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**OVERVIEW OF THE WATER PROFILE AND THE CAPACITY OF
NATIONAL INSTITUTIONS TO IMPLEMENT INTEGRATED
WATER RESOURCES MANAGEMENT
*(Antigua and Barbuda, Dominica, Grenada)***

This document has been reproduced without formal editing.

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Executive Summary

The Caribbean islands Antigua and Barbuda, Dominica and Grenada are Small Island Developing States (SIDS) each with populations less than 100,000 persons. The most important factor in the development of the economies of Antigua and Barbuda, and Grenada is tourism, whereas for Dominica it is agriculture.

Each of these islands enjoys a tropical marine climate with little seasonal variation. Annual rainfall for Antigua and Barbuda varies from 750 to 1,400 mm and for Grenada from 1,500 to 5,000 mm whereas average annual rainfall for Dominica ranges from 1270 mm to 7620 mm. Annual temperatures for these islands vary between 20° C and 34° C. Unlike Dominica and Grenada, the annual average evapotranspiration rate in Antigua and Barbuda is higher than the annual average rainfall.

In the three islands, the organizations responsible for the provision of a potable water supply, namely the Water Division of the Antigua Public Utilities Authority, the Dominican Water and Sewerage Company and the National Water and Sewerage Authority of Grenada, are also responsible for water resources management. However, the focus on water resources is minimal. Water resources/hydrological monitoring is inadequate and the data collected do not allow water availability to be assessed. Water sources in Antigua and Barbuda and Grenada are surface water, groundwater, rainwater harvesting and desalinated water, whereas in Dominica the water source is from surface water.

The water allocation mechanism for each of the islands is based on meeting water requirements of the various users and availability, otherwise known as a supply management approach. Domestic supply is a priority for each of the islands but tourism is also a priority for Antigua and Barbuda, and Grenada. In each of the islands, the World Health Organization (WHO) guidelines are used as the standards for water quality and the Ministry of Health monitors the potable water quality which generally meets the required standards. In each of the three islands, a department/division of the Ministry of Agriculture is responsible for watershed management which, in general, is not undertaken effectively and appears to be almost non-existent in Antigua and Barbuda. There is water abstraction licensing in Antigua and Barbuda, and Dominica. With respect to Grenada, legislation supports water licensing but there are no regulations and licensing of water abstraction has not been established.

Environmental impact assessments are requirements of the planning process in Dominica and Grenada but they are not mandatory in Antigua and Barbuda. The latter is certainly a deficiency to supporting sustainable management. However, recently in Antigua, an Environmental Management Protection Bill and an Environmental Health Bill were drafted.

Wastewater disposal in the islands of Antigua and Barbuda, Dominica and Grenada is mainly by septic systems and soak ways. However, in Dominica, there are three centralized sewerage systems – one serving 2,700 households in Roseau and two smaller sewerage systems in Canefield and Jimmit. Only at the Roseau system is basic material and sludge removed. In Grenada, there is one centralized sewerage system in the south of the island which has no treatment before disposal at sea. However, in Antigua and Barbuda, there is no centralized

sewerage system, although the Public Utilities Authority has powers to establish, operate and maintain a sewerage system.

Water is a social good, it has an economic value and it must be managed for sustainability. In Antigua and Barbuda, the cost of potable water to consumers indicates that the water supply is highly subsidized and poor areas in Antigua and Barbuda have access to free supplies of potable water through public standpipes. In Dominica, the latter is similar for the poor sector. The cost of water supply and sewerage services is a function of affordability to pay and not of economic value. A metering system for all consumers in Dominica was introduced as a deliberate conservation policy and a means of reducing wastage. Similarly, in Grenada metering has resulted in improved efficiency of domestic water use, and acceptance to pay for water used. In Grenada, standpipes were removed to ensure each household is connected to the potable water supply system in areas where metering was introduced. An easy payment plan was also introduced to facilitate household connections.

In Antigua and Barbuda because there is no centralized sewerage system, the tariff structure is only for water. For domestic purposes, the rates rise with an increase in consumption and therefore support efficiency of use and conservation. In Dominica and Grenada, the tariff structure is a system to recover costs for both potable water supply and sewerage services. In Dominica, the structure is not designed to reflect the economic value of water nor the need to encourage conservation. In Grenada, the tariff structure should be designed for full cost recovery according to the National Water and Sewerage Authority (NAWASA) Act 1990, but this is not the case.

Water resources data and information are neither comprehensive nor sufficient to support effective decision-making for sustainable water resources management in any of the three islands. There is also no mechanism for the dissemination of water resources data and information which are only disseminated on request.

An effective institutional framework is fundamental to implement policies and plans for successful integrated water resources management. Therefore, the structure, roles and responsibilities at the national, sectoral and community watershed levels must be clearly defined and coordinated to effectively undertake the scope of actions in the water sector. The responsibility of the water sector must be shared with key stakeholder departments. Hence, a number of sectoral policies and plans must be consistent with the National Water Resources Management Policy. This water resources management policy must also be in keeping with National Development Plans. Within the context of the specific functions and tasks inherent in Integrated Water Resources Management (IWRM), the present institutional framework of the water sector is inadequate with respect to planning, management and regulatory functions of water resources.

There is no specific IWRM policy, strategy and plan for the three islands. The water resources management activities being undertaken are based on a sectoral approach. Coordination is absent and collaboration on water resources issues is minimal. At present in Grenada, a National Water Policy in which IWRM is an integral part is being drafted. Dominica also expects to start work on development of an IWRM policy before the end of 2007. There is

also no legislation on IWRM in the three islands and insufficient enforcement of legislation which relates to water resources management.

In the three countries, neither a water resources master plan nor a water allocation mechanism has been developed. Water requirements of the various sectors have also not been determined and in the absence of an analysis of water demand, demand management is not directly applied

Conservation measures are minimal. In Antigua and Barbuda, and Grenada, the tariff structure and the limited public education support conservation. In addition, the metering programme in Grenada also supports conservation but the 40 per cent water loss in the distribution system is a major contributor to wastage. In Dominica, conservation measures seem almost non-existent.

Inherent in the core IWRM functions are actions linked to other sectors that are necessary for sustainability of use and development of this water resource and to support social and economic development. Effective IWRM must be undertaken in conjunction with effective land and landuse management, integrated watershed management, drainage and coastal zone management. These necessary complementary functions should be undertaken in a formalized coordinated approach with stakeholder partnerships and collaboration from planning to implementation and supported by proper public education and awareness.

In the three islands, water resources management is the responsibility of the potable water supply organizations but the core activities of IWRM are not being undertaken because of insufficient and competent human resources. In addition, the key stakeholder organizations generally lack the capacity or skills and experience needed, hence the establishment of IWRM would require additional capacity-building, training and recruitment of appropriate staff.

The core functions of IWRM should not be placed in the organization responsible for potable water supply and sewerage services or any organization that is a user of the resource, as this is conflicting and tantamount to the manager of the resource being managed by a user of the resource. Furthermore, in addition to the deficiencies in human resources capacity and capabilities and the lack of financial resources, challenges which have led to IWRM not being implemented or advanced include:

- Lack of understanding of IWRM;
- The location of IWRM;
- Lack of vision for IWRM;
- Development of an IWRM organizational structure;
- Implementation of an effective governance structure;
- Lack of skills and knowledge base required;
- Financing of an IWRM organization.

The way forward must, therefore, focus on how IWRM could be implemented in the islands.

Introduction

This report presents an overview of the water profile and the capacity of national institutions to implement Integrated Water Resources Management (IWRM) in three islands; Antigua and Barbuda, Dominica and Grenada. The methodology included the development of a questionnaire that was forwarded to the water organizations in the three islands and in the case of Grenada, to the Landuse Division of the Ministry of Agriculture as well. The questionnaire addressed the following:

- Water resources assessment;
- Enabling environment;
- Baseline on demand and supply;
- Institution;
- Social change instruments;
- Economic instruments;
- Regulatory instruments;
- Information management and exchange.

Additional information was obtained through face-to-face interviews and meetings with representatives of key IWRM government stakeholders in Dominica and Grenada as well as the telephone interviews with major stakeholder representatives in each of the islands. Further information was obtained through a review of the relevant literature.

A. IWRM

The Global Water Partnership (GWP) defines IWRM as “a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem.” (GWP, 2006).

B. Water management principles

Four water management principles developed in Dublin, Ireland,(UNCED - Rio de Janeiro 1992) play a major part in water sector reform:

Principle 1

Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment.

Principle 2

Water development and management should be based on a participatory approach involving users, planners and policy makers at all levels.

Principle 3

Women play a central role in the provision, management and safeguarding of water.

Principle 4

Water has an economic value in all its competing uses and should be recognized as an economic good as well as a social good.

C. IWRM change areas

When considering the method of managing water, the enabling environment, the institutional framework and the management instruments that comprise 13 IWRM change areas should be considered. The 13 key IWRM areas(Catalyzing Change,2004) are as follows:

The enabling environment

1. Policies;
2. Legislative framework;
3. Financing and incentives structures;

Institutional policies

4. Creating an organizational framework;
5. Institutional capacity-building;

Management instruments

6. Water resources assessment;
7. Plans for IWRM;
8. Demand management;
9. Social change instruments;
10. Conflict resolution;
11. Regulatory instruments;
12. Economic instruments;
13. Information management and exchange.

D. Structure of the report

The report was structured so that the water profile generally provides an overview of the IWRM change areas. Capacity of national institutions is one aspect of the institutional roles and an assessment of the capacity of governmental institutions with functions related to water management, at present, were undertaken. An overview of the water profile and capacity of national institutions in each of the islands was treated separately followed by recommendations, challenges and the way forward for the three islands.

I. ANTIGUA AND BARBUDA

A. General

The islands of Antigua and Barbuda are located in the eastern part of the Leeward Islands between Guadeloupe and St Maarten. Antigua lies at Latitude 17° 10' N and 61° 55' W while the island of Barbuda is at 17° 35' N and 61° 48' W which is approximately 45 km north of Antigua. Antigua is a small island developing State of 280 km² in area, characterized by relatively flat topography while Barbuda is 160 km². Antigua has a population of approximately 69,000 people with the largest population concentrations being on the coast whereas Barbuda has a population of approximately 1,200 persons. Antigua is prone to drought therefore there is a reliance on desalinated water because of a shortage of freshwater for potable water supply.

Tourism is the most important factor in the development of the economy of Antigua and Barbuda and accounts for approximately 60 per cent of the gross domestic product (GDP).

B. Climate

Antigua and Barbuda experience a tropical maritime climate with little variation in daily or seasonal temperatures. The annual rainfall for Antigua ranges from 890 to 1400 mm, one of the lowest in the Caribbean with an average annual rainfall of 1040 mm. Barbuda is drier and has an annual average rainfall between 750 and 950 mm. In Antigua, the wet season is usually from June to October and the dry season is from November to May. The average temperature ranges from 24° Celsius in December/January to 29° Celsius in August/September. The average relative humidity is 82 per cent. Evapotranspiration rates are high and the annual average is higher than the annual average rainfall.

C. Water resources assessment

The Water Division of the Antigua Public Utilities Authority undertakes water resources monitoring to support its operations for potable water supply but minimal historical hydrological data are available for planning. For groundwater monitoring, approximately 50 wells are visited monthly to check the pumping levels, extraction rates, take samples for water quality analysis and monitor saltwater intrusion. However, for surface water monitoring, water levels in the reservoirs and surface runoff are checked.

The water sources used for water supply are surface water, groundwater, harvested rainwater and desalinated water. No permanent rivers exist in Antigua. All major streams are intermittent or ephemeral and yield very small quantities of fresh water for a few months after heavy rainfalls. All the major catchments are dammed at several points to retain streamflow. Groundwater is obtained from a number of wells drilled to depths between 24 and 30 m. However, sea water is being used increasingly through desalination to provide water for domestic and agricultural use. In Barbuda, the primary source of freshwater is shallow aquifers in the Palmetto Point area (Cooper, Brian and Bowen, Vincent, 2001). Groundwater in other areas of Barbuda is saline and unsuitable even for agriculture.

D. Water supply

In Antigua, the Water Division of the Antigua Public Utilities Authority (APUA) is responsible for the transmission, distribution and supply of potable water. The pipe network is old dating back to the 1960s and 1970s and the APUA is in the process of replacing the old asbestos and cast iron pipes with PVC pipes throughout the island. This pipeline replacement programme is approximately 65 per cent completed and the pipe network is mapped in AUTOCAD. Antigua has 10 small surface water reservoirs but only three are important in meeting agricultural and municipal needs. During the dry season, the surface water is significantly reduced such that during droughts the reservoirs become dry. Approximately one third of the public water supply is obtained from surface water storage and groundwater aquifers. Desalination is a necessary means of obtaining potable water for water supply in Antigua. Water for desalination is taken from wells on the coast therefore the wells are monitored for saltwater intrusion. There are three water treatment plants on the island and the quality of potable water supplied exceeds World Health Organization (WHO) guidelines.

In addition to the potable water supply provided by the water division, household water demands are supplemented by water stored in cisterns. The tourism sector meets their water requirements by producing their own water through the construction of reverse osmosis desalination plants. However, the agricultural sector supplements its water needs by constructing dams, and utilizing rainwater harvesting.

Information from the water division states that 5.35 imperial million gallons per day (imgd) of potable water is produced, of which the surface water contribution is 0.45 imgd, groundwater is 1.00 imgd and desalination water produced is 4.0 imgd. The total water demand for the various sectors is estimated at 6.75 imgd and the percentage water requirements of each sector are: domestic – 42 per cent; agriculture – 0.1 per cent; tourism (hotels) and industrial – 21 per cent; cruise ships – 1.0 per cent; government - 35 per cent; and other – 0.9 per cent.

Water scheduling is not a norm, and only during periods of drought is a schedule for water supply developed. Leakage in the potable water supply system is estimated between 35 to 40 per cent but there is no leakage reduction programme at present. However, the entire system is metered.

E. Water allocation

The water department of the APUA has exclusive rights to supply, distribute, maintain and sell water but there is no water allocation mechanism. The method applied is to attempt to meet the water requirements of the various sectors, with tourism and domestic consumers being given priority. In addition, the Development Control Authority requires that new domestic buildings include in their construction plans permanent water storage facilities according to roof area. There are no reliable estimates of this stored rainwater but it is believed that it contributes approximately 20 per cent of the domestic water supply. There is no water quality testing or standards for the rainwater.

F. Water quality

The WHO guidelines are used as the standards for water quality and in general the water quality in Antigua meets these guidelines and is monitored by the Central Health Board of the Ministry of Health. The water quality parameters monitored by the water division are turbidity, pH, colour, total dissolved solids (TDS), alkalinity, calcium hardness, manganese, iron, phosphate, chlorine residual, total and faecal coliforms. Two operational surface water treatment plants, which work effectively, exist with the usual treatment processes for chlorination, sedimentation, turbidity, and pH. However, groundwater treatment is only chlorination. The Ministry of Health is responsible for monitoring water quality throughout the island.

G. Watershed management

Integrated watershed management is not practised and this has led to serious degradation in the watersheds and negative impacts on the water resources in terms of water quality. Discharge permits have not been established. Also, drainage and flood control actions have been minimal. For example, water in the Potworks reservoir, a major source of water supply, is polluted because of contaminated runoff from point and non-point sources particularly as a result of agricultural activities and siltation. The water quality of small streams in the St John's area is affected by effluent from septic systems while in the watersheds to the north, there are elevated faecal coliform levels caused by grazing animals.

The Forestry Division of the Ministry of Agriculture is the organization with responsibility for management of the upper watershed areas. Since 1990, a Draft Forestry Act was prepared, and, to date, it has not been approved. As a consequence, deforestation is a major issue in Antigua. Compounding the problems in the watersheds is the fact that Antigua has no physical development plan to guide landuse decisions which has led to poor landuse practices. Zoning of land for protection is also not undertaken because there are no zoning laws. However, a multisectoral and multidisciplinary committee was established in the Ministry of Agriculture to develop a landuse plan. This committee is headed by the junior Minister for Agriculture and work on a plan is expected to start before the end of 2007.

H. Environmental aspects

There is a National Environmental Strategy but it is not supported by environmental legislation. Recently, an Environmental Management Protection Bill and an Environmental Health Bill were drafted. To date, Environmental Impact Assessments (EIAs) are not mandatory requirements of the planning process for projects. This is certainly a deficiency to supporting sustainable management of the environment and its water resources. Over the years, several major wetlands have been removed through tourism-based development.

I. Sanitation

Under the Public Utilities Act 1973, the Public Utilities Authority has powers to establish, operate and maintain a sewerage system yet there is no centralized system for the collection, treatment and disposal of sewage. Wastewater disposal is by septic tanks and pit

latrines. Within the vicinity of St John's, the water quality of small streams is negatively impacted by effluent from overloaded septic systems. Management of sewage and other liquid wastes is a critical problem and there is serious need to replace the septic tank systems by proper sewerage systems. Most of the larger hotels have their own sewage treatment plants but another potential hazard is the disposal of bio-solid waste from package plants and domestic septic tanks. The Ministry of Health has responsibility for monitoring septic tanks.

With respect to solid waste, the National Solid Waste Management Authority is responsible for the management and control of its disposal. In Antigua, all solid waste is disposed of at a single managed disposal site at Cooks. All other dumps around the island have been closed. There are, however, no appropriate provisions for handling toxic chemicals and biologically hazardous waste.

J. Social dimensions

Water is a social good, it has an economic value and it must be managed for sustainability. The difference between the water production costs and the cost to consumers for potable water shows that the water supply is highly subsidized by the government.

The rural areas in Antigua have access to free potable water from public standpipes. With respect to housing developments, developers are responsible for installing the necessary infrastructure that will ensure that water can be provided to all of the potential residents. The efficient use of water and water conservation by domestic consumers are facilitated by the metering of consumers together with the tariff rates whereby rates increase with increase in consumption.

K. Economic instruments

The water tariff structure for Antigua is used to recover the costs of supplying water to consumers. In the tariff structure, water users in Antigua are categorized as domestic, government, commercial and industrial, and agriculture. The tariff structure established for potable water is as follows:

Government:	EC\$ 21.00 per 1000 gallons;
Domestic:	EC\$ 21.00 per 1000 gallons for the first 4000 gallons; and EC\$50.00 per 1000 gallons thereafter.
Commercial and industrial:	EC\$ 50.00 per 1000 gallons throughout;
Agriculture:	EC\$ 25.00 per 1000 gallons for potable water; EC\$ 7.00 per 1,000 gallons for untreated water

With respect to agricultural users, the tariff structure supports the use of untreated water once it is appropriate. There is also a royalty charge for use of saltwater and brackish water in desalination. However, there is no water licensing system established.

