

**The National Report
On
Integrating the Management
Of
Watersheds and Coastal Areas
In Jamaica**

**Prepared For
Caribbean Environmental Health Institute (CEHI)
United Nations Environment Programme (UNEP)**

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List Of Definitions

Coastal Area (definition given with Terms of Reference) –

A geographic entity of land and water affected by the biological and physical processes of both the terrestrial and the marine environments. Generally defined broadly for the purpose of natural resources management. Put more simply it is the area of land affected by its proximity to the sea and that part of the sea affected by its proximity to the land.

Watershed (definition given with Terms of Reference) -

Refers to the ecosystems contained within a contiguous watershed divide, from hinterland to coastline and drained by one major river system. A watershed is sometimes referred to as a catchment or drainage basin and constitutes an independent hydrological unit. Each watershed can also be divided into small units or sub-watersheds based on the tributaries of the main river system.

Aquifer

A saturated permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients, enough to yield economic quantities of water to wells. (Source: *Water Resources Development Master Plan, 1990*)

Aquiclude

A saturated geologic unit that is incapable of transmitting significant quantities of water under ordinary hydraulic gradients. (Source: *Water Resources Development Master Plan, 1990*)

FOREWORD

The content and structure of this National Report on *Integrating the Management of Watersheds and Coastal Areas In Jamaica*, were defined by the Outline Of National Reports, (See Appendix A), an output of the Regional Inception Workshop, held in Kingston, Jamaica, March 30-31, 2000.

As raised at the Regional Inception Workshop held, March 30-31, 2000, Jamaica has conducted several consultative processes involving a wide range of stakeholders on the subject of watershed and coastal management. The outputs of these consultations have been documented and the planning process for the management of watersheds and coastal areas is well advanced. In order to take the process forward, this report is informed by an overview of the relevant report and policy documents already generated and an analytical review of existing programmes and plans.

EXECUTIVE SUMMARY

The management of *watersheds areas* has often been approached separately from the management of *coastal areas*, primarily because of the significant difference in the ecology of these areas; freshwater versus marine.

It is generally accepted however, that the integrity of coastal environments is to a large extent determined by how well watersheds are managed, and therefore in recognition of the need to coordinate and integrate the management of watersheds and coastal areas, this report presents;

- i) an overview of the primary natural resources of watersheds and coastal areas
- ii) the problems and challenges of managing these areas and
- iii) identifies specific areas of need in the Jamaican context, making specific reference to those issues which could be addressed at the regional level.

Although management issues of watersheds and coastal areas are dealt with separately in the report, it is evident that there is no major distinction between these issues from a management perspective.

Watershed and Coastal Area Management Issues In Jamaica

MAJOR ISSUES

EFFECTS

Land Use

Uncontrolled housing development

- clearing of vegetation
- inappropriate sewage disposal

soil erosion
water pollution

Uncontrolled road construction

- poor road design

land slides

Uncontrolled agricultural activity

- deforestation
- poor soil conservation techniques
- overuse of agricultural chemical

siltation of rivers, gullies, sea

chemical pollution of water

Waste Management

Absence of full coverage solid waste collection System

solid waste in gullies & rivers

MAJOR ISSUES

EFFECTS

Non Compliant waste discharges from industries
Non-functional/malfunctioning treatment plants

pollution of rivers and seas

Data, Information Mgt and Research

Data collection and storage

- need to avoid overlap among agencies
- maximize the use of resources in data collection

Need to measure sediment levels in rivers to
Quantify extent of erosion

No quantitative measure of the
effect of conservation measures
applied

Research

- need specialized research to support the development of environmental standards and guidelines which are important tools of watershed and coastal area mgt.

Stakeholder Participation/Awareness and Education

Significant efforts have gone into raising awareness, however there is need to measure the effect of greater awareness on watershed and coastal area management.

Institutional

Need for additional research in support of development of standards and guidelines as tools in watershed and coastal area management

Capacity building: need to design appropriate geographical information systems (GIS) to support and serve watershed and coastal area management

Need to systematically examine the development of sustainability mechanisms for watershed projects: continuity after project life ends

Need to develop cost recovery mechanisms in watershed and coastal area management

Issues to be Addressed at the REGIONAL LEVEL

Research In Support Of Watershed and Coastal Area Management

Minimum Stream flow Requirement: development of a methodology suitable to the region for establishing minimum flow requirements for critical rivers and streams.

Clean up standards applicable to areas of leaks of petroleum products into the ground.

Design of Appropriate GIS Tools for Watershed and Coastal Area Management

Eg. Waste management information systems which keep track of all waste containment facilities, incidents of leaks and spills to the environment, extent of contamination, clean up activities, etc.

Sustainability Mechanisms For Watershed and Coastal Area Management

Development of creative mechanisms to ensure that the watershed and coastal area work done under special donor funded projects continues in some form after the project life ends.

Need for Training of Key Stakeholder Groups

With the present focus on public participation and multi-stakeholder involvement, there is the need to promote and teach the skills of group facilitation, non traditional problem solving strategies, techniques which facilitate and encourage co operation, collaboration and tolerance of differences.

CHAPTER 1

INTRODUCTION

1.1 Geographical Location

Jamaica is an island in the Caribbean Sea, approximately 145km south of Cuba and 161km west of Haiti. It is the third largest island in the Caribbean with a total land area of 10,939.7 km²

1.2 Climate

Jamaica has a tropical climate which is modified by north and north east trade winds and land sea breezes. The average temperature is 27 degrees Celsius. Temperature varies significantly with altitude. The coldest months are December through to February with temperatures between 23 and 26 degrees Celsius and the warmest months June to August, temperatures, 27.7 –30 degrees Celsius.

The island's rainfall is bi-modal with peaks in May and October and minima in March and June. The average annual rainfall for island is 195.8cm (77.1inches). The Blue Mountains and the northeast coast experience the highest annual rainfall, over 330cm (130 inches). Kingston receives less than 127cm (50inches) of rain annually. Damaging rains are associated with hurricanes which usually occur within the hurricane season: June to November.

