant representatives from government, industry, and research organizations, will undertake initiatives to meet the prioritized water needs of their members. Projects will be jointly funded by governments and industries commensurate with their interests. Research organizations will provide technical expertise to plan effective projects and resolve implementation barriers. The work of the consortia must be practical and timely, with specific deliverables and deadlines.

Municipal, agricultural, and industrial demand for water in the Americas is growing rapidly. Interrelated problems of adequate and economical supply, protection of water quality, cleanup of contaminated discharge, and protection of ecosystems require systematic solutions. These solutions must reflect the shared values and interests of all stakeholders, which can only be realized through effective partnerships. Democratic governments represent the interest of the public and provide policy guidance, approval, and funding. Private industries represent the commercial perspective needed to gauge the practicality and economic viability of projects, and they can provide needed technical and financial support. The research community provides access to state-of-the-art technology and the ability to develop and modify technologies to meet local needs. By combining these three groups into regional consortia, capitalizing on the assets of each, the challenge of systematically providing for water resource needs can be met.

D.2 The Relationship of Ownership Structure to Attracting Investment Capital to the Water Sector
Basil SUTHERLAND
Institution National Investment Bank of Jamaica Limited, JAMAICA

ACTION STATEMENT:

Government is developing sector strategies which will ensure economic allocation of water resources between conflicting users and also encourage private capital flows to the sector.

RATIONALE:

To ensure sustainable development of Jamaica's water resources, Government will need to incorporate approaches to planning for the utilization of water resources which ensure economic allocation of water resources between conflicting uses such as for potable water or for irrigation.

At the same time, arising from the need to reduce its fiscal deficit, and debt burden, Government is examining options for private participation in the water and sewerage sector. This is taking place within the context of the need to ensure adequate water supplies to segments of the population which may be unable to afford the economic cost.

Government is considering several options for private participation and these may be categorized according to the degree of private involvement, in the risk for both public and private sectors, the private operators autonomy and responsibility, the required capital investment, the duration of the contract with the private entity, and the contractual relationships with consumers,

The two main categories are:

- * Service contracts, management contracts, lease arrangements, and concessions and,
- * Private ownership, whether partial or full, which may include Build-Own-Operate transfer schemes, joint ownership and outright sale.

The foregoing options feature flexibility and the potential to progress from less risky arrangements with no private investment to more risky arrangements with significant private investment as the two parties gain credibility and confidence.

It is expected that the arrangements will promote improved operational efficiency and result in improved cost recovery by allowing for performance based compensation which will eventually result in commercial viability of water and sanitation utilities.



D. STRATEGIES FOR FUNDING AND INVESTING IN WATER RESOURCES

D.3 Training as an Instrument to Facilitate Knowledge and Adoption of Hard and Management Technologies

Armando LLOP

Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

To conduct training activities so as to institutionally adopt an interdisciplinary, interinstitutional and intersectoral work dynamics by means of a particular training-action method.

RATIONALE:

The experience gained with the many courses and workshops on "Integrated Water Resources Management" organized by INCYTH-CELAA in collaboration with CIDIAT (Venezuela), CEPAL, and other Latin American agencies, in addition to the technical assistance provided to agencies engaged in water or basin management have demonstrated that training for action is essential if the integrated management of water resources is to be achieved.

In Latin America, as in most countries, formal university education is mainly monodisciplinary (engineering, medicine, law, sociology, economics, etc.). The combination of the different types of knowledge required to design and implement solutions to real problems, interdisciplinary by nature, is left in the hands of managers or administrators. In general, they have a monodisciplinary professional profile or a political background; in any case, they lack interdisciplinary training.

In this context, the best way to institutionally adopt an interdisciplinary dynamics is through a particular training-action method. In the first place, it consists in presenting the ABC of management (economic, legal and administrative principles), new technological developments, and other relevant issues.

In the second place, and most importantly, it consists in assembling heterogeneous working groups (interdisciplinary, interinstitutional, intersectoral, etc.) which --given a situation-- are imparted instructions in sequence to develop a strategic planning process; to identify priority lines of action; to formulate investment or action projects to implement the strategies; and to devise project follow-up mechanisms.

In general, this type of experience allows participants to learn how to work in teams; to respect the opinions stemming from other disciplines, sectors and institutions; to think strategically; and to manage water or environmental projects.

D.4 Domestic Effluent Reuse for Irrigation Purposes to Increase Water Use Efficiency and Control Negative Environmental Impacts
Graciela FASCIOLO and Valeria MENDOZA
Instituto Nacional de Ciencia y Técnica Hídricas, ARGENTINA

ACTION STATEMENT:

Use of domestic effluents to promote plant growth, with either productive or aesthetic purposes, so that they are treated and disposed of through the soil-plant system by means of specific bio-physical processes.

RATIONALE:

The world we live in is undergoing fast changes and governments must solve emerging problems, among which environmental protection and, hence, water issues are a priority.

The rapid evolution of water uses and related pollution problems show that mankind is going through a transition phase. In the past it was believed that water was abundant but nowadays it has become evident that water use in the near future will be conditioned by increasing scarcity in many parts of the world.

In this context, effluent reuse consists in the planned treatment and final disposal of sewage effluents in order to a) preserve high quality water sources to meet basic needs and use the recovered water to meet demands requiring water of a lower quality; and b) to avoid pollution downstream of the treatment plants, which usually affects irrigation canals.

In this way, effluent treatment is no longer an end in itself but a means that permits an efficient use of the resource consistent with its adequate conservation.