

REPORT OF THE
SEMINAR ON INTEGRATED WATER RESOURCE MANAGEMENT:
INSTITUTIONAL AND POLICY REFORM
24-27 June 1997, Port of Spain, Trinidad and Tobago

Water resources management challenges

The Caribbean faces many challenges for managing its water resources in a socially acceptable, environmentally sustainable and economically efficient manner. The region's small island characteristics, geography, history, culture, and socio-economic conditions call for specific solutions as well as adaptation of traditional solutions to effectively manage the water resources. As well, the region exhibits diverse characteristics regarding water resources availability and use. Summarised, these characteristics include that :

The region's water resources are vulnerable to global factors such as climate change (and accompanying temperature increase, sea level rise, saltwater intrusion and reduced precipitation), hurricanes, and drought;

Water is a vital factor for the socio-economic development of the region;

Freshwater is scarce in many islands;

Total water use is dominated by domestic and commercial needs (including for tourism);

irrigation use accounts for about 20 per cent of total use;

Water utilities are facing financial management problems (due to inadequate pricing and tariffs policies), poor operations and maintenance, high unaccounted for losses, as well as problems due to human resources retention, limited capacity, etc;

Institutional fragmentation and inadequate policies, funding and institutional constraints are hampering effective management of water resources due to deteriorating hydrological data collection and analysis, poor land use, causing widespread degradation of watersheds and impacting downstream water utilities and the estuarine, marine and coastal resources,

water pollution from point sources and non-point sources, a growing problem affecting public health and freshwater and marine environments;

Coastal and marine resources are important to the island economies.

Progress to date

The various specific and special characteristics of the region have been discussed and addressed in many global and regional forums. However, in addressing the recommendations in the various sectors in the Small Island Developing States (SIDS) Programme of Action adopted in Barbados in

1994, it was recognized that a more integrated approach to water resources was necessary if these problems were to be addressed in a sustainable manner. Hence, subsequent initiatives and meetings have attempted to focus on an integrated approach. Examples of these include the 1992 Rio Earth Summit, the 1993 World Bank Water Resources Management Policy, the 1996 Bolivia Summit and the 1996 San Jos, Accord.

Seminar objectives

This report summarizes the papers presented, discussions and the results of working group exercises of a seminar on integrated water resource management, held on 24-27 June 1997, at the Holiday Inn Hotel in Port-of-Spain, Trinidad.

Based on progress to date, the seminar sought to promote integrated approaches to water resource management in the Caribbean by :

- developing a common understanding among the cross sectoral country team members of
- the water resources management challenges of the region;
- to share relevant water resources management experiences from within and outside the region;
- identifying and discussing priority areas requiring immediate action;
- recommending specific steps to address them.

The seminar/workshop targeted cross-sectoral country teams from water and sewerage authorities, ministries of Agriculture, Environment, Health, Planning and Finance from 23 Caribbean countries. Following sessions dealing with issues in water resources management, experiences in water resource management in the Caribbean, experiences in natural resources management, networks for cooperation and existing programmes for regional cooperation, participants worked together in groups to formulate strategies for promoting integrated water resources management. Four key areas for action were identified: public awareness and education, institutional coordination, water resources policy and legislation and innovative financing.

The workshop represented the fulfilment of a mandate of the fourteenth plenary session of the Caribbean Council for Science and Technology (CCST), and was sponsored by the CCST, Caribbean Development Bank (CDB), the Commonwealth Science Council (CSC), the Economic Development Institute (EDI) of the World Bank, the Inter-American Development Bank (IDB), the Organization

of American States (OAS), the Government of Trinidad and Tobago and the World Meteorological Organization (WMO).

Issues raised and key points

During the final two days, the participants formed working groups, deliberated on a number of important issues and recommended the following actions for immediate consideration:

The main recommendations of the seminar/workshop focused on the need to: (a) urgently manage water resources in an integrated manner, (b) take strategic rather than reactive action, (c) address freshwater, marine and coastal resources as a management continuum, and (d) develop strategic partnerships and networks for fostering information sharing and exchange. According to participants, these would involve :

- Identification and establishment of appropriate coordination units for promoting collaboration and cooperation at the regional and national levels. The primary goals for regional collaboration would be to foster cooperation for promoting the development of professional networks for addressing different components of water resources management (such as watershed management and pollution control) and information sharing and exchange (through electronic networks, etc.). The University of West Indies and other institutions of higher learning could, for example, develop appropriate curricula on a whole range of subjects related to water resources management (such as water resources economics, water legislation, water policy development, etc.) and strengthen existing programmes at the various campuses ;
- Development of integrated water resources management policies and strategies for each island based on the principle that water resources management activities need to be self financed and consider demand management as a vital cost effective policy option;
- Development of appropriate public awareness and education strategies.

Specific actions could include pilot projects for managing watersheds, specific strategies for sensitizing policy makers and for promoting changes in public attitudes and behavior, developing primary and secondary school curricula with a specific goal of sensitizing school children.

Other issues raised included :

Partnership - there is need to promote partnerships between the public sector, the private sector and the wider community, via policy;

Political awareness and commitment - to facilitate the process of policy reform, political awareness of the relevant issues must be promoted;

Conservation via tariff structures - tariff structures which encourage conservation in both metered and un-metered users need to be carefully designed;

Impacts of the tourism industry - the impact of the tourism industry on water demand and waste water production need to be recognized by policy makers. Policies should consider the localized impacts of tourism-related water demand, the seasonality of demand, the impacts of all related development and the critical need for hotel retrofit. Policies should include application of equitable pricing and tariff structures;

Multi-dimensional policies - policy for integrated water resource management should attempt to deal with all aspects of management - social, economic, political, technical and cultural issues all impact on efforts at effective management;

Settlement patterns - patterns of settlement represented a major impact on water resources in most islands, and should be addressed by policies for integrated water resource management;

Use of software based management tools - policy formulation processes based on the use of decision -support and other software- based management tools should recognize the strengths and limitations of these tools. In particular, the outputs of these tools should be viewed as preliminary indicators, and traditional information gathering, consultation and analysis processes should continue to be employed;

Policies for retrofit - policy to encourage retrofit should take into account that utilities often view retrofit programmes as leading to reductions in income;

Reduction of demand for irrigation water - policy interventions to reduce demand for water for irrigation should include subsidized loans to purchase technology and improve irrigation network design and assistance with selection of appropriate crop varieties;

Public information campaigns - public information campaigns should be considered a critical

aspect of water resource management policies and programmes, particularly in areas where education levels are major constraints to community action;

Stakeholder consultations - stakeholder consultations, should be conducted, and should include meetings with licensed abstractors;

Special coordinating mechanisms - special coordinating mechanisms should be employed by policies and programmes aimed at integrating water resource management. Conflict management based on a shared understanding of the resource limitations and impacting issues is key to success to any integrated water resource management plan. In particular, scientists and policy makers must be brought together so that policies are formulated based on the most reliable data;

Impact on the marine environment - policies and programmes for water resource management need to recognize and deal with impacts on the marine environment;

Community participation - the role of community participation in water resources management encompasses the identification of problems and solutions, issues and priorities. This should be embodied in any water resource management policy;

Economic importance of sectors - the economic importance of sectors should be reflected by water resource management policies addressing water conservation;

Separation of administrative roles - administrative structures should separate regulatory, enforcement, supply and monitoring and data collection roles. In addition, there is need to recognize the business focus of the privatized water utility, and to allocate responsibility for social aspects of water resource management to specialist institutions or government bodies;

Networking to maximize access to resources - there is need for increased international and regional networking to improve access to skills, knowledge and strategies;

Data collection - there is need for adequate and reliable data collection mechanisms;

Utility public image - while seeking to reduce wastage and become more effective, agencies with responsibility for supply of potable water must maintain a positive public image in order to ensure the success of conservation efforts.

Next steps

The governments of the Caribbean nations need to appoint dynamic lead persons to champion the promotion of integrated water resources management policies and strategies in each island country. The governments should also appoint cross sectoral task forces for promoting the necessary institutional and policy reforms. The governments should consider utilizing existing institutions (such as the Sustainable Development Councils to the extent that they feel appropriate) to champion the promotion of integrated water resources management.

There is need to identify the appropriate regional institution to promote and coordinate institutional reforms for integrated water resources management and to provide funds and/or information about available funding for technical assistance for developing integrated water resources policies and strategies. Such funds could become available from regional banks, multi-lateral development institutions as well as the Global Environment Facility.

A follow-up meeting is recommended for monitoring and evaluating the progress on regional and national level water resources management policy reforms.

PROGRAMME

Day 1

8:00 - 9:00 Registration

Opening Ceremony

Chair: Mr. Eric Ashcroft

9:00 - 9:05 Welcome - Mr. Eric Ashcroft, Water and Sewerage Authority

9:05 - 9:10 Brief Remark - Mr. Wendell Lawrence, Caribbean Development Bank

9:10 - 9:30 Seminar Opening - His Excellency, the Honourable Minister of Public Utilities, Mr.

Ganga Singh

9:30 - 9:45 Seminar Objectives - Mr. Donatus St. Aimee- Caribbean Council for Science and

Technology

9:45 - 9:50 Vote of thanks - Mr. Francois-Marie Patorni, Economic Development Institute

Keynote address

Chair: Mr. Wendell Lawrence

9:45-10:45 Water Resources Management Issues and Challenges in the Caribbean

(Speaker: Mr. Terence Lee-UNECLAC)

Discussions

10:45 - 11:15 Break

11:15 - 12:15 New Paradigm in the Economics of Water Resources Management

(Speaker: Mr. Sergio Ardila - IDB)

12:15 - 1:00 International Perspective on Water Supply Management , Financing and Private

Sector participation

(Speaker: Mr. Carlo Rietveld-World Bank)

Discussions

1:00 - 2:30 Lunch

2:00 - 2.30 Luncheon Address: Impacts of Climate Change on Water Resources in the Caribbean

(Speaker: Dr. Gyan Shrivastava--University of West Indies)

Issues in Water Resources Management

Chair: Mr. Luis Garcia

2:30 - 4:00 Watershed degradation and management in the Caribbean Islands
(Speaker: Dr. Frank Gumbs-UWI)

Impact of Agricultural Development on Water Resources in the
Caribbean

(Speaker: Dr. Compton Paul-CARDI)

Discussions

4:00 - 4:20 Break

4:20 - 5:30 Impact of Tourism on Integrated Water Resources in the Caribbean
(Speaker: Ms. Glenda Medina-CCA)

Water Pollution: Sources and cost-effective treatment options

(Speakers: Mr. James Stone-Enviro-Waste Services Inc. and Dr. Jason
Gondron, Red Fox Environmental Inc.)