If all revenue were collected, the water department would be in a much better financial position but domestic consumers do not always pay for their water supply. In addition, leakage is approximately 40 per cent.

L. Regulatory instruments

In Antigua, regulatory measures for water resources management are minimal and no water allocation mechanism has been developed. However, the water requirements of the tourist industry and domestic consumers are given priority. Water abstraction licensing for wells and pricing for abstraction of water were approved by Cabinet but the latter has not been implemented. With respect to water supply, water quality must meet WHO guidelines and it is monitored through water quality audits by the Central Health Board of the Ministry of Health. There are no discharge permits.

M. Information management and exchange

There is limited IWRM data and information and the absence of a comprehensive database and information system to facilitate effective decision-making for sustainable water management. There is also no systematic method of water resources data/information dissemination which, if available are disseminated on request. With respect to public education, lectures are delivered in schools and advertisements on conservation are carried on the television.

N. Key issues of IWRM

Previously, stakeholders identified the key issues to be addressed for IWRM in Antigua (Crichlow, 2006 IWRM workshop- Antigua) to include:

- A lack of political will and commitment;
- The need for an IWRM policy;
- The need for stakeholder participation;
- Lack of integrated watershed management;
- The need for a water resources agency separate from the water department;
- The need for effective landuse control;
- Deforestation;
- Inadequate water storage;
- Inadequate public education.

O. Institutional framework

An effective institutional framework is fundamental to implementation of the policies and plans for successful IWRM. The nature of water dictates that it must be operational at the national, sectoral and community watershed levels. Therefore, the structure, roles, responsibilities and scope of actions at each level must be clearly defined and coordinated to facilitate functionality of the various components.

Since water is the inextricable link in the environment and almost everything depends on water, the responsibility of the water sector must be shared with other key stakeholder departments. Hence a number of sectoral policies and plans must be consistent with the National Water Resources Management Policy.

The Ministry of Public Utilities has responsibility for the APUA, a statutory body consisting of electricity, water and telephone divisions, which was set up under the Public Utilities Act in 1973. Under this 1973 Act, the Water Division was given control over all water resources in the country and exclusive right to supply, distribute, maintain and sell water. The institutional and legal framework necessary for effective IWRM does not exist in Antigua and Barbuda. There is no IWRM policy, legislation and no IWRM strategy and plan.

However, some aspects of water management are being undertaken by various sectors as part of the organizations' responsibilities. There is no coordination mechanism and most of the existing legislation is outdated and/or not enforced. Cooperation or collaboration is undertaken informally. In addition, given the number of pieces of legislation governing the management of water resources, there needs to be coherence in the laws.

Other organizations with responsibilities related to water management include the Ministry of Agriculture, Lands and Fisheries – Forestry Division, Soil and Water Conservation Unit, the Pesticide Control Board, the Lands Division and the Extension Division; the Ministry of Health and Social Improvement; the National Solid Waste Management Authority (NSWMA); the Development Control Authority; and the Ministry of Planning, Implementation and Public Service Affairs. These organizations undertake functions that are critical to supporting major deliverables of IWRM such as water use efficiency, protection and conservation of the water resource, optimization of the resource and sustainable use and development of the resource.

P. Water resources management functions

Within the context of the specific functions or tasks inherent in IWRM, the present institutional framework of the water sector is inadequate with respect to the planning, management and regulatory functions.

Some core IWRM functions or tasks that must be included for IWRM are:

1. Policy and strategy formulation

Policy refers to the guiding principles for actions, whereas strategy is the methodologies and plans of actions to achieve objectives.

As already stated, there is no IWRM Policy, Strategy and Plan for Antigua. The aspects of water resources management undertaken by stakeholders are based on a sectoral approach. Coordination is absent while collaboration is minimal and informal.

2. *Legislation and enforcement*

This is the process to ensure that proper laws and regulations are established and complied with as regards abstraction of water, use of water, prevention of water pollution and use of land.

Effective legislation on IWRM is lacking and enforcement of existing legislations which relate to water resources management is inadequate. Under the Public Utilities Act 1973, the Public Utilities Authority has responsibility to control, manage and maintain, operate and supervise all water courses, and waterworks and provide so far as practicable an adequate supply of water for use of the public. However, the legislation needs updating and the many pieces of legislation governing the management of water resources need to be harmonized. It is possible that IWRM could be a lot more advanced if the human resource capacity and skills were available.

3. *Water resources assessment*

This refers to the continuous study of water availability through monitoring, analysis and research and development.

Water resources assessment and monitoring is a key component of sustainable water resources management. In Antigua, there is a lack of readily available baseline data for planning and development. The Water Division of the Public Utilities Authority measures water levels in all surface water reservoirs and groundwater levels on a monthly basis but geared towards water supply projects and not towards reliable hydrological databases. The data collected is therefore inadequate for sustainable management of the limited vulnerable water resources.

4. *Master planning and allocation of water*

This involves determination of the quantity of water to be provided to each sector or stakeholder.

In Antigua, neither a water resources master plan nor a water allocation mechanism was developed. It is clear that the water resources available are inadequate and therefore desalination is necessary to support water for all stakeholders/users. The water requirement for each sector has not been determined but the goal of the Water Department is to meet the potable water requirements of all stakeholders.

5. *Water demand analysis*

This activity involves determining the water requirements of the various sectors such as domestic, tourism, agriculture, commercial and industry.

In Antigua, the water requirements of the various sectors have not been determined. The total water demand was estimated at 6.75 m³/d.

6. *Demand management*

This is the process of controlling the quantity of water abstracted by the various sectors and stakeholders and ensuring the most efficient use of this water. The tariff structure for Antigua has been itemized on page 13.

7. *Conservation*

This refers to the prudent use and preservation of water resources. This activity comprises, *inter alia*, the reduction of demand through efficiency of use, the treatment and reuse of water, protection of the water resource through proper watershed management and public education and awareness.

In Antigua, watershed management is minimal and not undertaken in the integrated approach for protection of the water resources. With respect to the reduction of water demand, this is affected to some extent by the tariff structure, rainwater harvesting and public education which is undertaken although not consistently.

8. *Pricing of water*

This is the process of determining an economic valuation of water taking into consideration its social and ecological value. There are prices that are charged to water abstractors and prices that are charged by the abstractors to the end-users of the water.

In Antigua and Barbuda, there are no charges for freshwater abstraction for water supply as pricing for water abstraction was approved by Cabinet but it was not implemented. With respect to the use of saltwater and brackish water for desalination, a royalty charge is implemented. The prices that are charged to the end users of the potable water supply differ for domestic, commercial and agricultural purposes. For domestic users, the cost increases with the use of greater quantities as indicated in the section on Economic Instruments. The Water Department is of the opinion that if all revenue was collected, this department could be self sufficient.

9. *Water resources development and distribution*

This consists of the activities involved in making water available for use by the various consumers through the process of abstraction, storage, transmission and distribution. Just as important is the proper management of sewage collection, treatment and disposal.

In Antigua and Barbuda, the Water Department undertakes the responsibility for transmission and distribution of potable water. However it does not undertake any conveyance and disposal of sewage, and therefore provides no sewerage services. In fact there is no centralized sewerage system.

Inherent in these core IWRM functions are actions linked to other sectors that are necessary for sustainability of use and development of this water resource and to support social

and economic development. In addition, the very nature of water resources dictates that effective integrated water resources management must be undertaken in conjunction with effective land and landuse management, integrated watershed management, drainage and coastal zone management. As small island development States, coastal zone management has an important role. Furthermore, effective integrated water resources management is critical to the sustainable development of a country.

Institutional arrangements for water resources management must therefore include these necessary complementary functions that should be undertaken in a formalized coordinated approach with stakeholder partnerships and collaboration from the planning to implementation phases and supported by proper public education and awareness.

Q. Capacity of institutions to implement IWRM

The functions comprising integrated water resources management, listed above, demonstrate the scope of actions to be undertaken and the need for some unit/department to be dedicated to this objective. The fact that many of the core activities for IWRM are not being undertaken and there has been no specialized development of the skills and experience needed means that institutional strengthening and training would be required.

A number of organizations (See annex 1) because of their responsibilities have some role in the management of the water resources on the island. The Water Department has primary responsibility for water resources management but does not undertake it. There is no formalized coordinating mechanism or framework for organizational relationships in the sector and the process for stakeholder involvement is limited to projects or workshops/meetings on specific issues.

The Water Division of the Public Utilities Authority (See annex 2) has exclusive rights to supply, distribute, maintain and sell water and to perform related services. The Water Division also undertakes water resources monitoring and assessment only to support its operations for water supply. The Division has a water manager, one operations and maintenance engineer, a customer service engineer with supporting staff for customer service, a superintendent with responsibility for the Transmission and Distribution Department, a superintendent with responsibility for services and technology, a chemist in charge of the laboratory and a hydrologist. Support staff is mainly technicians. However there are a few vacant positions. The Water Division does not have excess capacity, skills or expertise for IWRM.

The Public Works Division of the Ministry of Works and Transportation is headed by a Director of Public Works and is responsible for road works and drainage. The core technical staff comprises four engineers with bachelor degrees in civil engineering. One of which is a senior engineer because of experience. In addition, the division has three contracted engineers from Cuba comprising one specialist in hydraulic engineering and two specialists in roads. The division does not have its full complement of staff and its core staff lacks specializations. Information indicates that the Division is adequately funded to undertake its activities however the remuneration packages of its staff are inadequate and at present are being reviewed. One of

the challenges of the division is to retain staff because of the inadequate salaries. As a result, expenditure on capacity-building is minimal.

The Development Control Authority is responsible for long term landuse planning and day-to-day development control. However, long term landuse planning is negligible. The Authority is understaffed. With respect to the technical human resource capacity, there is only one town planner and five building inspectors of which one is a senior inspector. There were also two Geographic Information Systems (GIS) trained members of staff but these were seconded to another department because of lack of equipment.

The Environmental Health Department of the Ministry of Health is responsible for monitoring the quality of potable water and coastal waters and among other things, enforcement of environmental sanitation regulations. Samples are taken on a weekly basis from source and on a daily basis from the distribution system, and sent to the laboratory in the Ministry of Agriculture. Recently, the Department was staffed with 15 environmental health officers including the chief environmental health officer but this was not the full complement of technical staff in the organizational structure. Now after a Voluntary Separation Programme which was offered to public service officers in Antigua, three senior professionals left the department. The Department now has nine environmental health officers. The Department is understaffed but historically it has been adequately funded by government to undertake its functions.

The laboratory in the Ministry of Agriculture is responsible for analyzing the quality of water samples. The challenges in the laboratory appear to be inadequate funding and the need to expand the functionality of the laboratory to undertake chemical and pesticide analyses. Technical staffing includes a chemist and biochemist, who are well qualified, and supporting laboratory staff.

The Forestry Department of the Ministry of Agriculture is one of the major units with responsibility for watershed management. The Department is understaffed and under-funded. At present, the two senior professional positions, namely the chief forestry officer and the senior forestry officer, are vacant. Other technical staff includes forestry assistants.

The Soil and Water Department of the Ministry of Agriculture is responsible for soil and water management focused on the agricultural sector. Previously the department was staffed with a senior engineer and an engineer qualified in agricultural engineering. Both engineers have left the government service and there is no resident engineer in the department. A Cuban national with a PhD degree has since been seconded from the Extension Division of the Ministry of Agriculture to assist farmers with irrigation and soil conservation. The department therefore has no staff at present. Information reveals that when the division was staffed with the two engineers, projects were outsourced. The department was also not adequately funded but the strategy was to create projects that would be funded by international organizations. It is clear that the Soil and Water Department would have to be completely staffed to undertake its responsibility. Hence, there is no capacity or competencies that can be obtained from this department towards supporting IWRM.

The Environmental Division has responsibility for environmental management. Some of its primary responsibilities are:

- Coordination and focal point for implementation of multilateral conventions/agreements;
- Review of EIAs;
- Environmental awareness and education; and
- Focus on the Organisation of Eastern Caribbean States (OECS) environmental strategy.

The Environmental Division is headed by a chief environmental officer supported by two senior environmental officers and three environmental officers. One of the positions of environmental officer is vacant. The chief environmental officer and two senior environmental officers are well qualified, each with bachelor degrees with two having masters degrees in environmental science and management, and the other having a masters degree in sustainable international development. One of the senior environmental officers is pursuing another masters in coastal engineering. The two environmental officers have bachelor degrees – one in geography and the other in ecology, with the latter pursuing a masters degree in natural resource and environmental management. These environmental officers are supported by one senior environment technician and two technicians. The three technicians have bachelor degrees and the senior environment technician also has a masters degree in environmental management systems. In addition to the technical staff, there are four technical support and administrative persons and two purely administrative persons. The technical capacity of this Division appears quite strong although, information from the Division suggests that there are areas such as chemical engineering and coastal zone management where capacity is lacking.

With respect to capacity-building, persons are sent on training courses and workshops both regional and international. Persons are also encouraged to further their education and some financial assistance may be provided. Information from the Division indicates that funding for the Division's work is satisfactory.

1. Capacity-building

Institutional capacity-building is undertaken through international and regional conferences/workshops and on-the-job training. However, capacity-building is limited in some divisions/departments by the lack of human resource capacity particularly at the professional level and in some cases support staff. Capacity-building at times is also limited by the organizational structure and inadequate funding. The latter may further impact on the development of skills, and productivity and effectiveness of staff, due to a lack of facilities such as equipment.

In the past, the Ministry of Finance focused on the development of projects for external funding as a way of overcoming the financial challenges. However, this meant the need for project development skills, a competency which will also be needed in IWRM particularly for sourcing funds.

Generally, the human resources capacity and expertise within national institutions/organizations are inadequate to undertake all the functions of IWRM effectively. This inadequacy has been further exacerbated by the exit of some of the more experienced and competent persons with the voluntary separation package, which was offered in 2007. It is therefore an opportunity to restructure units/divisions which were not as effective and productive to assist in advancing development. Adoption of IWRM responsibilities would definitely mean additional capacity-building, training and recruitment of appropriate staff.

Since there is the need to create an organization/unit with responsibility for the core functions of IWRM then there must be support from the political directorate for the establishment of such an organization/unit through cabinet approval, legislation, financial resources, human resources and rationalization of responsibilities among stakeholder organizations.

2. *Technical capabilities*

Apart from the administrative and project development and management capacity required, the technical capability required for the water resources management unit at the professional level includes:

- Water resources engineering and management;
- Surface water hydrology and management;
- Hydrology;
- Groundwater drilling and management;
- Flood management;
- Watershed management;
- Environmental management and water quality expertise;
- Database management; and
- GIS management.

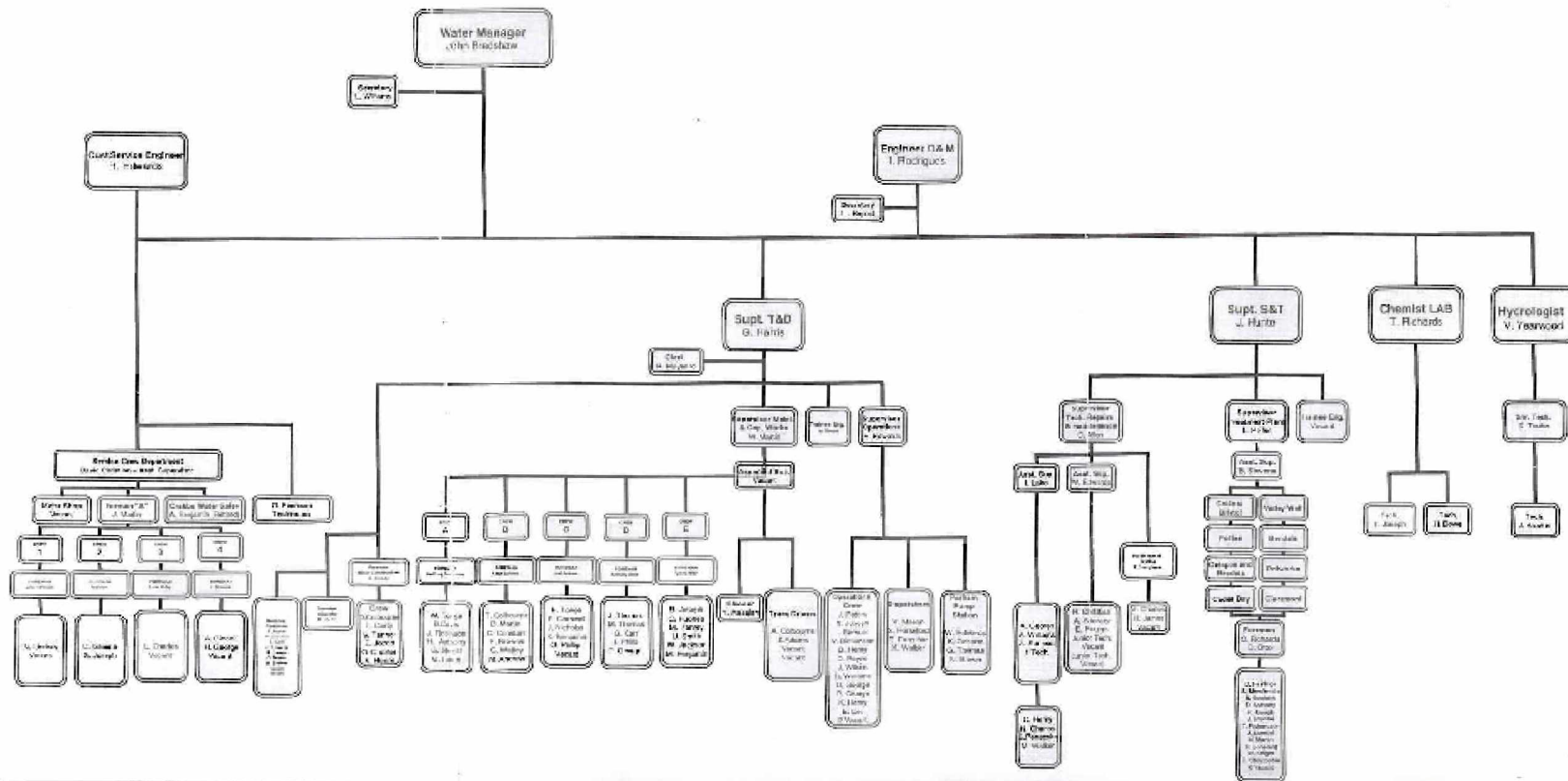
The mix of technical capabilities would depend on the functions to achieve the objectives of the initial structure and would inform the capacity-building needs. In Antigua, these skills and competencies are either limited or not available except probably in the area of environmental management.