1.3 Demography

Jamaica's population at the 1991 census was 2,388,666. Although a multi ethnic society, ethnic groups other than those of African origin comprise a very small minority of the population. In a 1980 Statistical Report, the total of those classified as East Indian, European and Chinese comprise 3.1% of the total population. The people of African descent accounted for 90.9%, 5.9% were listed as other races. Yet the impact of minorities cannot be gauged by numbers, as Jamaica was a slave society of over 150 years and a colony of over 300 years. During this lengthy period the society was controlled by a small minority of European origin. Consequently the laws, institutions, language and other cultural practices reflect this historical experience.

1.4 Geology and Hydrogeology

Jamaica's physiography closely reflects three major rock types. They are, in chronological order: - Quaternary alluviums, Tertiary limestone and Cretaceous volcanoclastics. There is a central mountain range running generally in an east –west direction, which forms the main watershed for rivers, which drain either to the north or the south coasts. The major alluvial lowlands occur in the southern half of the island. See Figure 1.4 A. Main Geological Formations In Jamaica. (*Source: Water Resources Development Master Plan, Final Report-Main Volume, 1990*)

For water management purposes, the island has been subdivided into ten hydrologic basins, shown in *Figure 1.4 B. Division of Jamaica Into Hydrological and Demand Basins. (Source: Water Resources Development Master Plan, Final Report-Main Volume, 1990)* Surface water predominates on the outcrops of basement rocks and interior valley alluviums and groundwater dominates in karstic limestone and coastal alluvium. The geology of Jamaica plays an important role in determining the occurrence of water resources and their availability. The rock formations of Jamaica are grouped into six hydrostratigraphic units. The three dominant units are : Basement Aquiclude, Limestone Aquifer and Alluvium Aquifer/Aquiclude.

1.5 Water Availability

Rainfall is the sole source of water in the island yielding three basic water resources types:- direct rainfall, surface water and groundwater. Availability of each type is determined by relating the reliable yield and level of utilization of the potential. Reliable surface water and groundwater safe yields total 4,084 MCM/year (2,463 MIGD). Island water use is estimated at 916 MCM/yr (22%), the remaining 3,197 MCM/year (78%) being available for development. (*Source: Water Resources Development Master Plan, Final Report- Main Volume, 1990*)

CHAPTER 2

CURRENT WATERSHED/WATER RESOURCES MANAGEMENT ISSUES

2.1 WATERSHED MANAGEMENT (FRESHWATER HABITATS AND ECOSYSTEMS)

Jamaica is divided into twenty six (26) Watershed Management Units (WMU) and these twenty six units cover the entire island and include over 100 streams and rivers. (See Figure 2.1A. Watershed Management Units of Jamaica)

Jamaica's topography is characterized by mountainous interior lands (60% of the land has altitudes of over 230m above sea level) with steep slopes, usually in excess of 20 degrees, and predominantly shallow erodible soils.

The Watersheds Protection Act of 1963 is the law governing watersheds in Jamaica and is administered by the Natural Resources Conservation Authority (NRCA)/National Environment and Planning Agency (NEPA)¹. The focus of this Act is the conservation of water resources through proper land use/management.

There are several other pieces of legislation which govern some aspect of watershed management. These are listed below:-

- Natural Resources Conservation Authority Act (1991)
- Forest Act(1996)
- Rural Agricultural Development Act(1990)
- Water Resources Act(1995)
- Town and Country Planning Act(1988)
- Land Development and Utilization Act(1966)
- The Mining Act(1947)
- Wildlife Protection Act (1945)

Reviews of these Acts have indicated areas of overlap or duplication, which highlights the need for further clarification and agreement on roles and areas of jurisdiction, as well as the need to review and update some pieces of legislation.

In November 1997, the Government of Jamaica approved a policy framework for the National System of Protected Areas. The policy defines a protected area as '*an area of land or water that is managed for the protection and maintenance of its ecological systems, biodiversity and/or specific natural, cultural or aesthetic resources*'. (Policy Framework for a National System of Protected Areas, Pg. 5) The policy recognizes that with the '*diversity of flora and fauna, land and water habitats, and wild and human landscapes*', Jamaica needs a system of protected areas as part of its national development strategy. Goal 1 of the policy is *Economic Development*, followed by Environmental Conservation, Sustainable Resource Use, Recreation and Public Education, Public Participation and Local Responsibility and Financial Sustainability. Jamaica presently has two designated protected areas; national park and marine park.

¹ See page 19 for details on the creation of the New Environment and Planning Agency (NEPA) which subsumes the Natural Resources Conservation Authority (NRCA).

Other types of protected areas will include;

- National Nature Reserves/Wilderness Areas
- Natural Landmarks/National Monuments
- Habitat/ Species Management Areas
- National Protected Landscapes/Seascapes and
- Managed Resource Protected Areas

Natural Forests: support biodiversity of native plants and animals, preserve water supply, water quality and flood protection, erosion control, scientific research, education, recreation and tourism.

Other critical habitats include rare, endangered and unusual species such as the iguana, hutia (coney) and manatee as well as birds, fish, turtles, molluscs and invertebrates.

(Source: Policy for Jamaica's System of Protected Areas, 1997)

Of the approximately 3,000 flowering plant species recorded in Jamaica, nearly one-third are endemic, and of the approximately 100 species of breeding birds, about 25% are endemic.