Discussions

5:30 - 6:00 Summary and participants input

7:00 -9:00 Cocktail Reception

Day 2

Issues in water resources management

Chair: Mr. David Moody

8:30 - 10:00 Use of decision support tools for Coastal Zone Management in
Curacao and Jamaica

(Speaker: Mr. Frank Rijsberman, Resource Analysis, Delft)

Discussions

10:00 - 10:30 Break

10:30 - 12:00 Demand Management

Demand Management Practices and economics for the Caribbean

(Speaker: Mr. Saul Arlosoroff-WWC)

Water production, Use and Conservation

(Speaker: Dr. Henry Smith-UVI-Water Resources Institute)

Discussions

12:00 - 1:30 Lunch

1:00 - 1:30 Luncheon Presentation: Economic Considerations in Hydrological
Data Collection

(Speaker: Mr. Kailas Narayan-Caribbean Meteorological Institute)

Experiences in water Resources Management in the Caribbean: Case Studies

Chair: Mr. John Bassier

1:30 - 3:00 Water Resources Management Policy Development in Haiti
(Speaker: Dr. Herve Raymond, Ministry of Environment, Haiti)
Groundwater Development and Management in Barbados
(Speaker: Dr. John Mwansa, Barbados)
Discussions

3:00 - 3:30 Break

3:30 - 5:30 A community approach to water resources management in the
Caribbean: The
case of St. Vincent
(Speaker: Mr. Nigel Weekes-Forestry Division, St. Vincent)
Water Resources Management Strategy Preparation in Trinidad and
Tobago
(Speaker: Ms. Marilyn Crichlow and Mrs. Victoria Mendez-Charles-
Trinidad and
Tobago)
Discussions

6:00 - 6:30 Group Meeting (Chairpersons + Rapporteur): Thematic Assignments,
Specific Outputs, Group Work preparation

Day 3

Experiences in Natural Resources Management

Chair: Mr. Francois-Marie Patorni

8:30 - 9:15 Watershed Management in Northeastern Puerto Rico
(Speaker: Dr. Fred Scatena, US Department of Agriculture)
Water Supply and Sanitation Collaborative Council
(Speaker : Mr. Charles Marville, Barbados Water Authority)
Small Island Water Information Network (SIWIN)
(Speaker : Dr. Siyan Malomo, Commonwealth Science Council)
Discussions

Networks for Cooperation

9:15 - 10:30 OAS: Inter-American Dialogue on Water Management and the Inter-
American Water Resources Network
(Speaker :Mr. David Moody)
WMO: Hydrological Cycle Observing System for the Caribbean Basin
(Speaker :Mr. John Bassier)
CATHALAC: Networking
(Speaker : Ms. Maria Concepcion Donoso)
INSULA: International Scientific Council for Island Development
(Speaker : Mr. Ronald Parris)
UNU/INWEH
(Speaker : Dr. R.J. Daley)
Discussion

10:30 - 11:00 Break

Existing Programmes for Regional Cooperation

11:00 - 12:30 IDB: Strategy for integrated Water Resources Management
(Speaker : Mr. Luis Garcia)
World Bank: Water Resources Management Policy
(Speaker : Mr. Francois Marie-Patorni)
CDB: Support for Water Resources Management
(Speaker : Mr. Wendell Lawrence)
Discussions
12:30 - 1:30 Lunch

WORKSHOP: Developing Specific Strategies for the Caribbean

1:30 - 3:30 Parallel Group Discussions
Themes :Public Awareness and Education Strategies
Strengthening Institutional and Coordination Strategies
Legislative and Policy Development
Financing Strategies
3:30 - 4:00 Break
4:00 - 6:00 Parallel Group Discussions (cont'd)

Day 4

8:30 - 12:00 Parallel Group Discussions (cont'd)
10:30 - 11:00 Break
12:00 - 1:30 Lunch

1:00-1:30 Luncheon Address: Model watershed management programmes focussing
on the
use of climate data
(Speaker :Mr. Allen Zack, NOAA)

Regional Strategy

Chair: Mr. Donatus St. Aim,e

1:30 - 3:00 Plenary presentation
Thematic Group Recommendations for regional development
3:00 - 4:15 Regional Strategy and Programme of Action for Strengthening Water
Resources Management in the Caribbean

Closing Session

Chair - Donatus St. Aim,e

4:15 - 4:45 Remarks
EDI : Mr. Francois-Marie Patorni
OAS : Mr. David Moody

IDB : Mr. Luis Garcia
CDB : Mr. Wendell Lawrence

Seminar Closure : His Excellency, the Honourable Trevor Sudama,
Minister of
Planning and Development, Government of Trinidad and Tobago

OPENING CEREMONY

Mr. Eric Ashcroft, Chief Executive Officer of the Water and Sewerage Authority, Trinidad and Tobago welcomed participants to the meeting, noting that the large attendance confirmed a growing interest in, and awareness of the need to conserve water. He stressed that many issues threatened water resources - climate change, pollution and over extraction, and indicated that there was a need for a better approach to management. To this end, he suggested that there should be greater collaboration between stakeholders in the form of an integrated approach to water resource management which would facilitate developmental and environmental sustainability and an improved quality of life for future generations. Mr. Ashcroft emphasized that thoughts, ideas and strategies should be transformed into action.

Mr. Wendell Lawrence, Deputy Director, Productive Sector Division of the Caribbean Development Bank, stressed that water was limited and limiting in the Caribbean, and that there had been calls for help from farmers, the tourism industry, and many other sectors of the wider community. He pointed out that currently there was not enough water for domestic, agricultural, transport, tourism and hydropower purposes, and suggested that better management of water resources was necessary. He identified two priority issues to be addressed - allocation of responsibility for costs of improvement, and appropriate levels of cost recovery. Mr. Lawrence expressed the hope that the seminar would provide some, if not all, of the answers and indicate the right direction in which to move forward.

The Honourable Ganga Singh, Minister of Public Utilities, Trinidad and Tobago, indicated that water management should not be treated as a sectoral issue and stressed that failure to develop an integrated water resource management programme had the potential to threaten biodiversity, food security and long term sustainability. Minister Singh suggested that sustainable development was consistent with a proactive approach to water resource management. Additionally, tariff systems and consumer accountability were important issues to be considered. Mr Singh proposed that planning for better water use in the population as a management strategy should include private sector participation in the Water and Sewerage Authority (WASA) to improve the quality of the service. He proposed also that a new regulatory body, a consultancy to develop a water

resources management strategy which would include surface water management, data collection, geographic information systems, and inter-ministerial water resources planning.

Minister Singh stressed that the priority of the Government of Trinidad and Tobago was the enforcement and monitoring of the laws governing water resources. Overall solutions required a commitment from governments, international agencies, public and private sectors and the wider community. Minister Singh made it clear that cooperation was needed to provide the support mechanisms that kept programmes together and therefore the public needed to be aware of water resources management projects. Achieving this goal required education about issues such as industrial and domestic dumping of waste and agricultural runoff. In addition, participation in coastal conservation efforts by fishermen and divers was essential for the success of such projects. Emphasizing that efforts at water resources management needed to be intensified in the Caribbean region, the Minister made a plea for all nations to share experiences and work together towards solutions.

Mr. Donatus St. Aim,e, Secretary of the Caribbean Council for Science and Technology, outlined the objectives of the seminar. He stated that the water supply in the Caribbean was not as abundant as before. There was thus a need to share and develop strategies for approaching water resources management since traditional approaches no longer worked. The strategies outlined in previous water resources management seminars should be implemented and accompanied by action with the assistance of the local and international community. Suggesting that the critical issues of water resources management should be central to the planning process in both the public and private sectors, he added that there was need to encourage the population to conserve water, protect watersheds and decrease pollution. Additionally, a holistic, conservation approach to water resources management was needed.

Mr. St. Aimee emphasized that these objectives would only be realized if there was action by policy makers, both in institutions and homes, and by all other stakeholders. He proposed the initiation of public awareness programmes which would encourage people to think critically about securing a reasonably clean, adequate supply of water now and in the future.

In his vote of thanks, Mr. Francois-Marie Patorni, Coordinator, Water Policy Reform

Committee of the Economic Development Institute of the World Bank, highlighted the fact that water was a very important issue in light of increasing pollution, a fragile natural environment and limited water resources. He suggested that some keywords which should be foremost in participants' minds throughout the seminar were - action, transparency, participation and partnership.

KEYNOTE ADDRESS

Water Resources Management Issues and Challenges in the Caribbean
Mr. Terence Lee, Division of Environment and Development, United Nations
Economic
Commission for Latin America and the Caribbean, Santiago, Chile

Mr. Lee proposed that the most critical aspects of water resources management were supply and demand for water, and the fact that most countries were ignorant of both usage and users. The impact of water use on water quality and the need to see water as part of the larger ecosystem were also important issues. Additionally, there was the need for consumers to view water as an economic commodity. According to Mr. Lee, the issues which most challenged water resources management centered on maximizing contribution to productivity. He emphasized that the user should pay the real cost of usage. Crucial was the need to minimize the impact of water use on the environment. Current policy trends that Mr. Lee felt were significant included the decentralization of public responsibility to lower levels of government, the open participation of all stakeholders, including the wider community and including the private sector in decision-making. These policy decisions would result in a revolution in policies, the elimination of established institutions and a redistribution of power. He stated that components of a new structure of public sector water resources management should include: regulatory institutions, data collection and monitoring agencies, municipalities, associations of users and private companies. Mr. Lee also suggested that in some cases it was more difficult to decentralize to lower levels of government than to transfer to the private sector. This meant that privatization should be a policy option for some governments. Even with this new approach there were outstanding issues, i.e. establishing the policy for water management, achieving institutional coordination, finding adequate planning mechanisms and project implementation.

New Paradigm in the Economics of Water Resources Management
Mr. Sergio Ardila, Economist, Region 3, Inter-American Development Bank,
Washington, USA

In his review of the economics of water resources management, Mr. Ardila indicated that there was a need to consider the analysis of incentives generated by institutional frameworks given that there were widespread failures of public provision of infrastructure services. Additionally, the implementation of new systems was necessary to allocate scarce water resources correctly. He also noted that there were several factors that impacted negatively on water resources management, including low quality of service, failure to invest to keep up with population demands, insufficient cost recovery, low efficiency (excess wastage) and lack of accountability to customers. Mr. Ardila stressed that the main source of problems in the provision of water resources management services included the confusion of regulatory and operational roles in state owned enterprises, political influence on management, lack of appropriate supervision, soft budget constraints and confusing incentives.

According to Mr. Ardila, incentives needed to be expressed by economic measures. These included, for instance, strict consequences for customers who did not pay for services, balanced books, enforcement of pollution charges, cost reduction and exploitation of profit opportunities by water utilities, and external regulation of quality, costs and environmental impacts. The Principal-Agent framework was suggested as a new paradigm applicable to water resources management. Referred to as the information approach to economics, this framework dealt with the variety of problems that arose from the absence of perfect information. A more rigorous and realistic new approach to economic analysis required the enrichment of the basic model with a full description of the objective functions of firms, consumers, regulators and information asymmetries.