Annex 1**ORGANIZATIONS AND RESPONSIBILITIES
(Antigua and Barbuda)**

ORGANIZATION	ROLES/RESPONSIBILITIES
Water Division (Public Utilities Authority)	<ul style="list-style-type: none"> • Exclusive rights to supply, distribute, maintain and sell water • Perform related services • Undertakes water resources monitoring and assessment only to support its operations for water supply
Public Works Division (Ministry of Works and Transportation)	<ul style="list-style-type: none"> • Road works and drainage
Development Control Authority	<ul style="list-style-type: none"> • Long term landuse planning • Day-to-day control
Environmental Health Department (Ministry of Health)	<ul style="list-style-type: none"> • Monitoring the quality of potable water and coastal waters • Enforcement of environmental sanitation regulations
Laboratory in Ministry of Agriculture	<ul style="list-style-type: none"> • Analyzing the quality of water samples
Forestry Department (Ministry of Agriculture)	<ul style="list-style-type: none"> • Watershed management
Soil and Water Department (Ministry of Agriculture)	<ul style="list-style-type: none"> • Soil and water management focused on the agricultural sector
Environmental Division	<ul style="list-style-type: none"> • Coordination and implementation of multilateral conventions/agreements • Review of EIAs • Environmental awareness and education • Focus on the Organization of Eastern Caribbean States (OECS) environmental strategy

Annex 2
ANTIGUA PUBLIC UTILITIES AUTHORITY

Antigua Public Utilities Authority
WATER DIVISION



II. DOMINICA

A. General

Dominica is a Caribbean island of volcanic origin located at approximately 15°18'N, 61°23'W between the French islands of Guadeloupe and Marie-Galante to the north and Martinique to the south. The total area of the island is approximately 750 sq km and is 47 km long with a maximum width of 26 km. The country has high forested mountains running north to south and broken in the centre by a plain drained by the Layou River which flows to the west. At present, the population is estimated at 72,000 persons. The economy is heavily dependent on agriculture, the main source of food and income for most of the population.

B. Climate

Dominica's climate is classified as humid tropical marine and is characterized by little seasonal or diurnal variation. The island has a dry season from January to June and a wet season from July to December. The average annual rainfall varies from approximately 300 inches at the central peaks to an average annual rainfall of 50 inches along the central part of the west coast which is normally the driest area of the island. Annual average temperature values range from 21° C at the highest elevations to 27° C on the coast, and seasonal fluctuation is generally less than 2° C.

C. Water resources assessment

Hydrological monitoring of water quantity and quality are not undertaken so that the water resources could be assessed over time. At present, the Dominican Water and Sewerage Company (DOWASCO) collects river flow and undertakes raw water quality analyses at stations in the rivers only when considering the feasibility of siting intakes for new water supply schemes. However analysis of streamflow data is also required to assess areas that are prone to flooding. The raw water quality parameters monitored are *E.Coli*, pH, total suspended solids and nitrates. Groundwater is not explored and there is no groundwater data. At present, the surface water resources are adequate to meet the present water requirements. The lack of hydrological monitoring and water resources assessment means that the long-term yields of the rivers are not determined and there is inadequate data and information to inform long-term water resources planning and management. However, the DOWASCO has indicated a commitment to the preparation of a national master plan for the management of water resources which will include plans for water resources assessment.

D. Water supply

Dominica has abundant water resources through its numerous rivers and streams and this has minimized the need to explore groundwater sources. Surface water is the only source of water used by DOWASCO for potable water supply and dams are built on rivers to store water for abstraction. However rainwater harvesting is practiced by individual households and institutions in remote areas. Some groundwater is utilized for commercial purposes in water

bottling from spring water. Out of the total potable water produced by DOWASCO, 3.24 m³/d is supplied for public water supply, 2.5 imperial million gallons per month for water supply to cruise ships and 6.0 m³/d for bulk water. The estimated leakage or unaccounted for water is 20 per cent (DOWASCO, 2007). It must be noted that water released to the distribution system is not being measured and not all customers are metered.

For potable water supply, the surface water is treated by chlorination. During the dry season, flows in the rivers and streams are substantially reduced sometimes as much as 30 per cent of average flows in the wet season, while the turbidity increases significantly during the heavy rains. The water supply is generally more than adequate to satisfy the user demands but during the dry season, the flow is not sufficient for areas of high elevation.

The Water and Sewerage Act 1991 of Dominica gives DOWASCO responsibility for the supply of potable water in the country. Users supplied with potable water are domestic, tourism, commercial, industrial, agriculture and bulk water export. Potable water supplies for domestic, commercial and industrial users are given priority. However, agriculture on a commercial scale utilizes a substantial volume of water that is abstracted directly from rivers and streams but there are no records of the quantity of water used. In addition, individuals and communities living adjacent to rivers and streams abstract water directly for various uses. There are also a few industries that utilize water from adjacent water courses for various processing activities. According to law, a licence is required to abstract water but this is not always enforced. In the odd community that is not served by a potable water system, the cistern system for collection and storage of water is used on an individual basis.

DOWASCO supplies approximately 80 per cent of the total population on a 24 hours seven days, (24/7) per week basis through connections to its water supply system and its existing standpipes, that serve communities with populations in excess of 200 persons. A number of small communities that are not served by DOWASCO are serviced through small water supply systems built by non-governmental organizations.

The main users of water are DOWASCO for supplying potable water and the Dominica Electricity Services (DOMLEC) for hydropower generation. On average more than 6 imperial million gallons per day of water is abstracted from surface sources for hydropower generation.

E. Water allocation

In addition to the provision of potable water and sewerage services, DOWASCO has statutory responsibility for managing the water resources in the country. As a consequence, DOWASCO was granted an exclusive licence to abstract and utilize the water resources of the country for 25 years by the Minister of Communication and Works in 1989.

DOWASCO allocates potable water to the various users based on requirements but has a licensing system in place for users that wish to abstract water from the surface sources directly and distribute the water. With respect to agriculture, DOWASCO has no obligation to provide water for irrigation. Recently, the Banana Trust was given responsibility for the management of irrigation for bananas.

F. Water quality

The WHO guidelines are used as the standard for water quality. The water quality parameters monitored for potable water are pH, total suspended solids (TSS), E-Coli and nitrates. However chlorination is the only form of water treatment. DOWASCO operates its own laboratory for testing of water quality whereas the Environmental Health Unit of the Ministry of Health has responsibility for auditing the health and sanitation practices in the country. This Unit audits the potable water quality but its programme of monitoring is not consistent and therefore not as effective as it should be. Water related diseases are however rare in Dominica and the water quality generally meets WHO guideline standards. In addition, DOWASCO undertakes water quality analysis once per month in major rivers.

G. Watershed management

Dominica has an operational protected areas system, consisting mainly of national parks and forest reserves, that is supported by the National Parks and Protected Areas Act of 1975. The main objective of this Act is watershed protection, soil erosion control and preservation of biodiversity. Only a small number of catchments used for water supply are contained wholly or partially within these protected areas among which is the water catchments area providing water for hydro-electricity generators.

Some landuse management is undertaken by the Department of Physical Planning based on a landuse policy although there is no landuse legislation. However, a number of existing policies and regulations impact watershed management. Notwithstanding this, there are a number of conflicts with respect to landuse due to a lack of enforcement (Drigo, Anthony. 2001). For example, agricultural activities which may negatively impact the water supply are allowed to continue even where the Stewart Hall Catchment rules prohibit this. In Dominica, inappropriate disposal of solid waste and effluent from commercial and industrial enterprises together with poor land management and agricultural practices pose great negative impacts in the watersheds and the coastal area. Data collection for proper watershed management particularly in areas such as level of erosion, deforestation, marine environment and the status of the coast needs to be improved.

Though Dominica may have a Natural Disaster Preparedness Plan, which pays particular attention to hurricanes, the damage that can be caused to the watersheds may impact the hydrological cycle. Recently Hurricane Dean caused some damage in Dominica when it passed in August 2007. This leads to the issues of global warming and climate change that can have potential negative impacts on the watersheds, coastal areas, and water supply particularly as a small island, and therefore must be addressed.

H. Environmental aspects

EIAs undertaken as part of the evaluation of new projects and serve as a method of environmental protection. However, sedimentation is a result of soil erosion and unregulated

quarry operations. The soil erosion, though, is a result of bad agricultural practices and poor land management.

However, negative environmental impacts arise because there are a number of threats to the management of watersheds and ecosystems, some of which are:

- Limited data on streamflows and therefore insufficient information to support effective decision-making and appropriate planning and management;
- Lack of a coordinated approach among the multisectors and multidisciplines in the management of the resources;
- Lack of a suitable mechanism for effective landuse management;
- Lack of public education and understanding of the role of integrated watershed management in ecological integrity;
- Lack of financial and human capital to effectively manage and monitor the resources.

Furthermore, there is a lack of enforcement of legislation and a need for effective environmental auditing.

I. Sanitation

DOWASCO is the organization responsible for conveyance, treatment and disposal of sewage and all sewerage services. In Dominica, there is one centralized sewerage system in the capital Roseau that serves 2,700 households and two smaller sewerage systems serving the areas of Canefield and Jimmit. Sewage is collected and disposed of at sea with some basic treatment consisting of the removal of material and sludge in the system at Roseau, whereas at Canefield and Jimmit the sewage is collected and disposed of at sea with no treatment. The most common form of sanitation in other areas of Dominica is by septic tank and soak ways. The organizations in sanitation management in Dominica are DOWASCO, the Ministry of Health, and the local authorities. DOWASCO is responsible for operating and maintaining the sewerage systems whereas the Ministry of Health and the local authorities are responsible for granting permission for onsite sanitation systems such as septic tanks for individual houses and institutions.

The Solid Waste Management Corporation is responsible for solid waste management and was formed in 1999 as part of an OECS project funded by the World Bank. A new landfill was built within the last two years at a cost of EC\$ 10 million. Solid waste management is taken seriously in Dominica and there are cost recovery measures to support its activities. In Dominica, there is 100 per cent coverage of the population with respect to garbage collection. With respect to waste that goes to the landfill, 50 to 60 per cent is organic and this is supported by public education programmes for waste reduction and recycling. At the landfill, wastewater is treated and then pumped back to the landfill. Recycling of used and damaged batteries is undertaken through export to an automotive company in Trinidad, as lead contamination is a major concern. Another initiative is the collection of old and derelict vehicles that are compacted and sent to France for use as raw material.

J. Social dimensions

Clearly, water is a social good. As such, water must be managed for sustainable use and development. In view of this, a metering system for all consumers was introduced as a deliberate conservation policy and a means of reducing wastage of water.

With respect to the tariff structure (Annex 3) for water supply and sewerage, the rates were designed more as a function of affordability to pay and not to reflect the economic value. The poor sector of the community has access to public standpipes and do not pay for water collected from standpipes. The government pays for water from standpipes. However, individuals or companies can obtain a licence to abstract water to sell as bulk water for export or as bottled water.

K. Economic instruments

The tariff structure (see attached annex 3) is a system used to recover costs for both potable water supply and sewerage services. Many times it is also used as a tool for conservation. However, design of the water and sewerage tariff structure for Dominica was not based on any scientific method nor to reflect the economic value of water nor the need to encourage conservation. The rates do not recover the operating and maintenance costs for all the small water systems on the island and the rates remain constant and do not escalate with increase in water quantity used.

L. Regulatory instruments

The regulatory instruments in place for water are water licensing for water abstraction, water abstraction at intakes are not to exceed 40 per cent of available water at river intakes, and potable water quality must meet World Health Organization (WHO) guidelines. With respect to water allocation, there is no specific mechanism but to meet the user requirements based on availability of water.

M. Information management and exchange

Public education is through the mass media but is not consistent and not based on a structured programme. With respect to water resources information, data collected on rainfall and streamflows are not continuous and mainly geared to establishing intakes for water supply. Information on water resources is therefore not comprehensive and sufficient to support effective decision-making. A geographical information system database for water management also does not exist although there exists an operational geographic information system in the Physical Planning Division. Data and information are only disseminated on request. There is need for an integrated information system database

N. Institutional framework

An effective institutional framework is fundamental to implement the policies and plans for successful integrated water resources management. The nature of water dictates that it must

be operational at the national, sectoral and community watershed levels. Therefore, the structure, roles and responsibilities at each level must be clearly defined and coordinated to facilitate functionality of the various components comprising the scope of actions to be undertaken in the water sector.

Since water is the inextricable link in the environment and almost everything depends on it, the responsibility of the water sector must be shared with other key stakeholder departments. Hence a number of sectoral policies and plans must be consistent with the National Water Resources Management Policy.

In Dominica, DOWASCO has responsibility for monitoring, assessing and managing the water resources in the country. However, the institutional and legal framework necessary for effective IWRM does not exist in Dominica. There is no IWRM policy, no IWRM legislation and no IWRM strategy and plan.

At present some aspects of water management are being undertaken but in a fragmented uncoordinated manner. In addition to its statutory mandate for water resources management, DOWASCO by the Water and Sewerage Act has responsibility to supply water and to collect and dispose of waste. DOWASCO however operates only as a service provider of potable water and wastewater services. Any water resources monitoring undertaken by DOWASCO is in relation to the provision of a potable water supply.

Other organizations with some responsibilities related to water management include the Ministry of Health; the Ministry of Agriculture – Forestry and Wildlife Division, Lands and Surveys, and Pesticide Control Board; the Ministry of Finance and Economic Development – Physical Planning Division and Development and Planning Corporation; the Ministry of Community Development and Gender Affairs – Cultural Division, Local Government and Community Division; the Solid Waste Management Authority and non-governmental organizations. The responsibilities of these organizations are seen in Annex 4.

Effective cooperation and collaboration as required by IWRM is not the approach but there is some informal cooperation and collaboration among organizations on a case-by-case basis. There is no coordinating organization or mechanism to deal with IWRM. Operations in IWRM are fragmented and sectoral, resulting sometimes in overlap and duplication of responsibility.

O. Water resources management functions

Within the context of the specific functions or tasks inherent in IWRM, the present institutional framework of the water sector is inadequate with respect to the planning, management and regulatory functions of water resources.

Some core IWRM functions or tasks that must be included for integrated water resources management are:

1. *Policy and strategy formulation*

Policy refers to the guiding principles for actions whereas strategy is the methodologies and plans of actions to achieve objectives.

There is no specific IWRM policy and strategy in Dominica. However, development of an IWRM policy is being championed by DOWASCO and GWP-C and expected to begin before the end of 2007.

2. *Legislation and enforcement*

This is a process to ensure that proper laws and regulations are established and complied with as regards abstraction of water, use of water, prevention of water pollution and use of land.

At present there is no legislation on IWRM. Within the Water and Sewerage Act 1991, DOWASCO is given responsibility for water resources but the integrated and holistic approach of IWRM is not captured in this legislation.

3. *Water resources assessment*

This refers to the continuous study of water availability through monitoring, analysis and research and development.

Long term continuous hydrological monitoring and assessment are almost non-existent therefore the assessment of water availability may not be reliable. With respect to river flows, data is collected and analysis undertaken only when considering the feasibility of new water supply schemes.

4. *Master planning and allocation of water*

This involves the determination of how much water is to be provided to each sector or stakeholder.

In Dominica, no systematic water allocation mechanism is established. The unwritten policy with respect to water allocation is to meet the needs of domestic, tourism and, depending on the availability of water, the small-scale irrigation requirements.

5. *Water demand analysis*

This activity involves determining the water requirements of the various sectors such as domestic, tourism, agriculture, commercial and industry.

In Dominica, the water requirements of the various sectors have not been determined as there are no bulk water meters in the water supply system.

6. *Demand management*

This is the process of controlling the quantity of water abstracted by the various sectors and stakeholders and ensuring the most efficient use of this water.

In Dominica, there appears to be no mechanism for demand management. Even the water rate structure for consumers does not support demand management as the rates remain constant with increase in volume of water used.

7. *Conservation*

This refers to the prudent use and preservation of water resources. This activity comprises, inter alia, the reduction of demand through efficiency of use, the treatment and reuse of water, protection of the water resource through proper watershed management and public education and awareness.

In Dominica, actions towards water conservation are minimal. Actions undertaken by the Ministry of Agriculture and the Environment with respect to watershed management may contribute but are not as effective as they should be, since solid waste, agricultural waste and manufacturing and industrial waste disposal are major sources of both point and non point pollution.

8. *Pricing of water*

This is the process of determining an economic valuation of water taking into consideration its social and ecological value. There are prices that are charged to water abstractors and prices that are charged by the abstractors to the end user of the water.

In Dominica, persons can apply for a licence to abstract water and there are persons that apply for licences to sell water. These abstractors pay royalties and the fees are based on the type of use for which the water is required.

As mentioned before, a tariff system for potable water supply operates in Dominica. The revenue gained from this tariff system does not recover the operating and maintenance costs as the rates were designed more towards affordability to pay than to reflect the economic value of water.

9. *Water resources development and distribution*

This consists of the activities involved in making water available for use by the various consumers through the process of abstraction, storage, transmission and distribution. Just as important is the proper management of sewage collection, treatment and disposal.

In Dominica, 90 per cent of the consumers are supplied with a 24 hour, seven day a week supply of potable water. Leakage in the transmission and distribution system is estimated at 20 per cent but this estimation is not based on measurement. With respect to sewage disposal there is a large centralized sewerage system in the capital, Roseau, and two small sewerage systems in the areas of Canefield and Jimmit. There is minimal treatment in the Roseau sewerage system and no treatment in the two small systems. Sewage is disposed out at sea at approximately 1000 feet away from the shore.

Inherent in these core IWRM functions are actions linked to other sectors that are necessary for sustainability of use and development of this water resource, and to support social and economic development. In addition, the very nature of water resources dictates that effective integrated water resources management must be undertaken in conjunction with effective land and landuse management, integrated watershed management, drainage and coastal zone management. As small island development States, coastal zone management has an important role. Furthermore, effective integrated water resources management is critical to sustainable development of a country.

Institutional arrangements for water resources management must therefore include these necessary complementary functions that should be undertaken in a formalized coordinated approach with stakeholder partnerships and collaboration from the planning to implementation phases and supported by proper public education and awareness.

P. Capacity of institutions to implement IWRM

The functions comprising integrated water resources management listed above demonstrate the scope of actions to be undertaken and the need for some unit/department to be dedicated to this objective. The fact that many of the core activities for IWRM are not being undertaken and there has been no specialized development of the skills and experience needed means that institutional strengthening and training would be required.

A number of organizations because of their responsibilities play some role in the management of the water resources in the island. However, no dedicated organization with primary responsibility for water resources management exists. There is no formalized coordinating mechanism or framework for organizational relationships in the sector and the process for stakeholder involvement is limited to projects or meetings on specific issues.

As previously stated, DOWASCO under the Water and Sewerage Act has responsibility for water resources management. However its focus is being a provider of potable water and wastewater services. Given the fact that a service provider of potable water is a user of the resource, it seems inappropriate and conflicting for the manager of the water resources to be under the control of a user of the resource. Hence it is preferable that IWRM be undertaken by a separate organization/unit.