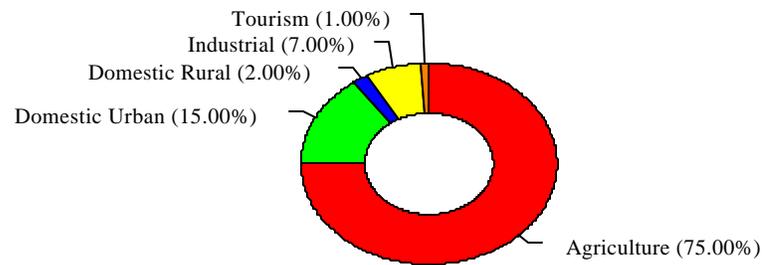
2.2 WATER RESOURCES ²

2.2.1 Supply and Demand

The Water Resources Development Master Plan, 1990, identifies two main water demand sectors; agricultural and non-agricultural. It further divides the non-agricultural sector into the following subsectors:- domestic urban, domestic rural, industrial and tourism. Water used for hydro-electricity or recreation is not quantified as these are considered non-consumptive uses. Water demands are estimated for the years; 1985, 2000 and 2015.

²Please note that the quantitative data on water availability and use, is obtained from the Water Resources Development Master Plan of 1990. To date, there has been no comprehensive update of this plan.

Figure 2.2.1A Water Demand By Sector



In 1985 the agricultural sector represented 75% of the total demand, 682 MCM/year, while the non-agricultural sector represented 25% of the demand, some 231 MCM/year. Of the non-agricultural sector, Domestic Urban represented 15%, Industrial 7%, Domestic Rural 2% and Tourism 1%. See Table 2.2.1A Water Demand by Non Agricultural Sectors, 1985, 2000 and 2015.

**Table 2.2.1A
Water Demand Of The Non-Agricultural Sectors, 1985, 2000 and 2015**

Sector	Year 1985		Year 2000		Year 2015	
	MCM/yr	%	MCM/yr	%	MCM/yr	%
Domestic Rural	21	9	46	16	62	18
Domestic Urban	138	60	161	56	181	52
Tourism	10	4	15	5	23	7
Industrial	62	27	66	23	80	23
Total	231	100	288	100	346	100

(Source: Water Resources Development Master Plan, 1990)

The term water shortage or deficit is not related to the total available water resources, but to the capacity of the existing infra-structure to deliver the required quantities of water to where it is needed. When the demand exceeds the capacity of the existing infrastructure,

water is not delivered to where it is needed, this is referred to as water shortage or deficit. Regular water shortages occur during the annual drought period in Jamaica, and this points to the need to develop new water supplies. The demand assessment of 1985 indicated a water shortage of 216MCM/year and the projected shortage for 2015 was 813MCM/year if no new water supplies are constructed. This shortage was based on the following projections:

- the increase in rural demand is based on a projected increase in population of 14%
- the increase in urban demand including tourism is based on a projected 22% increase in urban population and a plan to improve the service to 15% of the population now receiving less than 100 cubic meters/year per capita.
- The increase in industrial demand was due to expected industrial development
- The increase in agricultural demand was based on projected increase in irrigated area by 100% (Preliminary assessments of actual agricultural demands in 2000 indicates that the 100% projection is an over estimation of the increase

Water Demands of The Agricultural Sector

NIDP-Volume 1 Main Report, 1998, indicates that of the 90,000 ha or potential irrigable area, approximately 25, 000 ha or 10% of Jamaica's cultivated lands are currently irrigated. The main irrigated crop is sugar cane, which accounts for 70%-80% of the irrigated land area.

In 1985 it was estimated that 75% of the nation's total water demand went to agriculture (WRDMP, 1990). In 1997, the NIDP estimated that the demand of the agricultural sector was 60% (645MCM/yr) of the total water demand. This decline in sector demand is also confirmed by preliminary in-house evaluations conducted by the Water Resources Authority.

Fifty percent of the 10% (25,000 ha) of irrigated lands are served by public irrigation systems managed by the National Irrigation Commission, the other 50% is irrigated by private individuals.

Irrigation efficiencies

Studies of the surface irrigation systems indicate that between On-Farm and Conveyance 32% irrigation efficiency is achieved. It is expected that with physical improvements of the system and training of farmers as water managers, irrigation efficiencies could increase 57%. (Source: MG BOS and J.Nugteren, 'On Irrigation Efficiencies', 1990)

Plans To Increase Food Production

The NIDP of 1998 outlines projects to increase the irrigated area and the production of certain food crops. The following crop production increases are expected after the implementation of the projects proposed.

Table 2.2.1B Food Production Increase Projections

Crop	Area Increase (ha)	Production (1000tons)
Vegetables	4164	99.5
Sugar Cane	4483	318.6
Banana	2296	44.2
Mango	371	1.9
Papaya	128	1.8
Fish	1257	10.7
Pasture, Misc.	2259	0.0

Source: National Irrigation Development Plan, 1998.

2.2.2 Water Resources Management Strategies

Permits and Licensing

Under the Water Resources Authority Act of 1995, all commercial abstraction of surface and groundwater is to be licensed. A permit is required to drill any new well. One of the conditions of the license requires all abstractors/licensees to submit quantitative data on the rates of abstraction and volumes abstracted on a monthly basis. This facilitates the development and maintenance of an inventory of water production.

Cost Recovery and Water Pricing

The primary water agencies, Water Resources Authority, National Water Commission and the National Irrigation Commission are at different stages and states on the subject of water pricing and cost recovery and therefore each agency will be considered separately.

Water Resources Authority

The WRA is for the most part, dependent upon government subvention. It is expected that with the full application of the annual abstraction licensing fee, an increasing percentage of the annual budget will be from the payment of these fees.

National Irrigation Commission

NIC applies a single rate structure for all its six irrigation systems, which does not reflect the differential costs associated with delivering irrigation water to farms. Generally, the rates charged do not provide the necessary funds to cover the cost of operation and maintenance or capital costs. To a large extent the rates being charged are influenced by non economic considerations.

National Water Commission

The National Water Commission charges rates for delivery of sewerage services and delivery of potable water to households and commercial facilities. The National Water Commission Act of 1981 indicates that the *'revenue derived in any year... from... sales and services... will be sufficient and only sufficient to pay remuneration allowances, salaries, gratuities, working expense and other outgoings of the Commission...'* The rates and charges are subject to the guidelines of the Office of Utilities Regulation (OUR).