International Perspective on Water Supply Management, Financing
and Private Sector Participation
Mr. Carlo Rietveld, Task Manager, World Bank

Mr. Rietveld was of the view that urban growth was an impending crisis for water resources

management. The consequences of this growth included pollution, over-population and scarcity of water. According to Mr. Reitveld, the Water and Sanitation Decade had underestimated how much work needed to be done in water resources management, even though the old agenda appreciated that the provision of household water and sanitation was a formidable challenge. The financial issues associated with the old agenda, according to Mr. Rietveld, included high costs due to scarcity of natural water, political controversy, and the constraints of complying with Environmental Protection Agency (EPA) regulations, which posed problems even for industrialized nations. He added that compounding these problems were low user accountability, low user charges, resulting in inefficiency and wastage, and the benefits of public-spending going to the rich and not the poor.

Mr. Rietveld outlined the important lessons learned from international finance company investments. These included the need for support from government and labor, the choice of appropriate private sector companies and the need for a clear regulatory framework that included international arbitration. In closing, he stated that the new agenda for water resources management was focused on environmental sustainability.

Summary of discussions

Stakeholder partnerships

It was felt that water resources management should be implemented via a partnership between public and private sectors, as well as the wider community, and that partnership was a necessary element in all policy decisions.

Implications of privatization

Participants agreed that the role of the private sector in water resources management was task-specific. While partnerships between public and private institutions were to be encouraged, there needed to be the recognition that a privatized water utility operated as a business, i.e., to provide a service. Hence, while in an ideal situation there should be no antagonism between social and business goals, social issues were not the concern of the utility, which only provided the service. Social issues should be dealt with by the specialist institutions or government bodies.

Separation of management roles

It was stated that water resources management project structures needed to separate regulatory roles from monitoring and data collection and enforcement of legislation. In addition, water supply functions should be separated from collection of hydrological data. It was emphasized that there should be no one regulatory agency for all aspects of water resources management, even though it was difficult to avoid in very small countries where there was a shortage of qualified personnel.

ISSUES IN WATER RESOURCES MANAGEMENT

Watershed Degradation and Management in the Caribbean Islands

Dr. Frank Gumbs, Head, Department of Food Production,
University of the West Indies, St. Augustine Campus

In looking at watershed degradation and management in the Caribbean islands, Dr. Gumbs reviewed the factors affecting watershed degradation, the consequences of such degradation, soil management practices, and institutional arrangements for effective watershed management.

According to Dr. Gumbs, the two major parameters contributing to land degradation in the humid tropics were the climatic conditions, and the physiography of the Caribbean islands. These led to problems such as land slippage in steep areas during the wet season, and slumping in areas with thick soil profiles overlaid with heavily compacted or stony soils. Soil erosion, slippage and poor soil conditions were the result of poor management practices, such as overgrazing, and incorrect tilling patterns. Proper management practices, he said, were difficult to promote without encouragement to farmers. He referred to the case of St. Vincent, which had the best soil management practices in the Caribbean, due to benefits granted to farmers employing them. He noted that there was a complexity of terrain, slopes and soil types, which led to a complexity of problems. Attempts to promote proper management practices in Jamaica, Dominica and St. Vincent, included mixed cropping, stone terracing and mulching, and had met with varying levels of success due to the varying levels of commitment of the farmers. Caribbean rivers were plagued by removal of stones, which led to erosion of the river banks.

Dr. Gumbs listed the natural and man-made factors affecting watershed degradation, and indicated that problems of water quality deterioration could generally be attributed to sediments from

erosion, and over-utilization of chemicals for agriculture and industrial use. He provided an indication of beneficial watershed management practices, as they related to agricultural, forests and settlements . Management of agricultural land required that farming practices be based on appropriate soil management so that no real extra cost was incurred. Management of settlements, he said, primarily related to maintenance of infrastructure, such as drainage and waste disposal. He pointed out that multiple interest groups benefitted from Upper Watershed Management (UWM). As a result, he stated that farmers should not be required to bear the full costs of management, but a system of cost sharing should be instituted.

Dr. Gumbs stressed that the role of governments was to increase integration and coordination among subsectors impacting on watershed management. Administrative arrangements for effective watershed management centered on appropriate roles for local and central governments and integration and coordination among subsectors. Successful watershed management initiatives had been characterized by the government effectively fulfilling their roles, the role of communities being recognized, special incentive programmes, and public awareness. He closed with a list of requirements for integrated watershed management, which included: clear government policy on watershed protection, institutional arrangements to implement policy and plans, formulation and implementation of relevant legislation, appropriate land capability and land use schemes, appropriate watershed protection and water management in forested and upper watershed areas, land protection and flood control devices, and elimination or minimization of harmful activities in the watershed.

Impact of Agricultural Development on Water Resources in the Caribbean
Dr. Compton Paul, Director, Technical Programmes (Ag.), Caribbean Agricultural Research
and Development Institute (CARDI)

In his presentation, Dr. Paul examined agricultural development in the Caribbean, impacts on the hydrological cycle, future trends in agriculture and implications for water resources management, and recommended actions to be taken.

Based on their water resources and climate, he identified two groups of Caribbean islands: the drier Leeward islands and small islands off Venezuela, and the wetter islands where much water was

available, but water quality was a problem. He noted that the history, social structures and ethnic compositions of the islands were contributing factors to management practices. In the small islands of the Caribbean, varying ecosystem and settlement types also posed particular management issues. Taking a historical perspective, he traced the developments in the agricultural sector, starting with the growth in demand for sugar, increased deforestation, slavery, indentured labour, and agriculture based on plantation models, and settlements in upper watershed areas. Subsequent to independence, high use of agro-chemicals had led to problems of water quality and quantity. At the present time, urbanization, the growth of tourism and changing land use patterns had resulted in surface and ground water pollution and coastal water contamination.

Looking at the impacts on the hydrological cycle, he noted that agricultural development had led to problems such as inadequate water storage, scarcity in the dry season, and floods in the wet season. Problems of water supply and demand related to poor water quality and insufficient quantities, and arose from urbanization, plantation-type agriculture, which had a high water demand, and tourism. Agriculture-related factors such as road construction, agro-chemicals, agricultural and agro-processing waste also impacted negatively on water resources.

He indicated that future trends in Caribbean agriculture would be based on an increasing export orientation, which required larger producers, and more water for irrigation. Trade liberalization would result in decreasing importance of agriculture and increased consumerism and urbanization. He added that these developments would be accompanied by increasing urbanization, and domestic, municipal and industrial waste generation, deforestation, soil erosion and surface and ground water pollution.

The presentation ended with proposals for strategies needed for water resource development and use in the region. These included inter-sectoral cooperation and central coordination as key concepts related to policy reform. Proposed action included inventories of water resources, defining requirements of users and consideration of both supply-side development and demand side management, increased attention to water conservation, strengthening of institutions for water management, management of deforestation and settlement including waste management, proper land tenure systems. He urged execution of the National Environmental Action Plans (NEAPs) which had

been formulated in several countries, and added that this would require inter-regional and external cooperation.

Impact of Tourism on Integrated Water Resources in the Caribbean
Ms. Glenda Medina, Executive Director, Caribbean Conservation Association

Ms. Medina noted the significance of migration and immigration patterns for water resources management. She suggested that the tourism industry, with its concentration of development in coastal areas, represented new patterns of internal migration. Examining tourism statistics in Barbados, Aruba and Jamaica, she inferred impacts on water resources. These were based on comparisons of consumption by tourists and residents, comparisons of water use by sector against their economic significance and water pricing policies. Comparing average consumption per day by residents and by tourists, it was found that in Aruba, the tourist, on average, used four times as much water; in Barbados, about five times and in Jamaica, the usage was about twice as high as the resident rate. She added that the impacts on water resources management of the tourism sector arose from the demand and supply aspects as well as waste disposal.

Institutional and policy reforms, she suggested, should focus on reducing waste, reuse, recycling, recovering and changing consumption patterns by rethinking. The Pan-American Health Organization (PAHO) had formulated a proposal for conservation in hotels in 1994. Bearing in mind the objective of that proposal, the reduction of water consumption in the Caribbean hotels through effective and efficient conservation measures, she recommended several complementary actions. Governments, she suggested, should undertake annual consumption audits, cost analysis of water services, monitoring of water quality, update of environmental legislation, employ appropriate pricing structures, and tax incentives for conservation and identify the carrying capacity of the tourism sector. Civil society was urged to establish a corporate environmental management programme, design and implement public awareness campaigns, establish environmental performance rating schemes for hotels, and implement hotel staff training. She concluded her presentation with an illustration of the effectiveness of energy and water efficiency programmes in one hotel, which had realized reductions in the energy and water costs as a percentage of total revenue, even with increasing occupancy rates.

Water Pollution: Sources and Cost Effective Treatment Options
Mr. Jason Gondron, Chief Operating Officer, Red Fox Environmental Services, and

Mr. James Stone, President, Enviro-Waste Services, USA

Stating that the presentation reflected the private sector viewpoint, Mr. Gondron gave background information on his company, which manufactured packaged sewage treatment plants for all types of applications. His company had advocated new approaches to problem solving which included improving public awareness and consumer responsibility, strengthening regulatory capacity and improving wastewater management through treatment options. In attempting solutions, he suggested that there was need for an analysis of the opportunity costs. He gave the example where Germany, while employing a municipal treatment plant, still used the satellite distribution model in remote areas.

Factors critical to determining cost effective treatment options included design, so as to minimize operation and maintenance problems and flexibility in deciding on the degree of decentralization of treatment. Treatment should also be cost effective so that maintenance and operation did not become problems with the required design. Examples were provided of treatment systems that were used in the energy industry, the military and the navy. In closing, the speaker stressed the need to influence corporate activity through enforcement.

Summary of discussions

Reasons for inaction at national and regional levels

The lack of timely action at the regional level was noted. It was felt that this was in part due to the fact that watershed management and protection did not feature high on the agendas of regional policy makers. It was also suggested that governments did not have the human and financial resources to deal with all the problems in the region, hence these had been placed lower down on their list of priorities.

Seasonality of tourist arrivals and impacts

It was agreed that the low contribution of tourism to water use may be misleading due to peaks in tourist arrivals which coincided with the dry season in most islands. Statistics represented an average over the entire year. The true impacts therefore should be ascertained, particularly in light of attempts to lengthen the tourism season in many countries. Also important were the impacts at the local level, particularly where tourism development was concentrated, and the impacts of associated

activity, such as landscaping, on the water demand. It was further suggested that there was need for studies which showed the impact on the use of water resources by other sectors of the economy

Necessity of employing conservation technology

The difficulty of influencing tourists through public education was noted. It was stressed that retrofit using conservation technology was the only viable solution, and could result in conservation of up to 40% of current usage, with consequent decreases in the volumes of sewage discharged.

Impacts of water wastes and pollution

The impacts of wastewater and sewage dumping in coastal areas were identified as being particularly important, and as receiving inadequate attention. It was agreed that this problem required increased political will. Increased attention to water pollution was seen as necessary, since water quality had to be maintained to support a viable tourism industry. It was proposed that any action in this area should increase the quality, reliability and availability of information to the public on the quality of drinking water being received.

Pricing of water

It was suggested that pricing and tariff systems which were equitable, but which encouraged conservation should be applied to the tourism sector. While the appropriateness of tax incentives and preferential water rates for the tourism sector were questioned, it was felt that the economic contribution of particular sectors should be recognized when determining levels to which concessions would be granted.