The organization structure (see Annex 5) of DOWASCO is divided into four departments. Two of these departments are the core technical activities related to water and wastewater services – namely Engineering, and Technical Services including the water quality

laboratory. The other two departments are Finance, and Customer Service and Human Resources. The organization is fully staffed and there are 13 professionals. The technical professional staff includes three mechanical engineers, one civil engineer, one water engineer qualified in industrial engineering, and two information systems officers. With respect to the technical support staff, there are seven technicians. However, though there is a good technical base from which to build the expertise and skills required for IWRM core functions, there is no excess human resource capacity.

Other organizations identified as key stakeholders with responsibilities related to water resources management include the Lands and Surveys Department, the Physical Planning Unit, The Meteorological Services Unit and the Disaster Coordination Unit of the Ministry of Housing, Lands, Telecommunications, Energy and Ports have some activities related to water management.

The Land and Surveys Department (see annex 6) has responsibility to administer State lands, preserve and protect lands, and map and upkeep a GIS database and coordinate with other agencies. The department is not fully staffed and has lost a number of surveyors through attrition. There is, however, a shortage of surveyors. The department also has no land use plan. Land is becoming scarce and the management of the information needs to be addressed but is hindered by a lack of human resource capacity. Training to address gaps is not consistent. The department requires a number of new staff.

The Forestry and Wildlife Division of the Ministry of Agriculture, Fisheries and the Environment (see annex 7) is responsible for watershed protection and management, and regulation of activities within the forest reserves and national parks. This division is governed by the Forest Act, 1958, the Forest Rules and Regulations 1972 which support the Act and the National Parks and Protected Areas Act, 1975.

The division is staffed with a director who has a masters degree, a Forester 2 with an MSc degree, a forest officer for research, monitoring and environmental education with a bachelor of science degree, an assistant forest officer of national parks with a BSc degree and five other assistant forest officers with diploma level qualifications. The remaining staff has high school qualifications. The established monthly paid staff has 24 positions whereas the total staff including daily paid workers is 100.

The vacant positions include a forest officer and human resource manager. The forest officer is required to have a BSc or associate degree with five years experience. This person will be responsible for silviculture. However there is need for a forest planner and someone who can provide technical assistance in landscape planning.

Training is undertaken through an in-service training programme in forestry and national parks in the division plus local and international training. Information obtained indicated that there is a need for more support staff and professional training for in-house personnel. Lack of professional expertise within the division is reflected in the need for greater detail in special reports. In addition, there is need for larger office accommodation and adequate equipment.

The Environmental Coordinating Unit (Annex 8) of the Ministry of Agriculture, Fisheries and the Environment is responsible for, inter alia:

- Advising the government on the development of coherent environmental policies;
- Serving as focal point for environmental conventions and agreements and monitoring Dominica's compliance;
- Undertaking environmental impact assessments on development projects;
- Public education and awareness, and information dissemination on environmental matters.

The unit was established with Cabinet's approval but there is no legislation that governs it. The staffing of the unit comprises only a director and a messenger. Other staff members are employed through projects that are undertaken by the unit. The director has an MSc degree in forestry and a post-graduate diploma in environmental management and reports to the permanent secretary of the ministry. The unit is understaffed. Information suggests that there is an immediate need for a legal person and two to three more officers. Technical assistance is required for the drafting of legislation to establish the unit as an agency and in the consultation process to prepare relevant material.

The Physical Planning Division of the Ministry of Housing, Lands, Telecommunications, Energy and Ports (see annex 9) is responsible for landuse planning, approval of subdivisions and physical developments in the country. The activities of planning are guided by the Development and Planning Corporation which is governed by the Development and Planning Corporation Act. This corporation provides policy guidance but the permanent secretary of the Ministry manages day-to-day activities.

In the landuse section of this division, the staff is as follows:

- One senior physical planner and secretary/manager;
- Two physical planners, one with a BSc in planning and an MSc in landscape architecture and the other with a diploma in planning and a BSc in information systems and management;
- Two physical planning assistants, one with a BSc in environmental science and the other with a BSc in architecture; and
- One GIS technician position – vacant.

In the Development Control Section of this division, the staff is as follows:

- One senior development control position – vacant;
- Five development control officers, two with diplomas in civil engineering from a local college, one quantity surveyor, one with a diploma in construction and one architect.

The Physical Planning Division does not have the technical capacity to deal with water resource management but the division is equipped to deal with landuse. However the senior development control officer's position in the Development Control Section is vacant. Also, the

GIS technician's position in the landuse section is vacant. This position is essential to the data and information for effective land management.

Collaboration between the physical planning division and DOWASCO takes place on certain activities but there is need for policy formulation on setbacks at rivers and a proper landuse plan.

The Environmental Health Division of the Ministry of Health and Social Security is responsible for, inter alia, establishing water quality and treatment standards, monitoring water systems, water quality analysis and environmental health. The Environmental Health Unit is governed by the Environmental Health Services Act. Other Acts such as the Litter Act and Solid Waste Management Act play a part.

Staff of the Environmental Health Division comprises four senior officers, namely:

- One water and liquid waste officer;
- One vector control and solid waste officer;
- One occupational, health and safety officer; and
- One food officer.

These senior officers all have been trained to the diploma level. At present, a training programme is being funded by the Pan American Health Organization (PAHO) in conjunction with the Dominican State College to train 20 persons who will fill posts within the Ministry in the next two to three years. PAHO is also supporting the government to train a number of health officers in-house as many require further training. The senior officers need to be trained beyond the diploma level. Furthermore, with the increasing focus on water, there is a need to increase qualified members of staff with specialized training in water. The laboratory also needs to be updated and expanded to include chemical analysis and monitoring the quality of recreational water.

The Ministry is engaged in restructuring to respond to the new dynamics with respect to health and related standards. As such there may be the need for adaptation, retraining of personnel or redeployment to address the increasing environmental health challenges. At present, the United Nations Environment Programme (UNEP) is involved in monitoring beaches and rivers to ensure that these waters are safe. In addition, the National Oceanic and Atmospheric Administration (NOAA) is willing to partly fund the equipment required to monitor the water quality. The latter is welcomed, as one of the constraints of the Ministry is a lack of equipment that affects the enforcement of some legislation.

The Solid Waste Management Corporation (see annex 10) is responsible for solid waste management and the protection of the citizens from health risks and protection of the integrity of the environment. The corporation is governed by the Solid Waste Act of 2002 and supported by other Acts such as the 1997 Litter Amendments Acts. Solid waste management is taken seriously in Dominica and there are cost recovery measures to support the activities. Recycling measures are undertaken with respect to batteries and old vehicles. The Corporation, however, lacks its full complement of staff.

The drainage works and irrigation works undertaken in the Ministry of Public Works and Public Utilities (see annex 11) are activities that impact on water management. Both sets of activities are undertaken in the Civil Engineering Works Department of the Ministry which is headed by the Chief Technical Officer (CTO) (see attached structure). This department has between 20 and 30 members of staff.

The professionals that function in this department are:

- Architects;
- Quantity surveyors;
- Engineers;
- Technicians with City and Guild qualifications;
- Surveyors.

Information from the department indicates that this department reporting to the CTO requires some additional human resource capacity, updating skills to match global counterparts, and training in new technology so that professionals could be retooled and better equipped.

1. Capacity-building

There are a number of organizations/units with responsibility related to IWRM and there is no coordination. However, IWRM was not a consideration in the development of these organizational structures. Hence, staffing of these organizations/units is focused on their core functions. DOWASCO which also has responsibility for water resources management is focused on the provision of potable water supply and sewerage services and though staff may attend regional and international workshops related to IWRM, the focus, competencies and experience are not in IWRM.

With respect to the other governmental organizations/units, it appears that most organizations do not have excess human resource capacity or expertise to assign to a dedicated organization/unit with responsibility for the core functions of IWRM. It must be noted that the Physical Planning Division has an operational GIS and therefore it may be possible to utilize these resources in the development of a water resources data and information system to facilitate management of the water resources. Also the Ministry of Agriculture and the Environment may have human resource capacity in the areas of watershed management that can be utilized.

For the establishment of IWRM, additional capacity-building, training and recruitment of appropriate staff is required. Furthermore, there is need for institutional strengthening in already existing organizations with IWRM related functions.

However to create an organization/unit with responsibility for the core functions of IWRM that is recognized and supported by the political directorate, it should be established through cabinet approval and legislation, and be provided with the appropriate human and financial resources.

2. *Technical capabilities*

Apart from the administrative capacity, the technical capabilities required for the water resources management unit include:

- Water resources engineering and management;
- Surface water hydrology and management;
- Hydrology;
- Groundwater drilling;
- Groundwater management;
- Watershed management;
- Environmental management;
- Flood management;
- Database management; and
- GIS management.

The mix of technical capabilities would depend on the functions to achieve the objectives of the initial structure. However, these skills and competencies are either very limited or not available.

Annex 3**WATER RATES**DOWASCO'S Current Tariff Structure**METERED SUPPLY****Domestic****ECS**

- Fixed service charge per month \$10.00
- For 0 – 1000 gallons per month 8.80
- For more than 1000 gallons per month 8.80 per 1000 gallons

Commercial & Industrial

- Fixed service charge per month \$20.00
- For 0 – 1000 gallons per month 11.80
- For more than 1000 gallons per month 11.80 per 1000 gallons

Stand Pipes

- Fixed service charge per month \$ 20.00
- Flat rate per stand pipe per month 270.00

Bulk Water Shipment

- Water delivered to ships \$20.00/1000 gallons
- Water delivered to bulk carriers 10.00/1000 gallons

UNMETERED SUPPLY

- For property with one fixture \$25.00 per month
- For property with more than one fixture 42.00 per month

SEWERAGE

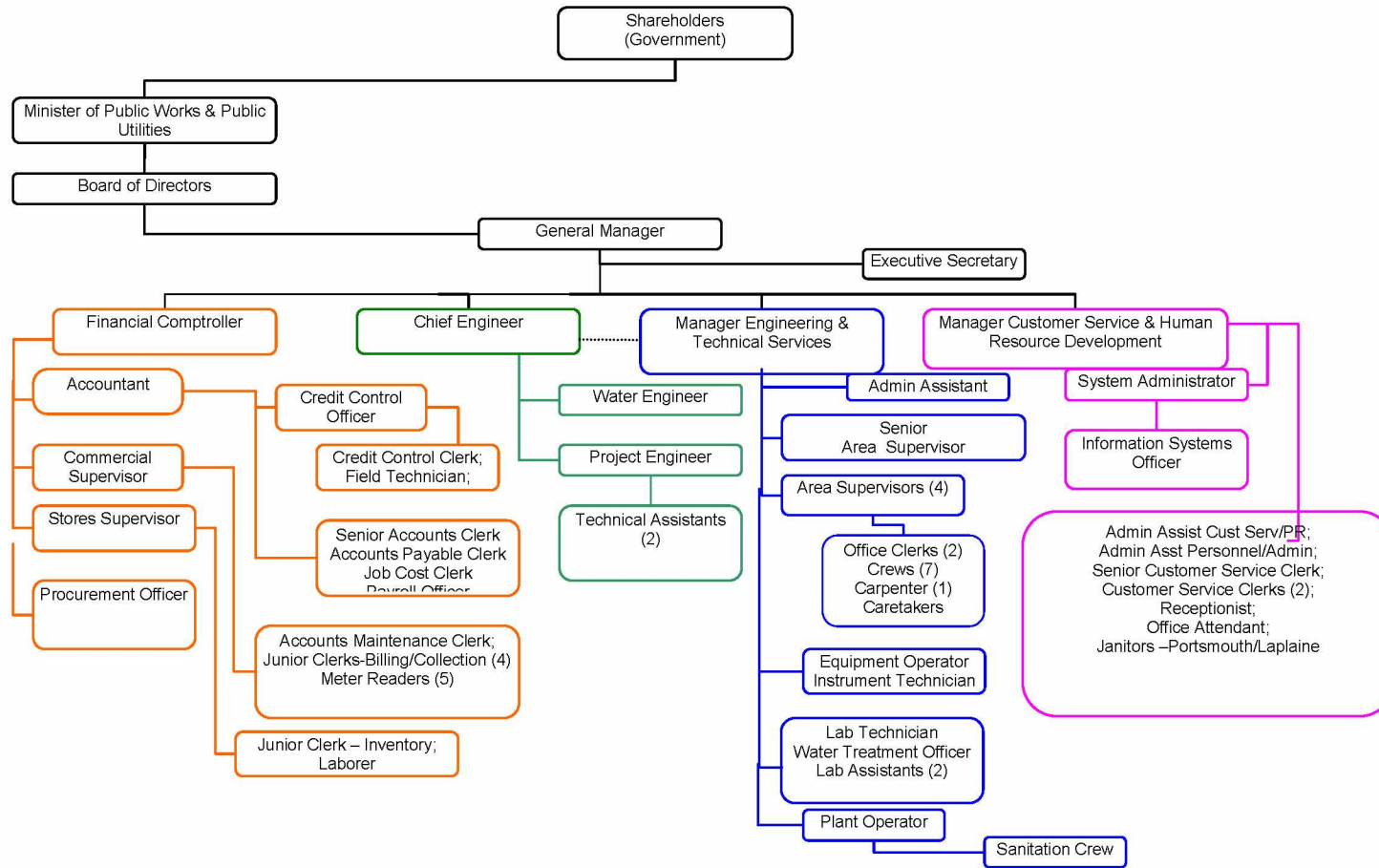
- Flat Rate \$10.60 per month

Annex 4**ORGANIZATIONS AND RESPONSIBILITIES
(Dominica)**

ORGANIZATION	ROLES/RESPONSIBILITIES	LEGISLATION
<p>DOWASCO</p> <p>Ministry of Communication and Works (MOCW)</p>	<ul style="list-style-type: none"> • Water resources monitoring and assessment as well as planning and organizing for water resources management • Collect and dispose wastewater • Exclusive licence to supply water • Catchment Protection Control 	<ul style="list-style-type: none"> • Water and Sewerage Act <i>Chap.43:04</i> • Water and Sewerage Act Section 13
<p>Ministry of Health</p>	<ul style="list-style-type: none"> • Establish water quality and treatment standards • Monitor source protection, water quality and water treatment throughout the island • Environmental Health 	
<p>Forestry and Wildlife Division</p> <p>Ministry of Agriculture, Fisheries and the Environment</p>	<ul style="list-style-type: none"> • Demarcate and protect water catchments • Water shed management and protection • Regulate activities within the forest reserves and national parks 	<ul style="list-style-type: none"> • Forestry Act <i>Section 5</i>
<p>Lands and Surveys</p> <p>Ministry of Housing, Lands, Telecommunications, Energy and Ports</p>	<ul style="list-style-type: none"> • Survey and administration of government lands • Preserving and protection lands 	<ul style="list-style-type: none"> • Crown Lands Ordinance

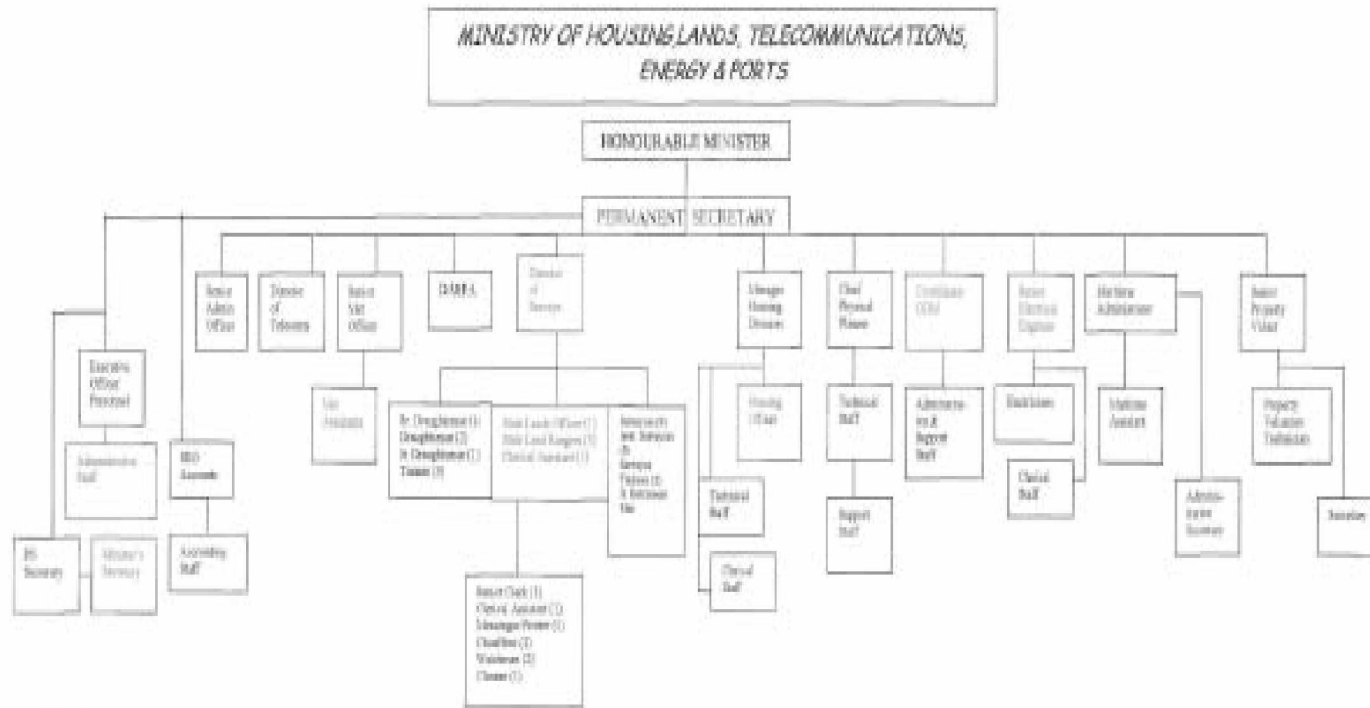
<p><i>Pesticide Control Board</i></p> <p>Ministry of Agriculture, Fisheries and the Environment</p>	<ul style="list-style-type: none"> • Enforcement of the Pesticides and Control Act and Regulations 	<ul style="list-style-type: none"> • Pesticides Control Act • Licensing and Registration of Pesticides
<p><i>Ministry of Agriculture</i></p>	<ul style="list-style-type: none"> • Soil and water conservation 	
<p><i>Physical Planning Division</i></p> <p>Ministry of Housing, Lands, Telecommunications, Energy and Port – Lands and Surveys</p>	<ul style="list-style-type: none"> • Development Control and Physical Planning • Administers removal permits 	<ul style="list-style-type: none"> • Town and Country Planning Act
<p><i>Development and Planning Corporation</i></p> <p>Ministry of Housing, Lands, Telecommunications, Energy and Port – Lands and Surveys</p>	<ul style="list-style-type: none"> • Decision-making for Planning and Development Control 	
<p><i>Cultural Division</i></p> <p>Ministry of Community Development and Gender Affairs</p>	<ul style="list-style-type: none"> • Within their jurisdictions, responsibility for sanitation, waste removal, nuisance abatement and beach control 	
<p><i>Local Government and Community Development Division</i></p> <p>Ministry of Community Development and Gender Affairs</p>	<ul style="list-style-type: none"> • Assist in areas of responsibilities such as disaster preparedness 	