2.3 LAND POLICY AND WATERSHED MANAGEMENT

The National Land Policy was tabled in the House of Parliament in July 1996. The following policies have been adopted by the Jamaican government:

- to establish a comprehensive, computerized, land information system network linking related agencies of government by 2000
- to create national standards for geographic data collection, storage and exchange
- to develop the human resources required to manage and operate Geographical Data Management Systems (GDMS)
- to establish a national digital geographic information database comprising topographic, cadastral, land use, soil, environmental, natural resource, infra-structural and socio-economic components
- to develop a digitized cadastral index and cadastral map for Jamaica to ensure that the graphic aspect of a networked geographic information system is established and to facilitate a national Land Titling Programme, and efficient land markets
- to commit all relevant government ministries and agencies to the National Geographic Information Systems (NGIS) network
- to develop use mechanisms and tools to facilitate access to and ease of the use of digital mapping information by the general community. Access will be limited in cases of security and confidentiality
- to implement measures to ensure that all digital data prepared or used during government projects, will be turned over to the executing/implementing agency of government, and

- to ensure that all projects/ programmes being undertaken by government agencies, which include land/land related data-collection and preparation, are properly coordinated and done according to standards set by the Survey Department and the Land Information Council of Jamaica (LICJ).

The Land Policy document acknowledges the direct relationship between the use of land for domestic, commercial, industrial or agricultural purposes, the generation of waste by these uses and the impact on the quality of both surface and groundwater resources. It states that the nexus between land use policies and water resource management, is undoubtedly of major importance in the optimization of two of the country's most valuable and finite resources.

The land policy addresses specific land use and water resource management issues and speaks to the following:-

- the need to expand existing and develop new sources of water supply to meet present and future demands
- the need to preserve and reforest watersheds to ensure the recharge of aquifers and reduce the problem of flooding and turbidity in rivers
- the institution of programmes to eliminate the pollution of river and streams by pesticides, herbicides and other pollutants
- banning the use of fire to clear hillside land
- preserving vegetation along water courses
- maintaining buffer zones around major reservoirs ie, making these areas free of squatter settlement and maintaining these areas as natural forests with minimum activity
- legislative protection of private lands within catchment areas and the acquisition by the state of these lands, if necessary : incentives will be considered to encourage environmentally friendly activities on private lands
- the prohibition of dumping of solid waste within a certain proximity to water bodies and
- the careful assessment of the impacts of open-face and other mining activities on water resources.

2.4 CLIMATE CHANGE AND NATURAL DISASTERS

Climate Change

With funding from UNDP-GEF, the Government of Jamaica has prepared a report titled *Draft National Statement of Vulnerability and Adaptation To Climate Change and Sea Level Rise*. The main focus of this work was to assess the likely impact of temperature and sea level rise on the agricultural sector.

The primary climatic factors considered are a) the increase in atmospheric temperature and b) the rise in sea level. The probable response to these changes have been identified as:-

- increased flooding of low lying coastal areas
- increased frequency and intensity of hurricanes
- saline intrusion
- coastal or beach erosion

Forecasts or possible scenarios of global climate change are being made with the use of general circulation models (GCMs) using mathematical calculations. Generally, the GCMs are designed for analysis of large geographic regions and hence their application to small Caribbean islands is limited. However, a model referred to as MAGICC – Model for the Assessment of Greenhouse-gas Induced Climate Change was used to generate the *National Statement*. Six emission scenarios of greenhouse gases and sulphur dioxide were selected and linked with assumptions of population, economic growth and energy supplies. The statements made after applying the model, MAGICC, are qualitative and not quantitative.

Natural Disasters

Jamaica is susceptible to earthquakes, hurricanes, tropical storms, flooding and landslides which usually result in loss and damage to human life, crops, ecosystems and property. Some of the natural disasters experienced are thought to be exacerbated by the activities of man, locally as well as globally.

Expanding urbanization of a) reclaimed land in low lying coastal areas and b) steep slopes, exacerbates the damage from, storm surges generated by tropical storms and hurricanes, and landslides which often occurs on steep and unstable slopes.

The inadequate use of soil conservation techniques in agricultural activity exacerbates the problem of soil erosion and river siltation, reducing the carrying capacity of rivers and causing overflow of river banks and flooding of adjacent lands.

Measures in Place

ODPEM

The Office of Disaster Preparedness and Emergency Management is the primary government agency responsible for the disaster preparedness. Specifically the objectives of the ODPEM are:-

- to prepare and maintain mitigation plans and programmes for high risk areas
- to ensure the development and resource management policies incorporate hazard and loss reduction components
- to encourage appropriate public response to disasters and emergency events

The primary functions include

- a) the coordination of relief activities
- b) the collection and analysis of data on disaster related events and the use of this data for planning to prevent and mitigate the impacts of disasters
- c) increasing public awareness, understanding and capabilities to cope with disasters.

The ODPEM is organized to coordinate disaster response islandwide through a system of National Disaster Committees, Parish Disaster Committees and National Zonal Programme. The ODPEM coordinates its activities with a network of support agencies Government agencies, Community Based Organizations and Private Companies.

2.5 TRANS-BOUNDARY THREATS

Jamaica is an island state and therefore does not share common watershed boundaries with any other country.

2.6 POLLUTION

The primary sources of pollution are sewage effluent, industrial effluent, solid waste and agricultural and urban runoff.

Sewage Effluent

Sewage is disposed of via on site and off site systems, however in the upper reaches of watersheds the primary method is the on-site system. In most instances, large absorption pits without septic tanks, are used or dry pit latrines. Pollution problems arise when these absorption pits are located close to river systems or shallow aquifers which feed nearby river flows. Poorly sited pit latrines can also be a source of pollution. In well known sections of Jamaica, there are pit latrines located at river heads and springs, which feed major river systems. In some instances these rivers are major sources of drinking water to several communities. There are also instances where large absorption pits are sited on aquicludes (rock material which does not allow the free movement of water), the result is that the sewage effluent is not absorbed by the earth and instead flows laterally towards a river or spring system causing contamination.