Integrating all aspects of water resources management

Referring to the "island systems" approach adopted by the Natural Resources Management Unit (NRMU) of the Organization of Eastern Caribbean States (OECS), it was noted that there was need to identify the critical activities which drove the socio-economic aspects of the watershed. Water pollution, while important, should be seen in the context of a holistic system which has social, technical, legal and economic aspects.

Use of Decision Support Tools

for Coastal Zone Management in Curacao and Jamaica
Dr. Frank Rijsberman, Managing Director, Resource Analysis, Delft, The Netherlands

Dr. Frank Rijsberman gave an overview of the similarities between Integrated Coastal Zone Management (ICZM) and Integrated Water Resources Management (IWRM). The similarities, he said lay in their treatment of the biophysical environment, processes and land use, frameworks for analysis and emerging issues. The key driving factor for using integrated approaches in the Caribbean was the small sizes of the Caribbean countries. He identified a number of physical linkages between coastal and freshwater resources and the similarity in their analytical framework. He introduced the Coral Decision Support System as a powerful tool for integrating land use, tourism and marine resources in sectoral planning. He described its major components (the user interface, economic activity model, water quality model, and ecological response model) and illustrated its usefulness using a case study. The case study focussed on cost-effective coral reef protection for Curacao, and identified development issues and options related to land use, marine park management plans and tourism plans based on analyses using the water quality model, the ecological response model and cost effective analysis. He stressed the tool's effectiveness as a communication tool rather than a decision support tool, and as a means of incorporating the views and knowledge of stakeholders in planning and decision-making. He also mentioned the use of some elements of the system in Montego Bay, Jamaica to prioritize issues in integrated coastal zone management. In conclusion, he gave a brief demonstration of the use of the tool.

Summary of discussions

Identification of benefits of proposed actions

To date, cost-benefit analysis had not been incorporated in the model. The first objective was cost-effectiveness analysis. Therefore no benefits in financial terms or as positive impacts to the biota could be predicted by the model.

Data availability and cost

The software had been developed at a cost of \$50,000.00 over a period of approximately a year. Acquiring the necessary data and information was identified as the most difficult task in using the model. An important criteria for the application of the tool was therefore the availability of the data.

The reliability of inputs and outputs

Dr. Rijsberman explained that although there may be some weakness in the accuracy of the data generated, the model's key strength was in identifying the impacts in order of their magnitude. He informed that there was a team working to set up more generic model testing, in Montego Bay, Jamaica.

Application of the tool for communication between interest groups

Dr. Rijsberman indicated that the tool had not yet been used in formal integrated planning. It had been used to teach courses on Coastal Zone Management at Universities in which representatives of various governmental agencies participated, and had been presented at high schools. While some participants questioned the validity of the outputs of the tool for policy and planning, Mr. Rijsberman stressed that the major strength of the tool lay in its application for promoting a shared understanding of coastal zone management issues among interest groups with widely differing perspectives. However, he agreed that all models should have some predictive ability. He also identified the decision support system as having an advantage over other quantitative deterministic models in that it took into account qualitative considerations. In response to a question regarding the existence of similar tools, Dr. Rijsberman indicated that there were similar tools used for IWRM. He cited the example of a tool developed for floodplain management which involved significant role-playing and interaction.

Water Resources Management - Demand management issues

Dr. Saul Arlosoroff, Senior Adviser, The Harry S. Truman Hebrew University, Israel

Dr. Arlosoroff highlighted the need to promote demand management as an integral part of water resources management. He lamented that demand management was often given low priority in management plans. He indicated that the need for demand management had arisen from the diminishing water supplies which had led to a new paradigm shift, depletion and pollution of traditional sources, remoteness of sources and growing costs of provision. Another important issue was the tremendous volumes of water unaccounted for. The problem was seen to be especially acute in developing countries where the problem was compounded by urban population growth. He explained that demand management entailed the comprehensive management at the municipal level

and highlighted pricing as a key tool.

The merits of demand management were illustrated by a case study of Israel which had achieved unexpected economic success and high standards of living, contrary to what might have been predicted from its per capita water consumption and availability. The most important factor responsible for its success was the large budgetary allocations given to demand management and the top priority given to water resource issues. Dr. Arlosoroff explained that demand management was especially critical for Israel's survival not only because of its natural aridity and the variability of annual rainfall, but also the high population growth. He described the main actions taken by the Government in its new approach. These entailed licensing, new legislation, including water metering laws, and quality control. He explained that water consumption had not changed with the addition of 2 million persons to the population because of pricing, education, technology and repair and maintenance of the distribution system.

He concluded with a summary of the findings of a survey of initiatives related to a demand management approach in the Caribbean. The survey revealed that budgetary allocations, legislation and institutional arrangements were inadequate although there had been recognition of the importance of these aspects of water resources management.

Interactions of Water Production, Use and Conservation
Dr. Henry Smith, Director, Water Resources Research Institute,
University of the Virgin Islands, St. Thomas, US Virgin Islands

Dr. Smith referred to a study which revealed that, in the United States Virgin Islands, water consumption was well above what was required to meet basic needs and that there was much room for more efficient use. He went on to describe water conservation initiatives and management in the United States Virgin Islands where efficient use of water resources was necessitated by the paucity of natural freshwater sources. In these islands water conservation had become a way of life, as reflected by widespread rain-water harvesting required by law, the distribution of salt-water to flush toilets, rationing, and aggressive public information campaigns. Top priority had been given to water resources conservation since the 1970's when a number of circumstances led to serious shortages in supplies. The subsequent drop in demand figures was largely due to metering, improvements in billing procedures, and in leakage detection and repair systems, performance standards for public fixture and

incentives to encourage use of more efficient fixtures, the encouragement of water conservation strategies in all development plans and changes in rate structures.

Dr. Smith concluded by highlighting the importance of education and information dissemination initiatives and approaches taken in the latter. He indicated that they should be carefully designed to suit the target population and especially their understanding of water resource issues. He also pointed out that such programmes had the added benefit of fostering goodwill between stakeholders.

Summary of discussions

Difficulty in water conservation efforts

It was pointed out that physical shortages in supply did not commonly occur in most developing countries and it was therefore difficult to convince the general public that it was important to conserve water. High levels of losses were therefore common-place. Dr. Arsoloff suggested that one approach that may be used was to make it a requirement that the main supply operations met certain levels of profitability. He also suggested that a privately run operation might have been advantageous. He stressed the usefulness of management strategies for dealing with extreme cases of waste. In expressing agreement with the latter, another participant felt that it was easier to justify conservation practices by the high cost of distribution (both operational and capital costs). The discussant added that there was a significant link between management approaches and influence over the behaviour of different sectors in water conservation efforts. He concluded by pointing out that utilities often objected to retrofitting because it reduced income and that retrofitting should be applied with increased rates.

Approaches to, and impacts of, levying high water rates to poor farmers

The question was raised about the difficulty and effectiveness of charging high water rates to poor farmers in Israel and how it was done. Dr. Arlosoroff indicated that this group did encounter great economic difficulty and that it had been granted access to subsidized loans to purchase technology to improve irrigation networks. Farmers also received assistance through agriculture extension services to cultivate marketable crops which required less water. Negative consequences included a significant decline in the size of the farming community and transition from self-sufficiency in food production to a country with a net import bill for agricultural products.

Institutional arrangements in Israel

Dr. Arlosoroff informed that in Israel, by law there was one body with authority over water resources. However in cases of proposals to increase water rates to farming communities (not including periodic increases which took into account the rising cost of living), discussions had to be held with the Ministry responsible for agriculture. He added that within the water resources authority there existed a department solely for demand management.

The Bahamas experience

The two previous presentations were commended, and similar experiences in Bahamas briefly described. There, water shortage crises had resulted in the formation of a national water corporation resulting in the rescinding of laws concerning individual rain-water catchment. The main problem experienced was the lack of resources for policing groundwater extraction practices. There was virtually no control over the latter. Dr Arlosoroff added that in countries with shallow water tables policing would be a problem.

Legislation

Although there the need for demand management was acknowledged in most countries, it was felt that this had not been reflected by changes in legislation. Where legislation existed, enforcement was a problem. It was indicated that demand management policy for certain sectors should be sensitive to the economic importance of these sectors and possible negative impacts. The tourist industry, the mainstay of many small Caribbean countries was cited as an example

Redesign of water supply systems

The question was raised about the possibility of redesign of the civil engineer works as another strategy for demand management. Dr. Arlosoroff responded by explaining that to date there had been no economic justification for the tremendous capital inputs that would be required. He also referred to his earlier mention of the paradigm shift where only a few engineers had begun to stop thinking about water consumption as a rigid parameter. The latter was indicative of the low priority given to demand management.

EXPERIENCES IN WATER RESOURCES MANAGEMENT IN THE CARIBBEAN

Water resources management policy development in Haiti

Dr. John Herv, Raymond, National Coordinator,
IDB project on Water Policy Formulation, Haiti

Dr. Raymond gave an overview of the water resources in Haiti, noting that only 10 per cent of annual rainfall went to deep percolation and groundwater. The distribution of water for irrigation, drinking, and other sources revealed that 90 per cent was allocated for use for irrigation. He stated that some of the problems experienced in Haiti in managing its limited water resources related to lack of regulations for users, dispersed responsibility among several institutions, confusion between the roles of managers and users, inefficient and inadequate controls over water users, demographic factors, inadequate human resource development, data unavailability and over-centralization.

Identifying the institutions involved in various aspects of water resources management in Haiti, he looked at their roles, objectives, and relevant functional units. In the Ministry of Agriculture, Natural Resources and Rural Development which was responsible for policy establishment for agriculture, natural resources and rural development, the two important units were the National Service for Water Resources and the Irrigation Service. In the Ministry of Public Works, Transportation and Communications, the main units with responsibility for water resources management were the National Service for Potable Water and the Metropolitan Autonomous Center for Potable Water. Indicating their missions, populations served and daily production, he stated that the two latter units were responsible for distribution and production, divided geographically between the metropolitan area, and the rest of the island. Other relevant institutions included Electricity of Haiti, the Ministry of Environment, the Ministry of Planning and External Cooperation, the Ministry of Public Health, numerous NGOs and international funding institutions. Outlining the key provisions of legislation relevant to water resources management, he noted that each institution was covered by organic law.

Early initiatives in integrated water resources management in Haiti were marked by the establishment of a National Committee for Water in 1977, which evaluated the water sector. Various committees were subsequently formed, and a National Institute for Water established. While effective, the latter had been dismantled and its mandates taken up by the Ministry of Agriculture. Later activities included several internationally-funded projects, the most recent of which was an IDB-financed programme based at the Ministry of Environment in 1997.

Current efforts at water policy formulation attempted to separate regulatory functions from the service provision functions. Key mechanisms for the policy formulation process included an inter-sectoral committee which attempted to foster communication, coordination and consultation between the various interest groups, information gathering and use of technical tools to establish priorities.