Annex 5
DOMINICA WATER AND SEWERAGE COMPANY LIMITED
ORGANIZATION CHART



Annex 6

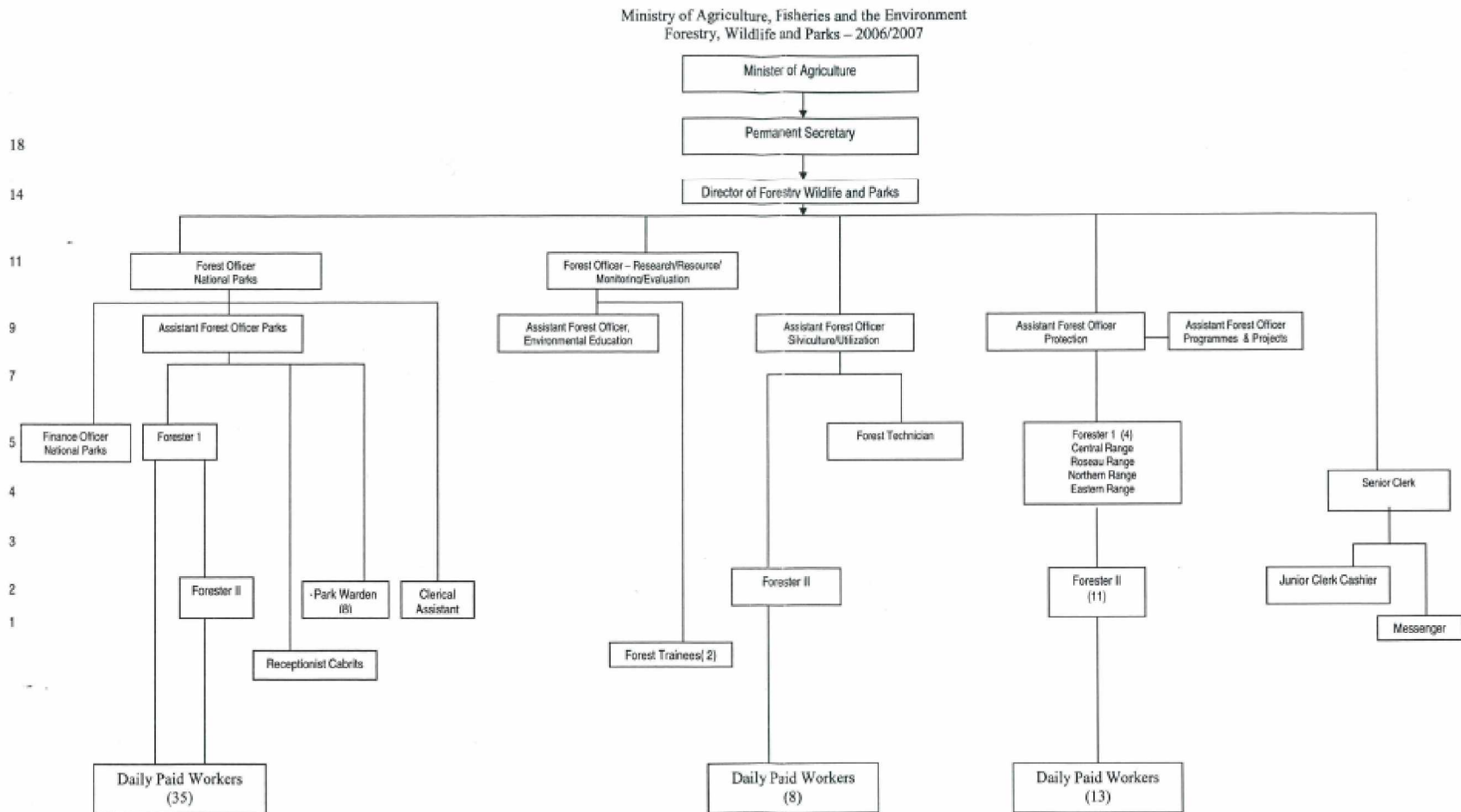
Lands and Surveys (Ministry of Housing, Lands,



LEGEND

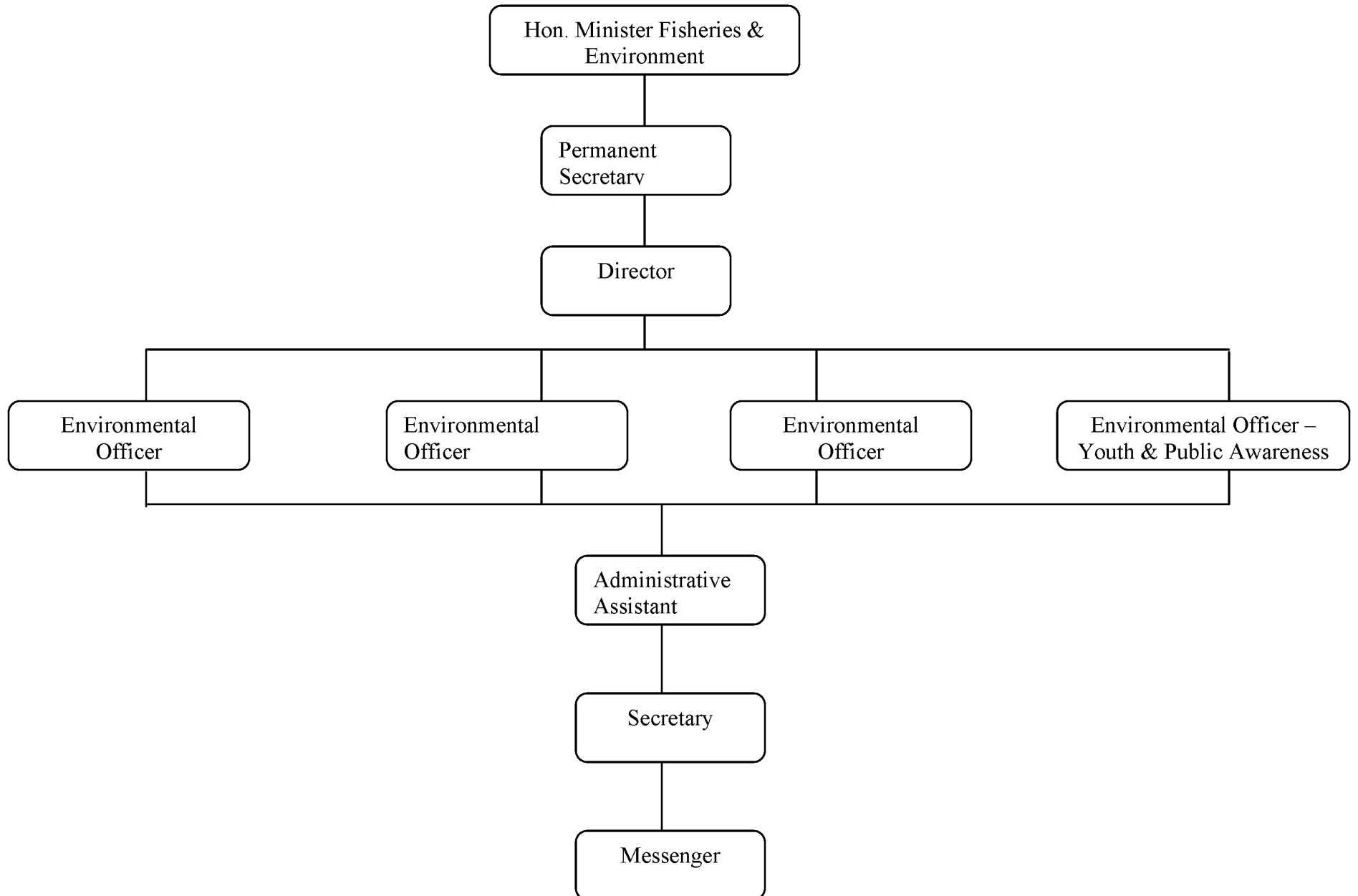
- SAO - Senior Administrative Officer
- CTO - Chief Technical Officer
- CTP - Chief Physical Planner
- DANPA - Domestic Air and Sea Ports Authority
- DOM - Office of Director Management
- MA - Marine Administrator
- SEO - Senior Executive Officer

Annex 7
Forestry and Wildlife Division
(Ministry of Agriculture, Fisheries and the Environment)

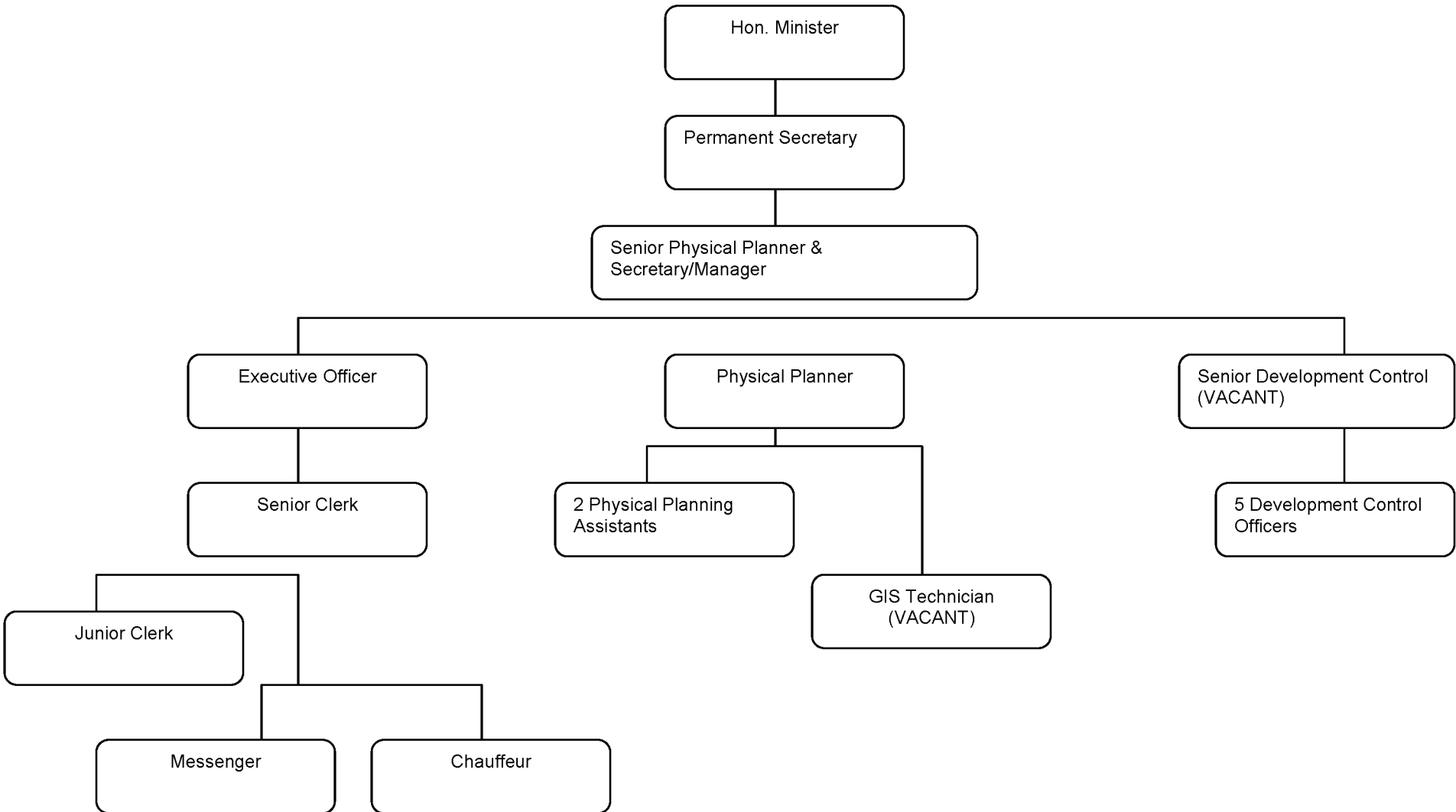


Annex 8

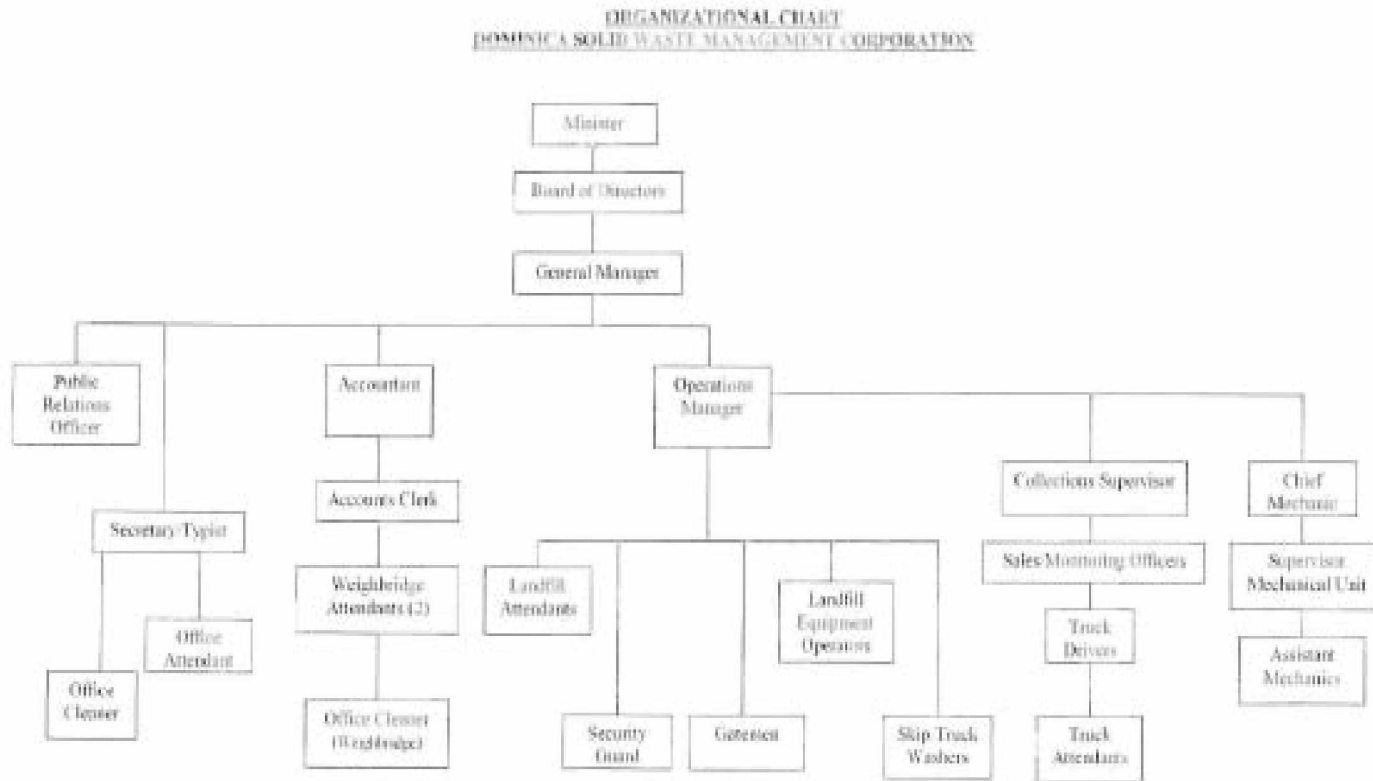
Environmental Coordinating Unit



Annex 9
Ministry of Housing, Lands, Telecommunications, Energy and Ports
Physical Planning Division

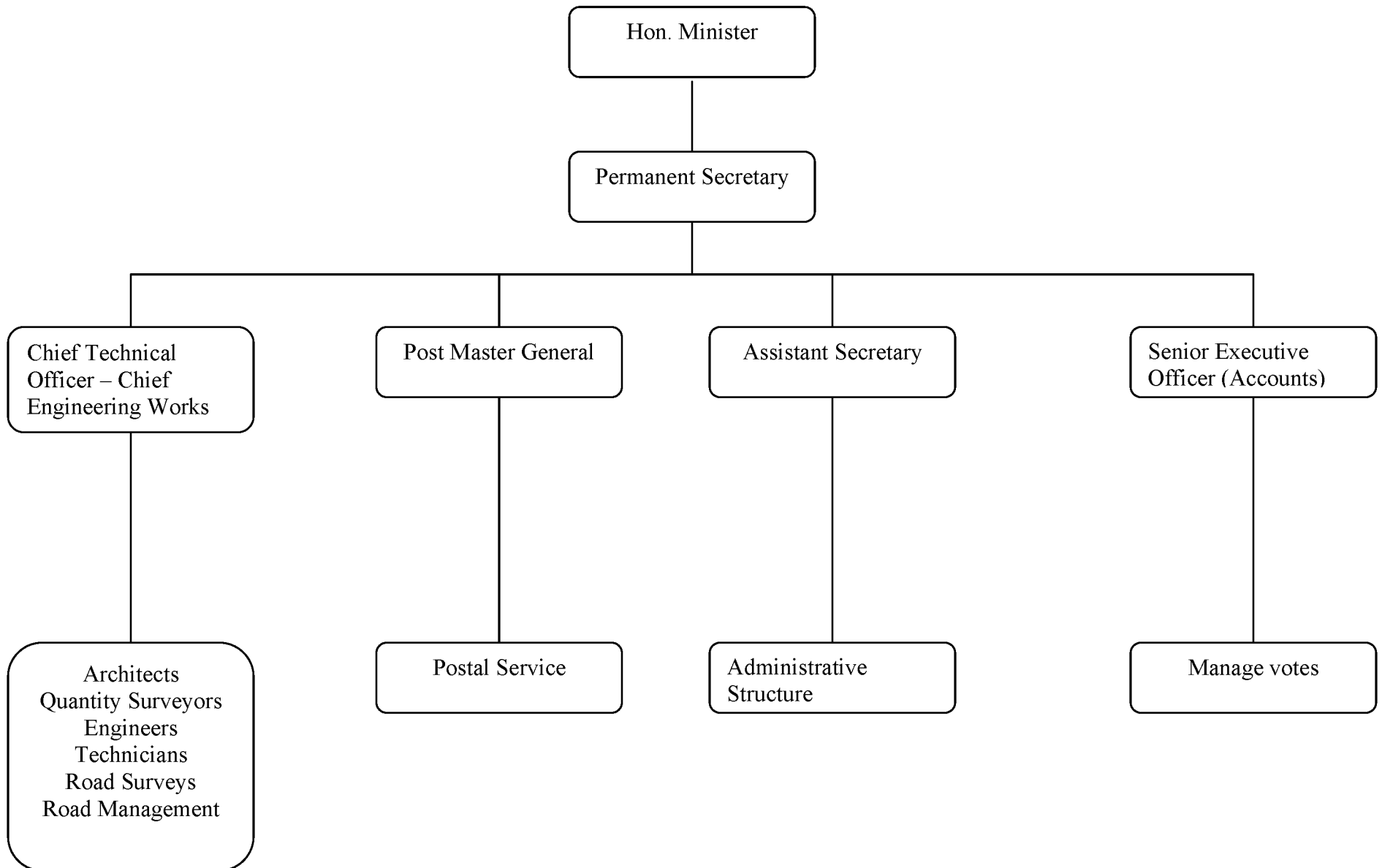


SOLID WASTE MANAGEMENT CORPORATION



Annex 11

Ministry of Public Works & Public Utilities



III. GRENADA

A. General

Grenada comprises the three islands of Grenada, Carriacou and Petit Martinique, which are of volcanic origin. Grenada is the most southerly of the Windward islands and is located between St. Vincent and the Grenadines on the north and Trinidad and Tobago on the south between 11°58' and 12°13' N latitude and 61° 20' and 61° 35' W longitude. The mainland Grenada is approximately 312 sq km and 33.8 km long by 19.3 km wide, while Carriacou and Petit Martinique are 34 sq km and 2.3 sq km respectively. The island is characterized by a mountainous terrain which rises steeply from the west coast and descends more gently to the east coast. At present, the population is approximately 100,000.