Industrial Effluent

Industrial effluent is often discharged to rivers or stored in large open unlined depressions called holding ponds. In the case of discharges to rivers, depending on the volume of flow or the capacity of the river to assimilate the waste, pollution may result. In the case of storage of industrial waste in unlined holding ponds, seepage of the waste into Jamaica's predominant limestone rocks often leads to contamination of groundwater. The discharge of industrial effluent into sinkholes is also a common feature, resulting in the rapid movement of the waste towards local aquifers and nearby springs.

Solid Waste

The absence of a full coverage solid waste collection system, presents problems of inappropriate disposal of solid waste. Garbage is thrown in natural and concretized gullies, and along river banks. The result is the pollution of rivers, streams and ultimately the coastal waters into which these rivers drain.

Deforestation and Siltation

Steep slopes and shallow soils lead to high levels of erosion, siltation of rivers, loss of soil fertility. These natural factors together with inappropriate agricultural techniques and road construction is considered the single most important cause of watershed degradation in Jamaica. It is estimated that more than 170,000 farmers cultivate less than 245,000 hectares of land using inappropriate agricultural techniques, leading to extensive soil loss, silting of drains and rivers and destructive downstream flooding. The explanation for poor agricultural practices by farmers has been the insecurity of land tenure among most farmers and weak agricultural extension services.

Large scale removal of trees for housing development and squatter settlement, lumber harvesting, charcoal production, yam sticks, have created a problem of deforestation. Extended drought periods also exacerbate the deforestation process and after heavy rains, flooding is more severe and frequent.

Urban and Agricultural Runoff

Agricultural runoff often contains elevated levels of nutrients from fertilizers and other agricultural chemicals applied to the fields. These chemicals are carried with rainfall runoff into rivers and streams, reservoirs and coastal waters, polluting water bodies and modifying aquatic habitats. Eutrophic conditions and anoxic conditions result and accumulation of heavy metals in sediments and animal tissue is known to occur in the Kingston Harbor.

2.7 TOURISM

A major pull factor of visitors to Jamaica is the beauty of the island's natural environment; the climate, flora, fauna, water bodies and the lush green vegetated mountains.

Many of the major tourist attractions are developed around water bodies.

One of the primary tourism concerns relate to recreational water quality. Though there have been no significant water quality related problems which have affected tourism, there is always the need to ensure that the requisite standards for recreational water are maintained.

The more recent focus on tourism based on natural ecological systems such as wetlands, natural forests and geological features such as the Cockpit Country requires a system of control. The number of persons accessing these natural environments and the types of activities which are allowed within these natural environments, if not regulated, may result in the gradual or rapid destruction of these natural environments. The challenge therefore is to meet the need to generate foreign exchange and increase economic activity throughout Jamaica with the need to maintain the integrity of these environments through carefully considered guidelines and restrictions on the use of these ecosystems.

2.8 HEALTH

The health issues related to watershed management are often linked with poor water quality resulting from inadequate sanitation facilities. To date Jamaica has experienced disease outbreaks which have been related to unsanitary conditions resulting from inadequate water supply for hygiene purposes. The link has been based on the timing of outbreaks ie. occurrences of illness usually coincide with periods of low rainfall/dry season. The most vulnerable group to these illnesses are generally population groups with weaker immune systems such as young children (five years and under) and the elderly. These outbreaks are often localized and brought under control with the help of specifically designed public education programmes of the Ministry of Health and trucking of water to the areas most affected.

2.9 DATA, INFORMATION MANAGEMENT AND RESEARCH

Several government agencies are involved with the collection and storage of data. Some undertake research and many are involved with information management at different levels.

Several parameters are measured by different agencies. See Table 2.9A Types of Data Collected By Agencies.

Table 2.9A. Types of Data Collected By Agencies

Parameters	Responsible Agency
Rainfall	National Meteorological Service
Streamflow	Water Resources Authority
In stream Water levels	Water Resources Authority
Groundwater Levels	Water Resources Authority
Water Quality	Natural Resources Conservation Authority National Water Commission Water Resources Authority Environmental Health Unit (Ministry of Health) Int'l Center for Environment and Nuclear Science
Sediments in Rivers	None At Present (Historically, WRA has collected sediment data)

Information Management

Generally, government agencies store data on computer databases located within the relevant agency. The process of converting data to information has traditionally involved expert data analysis and interpretation and the presentation of information in the form of written reports, including maps and charts. More recently some agencies have been investing in specialized software programmes (Management Information Systems, MIS) designed to analyse and interpret data and prepare outputs in the form of useful information.

Research

Generally, government agencies involved with data collection are not mandated to conduct research and as such do not get involved to large extent with research activity. However, some of these agencies are required to develop national environmental standards, regulations and guidelines, which must be based on scientific research. Those agencies with a mandate to conduct research are not required to serve the research needs of other government agencies. Several agencies have found that there are gaps in local research, areas of research which would ideally form the basis of the standard development process. In the absence of local research information, international guidelines are used and in some instances these guidelines are inappropriate for Jamaica, as peculiar local conditions are not taken into consideration.

2.10 STAKEHOLDER PARTICIPATION/ AWARENESS AND EDUCATION

Over the last eight years the level of awareness of environmental issues, particularly watershed and coastal zone management issues, among the general public has increased. This heightened awareness is as a result of consistent efforts by several government agencies to inform and educate through a wide range of media.