Summary of discussions

Coordination between internationally-funded programmes

In Haiti, the plethora of regulatory and administrative structures with responsibility for various aspects of water resources management was attributed to the distribution of responsibilities for water resources management among various institutions. It was proposed that this was also responsible, in part, for the concurrent implementation of more than one internationally-funded projects with the objective of restructuring water resources management in Haiti. Attempts to coordinate activities under these programmes had proven to be very difficult. Approaches to solving similar problems in St. Lucia under an environment and watershed management programme included a national environment committee with a supporting arm comprised of relevant ministries to foster inter-ministerial communication.

Responses of user groups to efforts at integration of management

Dr. Raymond stated that positive responses to efforts at increasing the involvement of user groups in water resources management in Haiti was evidenced by initiatives at formal organization of user groups to increase management capacity.

Level of local involvement and control in internationally funded programmes

It was recognized that the policy formulation process could be carried out through long-term-oriented local capacity building processes. In the case of Haiti, teams of foreign consultants had been employed, which each had at least one local expert counterpart and a local coordinator.

Groundwater Development and Management in Barbados Dr. John Mwansa, Project Manager, Water Resources Management and Water Loss Study, Barbados

Presenting a hydrogeological cross-section of Barbados, Dr. Mwansa reviewed data which indicated the distribution of private and public wells in groundwater abstraction zones. He stated that

in Barbados, private well operators had a poor understanding of the impacts of over exploitation of the resource. This had led to high salinity levels in freshwater supplies, as had been experienced on the West Coast. Highlighting the existence of ground water protection zones since 1963, he listed major policies and legislation regarding ground water resources management in Barbados.

Comparing the total volume of groundwater resources in an average rainfall year with the total usage, he noted that the latter exceeded sustainable and safe yield levels. Commenting on the water quality data as they related to levels of atrazine present, he indicated that while they were found to be below the microgramme/litre limit of the EPA and the Canadian standards, they exceeded the more stringent European standards.

Policies and legislation governing water resources management in Barbados made provisions for riparian rights licensing requirements and established a water board responsible for data collection. A ground water protection policy, not covered by any legislation, was administered by three agencies. In addition, the Barbados Water Authority had been established as a statutory authority. Dr. Mwansa outlined the zoning system employed in Barbados, which placed various restrictions on sewage systems and domestic and industrial waste disposal methods in certain areas.

The most recent comprehensive study of the groundwater resources of Barbados had been undertaken in 1997, and, he stated, was limited by the unavailability of data. The lack of significant effort at hydrological data collection had resulted in the inability to calibrate groundwater models developed. Dr. Mwansa highlighted the main findings of the study, which included that sewerage of the south and west coasts would impact adversely on the salt-water-freshwater interface, that the zoning policy was not enforceable, and that the present responsibility of the Barbados Water Authority for both supply and regulation may represent a conflict of interest.

In an effort to deal with these problems, strategies currently employed included the design of new zoning restrictions, policy change, legislative change, pricing and tariff structures, pollution penalties, public awareness, coordination and consultation, capacity building and monitoring.

Dr. Mwansa concluded that the Barbados Water Authority was hampered by existing structures,

and inadequate numbers of trained and qualified personnel. The Authority also concentrated on water supply, to the detriment of other aspects. The major problem with groundwater management lay in the lack of up-to-date and accurate information. In addition, insufficient research and public education was carried out. Steps had been taken to address these deficiencies. Lessons which could be learnt by other countries in the Caribbean included the need to avoid short-term projects to meet long term goals, the need to develop in-house capabilities for long-term management and planning, laws and regulations should allocate responsibility appropriately to appropriately trained staff, and public education and information dissemination should be viewed as long-term programmes.

Summary of discussions

Limitations of demand management programmes

Dr. Mwansa indicated that while the Barbados Water Authority had attempted to encourage conservation through distribution of shower heads and kitchen tap aerators to consumers who had fully paid their bills, this was not as successful as hoped because consumers did not view these as sufficient incentives for keeping up to date with their payments. He illustrated this with a comparison of the average daily consumption per person in un-metered households (148 litres), with that in metered households (243 litres). Tariff structures, he said did not encourage conservation in either metered or un-metered users. In the case of the metered users, monthly water bills represented a minimal average 1 per cent of monthly expenses, and in the case of un-metered users, usage was generally too far below the volume of water allowed by the lowest fixed rate to offer potential savings through conservation.

Impact of sea level rise on water resources in Barbados

Dr. Mwansa noted that contrary to conclusions of a previous speaker, sea level rise could possibly have beneficial impacts for Barbados, due to an increased head, which would make groundwater abstraction easier, and movement of the saltwater-freshwater interface inland. This could also apply to other larger islands sharing certain characteristics of Barbados' hydrogeology which included the presence of limestone aquifers and narrow, deep fresh water lanes.

Approaches to controlling illegal abstraction

In Barbados, as in Trinidad, problems of illegal abstraction were related to problems of enforcement. In addition, unclear statement of licence conditions, as well as a lack of monitoring of licenced abstractors, contributed to the problem. Approaches taken in Barbados to controlling this problem encompassed communicating resource limitations and consequences of over-exploitation to abstractors, and enlisting the support of the public in reporting instances of illegal abstraction.

Approaches to controlling salinity problems

The major approach to controlling salinity problems was to shut down production, which yielded significant reductions in salinity in as little as 24 hours. Public education programmes had resulted in a positive response by the public abstractor, but private abstractors were not as supportive. Artificial recharge was not used.

A Community Approach To Water Resources Management In The Caribbean:
The Case of St. Vincent
Mr. Nigel Weekes - Forestry Division, St. Vincent and the Grenadines

In his presentation, Mr. Weekes outlined the water resources management plan for St. Vincent and the Grenadines. Watershed management policy had been developed to meet the needs of the small rural communities, taking into consideration the constraints that the plurality of cultures placed on water resources management policies and programmes, in addition to population pressure and inappropriate national development policies. The critical constraint was the small size of the individual islands which made it difficult to distinguish watershed from non-watershed areas.

He stated that a water resources management strategy for this limited land base needed to consider the multiple user issue, the decline in agricultural productivity, increasing incidence of drought and floods, environmental decline, and a consequent decline in water quality over the nation's 13 watersheds. He described the model watershed plan collaboratively developed by the Forestry Department and Canadian expertise beginning in 1989. The first step involved a five-month socio-economic study of the Colonarie River Basin. One hundred and fifty-five interviews had been conducted with 121 householders and two State agencies operating in 10 percent of the watershed area. The demonstration project promoted agroforestry and soil conservation techniques, technology for improved land use and practical research trials. Private land owners were encouraged to subscribe to conservation practices or they would be subject to prosecution.

Problems encountered were that the demonstration project ignored the users in the lower watershed areas. Additionally it was difficult to convince the poor, landless rural people that their daily activities were problematic. The model was a technical success but lack of appropriate legislation was now the limiting factor. Lessons learnt were that water resources management could not be divorced from conservation and natural resource development, and that human behavior and compliance could not be legislated. He concluded that community empowerment and participation were necessary for achieving compliance.

Summary of discussions

Involvement of all stakeholders

In response to a question on the extent of participation, Mr. Weekes informed that all stakeholders including members of the local community had been involved in the watershed management project from the planning to implementation stages. After implementation of the pilot project, people from other areas of St Vincent visited the demonstration site. Mr. Weekes felt that the pilot project was also a good avenue to involve the community in monitoring land use and environmental problems in the watershed. The constraint regarding the low levels of literacy and widely differing perspectives would be addressed in the next financial year by a facilitator to promote dialogue with the community and with the youth development arm of the Ministry of Education. More radio and TV advertising was proposed to help to educate and mobilize communities.

Institutional concerns

In response to a question regarding the institutional relationships in implementation of the project and water resources management in general, Mr. Weekes informed that the project had been accepted by the Ministries of Agriculture and Physical Planning, and there were several pieces of legislation dealing with watershed management. However, the Environmental Advisory Committee's sole interest was to harvest the water. It was not concerned with the problems of water resources management. Funds had not been released for the Forestry Department to manage water quality and quantity. Another of the institutional problems was that the Water Authority also acquired land and with the expectation that the Forestry Department would rehabilitate it, although land reform was not

under the jurisdiction of that department. Further the authority of the Surveyors Department in some aspects lead to poor coordination of activities.

Indicators of project success

In response to an enquiry about the approach employed in determining the levels of success of the project, Mr. Weekes informed that the water quantities and quality and sediment levels were measured before and after the intervention. The findings were that there was success in the upper areas where farmers planted trees, while in the middle basin, agriculture continued to have negative impacts. This was in part because regulations to support legislation had not been fully established. While he reported success in the technical aspects, other areas were estimated to be weak and the some aspects of the five year plan were two years behind schedule. According to Mr. Weekes, one drawback had been the supply of technology which could not be locally maintained. This had severely hampered the development of the project.

Importance of clear goal identification, communication and political will

In response to a question regarding the major reasons for the success of the project, Mr. Weekes stated that the clear identification of objectives from the start had been a critical factor. The plan had been approved in cabinet and all the stakeholders understood the concept of the pilot project and its goals. In support, he gave example of the development of Colombia's management plan for an area covering 15 municipalities which had problems such as illegal drugs and guerillas. Conflict management was needed, and was undertaken based on instilling understanding of the water supply issues. Subsequently, understanding of the goals of the project became easier. Another lesson to be learnt from the experience in St. Vincent and the Grenadines, said Mr. Weekes, was that political will to sanction the plan needed to be present, especially at the highest levels.

Water Resources Management Strategy Preparation In Trinidad And Tobago
Mrs. Marilyn Crichlow Director, Water Resources Agency, Trinidad and Tobago and
Mrs. Victoria Mendez-Charles, Acting Permanent Secretary, Ministry of Planning
and

Development, Trinidad and Tobago

Mrs. Crichlow and Mrs. Mendez-Charles informed that the Government of Trinidad and Tobago's new paradigm for water resources management took a holistic and integrated approach

in relation to economic, environmental, technical, social and political considerations. This formed the basis for the development of a comprehensive framework for the rational development and utilization of the water resources, and for a strengthened institutional framework for sustainable development. The new medium to long term water resources management strategy was one element of the World Bank- funded Water Sector Institutional Strengthening Project. It sought to mitigate several constraints including the loose coordination of the multiplicity of relevant agencies, the lack of a proper institutional and legislative framework, instability in the quantity of available raw water, increased demand for water by the tourism and petrochemical industries and declining productivity of ground and surface water sources.

According to Mrs. Crichlow and Mrs. Mendez-Charles, the strategy had been informed by other national strategic plans. Management challenges to be faced in the development of this water resources management strategy for the future included the Water Resources Agency organizational structure and staffing, the institutional and legislative framework for integrated and sustainable management, stakeholder participation, changing the national culture to support water metering and the development of an effective decision support system. Specific issues addressed were also highlighted and included topics, such as financing, capacity building, water resources allocation and the institutional framework.