B. Climate

Grenada enjoys a humid tropical marine climate with little seasonal variation in relative humidity. The island has a dry season from January to May and a wet season from June to December. Rainfall varies from 1500 to 5000 mm per annum with a mean annual rainfall of 2300 mm(Baptiste, Raymond-Landuse Division). Annual average temperature ranges from 28.3°C to 33.3°C. However the temperature in the mountain tops can occasionally drop to about 20°C. The temperature at sea level is generally high with little variation throughout the year.

C. Water resources assessment

Hydrological monitoring of both water quantity and quality parameters is very limited. The National Water and Sewerage Authority (NAWASA) gives little attention to water resources data collection, therefore analysis of hydrological data to provide information to inform decisions is also very limited. However, the irrigation unit of the Ministry of Agriculture collects information on conductivity and pH and undertakes some chemical analyses, but no streamflow data is collected on the streams used for supplying irrigation water. Because of the lack of hydrological/water resources monitoring and data, water balances for the watersheds cannot be determined.

D. Water supply

The sources of water are surface water, ground water, rainwater harvesting and desalination. The total quantity of water produced from surface water and ground water for potable water supply is 7 million gallons per day (mgd) with 5.7 mgd from surface water and 1.3 mgd from ground water (NAWASA,2007). Surface water provides about 90 per cent of the island's potable water and is augmented from groundwater sources particularly during the dry season. For potable water supply, the surface water is treated by sand filtration and chlorination while the ground water is only chlorinated.

The available water resources are affected by seasonality; hence there is an estimated 30-40 per cent drop in the available surface water during the dry season depending on the length and severity of this period. The potable supply of water is therefore affected during this season and

some scheduling of water and water trucking takes place. This shortage of potable water supply during the dry season is a recurring problem and has been attributed to a lack of adequate water storage by NAWASA. With respect to the needs of each sector, no analysis is undertaken to determine the water requirements.

NAWASA serves only Grenada and supplies all water for domestic uses, whereas in Carriacou and Petit Martinique almost all the water is from rainwater harvesting (Peters 2006). The tourism sector is a priority with respect to potable water supply and though NAWASA provides the sector with potable water, hotels are advised to have water storage tanks to support a continuous water supply. In times of water shortage, water trucking is used to supply potable water. However some hotels have their own wells and desalination plants.

Water for agricultural purposes is mainly undertaken through the Irrigation Management Unit of the Ministry of Agriculture, although a small percentage of irrigation water is supplied by NAWASA. The Ministry of Agriculture's policy does not support the use of domestic water for irrigation and seeks to discourage it by not providing equipment to those farmers. Water requirements for the irrigation of lands under the Ministry of Agriculture have been calculated to be 1.5 million cubic meters per year. This irrigation water demand does not include the irrigation water requirements for lands outside the Ministry of Agriculture's programme.

With respect to industries, they are supplied with potable water by NAWASA but some supplement this water by having wells e.g. Grenada Brewery. With the establishment of the metering programme, wastage and leakage have reduced because of improved water use by households and the removal of roadside standpipes. In addition, leakage has been reduced due to a pipe replacement programme across the country.

E. Water allocation

NAWASA allocates potable water to the various users based on water requirements and availability. However, the tourism sector is given high priority. With respect to the allocation of water for irrigation by the Ministry of Agriculture, this is also based on user requirements but water is supplied directly from river courses using single pump units. The Ministry of Agriculture has no irrigation schemes using dams for water storage to supply water to farmers.

F. Water quality

The WHO guidelines are the standards used for water quality. A Grenada Water Quality Act was developed in 2005. The water quality parameters monitored for potable water are nitrate, BOD (Biological Oxygen Demand), chlorine residue, conductivity, alkalinity, sulphate, organic carbon, iron, odour, turbidity and pH. The Ministry of Health monitors the water quality and seeks to ensure that NAWASA adheres to the WHO guidelines for drinking water. Improved water management has positively impacted the health of consumers since there is a decrease in gastrointestinal illnesses.

G. Watershed management

Watershed management is undertaken mainly by divisions in the Ministry of Agriculture such as the Forestry Division, the Landuse Division and the Agricultural Extension Division and non-governmental organizations such as the Grenada Community Development Organization (GRENCODA). The Forestry Department's primary function is to ensure watershed management in the upland areas (National Report – Integrating Management of Watersheds and Coastal Areas, 2001), but it addresses government owned forests in both the high and low catchment areas. However, the Landuse Division and Planning Units are responsible for the activities in the lower catchment areas and respectively monitor the impacts that farmers and hotels have on water.

Specific actions being undertaken as part of the watershed management are:

- Land sustainability analysis for best crop type for new developments;
- Irrigation efficiency through the use of drip irrigation systems;
- Agro-climatic data collection;
- Formation of farmers groups and Water Users Associations;
- Initial steps in the development of an IWRM Action Plan in collaboration with the Caribbean Environmental Health Institute (CEHI).

However, poor landuse practices have had severe negative impacts on the country's water resources. In 2007, severe forest fires and burning of secondary forests by farmers to cultivate land resulted in flooding, damage to coral reefs and siltation of reservoirs. NAWASA had to suspend the water supply to communities in order to clean these reservoirs. Poor agricultural practices are also causing contamination of the water quality. In addition, landuse changes from agriculture to housing and tourism are affecting water resources negatively, because reduced infiltration will mean less groundwater. Generally, landuse management is not implemented effectively and there is no pollution management system or wastewater discharge permit system in place. NAWASA is supposed to control the discharges to the ground but this is not being undertaken.

H. Environmental aspects

EIAs are requirements of the planning process for projects in Grenada. However, it appears that undertaking EIAs on projects depends to a certain extent on the public's perception of the project therefore EIAs may not always be undertaken when they should. It should be noted though that EIAs play a significant role in sustainable management of the environment and its water resources if recommendations are implemented and best practice guidelines for its implementation are adhered to.

I. Sanitation

In Grenada, sewage is disposed of by septic systems or collected and pumped out to sea without any treatment. The existing sewerage systems are in the south of the island in the Grand Anse, St. Georges and Grenville areas, but every household is not connected.

J. Social dimensions

Water is a social good and impacts the health of a nation. A metering programme of potable water used by households was implemented by NAWASA. In areas where this metering programme has been established all stand pipes are removed therefore it is imperative that each household is connected to the water supply system. To facilitate household connections, an easy payment plan was introduced.

Metering of household users has resulted in improvements in the efficiency of domestic water use, awareness of the need for water conservation and acceptance to pay for the water used. Water is therefore more valued rather than just consumed as a right.

With respect to the tariff structure, since farmers are classified as domestic users, the same metered rate for household users applies. As a consequence, it has been suggested by an interviewee that some small scale farmers may have been forced out of business because of their inability to pay the tariffs.

K. Economic instruments

Water users in Grenada are categorized as domestic and non-domestic where domestic includes agricultural users. The tariff structure (See annex 12) is the system used to recover costs incurred by the water company NAWASA for both potable water supply and sewerage services. Although the tariff structure was to be designed to recover the water company's full costs, according to NAWASA Act 1990, the mechanism for full cost recovery has not been established. Main constraints to the implementation of full cost recovery for potable water are lack of political will, loss of water through leakage and the exclusion of a watershed management cost in the production cost. The revenue from tariffs fund NAWASA's recurrent costs but capital infrastructural expenditure is mainly financed externally through loans.

L. Regulatory instruments

In Grenada, regulatory measures in place for water resources management are almost non-existent and possibly limited to the quality of potable water supplied. There is also no water allocation mechanism. With respect to the latter, water is supplied based on the requirements of users and availability of water. Legislation supports water licensing but licensing of water abstraction has not been established.

M. Information management and exchange

With the limited IWRM data and information and the absence of a comprehensive data and information system for water management, there is no method of disseminating information. In fact, available data/information is disseminated only on request. There is however some education of the general public on water particularly targeting primary and secondary school children.

N. Institutional framework

An effective institutional framework is fundamental to implementation of policies and plans for successful IWRM. The nature of water dictates that it must be operational at the national, sectoral and community watershed levels. Therefore, the structure, roles, responsibilities and scope of actions at each level must be clearly defined and coordinated to facilitate functionality of the various components.

Since water is the inextricable link in the environment and almost everything depends on it, the responsibility of the water sector must be shared with other key stakeholder departments. Hence a number of sectoral policies and plans must be consistent with the National Water Resources Management Policy.

In Grenada, the State exercises proprietary rights over the water resources, which means that it has authority to legislate on all aspects of water. However, the institutional and legal framework necessary for effective IWRM does not exist in Grenada. There is no IWRM policy, no IWRM legislation and no IWRM strategy and plan. Water legislation exists but it is not effectively applied and there are gaps that will not facilitate IWRM in a comprehensive and holistic manner.

At present, some aspects of water management are being undertaken but in a fragmented manner. What exist are sectoral organizations with some responsibility for water management. NAWASA has authority and responsibility over all fresh water throughout Grenada, including on State and private lands, and the protection of these resources, but is mainly a provider of potable water and sewerage services to consumers. NAWASA is governed by the NAWASA Act No. 250, 1990. Part VIII Section 38 of this Act also gives responsibility for the protection, conservation and maintenance of forest reserves in waterworks areas to the Chief Forestry Officer (National Report, 2001), who is head of the Forestry and National Parks Department of the Ministry of Agriculture.

Other organizations with some responsibilities related to water management include the Ministry of Health and the Environment; the Ministry of Agriculture - Forestry Department, Landuse Division, and Agricultural Extension Division; the Solid Waste Management Authority; Ministry of Finance; Ministry of Works; Ministry of National Security and non-governmental organizations, such as the Agency for Rural Transformation (ART), and GRENCODA. The responsibilities of these organizations are seen in annex 13.

Cooperation or collaboration among agencies/organizations/sectors involved in water management is limited and mainly through meetings and workshops. Within the last year (2006-2007), through the introduction of the Global Water Partnership Caribbean (GWP-C) and the need to form a Country Water Partnership (CWP), there have been stakeholder meetings. There has also been some collaboration on the development of a roadmap for implementing IWRM in Grenada.

O. Water resources management functions

Within the context of the specific functions or tasks inherent in IWRM, the present institutional framework of the water sector is inadequate with respect to the planning, management, and regulatory functions of water resources.

Some core IWRM functions or tasks that must be included for integrated water resources management are:

1. Policy and strategy formulation

Policy refers to the guiding principles for actions, whereas strategy is the methodologies and plans of actions to achieve objectives.

As previously stated, there is no specific IWRM policy, strategy and plan for Grenada. The aspects of water resources management being practiced are undertaken by stakeholders based on a sectoral approach. There is little coordination and collaboration with respect to water resources issues and sometimes there is duplication. The environmental policy which was developed in 2005 has objectives which give support to IWRM but there was no specific IWRM focus.

Recently there has been the formation of a cabinet appointed committee to oversee the drafting of a National Water Policy in which IWRM will be an integral part. At present a draft water policy has been developed by a consultant. There has also been some collaboration with CEHI on the development of a roadmap for IWRM implementation in Grenada.

2. Legislation and enforcement

This is the process to ensure that proper laws and regulations are established and complied with as regards abstraction of water, use of water, prevention of water pollution and use of land.

At present there is no legislation on IWRM and insufficient enforcement of existing legislations which relate to water resources management. However there is a National Environmental Act which was drafted in 2005 following the establishment of the National Environmental Policy and Management Strategy. The goal of the policy is to ensure development is environmentally sustainable while optimizing the contribution of environment to economic, social and cultural development. Although IWRM is not mentioned specifically, the objective of the policy and strategy supports it (National Environmental Policy and Management Strategy, 2005).

3. Water resources assessment

This refers to the continuous study of water availability through monitoring, analysis and research and development.

Long-term continuous hydrological monitoring and assessment are almost non-existent as there is no hydrological network for monitoring water quantity and quality on a long-term basis to assess trends in water resources availability.

4. *Master planning and allocation of water*

This involves the determination of how much water is to be provided to each sector or stakeholder.

As previously stated, in Grenada no specific water allocation mechanism is established. The goal is to meet the requests of the various sectors/stakeholders requiring potable water through the supply provided by NAWASA with domestic, including tourism, being given priority. In the case of water for irrigation purposes, the Irrigation Management Unit in the Ministry of Agriculture is responsible.

5. *Water demand analysis*

This activity involves determining the water requirements of the various sectors such as domestic, tourism, agriculture, commercial and industry.

In Grenada, the water requirements of the various sectors have not been determined. There is also no monitoring of the quantity of water used by the few private users who supply themselves either through wells or desalination.

6. *Demand management*

This is the process of controlling the quantity of water abstracted by the various sectors and stakeholders and ensuring the most efficient use of this water.

In Grenada, the metering programme and the water rate structure for metered domestic consumers can be considered a demand management mechanism because rates increase with volume of water used.

7. *Conservation*

This refers to the prudent use and preservation of water resources. This activity comprises, *inter alia*, the reduction of demand through efficiency of use, the treatment and reuse of water, protection of the water resource through proper watershed management and public education and awareness.

In Grenada, actions towards water conservation include the metering programme, limited watershed management which could be more effective, creation of the Uplands Watershed Management Unit in the Forestry and National Parks Department of the Ministry of Agriculture,

limited public information and extensive use of the cistern system for the collection and storage of water in Carriacou and Petit Martinique. However, water loss in the distribution system is approximately 40 per cent and a major contributor to wastage.

8. *Pricing of water*

This is the process of determining an economic valuation of water taking into consideration its social and ecological value. There are prices that are charged to water abstractors and prices that are charged by the abstractors to the end-users of the water.

The former does not apply in Grenada as NAWASA is recognized as the sole abstractor for water supply. In reality, there are private abstractors like the Grenada Breweries Company and St. George's University that abstract water for their own purposes. No water abstraction licensing system exists although it is included in legislation.

Under the provisions of the NAWASA Act of 1990, water and sewerage tariffs were established to achieve full cost recovery. The unmetered consumers are charged percentage rates of the market value of their property for potable water on a quarterly bill. Metered consumers are charged at an escalating cost per 1000 gallons per month with a fixed charge per connection. Sewerage rates are one third and two third of water rates or charges for domestic consumers, and commercial and industrial consumers, respectively.

9. *Water resources development and distribution*

This consists of the activities involved in making water available for use by the various consumers through the process of abstraction, storage, transmission and distribution. Just as important is the proper management of sewage collection, treatment and disposal.

In Grenada, sewage disposal is mainly by septic systems. Sewerage systems exist only in the south of the island in the environs of Grand Anse, St. Georges and Grenville. There is no treatment of the sewage and it is pumped out to sea.

Inherent in these core IWRM functions are actions linked to other sectors that are necessary for sustainability of use and development of this water resource and to support social and economic development. In addition, the very nature of water resources dictates that effective IWRM must be undertaken in conjunction with effective land and landuse management, integrated watershed management, drainage and coastal zone management. As small island developing States, coastal zone management has an important role. Furthermore, effective integrated water resources management is critical to sustainable development of a country.

Institutional arrangements for water resources management must therefore include these necessary complementary functions that should be undertaken in a formalized coordinated approach with stakeholder partnerships and collaboration from the planning to implementation phases and supported by proper public education and awareness.

P. Capacity of institutions to implement IWRM

The functions comprising IWRM and listed above demonstrate the scope of actions to be undertaken and the need for some unit/department to be dedicated to this objective. The fact that many of the core activities for IWRM are not being undertaken and there has been no specialized development of the skills and experience needed means that institutional strengthening and training would be required.

A number of organizations because of their responsibilities have some role in the management of the water resources on the island. However, no dedicated organization with primary responsibility for water resources management exists. There is no formalized coordinating mechanism or framework for organizational relationships in the sector and the process for stakeholder involvement is limited to projects or meetings on specific issues.

NAWASA, under the National Water and Sewerage Act, has overall responsibility for fresh water. However its focus is being a utility provider of potable water and wastewater services. With the challenges of water supply and sewage disposal and the existing technical capacity, IWRM cannot be undertaken. Furthermore, the service provider will not be the most appropriate location for core IWRM functions.

The organization structure of NAWASA (see annex 14) is divided into five departments namely planning, design and construction; production and quality; transmission and distribution; administration; and finance. There are 207 permanent staff members including a general manager and deputy general manager and 10 contract officers. The deputy general manager position is not filled. With respect to graduate technical staff, apart from the general manager, there are three engineers, two of whom are managers and some junior staff members.

Other organizations identified as key stakeholders with responsibilities for some aspect of water resource management include the Ministry of Agriculture, Lands, Forestry, Fisheries, Energy and Public Utilities which has five areas with particular responsibilities related to the water sector namely the Landuse Division, the Department of Forestry and National Parks, the Department of Fisheries, the Agricultural Extension Division and the Agronomy Division. In the Ministry of Agriculture there are a number of vacant positions such as the Chief Technical Officer and the Senior Agricultural Officer, while persons in some of the head positions are only acting.