The public awareness activities include:

- Annual Exhibitions - where students, teachers and the general public are invited to attend
- Production and distribution of brochures and pamphlets.
- Regular articles published in the national news papers
- Use of national television stations for broadcasting short educational films on watershed/coastal area management
- Lectures and field trips for students
- Teacher On The Job Experience – where teachers, particularly geography and science teachers are invited to work at a government agency responsible for some aspect of watershed or coastal area management
- National Environmental Education Committee (NEEC)

Environmental Non Government Organizations

National Environmental Societies Trust (NEST) – is an umbrella organization for some forty Non Government Organizations. NEST was formed to assist the small local Non Governmental Organizations technically and financially.

Jamaica Conservation Development Trust (JCDDT) – a registered charity, formed in 1987 and is responsible for the management of the Blue and John Crow Mountain area. The NRCA having the power to delegate management responsibilities, used this as a pilot project.

Environmental Foundation Of Jamaica – was created from a debt-for-nature-swap agreement between the Jamaican and United States Governments. The aim was to provide a funding mechanism for environmental, child survival and child welfare projects.

Community Based NGO Groups

Within the last ten years, several community based groups have come into existence. Some have remained active, others have become dormant and others operate in ebbs and flows.

These groups were established primarily by the parishes;

- Portland Environmental Protection Agency (PEPA)
- St. Thomas Environmental Protection Agency (STEPA)
- Negril Coral Reef Preservation Society (NCRPS)
- Negril Environmental Protection Agency (NEPT)
- St. Elizabeth Environmental Agency (SEEA)
- South Coast Conservation Foundation (SCCF)
- Bluefields People's Community Association (BPCA)

No studies exist which examine the effect of public awareness on the management of watersheds and coastal areas.

The Public In The Decision Making Process

Public involvement in decision the making process is through the EIA process, administered by the Natural Resources Conservation Authority (NRCA). The process requires that any new development which may affect a community, be announced and the details of the proposed activity presented (in written format) to the public for their review and comment. In some instances a public presentation of the proposed activity is required as part of the preliminary stage of the approval process. Feedback is solicited and concerns of the public must be adequately addressed by the proponent in the Environmental Impact Assessment Report.

In some instances, proposed developments have met with such strong opposition from the public that the projects were abandoned, relocated or considerably redefined. On the other hand there have been projects which, though strongly opposed, have been fast tracked and approved despite public objection.

2.11 INSTITUTIONAL FRAMEWORK

Several government agencies are involved in water/watershed management. Some of these agencies and their specific responsibilities related to watershed management are listed below in *Table 2.11A Government Agencies and Their Watershed Management Responsibilities*.

There are several ongoing initiatives related to water/watershed management, funded by international donor agencies. Table 2.11B lists some of the projects being undertaken in the parish of Portland alone.

The Public Sector Modernization Project

The Government Of Jamaica has undertaken the Public Sector Modernization Project (PSMP). The objectives of the project are;

- i) to modernize seventeen (17) pilot agencies and three pilot ministries to improve the quality of service
- ii) to formulate sound policies, standards and operations
- iii) to rationalize the public sector and
- iv) to introduce computerized systems for improved financial and personnel management

The New Environment and Planning Agency (NEPA)

The Government of Jamaica, under the Public Sector Modernization Project has created a New Environment and Planning Agency (NEPA) by merging three agencies; the Town Planning Department, the Natural Resources Conservation Authority (NRCCA) and the Land Development Utilization Commission (LDUC).

The stated objectives of this merger are to deliver services more efficiently, effectively and accountably, within available resources, for the benefit of customers, taxpayers and staff.

Five strategic directions have been proposed;

1. develop a customer oriented service delivery system for all agency approvals and program operations
2. Establish comprehensive national and local policy frameworks and information systems for sustainable development planning and natural resources management
3. develop broad public support for agency plans and programs
4. form an effective working relationship with the ministry
5. effectively manage the change associated with the merger of NRCA, TPD and LDUC and the establishment of the new agency.

Having reviewed the *Final Modernization Plan – New Environment and Planning Agency, October 1998*, in the consultant's assessment, one of the most significant opportunities under the new merger is the coming together of two major functions; land use planning and environmental management. The experience of separating these two components has resulted in significant conflicts and counter productive decisions.

Bringing these functions within the same agency provides a greater opportunity for coordination, collaboration and mutually supportive decisions.

Another potential advantage of establishing this new agency as an Executive Agency is the change toward revenue generation and less dependence on government subventions.

Although the new agency will not have the potential to be totally self financing, it is anticipated that within five years, more than quarter of the recurrent budget will be funded by revenues earned for services.

On the other hand, the New Environmental and Planning Agency represents the creation of a larger single government agency, which in itself presents the challenges of overcoming bureaucratic inefficiencies.

Under the Public Sector Modernization Programme it is also proposed that a New Land Agency be created by merging three units within Ministry of Environment and Housing; Titles, Surveys, Land Valuation and Estates Management.

Table 2.11A Government Agencies and Their Watershed Management Responsibilities

Institution	Legislation	Responsibilities
Natural Resources Conservation Authority	Natural Resources Conservation Authority Act, 1991 Watershed Protection Act, 1963 Wildlife Protection Act, 1948	Natural resource management, permitting and regulation
Forest Department	Forest Act, 1996	Watershed management
Water Resources Authority	Water Resources Authority Act, 1995	Ground and surfacewater quantity and quality Management
National Water Commission	National Water Commission Act, 1963	Establish, maintain and operate waters supply Services. To constantly review quality, quantity and availability
Ministry of Health	Public Health Act, 1985	All matters related to protection of public health
Parish Councils	Parish Council Act, 1901 Parishes Water Supply Act, 1889	Rural roads and government planning
National Meteorological Service		Collection and interpretation of weather data
Town and Country Planning Authority	Town and Country Planning Authority Act	Development planning and approval
Rural Agricultural Development Agency		Sustainable Farming and Land Husbandry
Ministry of Transport and Works		Road slope protection, river training and drainage

Table 2.11B Ongoing Watershed Management Projects In the Parish of Portland (Funded by International Donor Agencies)