Mrs Crichlow and Mrs Mendez-Charles listed the important lessons learnt in the preparatory work and stressed the importance of identifying the scope of the work, and hiring the required expertise and experienced professionals for the evaluation of the technical proposal. The need for preparation for negotiation was highlighted as one important lesson for the future. The presenters then summarized the innovations in this holistic approach which included a focus on re-use, re-cycling and artificial re-charge of water, the application of GIS, the introduction of software models, and stakeholder participation.

Summary of discussions

Marine ecosystem

Responding to a question regarding the treatment of the marine ecosystem by the strategy, the presenters indicated that marine water issues and integrated coastal ecosystem aspects had been taken

into consideration. At present the issue was addressed only by ensuring that there were sufficient quantities of surface water for ecosystem function. They added that some by-laws to effect pollution prevention and enforcement of these laws were needed.

Cost effectiveness of water resources management strategies

It was stated that the terms of reference for the water resources management strategy for Trinidad and Tobago stipulated that all recommendations must be cost effective. Costs and alternatives had to be assessed, bearing in mind that the driving factor for the strategy was the need to provide water for existing and expected needs.

Community participation

In response to a question regarding the role of community participation, the presenters indicated that this was viewed as essential. They added that in order to be successful, the strategy would need to clearly indicate how often to contact communities, means of obtaining information, and how to address and incorporate issues raised by the communities. The community would participate by contributing to the strategy by identifying issues, problems and priorities, monitoring of resources and alerting to incidences affecting water quality and quantity.

Institutional relationships

In response to a query about the relationship between the Water Resources Agency (WRA) and the Water and Sewage Authority (WASA), participants were informed that the Water Resources Agency had been established in 1966 and had been affiliated with WASA since then. In the past, some stakeholders held varying views on whether this partnership was ideal. Some felt that WRA should not have been part of WASA since the latter was an operations and user-focused utility. Some also felt that the relationship compromised the Agency's integrity. Others felt that since the primary function of the WRA was for planning, WRA should fall under the Ministry of Planning. With the inception of new management bodies, some suggested that WRA could be affiliated with these, for example the Environmental Management Authority of Trinidad and Tobago.

Political commitment and public awareness

Participants agreed that political commitment was essential and the public should realize the need for water resources management. It was suggested that it was worthwhile to enlist the services of education and public information experts to meet these.

Watershed Management In Northeastern Puerto Rico
Dr. Fred Scatena, Ecosystem Group Leader, International Institute of Tropical Forestry,

United States Department of Agriculture

Dr. Scatena presented an overview of the problems of water resources management in Puerto Rico with specific reference to the Northeastern region and described the institutional responses to address these problems. In spite of high precipitation and abundant surface water resources in the Northeastern region the tremendous urban demand, recreational use, high levels of unaccounted for water (approximately 40 per cent), and inadequate storage facilities, led to water supply crises which necessitated strict rationing. Dr. Scatena indicated that the forest played a key role in maintaining the quality and ensuring the availability of freshwater, which he felt to be the most significant benefit provided by the forest. Other benefits were for the tourism industry, recreation and general ecological health. The water resources in this area accounted for 20 per cent of the island's total water supply. Water supply crises in 1980s stimulated the development of a new approach to water resources management which was still being developed. The strategy to address these problems entailed reduction of water losses through decentralization of the water authority, privatization of management, emergency telephone numbers, credit facilities for pipe repairs, integrated water supply and distribution systems to tackle the problems caused by localized drought, dredging of existing reservoirs, inter-agency cooperation (which led to the formulation of a Puerto Rico Water Plan and the Fast-tracking approach), plans for reforestation (Riparian buffer zones around reservoirs and island-wide projects) and conservation efforts (public awareness campaigns, low-water use in toilets, rationing).

In addition, Dr. Scatena described plans for regional waste-water treatment plants and construction of settlement ponds upstream of these reservoirs. Night-time reductions of withdrawals from streams was identified as one option to help reduce the losses in aquatic larval populations of species which migrate up and downstream.

Dr. Scatena indicated that a number of these plans did not win the support of the public in different localities. The integrated water supply and distribution system and regional treatment sewerage plants were of particular concern. In addition, the fast-tracking approach was not

successful. The poor public image of Puerto Rico's Water and Sewerage Authority was a key factor in the response of the general populace to public awareness campaigns. Dr Scatena concluded by stressing the importance of the latter to the success of conservation efforts.

Summary of discussions

Land tenure system in upper watershed areas

Dr. Scatena indicated that the forest was a protected area and therefore officially State lands. He added that land tenure might cause problems for necessary works in areas around reservoirs.

Financing of water supplies

Dr. Scatena indicated that cost of supply was borne by the State and that more emphasis was placed on the costs of sewerage treatment. He added that there were attempts to determine the true economic value of the resource.

Institutional framework

Dr. Scatena described the existing institutional framework as suitable for implementing new management strategies and policies. The Department of Natural Resources and the Puerto Rico Water and Sewerage Authority were identified as the two main agencies with authority over water resources and water supply. He indicated that the problem was ensuring smooth collaboration of these agencies.

Water Supply and Sanitation Collaborative Council

Mr. Charles Marville, Engineer, Operations and Maintenance, Barbados Water Authority

Mr. Marville's presentation reviewed the work of the Water Supply and Sanitation Collaborative Council (WSSCC), examined small island water issues and made recommendations for the way forward. He began with a historical account of meetings and other work, (making mention of the first global forum in Oslo 1991 and subsequent meetings in Rabat 1993, and Barbados 1995), which led to the identification of water resource issues of priority to small islands. The major issues identified were; watershed management, pollution, and desalination. He stressed the importance of identifying target groups to develop strategies for different sectors. The identification of finances and technical resources was also seen as necessary. He added that the formulation of effective

communication strategies would generate technical aid. He concluded by announcing the fourth global forum to be held in Manila, November, 1997, as the next activity on the schedule to promote water conservation.

Small Island Water Information Network (SIWIN)
Dr. Siyan Malomo, Chief Project Officer, Commonwealth Science Council

Dr. Malomo provided an insight into the work of the Commonwealth Science Council (CSC) and its relation to the Caribbean and integrated water resources management. He pointed out that the Commonwealth Science Council utilized science and technology for social, economic and environmental development. He informed that the CSC carried out its mission through collaborative efforts by providing support of research and development, human resources development, the development of science and technology policy, technology transfer, and information exchange. The establishment of a Small Island Water Information Network (SIWIN) was one outcome of a meeting of the Administrative Group of the CSC. The SIWIN, he said, was primarily a network to address water resource information in small islands, arid and semi-arid states.

The Network was established on the basis that small islands had limited water resources, and were experiencing increasing pollution and demand for water. Professionals tended to be isolated, and required information available in other parts of the world. Other partners of the network included the the University of the West Indies Center for Environment and Development (UWICED), the South Pacific Applied Geoscience Commission (SOPAC) Secretariat, the University of Mauritius, the Geological Survey of Cyprus and the British Geological Survey. A SIWIN workshop had been held at the SOPAC Secretariat in Fiji from 5-7 February, 1997. At this workshop, the issues identified were similar to those in the Caribbean, and it was decided that a similar network be set up to provide water information in the Caribbean.

NETWORKS FOR COOPERATION

OAS Inter-American Dialogue on Water Management and
the Inter-American Water Resources Network
Mr. David Moody, Water Resources Consultant, Unit of Sustainable Development and
Environment, Organization of American States

Mr. Moody summarized the Action Plan for the Sustainable Development of the Americas Water Resources Initiatives, presented at the agency's summit in Bolivia in 1996. At this summit the OAS was charged with the coordination and follow-up of the deliberations from the meeting. He pointed out that each recommended action arising from the meeting could benefit from an information network. He described the Inter-American Water Resources Network (IWRN) as a grass-roots organization born out of the first Inter-American Dialogue on Water Management held in Miami in 1993. The participants in this Dialogue viewed the IWRN as a forum for bringing together key actors in the water sector to facilitate sustainable development and integrated water resources management world-wide. The objectives of the IWRN included building shared understanding of issues; clarifying water resources needs and priorities; increasing access to skills, knowledge and strategies; building a network of networks; and creating collaborative partnerships. In building partnerships, strategies and infrastructure employed included directories which could be used by consultants and other interested parties, a list-serve, a World-Wide-Web site and a number of workshops and dialogues. In closing, Mr. Moody commented that all interested parties could get involved by subscribing to the available databases not only to obtain information, but also to post activities in which they may be involved. In so doing, continued dialogue would be promoted.

WMO : Hydrological Cycle Observing System for the Caribbean Basin
Mr. John Bassier, Chief, Hydrology Division, Hydrological and Water Resources
Department,
World Meteorological Organization

To underscore the growing urgency of addressing the global freshwater situation, Mr. Bassier presented a number of slides showing water issues as featured in the international press. The major question, he said, was whether there would be enough water in the twenty-first century and how the international community should respond to the problems facing the world. In the Caribbean developments in the earth's environment related to global warming indicated the critical importance

of addressing water resource management issues. To assist in addressing these issues, the WMO had established a programme called the World Hydrological Cycle Observing System (WHYCOS).

WHYCOS sought to address the constraints placed on the development of water projects resulting from inadequate or unreliable hydrological data. Mr. Bassier informed that it was a tool for improving the collection, dissemination and use of high quality standardised and consistent hydrological and related data at the national and international levels. In addition to the other WHYCOS initiatives, there were plans currently underway to develop a similar project for the Caribbean region (CARIB-HYCOS). In closing, Mr. Bassier noted that such a system would be beneficial to the region, if only because external support agencies insisted on design data for implementation of projects.

CATHALAC: Networking in the Humid Tropical Regions of
Latin America and the Caribbean
Mrs. Maria Concepcion Donoso, Director, Centro del Agua del
Trópico Húmedo para América Latina y el Caribe, (CATHALAC)

Mrs. Donoso described CATHALAC as an NGO with representatives from all countries of the humid tropics of the Americas, which was established under an agreement between the Government of Panama and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Its principal objective was to transfer information, knowledge and new technologies among scientists and decision makers throughout the region. This was done through the organization of workshops, seminars and conferences, and by the construction of networks within the region and cooperation with existing networks. According to Mrs. Donoso, CATHALAC also provided support for policy makers in the region. The major network comprised 15 organisations with focal points in each. She added that all the networks with which the organization was involved had the common objective of the sharing of information and the exchange of knowledge through cooperation. According to Mrs. Donoso, this was chiefly responsible for the major accomplishments of these networks in the regionalization and internationalisation of research. She anticipated that increased networking would be employed to address the problems related to water resources management in the region.

INSULA : International Scientific Council for Island Development
Mr. Ronald Parris, President, INSULA

Mr. Parris described INSULA as an NGO affiliated to UNESCO, established to promote sustainable development in all regions of the world by encouraging scientific and cultural cooperation among islands and by contributing to integrated planning and management of island resources. He informed that there were some 300 institutional and individual members constituting a multidisciplinary network of experts. Highlighting one activity of INSULA, he informed that on that organization's involvement with a number of information networks in European islands, involving computer technology applications, and with other information networks. INSULA's interests in the Caribbean, he stated, focused on initiating or collaborating in the development of similar information networks that would help address some of the data management issues raised at the meeting. He also emphasised the importance of bringing together social scientists, such as anthropologists and sociologists, since many of the problems of water resource management were cultural.