The Department of Forestry and National Parks (See Annex 15) contains the Upland Watershed Management, Forest conservation, and Mangrove and Coastal Woodland Conservation Units. Heritage Conservation was removed to the Ministry of Tourism. Information from the Forestry and National Parks Department indicates that there are eight vacant positions and therefore it is grossly understaffed.

The Landuse Division of the Ministry of Agriculture (See Annex 16) is responsible for soils and the information management using geographic information systems, irrigation and agrometeorology. The division operates in an advisory manner and is not governed by legislation. The division is headed by a chief landuse officer who has a BSc degree in

environmental studies, GIS and natural resources management and an MSc. The division has a total of eight positions. These positions are filled by locals with the exception of the engineer post which is filled by a Cuban consultant. There are three landuse officers, two have diplomas in agriculture and one has a certificate in agriculture. There are also one soil analyst and one agronomist, both with BSc degrees in their respective disciplines and one agrometeorology officer trained at the technical level at the Caribbean Meteorology Institute (CMI). See attached structure).

Information obtained in Grenada indicates that staff training is required in all areas to increase the competence in the unit to undertake its responsibilities completely. There is also need for additional staff in the soils laboratory. Training needs have been identified in the following areas:

- Data collection, analysis and forecasting;
- Automatic data collection;
- GIS and database management.

The Disaster Management Unit of the Ministry of National Security is responsible for disaster mitigation, preparedness response, and coordination of stakeholder involvement and information. The unit is also responsible for the preparation of disaster management plans and needs assessment. The National Disaster Coordinator is someone who was assigned from the police service. The qualifications of staff in this ministry vary from degrees to GCE certificates. Overall, the positions in the ministry may be near adequately staffed but the structure may be lacking in the positions at the senior level to accomplish the work that is required.

The Environmental Health Department of the Ministry of Health (See Annex 17) and the Environment is responsible for policy issues, pollution control and water quality control. The Public Health Act of 1990 and the Water Quality Act govern the work of the department. This department is headed by a chief environmental health officer who has an MSc degree in public health. Other staff members in the department are:

- Four senior environmental health officers: three have associate degrees in public health and one has an MSc degree;
- Nine/20 district officers/environmental health officers: all at the associate degree level in environmental health;
- Three environmental health assistants – all having five GCE passes.

Information obtained indicates that the department is not adequately staffed. In addition, the structure may need more officers. At present, the department functions in a system where all public health officers are generalists. However, the department is being restructured to function via programmes on food, water quality, housing, and sanitation where officers will be attached to the units. This new structure will seek to develop competencies and build capacity in the various areas through training.

The Environmental Affairs Department of the Ministry of Health (See Annex 18) and the Environment is responsible for coordination of environmental issues at the national level.

However, there is only a draft environmental legislation. At present, the department is staffed with one person who operates as the coordinator. Proposed structures for the department are being considered therefore no assessment could be made of the structure for the department.

The Ministry of Economic Development and Planning (See Annex 19) is a new ministry which was formed in May 2007. Among its responsibilities are sourcing financing for projects, developing the capital section of the budget, sustainable development issues and conservation, and implementation of conventions such as climate change, and the convention on biological diversity. There are many vacancies in this ministry including that of director of the new ministry who will report to the permanent secretary. The Physical Planning Division of this ministry, which has responsibilities impacting on water management, is inadequately staffed. The ministry needs assistance with capacity-building as there is a need for training.

The Grenada Sustainable Development Council was established by an Act of Cabinet in 1996 and operates under the Ministry of Finance. The Council is not an organization but a committee with broad-based and cross-sectoral membership with representatives from government, private sector, non-governmental organizations, community-based organizations, academia and the general public. It has as its mandate to serve as a primary mechanism for coordination and information exchange in the implementation of sustainable development plans, for stimulating public awareness on sustainable development issues, and for advising the government on sustainable development policy. Given the fact that IWRM is a major issue in sustainable development, IWRM policy considerations should be a focus with respect to the objectives of the Council. At present, IWRM is not a topic being dealt with by the Sustainable Development Council.

1. Capacity-building

The institutional capacity-building is limited consisting mainly of regional training to a cadre of technical persons and, to a small extent, on-the-job training. At present, in the Landuse Division of the Ministry of Agriculture on-the-job training is obtained through Cuban engineers on short-term contracts.

Generally, the human resources capacity and expertise within national institutions/organizations are inadequate to undertake all the functions effectively. Hence adoption of IWRM responsibilities would mean additional capacity-building, training and recruitment of appropriate staff.

Since there is the need to create an organization/unit with responsibility for the core functions of IWRM, then there must be support from the political directorate for the establishment of such an organization/unit through cabinet approval, legislation, financial resources, human resources and rationalization of responsibilities among stakeholder organizations.

2. *Technical capabilities*

Apart from the administrative and project development and management capacity, the technical capabilities required for the water resources management unit include:

- Water resources engineering and management;
- Surface water hydrology and management;
- Hydrogeology;
- Groundwater drilling;
- Groundwater management;
- Flood management;
- Watershed management;
- Environmental management;
- Database management; and
- GIS management.

The mix of technical capabilities would depend on the functions to achieve the objectives of the initial structure. In Grenada, these skills and competencies are either limited or not available.

Tariff Structure

Unmetered Domestic Consumers

- 0.25% of the Market Value of the property for the first \$100,000.00
- 0.15% of the Market Value of the property for the next \$200,000.00
- 0.05% of the Market Value of the property for the next \$300,000.00
- 0.025% of the Market Value of the property above \$600,000.00

Minimum charge of \$96.00 per year (If Property value is \$38,000.00 or less)

Example: Property Value (PV) - \$750,000.00

	PV		\$
	750,000.00		
subtract first	100,000.00	- 0.25%	250.00
	650,000.00		
subtract next	200,000.00	- 0.15%	300.00
	450,000.00		
subtract next	300,000.00	- 0.05%	150.00
remainder	150,000.00	- 0.025%	37.50
		<i>New rate:</i>	<u>737.50</u>

Sewerage Rates remains same: one third (1/3) of water rates or charges.

Unmetered Commercial and Industrial Consumers and Government Buildings

- 0.35% of the Market Value of the property for the first \$500,000.00
- 0.30% of the Market Value of the property for the next \$500,000.00
- 0.25% of the Market Value of the property above \$1,000,000.00

Minimum charge of \$96.00 per year

Example: Property Value (PV)- \$1,500,000.00

	PV (\$)		\$
	1,500,000.00		
subtract first	500,000.00	- 0.35%	1750.00
	1,000,000.00		
subtract next	500,000.00	- 0.30%	1500.00
Remainder	500,000.00	- 0.25%	1250.00
		<i>New rate:</i>	<u>4500.00</u>

Sewerage Rates remains same: two thirds (2/3) of water rates or charges.

Metered Domestic Consumers

Proportional Charge

Category 1: consumption less than 2200 gals. - \$6/1000 gals. per month

Category 2: consumption between 2200 and 5500 gals - \$10/1000 gals. per month

Category 3: consumption above 5500 gals. - \$15/1000 gals. per month

Fixed Charge

\$8 per month per connection

Sewerage Rates remains same: one third (1/3) of water rates or charges.

Metered Commercial & Industrial Consumers

Proportional Part

\$15.81 per 1000 gals per month

Fixed Part

40% of unmetered rates for these premises.

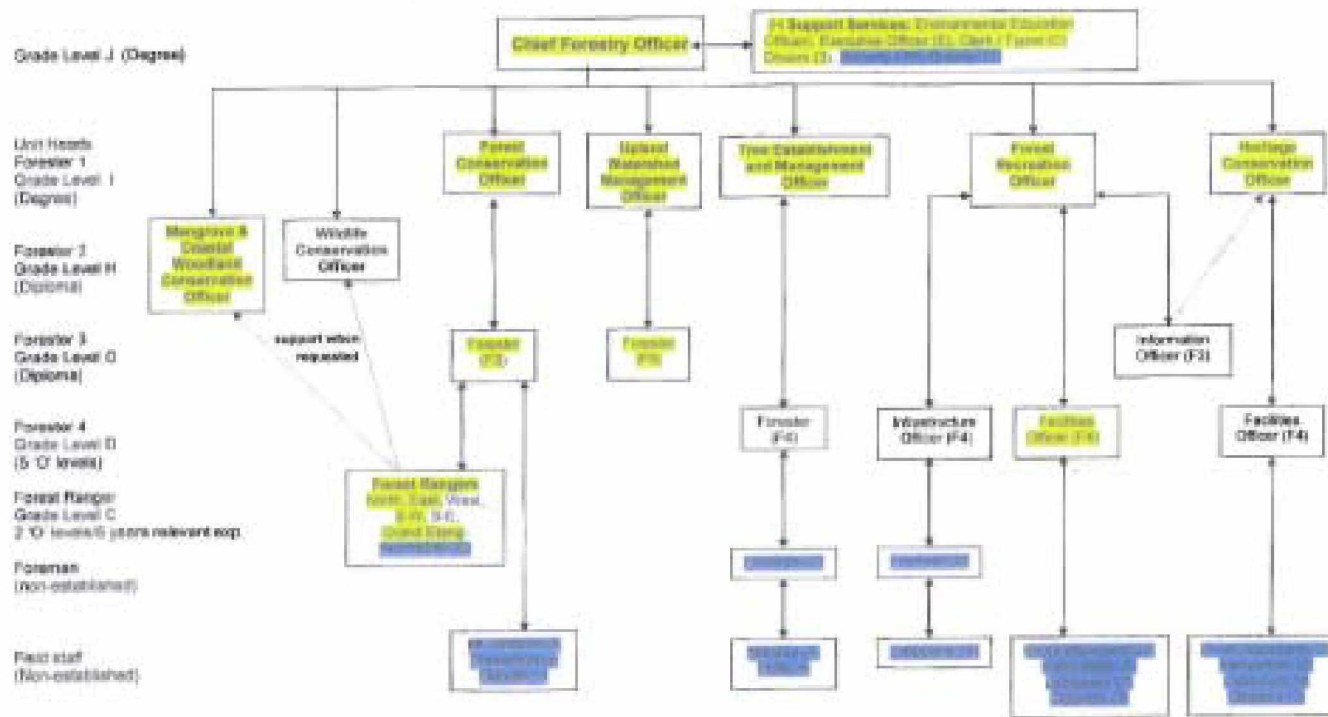
Sewerage Rates remains same: two thirds (2/3) of water rates or charges.

Annex 13**Organizations and responsibilities (Grenada)**

ORGANIZATION	ROLES/RESPONSIBILITIES	LEGISLATION
<i>National Water and Sewerage Authority (NAWASA)</i>	<ul style="list-style-type: none"> • Fresh water • Focus on providing potable water and wastewater services 	<ul style="list-style-type: none"> • NAWASA Act 1990
<i>Department of Forestry and National Parks</i> (Ministry of Agriculture)	<ul style="list-style-type: none"> • Watershed management and forest conservation 	
<i>Landuse Division</i> (Ministry of Agriculture)	<ul style="list-style-type: none"> • Soils • Information management using GIS • Irrigation • Agrometeorology 	
<i>Disaster Management Unit</i> (Ministry of National Security)	<ul style="list-style-type: none"> • Disaster mitigation • Preparedness response • Coordination of stakeholder and information 	
<i>Environmental Health Department</i> (Ministry of Health)	<ul style="list-style-type: none"> • Policy issues • Pollution control • Water quality control 	<ul style="list-style-type: none"> • Public Health Act 1990
<i>Environmental Affairs Department</i> (Ministry of Health)	<ul style="list-style-type: none"> • Coordination of environmental issues at the national level 	<ul style="list-style-type: none"> • Only draft legislation is available at this time
<i>Ministry of Economic Development and Planning</i> (as part of the Ministry of Finance)	<ul style="list-style-type: none"> • Sourcing financing for projects • Developing the capital section of the budget • Addressing sustainable development issues and conservation and implementation of convention (e.g. Climate Change, Convention on Biological Diversity) 	
<i>Grenada Sustainable Development Council</i> (Ministry of Finance)	<ul style="list-style-type: none"> • Its mandate is to serve as a primary mechanism for coordination and information exchange in the implementation of sustainable development plans • Stimulates public awareness on sustainable development issues • Advises the government on sustainable development policy 	

Forestry and National Parks Department

Proposed Forestry and National Parks Department Structure, March 2008

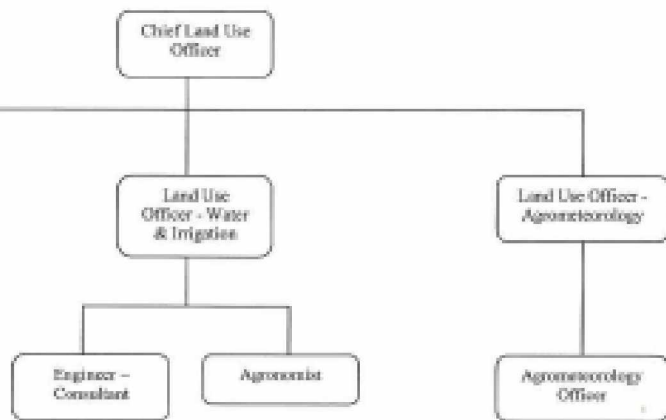




Annex 16

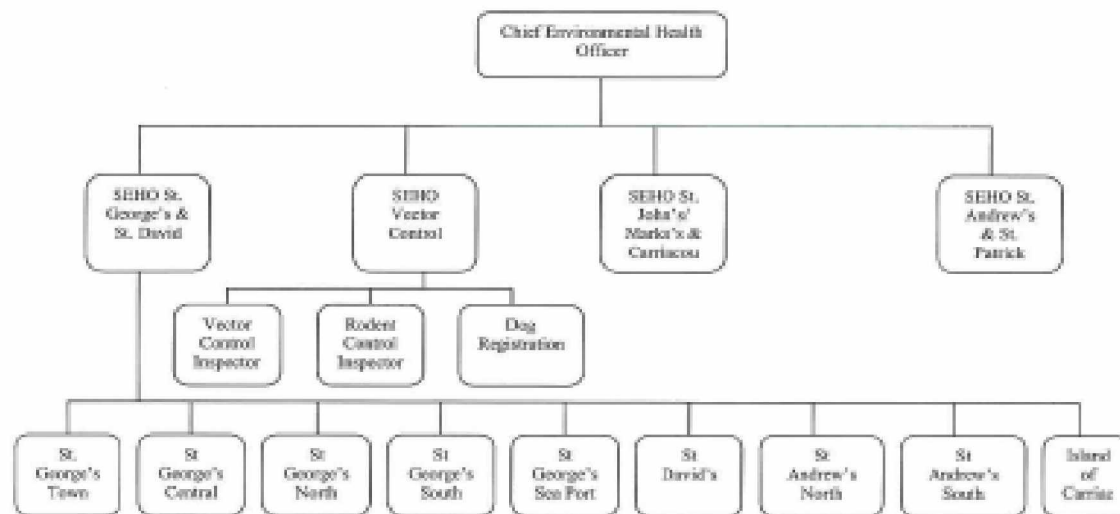
Landuse Division

**MINISTRY OF AGRICULTURE
LAND USE DIVISION**



Environmental Health Department (Ministry of Health and the environment)

MINISTRY OF HEALTH & THE ENVIRONMENT
THE ENVIRONMENTAL HEALTH DEPARTMENT



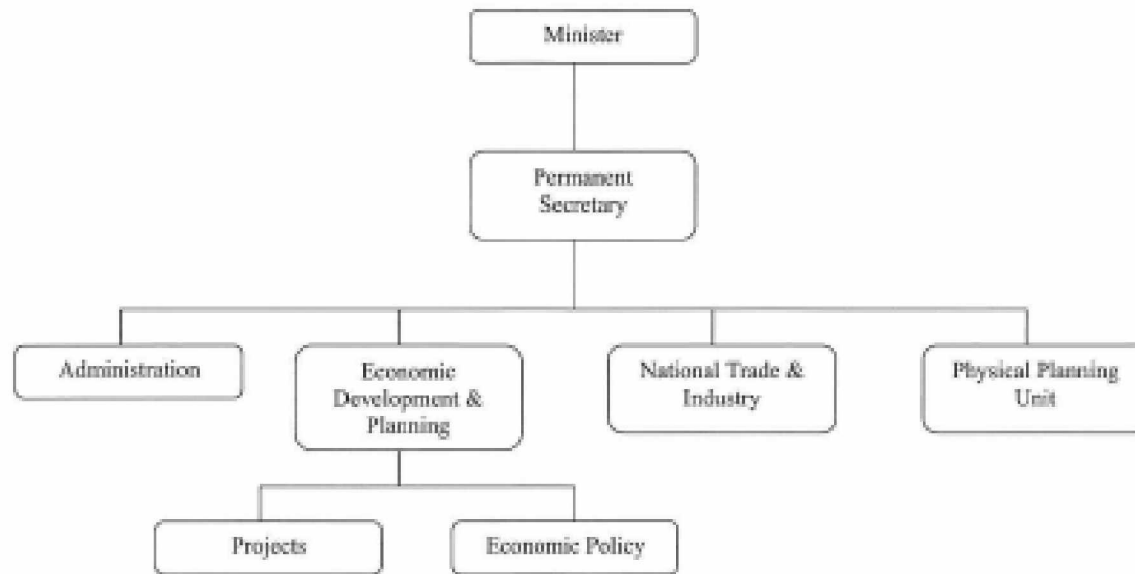
The Environmental Affairs Department (Ministry of Health and the Environment)

MINISTRY OF HEALTH & THE ENVIRONMENT – Officer in Charge of the Environment



The Ministry of Economic Development and

MINISTRY OF FINANCE
MINISTRY OF ECONOMIC DEVELOPMENT AND PLANNING



IV. CHALLENGES, RECOMMENDATIONS, AND THE WAY FORWARD

A. Challenges

In addition to the identified deficiencies in human resources capacity and capabilities and the lack of financial resources, there are a number of challenges to the implementation of IWRM which has led to IWRM not being advanced.

1. *Lack of understanding of IWRM*

Although there may be some regional training in IWRM not many persons, including policy makers and the political directorate, have a comprehensive understanding of the scope of functions and actions that comprise IWRM and the benefits that can be obtained. Part of the problem appears to be information dissemination as most times it is the same circle of persons attending the various training programmes. Effective IWRM is a major pillar in sustainable development of a country and though it supports social and economic development, actions are slow towards institutionalizing IWRM.

2. *The location of IWRM*

A major stumbling block for actions at implementing IWRM is its location. For most of the countries in the Caribbean including Antigua, Dominica and Grenada, water resources management is legislated as the responsibility of the same organization that provides the potable water supply and sewerage services except Antigua's Water Department which does not provide sewerage services. These water organizations do not focus on integrated water resources management. This IWRM neglect is possibly because of a lack of understanding of IWRM by the decision makers, a lack of human resource capacity and competencies in IWRM, the overwhelming challenges of the service provider and the limited financial resources.