PROJECT	OBJECTIVE	DONOR	STAKEHOLDERS/PARTNERS
<p>Environmental Action Program of Jamaica (ENACT)</p> <p>Local Sustainable Development Planning (LSDP)</p>	<ul style="list-style-type: none"> • Environmental Management and Education • Sustainable Development Planning • Capacity Building in Communities 	<p>CIDA</p>	<ul style="list-style-type: none"> • Ministry of Local Government, Youth and Community Development • Social Development Commission (SDC) • Natural Resources Conservation Authority- National Environment Planning Agency (NRCA-NEPA) • Parish Councils • Portland Parish Development Committee (PDC)
<p>Green Fund Small Grants Four (4) Projects</p>	<ul style="list-style-type: none"> • Establishing Biological Waste Treatment Facilities on CASE Tutorial farm. • Bryan’s Bay Sanitation Project • Sanitation for the Naylor’s Hil Community 	<p>CIDA</p>	<ul style="list-style-type: none"> • College of Agriculture Science and Education • Portland Environmental Protection Agency (PEPA) • Naylor’s Hill United Club

Table 2.11B (cont'd) Ongoing Watershed Management Projects In the Parish of Portland (Funded by International Donor Agencies)

PROJECT	OBJECTIVE	DONOR	STAKEHOLDER/PARTNERS
Trees For Tomorrow	* Sustainable Forest Management Watershed Management <ul style="list-style-type: none"> • Development of Prototype Planning Area 	CIDA	Forest Department, Ministry of Agriculture
Eastern Jamaica Agricultural Support Project (EJASP) Banana Support Project Institutional Strengthening of Trail Guide Association Project Ecosystem management, preservation and conservation project	<ul style="list-style-type: none"> • Farming systems and watershed management principles • Farmer certification based on use of integrated pest management and control/ safe chemical use • Capacity Building in Ecotourism • Ecosystem management curriculum in schools • Building greenhouses, tide pools/aquarium systems 	European Union European Union Environmental Foundation of Jamaica Environmental Foundation of Jamaica	Farmers Associations Rural Agricultural Development IICA Farmers, Banana Board Valley Hikes North Eastern Education Development Organization

TABLE 2.11B (Cont'd)			
PROJECTS	OBJECTIVES	DONOR	STAKEHOLDER/PARTNER
Forest Capacity Bridging Project	<ul style="list-style-type: none"> • Capacity Building and management of the forestry sector • Rehabilitation, protection and management of forestry resources 	United Nations Development Programme	Forestry Department, National Environmental /societies Trust (NEST) RADA Forestry NGOs
Ridge To Reef	<ul style="list-style-type: none"> • Watershed management • Establishing environmental programmes in selected geographic areas 	United States Agency for International Development	Associates in Rural Development (ARD) NRCA – National Environment & Planning Agency (NEPA) Ministry of Agriculture
Coastal Water Quality and Improvement Project (CWIP)	<ul style="list-style-type: none"> • Promotion of sound environmental practices through an integrated coastal resources management approach working with all sectors of society 	United States Agency for International Development	ARD, NRCA-NEPA, National Water Commission, NGO's

Table 2.11C : IMPACTS IN COASTAL AREAS OF WATERSHED ACTIVITIES

Impacts in Coastal Areas	Pollution	Depletion of Stock & Ecosystem Change	Hypo-Thermal Conditions	Inundation and Flooding	Nutrient Loading	Salt Water Intrusion	Siltation	Coastal Erosion
Activities in Watersheds								
Agriculture	3	1	1	1	3	1	4	1
Alien Species Invasion	1	1	1	1	1	1	1	1
Channalization	1	1	1	1	4	1	3	1
Deforestation	1	3	1	3	1	1	3	2
Energy Generation	2	2	3	1	1	1	1	1
Fisheries	1	2	1	1	1	1	1	1
Inappropriate Sewage Disposal	4	3	2	1	4	1	1	1

Numbers represent weighting of degree of significance of the impact.
 1- less significant 2- significant 3- highly significant

CHAPTER 3

CURRENT COASTAL AREA MANAGEMENT ISSUES

3.1 COASTAL HABITATS AND ECOSYSTEMS

The major ecosystems in the ocean and coastal zone environment are:

- Coral Reefs
- Seagrass Beds
- Mangroves / Wetlands
- Rocky Shores and
- the Benthos

The living ocean and coastal resources include; marine mammals such as manatees, dolphins and whales: sea birds: reptiles such as crocodiles: finfish and shellfish, conch, lobster: coral reefs, invertebrates such as sea turtles, other fauna such as shrimp and oysters. (*Source: Discussion Paper-Toward Developing A National Policy on Ocean and Coastal Zone Management.*)

3.2 EXPLOITATION AND OTHER THREATS TO MARINE RESOURCES

3.2.1 Exploitation Of Marine Resources

Harvesting of manatees, crocodiles, booby eggs, black coral, sea turtles and their eggs as dietary delicacies, specialist collections and souvenir items is being addressed through international and national legislation. However, illegal harvesting of these resources continues and prevention has been a challenge. The lack of manpower to enforce the legislative limits being the most important factor. (*Source: Discussion Paper-Toward Developing A National Policy on Ocean and Coastal Zone Management.*)

Table 3.2.1A Coastal Resources and Types of Exploitation

Coastal Resource	Type Of Exploitation
Wetlands	Timber Cutting Oyster Harvesting Land-filling to facilitate coastal development and expansion
Coral Reefs	Harvesting of certain types of coral eg. Black coral
Beaches	Sand mining
Sea grass	Removal of sea grasses by hotel owners, damage by recreational users and seine nets, land reclamation and coastal development
Benthos	Over harvesting of benthic species, damage from exploration, dredging and seabed mining.