UNU/INWEH

Dr. Ralph J. Daley, Director, United Nations University/International Network on Water

Environment and Health

Dr. Daley provided an overview of the INWEH, presenting it as a possible networking organization which could be accessed by interested parties in the region. He stated that INWEH was a new agency in the United Nations system, and was sponsored by the Canadian Government. Its approach was described as non-traditional, employing no in-house staff, but soliciting the services of a team of professionals whose services were solicited for various projects. The organization's approach was an integrated one, which attempted to take a long-term perspective on the agency's activities. He expressed the hope that the agency's resources would be exploited when problem solving exercises were undertaken in the Caribbean.

EXISTING PROGRAMMES FOR REGIONAL COOPERATION

The Inter-American Development Bank :

Strategy for Integrated Water Resources Management

Mr. Luis Garcia, Principal Water Resources Specialist, Inter-American Development Bank (IDB)

Mr. Garcia presented the strategy used by the Inter-American Development Bank in its work in integrated water resources management in Latin America and the Caribbean (LAC). The strategy had been developed through an iterative procedure in consultation with country water resource officials, Bank staff, NGOs, and international lending and technical assistance organizations. Bank financing of water-related projects had been substantial during the past 35 years (approximately US \$33 billion). Under the Eighth General Increase in the Resources of the IDB (IDB8), bank programmes in the water resource sector were required to reflect the socioeconomic and environmental needs of the borrower countries and serve the interests and needs of water users at the local and community level.

According to Mr. Garcia, the external goals of the Bank's strategy were to support a process of change regarding water resources issues - namely a shift from development to management and from a sectoral to an integrated approach. The focus of the strategy was on the flexible application of principles and instruments, taking a problem solving approach. Mr. Garcia described several instruments used by the Bank to assist borrowing member countries to achieve improvements in

integrated water resources management. These instruments included country dialogue, country and regional technical cooperation, trust funds, sector and hybrid loans, project specific loans, small project loans, private sector loans, cofinancing and the Committee of Environmental and Social Impact (CESI).

World Bank: Water Resources Management Policy
Mr. Francois-Marie Patorni, Coordinator, Water Policy Reform Programme,
Economic Development Institute of the World Bank

Mr. Patorni informed the meeting on the work of the World Bank in water resources management. To date, the World Bank had lent \$40 billion for water resources management, and projected that a further \$40 billion, or 15 per cent of total bank lending, would be disbursed over the next decade. According to Mr. Patorni, in the last decade growing international consensus on sound water resources management principles had emerged. Application of these principles was required to deal with such problems as low irrigation efficiencies, the loss of 50-60 per cent of wetlands, losses in biodiversity. Traditional approaches to water management based on "getting more water to meet demands", had proved sustainable. The World Bank had assisted with the formulation of regional water resources management strategies for the Middle East, Sub Saharan Africa and the Caribbean. In the Caribbean, World Bank support was partly provided through the Global Environment Fund (GEF), and in Trinidad, had included institutional strengthening, private sector management of the water supply, a watershed rehabilitation project, a national parks and watershed project, and a flood control and drainage project. Mr. Patorni indicated that the World Bank did not disburse funds unless the requesting country had a national water policy and strategy. The World Bank also operated at the macro level dealing with institutions based on approaches which included donor coordination, global water partnership as represented by the World Water Supply and Sanitation Collaborative Council, and capacity building.

Caribbean Development Bank Support For Water Resources Management
Mr Wendell Lawrence, Deputy Director, Productive Sector Division,
Caribbean Development Bank

Mr. Lawrence indicated that the Caribbean Development Bank and its member countries, from

Belize to Guyana were limited in size and resources, and therefore the disbursements of the Bank were substantially smaller than those of the World Bank. According to Mr. Lawrence, the CDB's traditional function had been to provide financial assistance to governments and water utilities to develop water supplies, based on concern that these supplies were diminishing. The Bank's members were small islands developing States, where water supply was characterized by extensive losses, as high as 50-60 per cent. The result of this was that the costs to produce the water were not recovered. Other critical issues included polluted watersheds, problems of solid and liquid waste management and inadequate institutional arrangements. The Bank's role had been to enhance the capacity of these member States to deal with these issues themselves. Each CDB member country had its water supply under the control of different government departments, in which weak institutional arrangements, lack of regulations, and poor enforcement of policies were major constraints. Additional problems included limited finances, the inability to generate funds for new business or maintenance and repairs, flood control, storm damage, the shortage of skills, and budgetary problems. Mr. Lawrence informed that the CDB had been working to help members develop commercially viable, autonomous water supplies, but desalination projects were extremely costly.

WORKING GROUP REPORTS

Group 1 : Public Awareness and Education Strategies

Statement of the problem: Human behaviour is not consistent with proper Water Resources Management (WRM)

Causes of the problem

- Lack of information
- Lack of understanding
- Lack of appreciation
- Poor packaging of information
- Lack of motivation/incentives
- Lack of resources
- Inefficiencies in infrastructure
- Lack of enforcement of legislation
- Inadequate legislation
- Inadequate human and financial resources for monitoring, training, etc
- Poor co-ordination and co-operation between agencies
- Poor user perception as guardians/protectors of water resources
- Lack of trained personnel to disseminate information
- Low political priority
- Cultural practices
- Poverty/affluence

Conceptual solutions to problems

Focus - Public awareness

1. Research target groups:
 - Identify needs
 - Evaluate past and existing programmes
 - Disseminate information effectivelyIncrease in qualitative and quantitative information will result in better understanding and appreciation of water resources.
2. Promote feelings of ownership/stewardship:
 - Include users as part of planning process
 - Foster attitudes towards protectionEmpowered persons can put pressure on politicians
3. Develop advocacy programmes
 - To target low political priority
4. Cultural practices
 - Involve all affected groups
 - Develop strategies consistent with societal norms
5. Poverty/Affluence
 - Involve poor groups in planning from inception of programme
 - Educate about negative practices
 - Provide practical, reasonable and economic alternatives
 - Strict enforcement of legislation as a deterrent

One practical solution

Project Plan : Development of a model catchment area for demonstrating proper integrated Water Resources Management practices.

Purpose of plan : To access the real situation in natural catchments
Activities to achieve project completion

Who?

Mass Media - dissemination of information
Schools - target youths to increase public awareness
General public - Community participation to foster feelings of ownership and empowerment
towards achieving sustainable water resources management. Includes NGOs, environmentalists,
university students, agriculturists, industry, health departments, etc.

How?

Promotion of project through competitions
Schools: essays ; drawing/art; photography ; debates; television quizzes; small scale models;
General public: technical proposals; photography; debates;
National competition winners will go on to regional level

3. Define the project team

At the national level:

- Project Manager
- Hydrologists
- Communications experts
- Water Resource Managers
- Environmentalists
- Educators
- Architects
- Planners
- Engineers
- Artists
- Land Resources Persons
- Sociologists

Economists
Politicians
etc

Regional level requires coordination

General function of project coordinator

To provide complementary support to national team.

To bring together other regional bodies

Time-frame for project : 5 years

Year 1 Collection of baseline data

Project proposal

EIA + Gender Impact Assessment

Site Selection

Initial presentation to public

Budget formulation

Cash flow preparation

Progress review - regional and national

Year 2

Source funding

Tendering

Contract awards for design works

Provide public information

Review progress to date

Year 3

Start design model works

Continue public participation through
consultation. Produce brochures,

posters, etc

Start construction

Progress review

Year 4

Design continues

Public information continues

Initiate site visits and tours

Increase output of brochures, posters,
info sheets, handbooks

Press exposure - TV, newspapers, radio

Completion of model design

Involve community in management

practices for future upkeep of project

(sustainability of project)

Year 5

Finalize construction works

Implement maintenance programme for
sustainability of project (include training)

Further development of material

GRAND OPENING

Progress review - lessons learnt, plans
for future

Regional Coordinator will bring bodies
together to ensure project success.

Financing the project

Average cost of project for each Caribbean island = US\$5m

Total for all of the Caribbean - US\$150m

Group 2 : Institutional Coordination Strategies

Recommendations

1. Establish national water resources councils and a regional task force for the development of policy framework at the national and regional levels

Facilitate, coordinate and monitor the implementation of water policies and programmes

- coordinating unit (legal authority/ normative/ regulatory and enforcement functions)
- adoption of an integrated water resources management and scientific model at the national level

Review and evaluate existing water related institutions (which include formal consultation between stakeholders)

Reform/ improve water resources management related institutions

- institutional strengthening and inter-agency/ inter-sectoral coordination through the use of memoranda of understanding, steering committee mechanisms

Who: National government

When: Short term (1- 2 years)

How: Through inter-agency and inter-sectoral units/ agencies together with the support

agencies ; routine monitoring and reporting of general progress through CCST

2. Take actions to achieve efficient and effective coordination of support agencies

Establish and identify regional coordinating units for water resources management at the regional level

Prepare and disseminate inventory of ongoing and planned water related projects at the national and regional level

Coordinate support agencies through instruments of cooperation (formal agreements/

joint funding agreements : MOU/ through coordinating units of water resources council,

periodic evaluation meetings)
Conduct periodic evaluation meetings among support agencies and regional countries

Who: Coordinating units at national level and principal support agencies at regional level

(through CCST, NRMU, UWI)

When: Short term (1- 2 years)

How: Through organization of periodic evaluation meetings by CCST

3. Review and strengthen inter-agency training at both national and regional levels

Develop regulatory and enforcement Programmes/instruments

Training in demand management techniques

Revise curricula (formal and informal)

Conduct resources inventory

- human resources

- financial resources

Who: Water resources councils at national level, and UWI, associate universities, UNESCO,

regional coordinating task force through CCST

When: Immediate and short term

How: Surveys/ questionnaires ; analysis and conclusions; sponsored seminars/ workshops

4. Develop water resources information systems for sharing at regional and national levels

Develop data collection standards and databases formats

Evaluate the feasibility of developing general information system (GIS with multi-user

capacity)

Formulate and conduct research and development

Initiate resources inventory

- human and financial/ physical

- databases/ bibliographic, data and information

Who: CMI, INSULA, CSC, at regional level; water councils, at national level

When: Immediate to medium term (3- 5 years)

How: Technical assistance; joint technical and scientific efforts through technical cooperation activities/ projects

5. Implement joint technical projects at the national and regional levels

Identify issues

Transfer technology

Conduct demonstration/ pilot projects for innovative technologies (e.g. Scavenger wells/ retention dams for water resources management)

Who: National water councils at the national level, and NRMU/OECS, UNESCO, supporting

regional agencies at the regional level ; regional coordinating task force (CCST will coordinate)

When: Immediate and on-going

How: Through national natural resources institutes, regional university and regional research institution

Group 3 : Water Resources Policy and Legislation

Purpose statement: To sensitize politicians and public to the situation in the future where water scarcity problems will limit economic growth and consequently affect the quality of life.