The core functions of IWRM should not be in the organization responsible for potable water supply and sewerage services or any organization that is a user of the resource, as this is conflicting and tantamount to the manager of the resource being managed by a user of the resource. However, there are persons for unknown reasons that influence the decision makers to locate the core functions of IWRM in the water supply service organization – a position which would certainly not lend itself to effective integrated water resources management.

3. *Lack of a vision for IWRM*

IWRM policy, legislation and plans have not been developed. The inertia in having these developed could probably also be attributed to a lack of vision for IWRM in the country. What may be required is a comprehensive consultative process to develop a shared national vision. At a regional level, a model IWRM policy, a model IWRM legislation and a model IWRM plan could be developed which would facilitate their development in the islands.

4. *Development of an IWRM organizational structure*

What is the most appropriate organizational structure to be developed and how is this organization to be made functional? Without the country/local experience and skills, it appears that in the initial stage expertise would be required to assist in the development of a base structure to accomplish the objectives needed for IWRM. It must be noted that the actual structure developed would depend on the functions to be performed and the activities for which emphasis is placed.

Annex (5a) provides an example of a possible structure of a water resources agency taken from the Programme for Water Governance Fiji – Water Resources Management at National Level: Final Report: Chapter 5: Institutional Reform. Fiji was used because it is also a small island and restructuring of the water sector making IWRM integral was recently undertaken in 2006.

5. *Implementation of an effective governance structure*

Effective IWRM is not only about the core functions that an organization with responsibility for IWRM will undertake, but also about effective implementation of all the actions related to the water sector of which key stakeholders are responsible. Hence coordination, collaboration and stakeholder partnerships from planning to implementation must be reflected in the governance structure and be formalized in policy and legislation with roles and responsibilities from the national to the community levels clearly defined. In addition, everyone is a stakeholder, therefore IWRM must be supported by public education to allow each person to undertake his/her role effectively.

6. *The skills and knowledge base required*

The skills and competencies required would be determined by the functions to be undertaken in the core IWRM organization defined and the skills and competency gaps in the IWRM functional areas of key stakeholder organizations and the water supply and sewerage service provider.

Technical capacity required by a water resources unit/organization with core IWRM functions span several disciplines and categories as indicated previously in the section on Technical Capacity. As a consequence, initially there may be a mix of retained staff and private sector involvement. However, there must be a minimum technical capacity and professional ability for the organization to be effective.

7. *Financing an IWRM organization*

The limited financial resources to meet the competing needs in the islands coupled with the lack of understanding of IWRM and the benefits of its implementation to a country are stumbling blocks to establishing an IWRM organization. However the importance of IWRM to

sustainable development in a country makes it imperative that a mechanism be developed for establishing an IWRM organization that is appropriately staffed and can be funded to be effective.

B. Recommendations

For effective water resources management, an integrated approach must be adopted holistically and within the context of good governance (CATHALAC, Vision on Water,2000). As such, the following critical actions are necessary to support the institutional structure to be established:

- Collaboration with major stakeholders to obtain agreement on the decision making process for major water projects and their implementation;
- Decisions taken and implemented must be in the best interest of the island and its people both in the short and long terms;
- Appropriate capacity-building for effective water management at the various levels including the political directorate should be facilitated and supported;
- Positions should be staffed with the appropriate human resource capacities;
- Public education and awareness must be an ongoing action.

IWRM principles and practices in these island countries should be implemented through:

- Coordination among all relevant agencies;
- Long-term planning and commitment for IWRM implementation; and
- Appropriate support from relevant regional and international agencies.

C. Institutional framework

An effective institutional framework is fundamental to implement the policies and plans for successful integrated water resources management. This means that the structure, roles and responsibilities must encompass all the core functions and necessary complementary functions that comprise IWRM. Components of these functions include water resources assessment, water planning and management, water regulation, water and sewerage service and the many support and complementary services.

For regulation to be successful it must be kept separate from user organizations including the service provider. The responsibility of the water sector must be shared with other key stakeholders and therefore an effective structure for coordination and collaboration is necessary.

There must also be consistency in sectoral policies and plans to obtain maximum benefits for the country.

D. The water resources organization

The organization/unit with primary responsibility for integrated water resource management should not be located within the organization responsible for potable water supply and sewerage services or any organization that is a user of the resource. The organization/unit should have the following functions.

- Development and implementation of an IWRM policy and strategy;
- Development and implementation of IWRM legislation and enforcement;
- Development of an IWRM master plan;
- Water resources assessment;
- Regulation of the use of available water resources;
- Establishment of a national water resources database and dissemination of data and information;
- Allocation of water resources;
- Water demand analysis;
- Demand management;
- Development and implementation of water conservation plans;
- Designation of source protection zones;
- Establishment and implementation of abstraction licenses and fees;
- Development and implementation of a water quality control plan;
- Flood management – planning and development of guidelines;
- Public education on water resources.

These functions would be undertaken in cooperation and collaboration with other appropriate organizations.

E. The water supply and wastewater services organization

The responsibilities of the Water and Sewerage Authority should at least include:

- The provision of a clean, safe potable water supply;
- The provision of wastewater collection, treatment and disposal to the extent and standards determined;
- Development and implementation of sewerage regulations to deal with connection of premises, construction of private sewers and control of private sewerage installations;
- Development and implementation of rates and charges in accordance with the pricing policy;
- Development of a water supply and wastewater policy, legislation, strategy and master plan;
- Development of a drought management plan.

For islands with inadequate water resources, optimizing the water resources by harnessing and managing all water including wastewater and storm water appears to be an effective method but implementation requires that the country is sewerage (Singapore Utilities, 2007) . Unfortunately the sewerage systems in Grenada and Dominica are inadequate covering a small percentage of the population while in Antigua there are no centralized sewerage systems.

The first priority source for water supply is the harnessing of water resources in the respective water catchments and therefore management and protection of the land area is important. However, landuse management and watershed management in the islands are not given the priority required. It must be noted that effective water management cannot be separated from effective landuse management and watershed management.

To ensure a sustainable water supply, optimization of the water resources must include conservation and a water demand management programme. The water supply organizations in the islands therefore have a major responsibility with respect to the management of water demand, as it includes the proper handling of the transmission and distribution network to minimize losses and implement water conservation measures.

F. Key water stakeholder organizations

Other actions of key stakeholders necessary for effective integrated water resources management include, inter alia, development and implementation of the following:

- Landuse plan;
- Development control plan;
- Land development regulations and zoning;
- Integrated watershed management plan;
- Coastal zone management plan;
- Irrigation management plan;
- Agriculture water use efficiency plan;
- Soil conservation plan;
- Solid waste management plan;
- Standards and/or guidelines for environmental quality;
- Environmental impact assessment;
- Standards for water quality;
- Public health monitoring plan;
- Emergency management plan for flooding.

The scope of responsibilities and actions to be undertaken by the primary organization for IWRM, the utility provider of water and sewerage services and other key stakeholders have been outlined to demonstrate the areas for which human resource capacity must be built or obtained.

From the information collected by questionnaire, telephone interviews and literature review, it is clear that most of the organizations with responsibilities related to IWRM do not have the human resource capacity and/or the capabilities to effect these actions. Furthermore

there appears to be no excess capacity or expertise to staff a unit dedicated to IWRM as outlined above. To clearly identify gaps in the organizations responsible for one or more of these actions, institutional audits would have had to be undertaken and this meant visiting the organizations in each of the islands as there is some difficulty in obtaining comprehensive information from the islands

However, this assessment provided sufficient information to determine that the human resources with the capability of undertaking IWRM actions must be acquired and appropriate capacity-building must be undertaken both for the core IWRM organization/unit and the key stakeholder organizations.

G. The way forward

At present, the focus on IWRM in the islands should be on how IWRM could be implemented. For some time, attention has been on what actions are to be undertaken together with some sporadic IWRM training to technocrats in the region.

A mechanism must be found to engage and educate the policy makers and political directorate so that momentum can be developed and “buy-in” obtained for the implementation of IWRM in a holistic manner before negative impacts, that could be avoided, occur.

A catalyst for IWRM implementation in these islands, given the challenges and status of IWRM in the countries is the development of the following models for IWRM. These models would give support to the islands and the wider Caribbean as they could then be adapted to the specific countries:

- Policy;
- Strategy;
- Legislation;
- Water resources organization/unit structure;
- Institutional framework/structure;
- Public education programme;
- Financing mechanism for the IWRM organization/unit.

Complementing the models are other important studies to advance the planning and management of water resources and facilitate development. These studies include:

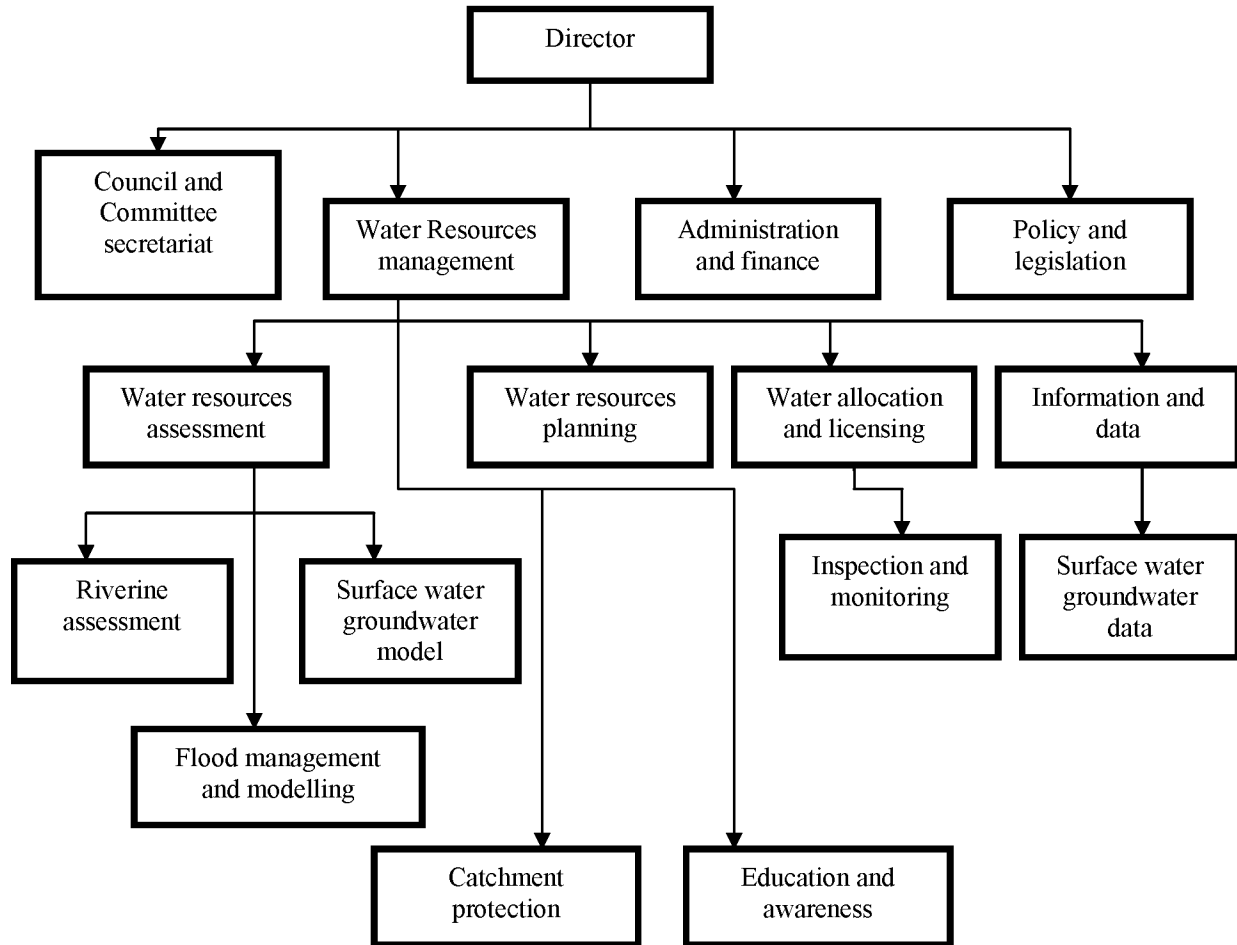
- The economics of IWRM;
- The impacts (including economic impacts) of climate change on IWRM;
- Development of a strategy for building IWRM capacity in the Caribbean;
- Mechanisms for effective stakeholder involvement/participation in IWRM;
- A compilation of best management practices in IWRM internationally;
- Comparison of the economics of water reuse and desalination.

Given the status of the human resources capacity and the competencies required in these islands, achieving development of the models and studies recommended would not be sufficient

to implement IWRM. It is clear that human resources capacity is required in most areas identified in the technical capabilities requirement. It is therefore critical that a strategy be developed for each island to obtain the human resources with the appropriate capabilities to undertake the actions.

The lack of adequate and reliable data and information which are fundamental to planning, management and decision-making points the direction to one of the actions that must be undertaken in the initial stage. Hence one of the areas of capacity-building must be in water resources monitoring and assessment. Lessons could be learnt from the Jamaica and Trinidad and Tobago experiences in water resources management and the functions of the proposed Water Resources Organization for Fiji (see Annex 20b) could be used as another guide. However, whatever actions are undertaken to implement IWRM must be within best management practices globally.

Finally, the notion that water management is only about transmission and distribution of potable water and disposal of sewage must be dispelled. Water must be managed for optimization of use and sustainability while supporting social and economic development. Remember the findings of the World Water Council at the Conference in The Hague in 2000 “Water Management is in Crisis”.

Annex 20 (a)**Potential structure of water resources agency**

The divisions or units in the above diagram outlined in black are those which would logically be established initially, while other sub-divisions could be added later or as required.

Annex 20 (b)**FUNCTIONS OF KEY UNITS OF THE WATER RESOURCES AGENCY – FIJI**

UNIT	FUNCTION AND COMMENT
Council and Committee Secretariat	The secretariat could exist as an independent entity to provide support for the National Water Council and the Committee and other as hoc arrangements from time to time. It needs to be headed up by a person at level of director; otherwise the Director of the Secretariat and should be supported by a full-time official who reports directly to the Director.
Policy and legislation	<p>The preparation of policy at national and subsidiary policy guidelines, including oversight or coordination of the production of technical guidelines (e.g. floodplain planning guidelines)</p> <p>Preparation of legislation proposals and implementation of legislation.</p>
Water resources management	<p>This division includes all key water management activities and the technical facilities. In an alternative structure, information and technical could be separate.</p> <p>The water management division would investigate and analyze issues on which decisions need to be made and implement the solution in the relevant areas.</p>
Water resources assessment	The unit is responsible for the measurement and analysis of (i) streamflow and (ii) groundwater occurrence. Analytical tools also form part of assessment, such as modelling to obtain information about the behaviour of water sources and the impacts on water of abstracting water or diverting rivers, etc. This unit would provide information on which to base decisions about water allocation and major development of water sources.
Water allocation and licensing	The unit is responsible for issuing water licences to relevant water users and administering the licences. It includes a monitoring and regulatory role, to ensure that water is taken according to authorizations. It would also act in cases of water scarcity to assert priorities such as in case of drought.
Information and data	<p>This unit build up and ensure coordination of water resources data bases for the whole of the Fiji islands. It is proposed that surface water quality and groundwater quality/occurrence be the two main data bases, but links with other data would also be encouraged.</p> <p>Regardless where the hydrology unit is finally located, the water agency should lead in defining the purposes and scope of data needed for water management and therefore the features of the surface water data networks.</p>

Flood management and modelling	This unit's function would be limited to water assessment and it could be located differently. Flooding modelling would be relevant to assessment, but would be required for planning. Additionally, hydrological studies with respect to floods would be undertaken.
Administration and finance	This unit is necessary for support of the agency is located within an existing organization, it would not be needed as a separate unit.
Water resources planning	This unit would be established if an active planning scheme is developed. Planning areas could include floodplain planning, water allocation planning and planning for the protection of riverine areas and other special areas. Note that some planning, such as floodplain planning would necessarily have extensive involvement by the Planning agency, which might adopt the leading role, but with support on technical aspects by the water agency.
Education and awareness	This unit would develop information and media for promoting public understanding of water resources management, for national issues but also increasingly for the local level village and small island. Other agencies and NGOs will be producing related material, so a high degree of liaison would be necessary.

Adapted from European Union and SOPAC, Programme for Water Governance Fiji – Water Resources Management at National Level, Final Report: Chapter 5 Institutional Reform

References

Drigo, Anthony. Integrating Management of Watersheds and Coastal Areas in Small Developing States of the Caribbean – National Report, Commonwealth of Dominica. March 2001.

National Report - Integrating Management of Watersheds and Coastal Areas, Grenada. (Department of Economic Affairs – Ministry of Finance and, Financial Complex, Carenage, St. George's): July 2001.

National Environmental Policy and Management Strategy for Grenada. (Ministry of Health, Social Security, the Environment and Ecclesiastic Relations): April 2005.

Baptiste, Raymond. Land Resources Information Systems in the Caribbean – Grenada. (Ministry of Agriculture – Landuse Division).

Peters E.J. Rainwater Potential for Domestic Water Supply in Grenada. September 2006.

Cooper, Brian and Bowen, Vincent. Integrating Management of Watershed and Coastal Areas in Small Island Developing States of the Caribbean – National Report for Antigua and Barbuda. (Environment Division, Ministry of Tourism and Environment): April 2001.

Crichlow, Marilyn. Integrated Water Resources Management Workshop – Antigua. January 2006.

Catalyzing Change: A handbook for developing integrated water resources management (IWRM) and water efficiency strategies – produced by the Global Water Partnership (GWP) Technical Committee with support from Norway' Ministry of Foreign Affairs

Singapore Utilities International PTE Ltd <http://www.sui.com.sg.htm> 14/08/2007

Singapore Public Utilities Board <http://www.pub.gov.sg> 20/08/2007

European Union and SOPAC Programme for Water Governance Fiji Water Resources Management at National Level – Final Report, Water Policy Services PTY, November 2006 <http://www.sopac.org/tiki/tiki-index.php?page=Water+Governance+Fiji>

Proceedings of the Seminar on Integrated Water Resources Management: Institutional and Policy Reform, Port of Spain, Trinidad and Tobago, 24-27 June 1997

Pacific Regional Action Plan on Sustainable Water Management, In Preparation for the 3rd World Water Forum Kyoto, Japan, 2003, 3rd August 2002 Sigatoka, Fiji Islands

Vision on Water – Life and the Environment for the 21st Century, Regional Consultation The Caribbean, Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC), March 2000