Two major policies analyzed :

Establishment of a comprehensive water resources management agency
Management of water resources must be guided by the concept of sustainability as laid down
in the landmark report ; "Our Common Future"

For the politician :

1. Water is finite and must be managed sustainably. Access to potable water is a basic human right
2. a) In (name of country) water resources will last for (x) years
b) The impact of development on water demand
3. People/Institutions will be identified to assess water resources
4. Determination by legislation that the agencies responsible for supply and distribution carry out
these functions by using acceptable water demand management practices

Legislative issues :

5. Establishment of a water resources agency and identification of its main functions
6. Allocation, priorities, norms-regulations
7. Watersheds/Zones/Emergency areas
8. Drilling codes
9. Hydrogeological data collection and research : data collection, levels, quality, access,
monitoring of abstraction
10. Metering law : Two stages - comprehensive second stage
11. Economic Unit : evaluation of economic and financial incentives, sanctions
12. Water Quality : pollution, rules, regulations
13. Water rate-setting: automatic/special rates
14. Board : composition, who dominates, chairperson, functions
15. Specifications for water fittings : standards
16. Retrofitting : incentives for, manufacture/import
17. Monitoring unit : functions, access
18. Special tribunal for water affairs : composition one or two judges, representative from the public

TOPIC
POLICY
LEGISLATION

Institutional/Administrative
Issues

Establishment of a board by
law in which stakeholders are
represented

Enactment by law of a water
resources agency : Functions
to include :

- Allocation and permits for
development and supply
- Monitoring
- Rate-setting for resources
- Hydrological data
collection and research
- Supply
- Planning

Demand Management

A water demand impact
assessment for every project,
to be considered in the overall
evaluation of project
proposals

Legislation which explicitly
states that all water resources
belong to the States and is
administered by the water
resources agency.

Comprehensive metering laws

Drilling laws

Allocation laws

Hydrological responsibility

Institutional/administrative issues

1. Institutional Development & Interaction between Institutions.
2. Cross-sectoral linkages (coordination between agencies).
3. Policy to ensure administrative reform towards efficiency.
4. Capacity retention and capacity building in organizations.
5. Policy to ensure private sector participation in water resource development and management.
6. The establishment of a unit responsible for Demand Management.

PROTECTION OF WATER RESOURCES

1. Water quantity and quality monitoring.
2. Development of mechanisms for enforcement (and for more effective enforcement) and
Supporting legislation to curtail and discourage water pollution and to promote
coordinated concerted efforts by all sectors.
3. Development and application of regional standards and guidelines for monitoring water
resources.
4. Policy to promote water conservation.
5. Development of regulatory frameworks.

ISSUES RELATED TO GENERAL PUBLIC

1. Public education and awareness creation to promote sustainable water resources use.
2. Policy to ensure community participation in planning and the decision-making process.
- 3 Policies to ensure sustainable participation in water resources management with the aim
of empowerment.
4. Policy to ensure equitable and just allocation of potable water/all water resources

ISSUES IN WATERSHED MANAGEMENT

1. Land use management in critical watersheds/all watersheds.
2. Review of policy and legislation related to watershed management

OTHER ISSUES RELATED TO MANAGEMENT

1. Development of policy tools for watershed management.
2. Policy for investment taking into account the master plan and institutional performance.
3. Resource-oriented management policy (ensuring that activities are not project oriented).
4. The incorporation of demand management as a developmental approach.

ACTION PLAN
SOURCE/TYPE OF FUNDING

1.0 NATIONAL WATER POLICY

To create a national water policy for the management and complete assessment of water resources as a function of natural social and economic growth trends
National budgetary allocation

N.B. This depends greatly on the political will to manage the water resource

2.0 WATER RESOURCES MASTER
PLAN - (IWRM)

To define the supply and demand for water at the level of hydrographic basin, making them an integral part of the national development policies.

To create a National Waters Policy for the management and complete assessment of water resources - as a function of national, social and economic growth trends, and the countries development strategies, and with the participation of the user sectors and the rest of society

To establish measures to ensure that the policy is executed continuously and independently of changes in government

To create the necessary standards to ensure that all water-related economic, social and environmental projects are based on comprehensive, up-to-date water resources assessment.

To create, for the territories with extreme water scarcity, special research studies on storage, collection and retention of precipitation and surface runoffs, as well as other means of increasing water availability (desalinization, management of demand, importation of water)

To establish intensive publicity programmes for education, communication and information aimed at raising the public awareness of the rational use of water and the need to pay its real cost, as being indispensable for the efficiency of services and the continued capacity for re-investment

To foster the protection of the natural water resources of the basin as a means of conserving water resources.
National

(To establish and maintain the institutional

arrangements. May require technical assistance support)

External

Regional - CDB, OAS

Bilateral - UK, ODA, USAID

Multilateral - IDB, WB, EC, IDA, UNDP

Note : the first priority would be to use grant aid financing, preferential credit

3.0 IMPLEMENTATION OF COMPONENTS OF THE MASTER PLAN

COMPONENT FINANCING

3.1 Institutional Arrangements

To establish institutional and legal mechanisms for the management of the water resources

To establish the institutional mechanisms for effective coordination and integration among the water users

Local/Government

3.2 Public Education

To design and carry out ongoing public education programmes nationally and regionally

To establish inter-regional communication links for the exchange and dissemination of information

Local/Government/Regional

3.3 Legislation /Regulations

To develop water-related legislation and regulations covering surface and ground water uses

To develop water-related legislation and regulations
for the protection and conservation of water resources

Local/National

3.4 Human Resources

To satisfy human resources needs of the water sector
for the short, medium and long terms

Local/regional/International

3.5 Information Systems

To establish a national/regional Information System

To establish appropriate programmes of rate
management , compilation, storage and dissemination
of water-related data and information

Local/Regional/International

4.0 SUSTAINABILITY

Financing for the continuous operation of systems and programmes established
after the limited
implementation of the sector plan.

4.1 Systems and programmes

GIS/MIS/Hydrological Data

Public Education

Human Resources

Institutional coordination and monitoring

Sources of Financing

Regional/International

Government Budget allocation

User fees

Licences

Royalties

Incentives

4.2 Sectors

Sector

Method(s)/Goal(s)

- 4.2.1 Tourism Full cost recovery
 - Taxation (direct)
 - User fees
- 4.2.2 Irrigation Scaled User Fees
 - Subsidies (Public Funds)
 - Cost of water
 - Licensing fees
- 4.2.3 Potable Water User Fees (scaled)
 - Subsidies (Public Funds)
 - Licensing Fees
 - Royalties (for quantity used)
- 4.2.4 Industry Scaled user fees
 - Licensing Fees
 - Royalties
- 4.2.5 Electricity Royalty
 - (Hydroelectric power)
- 4.2.6 Waste Water
 - (General Company)
 - Domestic Discharge fees
 - Industrial Discharge fees
- 4.2.7 Other sectors/activities
 - Mining permits Licences
 - Commercial Fishing permits Licences
 - Forestry Licences
 - Insurance Companies Licences
 - (information)
 - Recreation Licences
 - Data dissemination User fees
 - Penalties/fines User fees

5.0 REGIONAL PROGRAMMES AND FINANCING

5.1 Human Resources Development

Human Resource needs to be assessed and training programmes identified, e.g.

CMI programmes for measurements in hydrology
 UWI programme - water resources and hydraulic engineer/Technicians
 Lab technician training through CEHI/CBWMP

Regional organizations to finance, e.g. CDB,
CCST, OAS/UNDP, etc. along with local
and international financing

financed by local governments

5.2 Networking/MIS

Establishment of regional network including provision of computers

5.3 SUSTAINABILITY

Ongoing monitoring of IWRM strategies - workshop/seminars

OAS,CATHALAC,CSC
Commonwealth Secretariat
local user subscription fees to be established

CCST/OAS/CDB/UNDP

CLOSING SESSION

Initiating a round of closing remarks, Mr. Donatus St. Aimee, expressed his hope that the mix of persons represented would translate to the integration of actions in the future. He was of the view that some of the tasks set by the Honourable Minister Ganga Singh had been achieved, and clear directions for the way forward set.

Mr. Francois-Marie Patorni, clarified that the aim of the Economic Development Institute was to help disseminate seed money for water policy reform. He was of the view that the seminar had enlightened and uplifted, and provided a chance to work together. He had witnessed genuine concern and commitment for integrated water resources management and a valuable exchange of views. In his estimation, there was a better understanding of the need for an integrated water resources management, and participants had had the opportunity to define a realistic future agenda for policy reform. Where some concrete recommendations had been made, other specific actions could be extracted from the general recommendations. Mr. Patorni emphasized that whatever actions were to be taken required champions to drive change.

Mr. David Moody spoke about the growing urgency of integrated water resources management, and the plans and strategies needed to put discussions of the meeting into effect. He was of the view that progress could be achieved, even if only a few of the recommended actions were implemented, and that such progress would require good will, innovative thinking and hard work.

Mr. Luis Garcia stated that water resources management was a continuous process that was started many years ago. In Costa Rica in 1996 a master plan for the region had been drafted. The present seminar had moved forward and looked at the details, and brought perspective and vision. This was attributed to the work of the working groups, whose mandates had been appropriately identified in his view. Solutions and ideas had been formulated for all levels. While the elements of an action plan had been achieved, someone had to move and coordinate and make things a reality, and he challenged participants to form many "working groups" to undertake this responsibility.

Mr. Wendell Lawrence was of the view that the working groups had provided a basis for future work. While acknowledging that it was sometimes difficult to follow up after meetings,

he challenged each participant to do their best to accelerate and pursue the development of integrated Water resources management. Mr. Lawrence urged all the participants to disseminate their own report on the conclusions of meeting as widely as possible, and to ensure its use as the basis for discussion at the national level.

The Minister of Planning and Development, Trinidad and Tobago, the Honourable Trevor Sudama, expressed his appreciation to the organizers and sponsors of the meeting. Indicating that he considered the seminar of extreme importance, he extended special thanks to the participants of the meeting. He stated that the meeting was a timely one in light of his Government's initiatives to improve the efficiency of the water sector, and would be of benefit to activities in Trinidad and Tobago, as well as other countries. He highlighted initiatives in his country which recognized that water resources management needed to be consistent with broader national goals. These included a draft National Environmental Policy, a Strategic Socio-Economic Development Planning Framework, and the review of the then-existing National Physical Development Plan and the current Public Sector Investment Programme. Referring to some of the conclusions of the working groups at the meeting, he stated his commitment to ensuring that due attention was given to these. Responding to indications of interest in Trinidad and Tobago's experience with a private sector operator, he stated his willingness to share this experience. Government commitment and action in partnership with the private sector and NGOs, with the support of the regional and international organizations, he stated, would boost progress in developing and implementing water resources management strategies. In closing he reiterated his appreciation to the organizers and cosponsors, and expressed the hope that participants would be able to contribute to the improvement of the quality of life of the peoples of the region.