3.2.2 Pollution Of Marine Resources

Generally, the following factors are of concern:-

- Improperly treated sewage
- Improper disposal of solid waste
- Pollution from industrial effluent
- Pollution from non-point sources such as fertilizers and pesticides

Improperly Treated Sewage

The contamination of coastal waters from improperly treated sewage decreases the quality of bathing waters and increases nutrient levels leading to eutrophic conditions.

Improper Disposal of Solid Waste

The garbage collection system and disposal facilities in Jamaica are inadequate. Consequently, a large section of the population is left to determine how solid waste is managed. The result is the disposal of waste in nearby gullies and waterways, eventually reaching coastal areas via rivers and surface runoff via gullies.

Pollution From Industrial Effluent

Despite the existence of new regulations ie. environmental permits and licenses, there are several factories and facilities which have not been brought into compliance with the regulations governing the discharge of industrial effluent. While efforts are being made by the relevant government agencies to enforce these laws, there are still pollution of rivers which eventually impacts coastal waters.

Pollution from non-point sources such as fertilizers and pesticides

The over use of pesticides and fertilizers can result in the pollution of rivers and coastal waters. Although there have been insufficient empirical data to confirm the levels of contamination, the few studies that have been undertaken in specific watershed areas have indicated that agricultural chemicals are reaching some rivers and by extrapolation, the coastal waters.

In addition to these pollution problems there is light pollution and noise pollution. Bright lights on beaches and other coastal areas disrupt the natural ecological conditions affecting particularly the nocturnal habit of sea turtles of coming ashore and the movement of newly hatched turtle from the shore into the sea.

Noise pollution from recreational paraphernalia such as jet skis and motor boats disturbs fish populations. (Source: *Discussion Paper-Toward Developing A National Policy on Ocean and Coastal Zone Management*)

3.2.3 Marine Protected Areas

To date, there are three parks and protected areas in the marine environment. They are the Montego Bay Marine Park, the Negril Marine Park and the Portland Bight Protected Area, which includes both terrestrial and marine space. Forty nine (49) additional sites, which fall within the coastal zone, have been identified and recommended as Protected Area Candidates, in the Policy for Jamaica's System of Protected Areas.

(Source: *Discussion Paper-Toward Developing A National Policy on Ocean and Coastal Zone Management*)

3.3 CLIMATE CHANGE – SEA LEVEL RISE

It is predicted that sea level rise due to the increase in global atmospheric temperature will reduce land masses by the submergence of low lying coastal land area. With the use of tidal gauges, it has been estimated that sea level rose an average of 2.4mm per year between 1940 and 1970.³

Changes in sea level in the Caribbean region are linked to natural subsidence and subsidence due to petroleum extraction, groundwater pumping and sediment compaction.⁴ There has been large variability in tide gauge readings across the Caribbean region and Jamaica has only recently installed two tide gauges. However, it has been stated in the National Statement of Vulnerability and Adaptation for Agriculture Draft Report, that ‘ a regional value for sea level rise in the Greater Caribbean must be viewed with caution, but 30-35mm over the next fifty years is not unreasonable.

Most of the software generated to model climate change and predict sea level rise covers extensive geographic areas and therefore does not provide reliable insight into the Jamaican situation.

However, with the prediction using tidal gauges, of a 30-35mm rise in sea level in fifty years is cause for concern in Jamaica, as the low lying coastal areas, with high population densities and intensive infrastructure to support tourism and agriculture will be at risk.

3.3.1 Likely Impacts of Sea Level Rise

The ecosystems most vulnerable are coastal ecosystems; beaches, wetlands, seagrass beds and coral reefs. Beach erosion patterns are expected to change with the increase of the forces of wind, tides and currents. Wetland ecosystems may become modified with the change in saline to freshwater balance. Coral reefs are sensitive to slight changes of seawater temperature and may also be threatened by the increased wave forces associated with hurricanes and tropical storms.

Saline intrusion of coastal aquifers is a likely effect of sea level rise. This will result in the abandonment of affected wells and the loss of existing water supply infrastructure.

³ Aubrey DG Every Ko and Uchupi E. 1988, ‘Changing Coastal Levels of South America and the Caribbean Region from Tide Gauge Records’

⁴ Gable F, 1987 ‘Changing Climates and Caribbean Coastlines’

3.4 DATA, INFORMATION MANAGEMENT AND RESEARCH

There have been a series of academic research papers on coastal and marine resources of Jamaica. The primary academic institution involved with coastal management research is the University of the West Indies, in particular the Department of Life Sciences, the Discovery Bay Marine Laboratory and Port Royal Marine Laboratory, Department of Chemistry and the Departments of Geology and Geography.

Data on a range of parameters have been collected and at present there are a number of coastal zone projects being implemented: projects which involve international donor agencies, Community Based Organizations and Environmental Non Government Organizations. The Coastal Water Quality Improvement Project (CWIP), a project funded by the USAID focuses on collecting data for selected coastal regions, improving wastewater management, adopting policies for improved environmental management and increased capacity of key government agencies.

3.5 STAKEHOLDER PARTICIPATION/ AWARENESS AND EDUCATION

Over the years, the work being undertaken in coastal zone management by government and Environmental Non Government Organizations has been structured to involve communities based organizations. Through this approach, awareness levels among a wide range of stakeholders has increased. A case in point is the USAID funded project, Coastal Water Quality Improvement Project (CWIP), where members of the community are trained specifically in the techniques of water sampling and interpreting the data. The involvement of fishermen in this effort goes a far way, as they are made aware of the impact of their fishing techniques on the coastal resources and often willing to cease destructive practices.

The National Environmental Education Committee (NEEC) was established in 1993 to give focus and momentum to environmental education initiatives in Jamaica. It supports partner based projects which will achieve outcomes in the national plan:-

- Teacher professional development
- Curriculum Development
- National Public Awareness

3.6 INSTITUTIONAL FRAMEWORK

Several government agencies have legal mandates which directly relate to coastal zone management. The following table lists these agencies and their coastal related responsibilities.

Table 3.6A Government Agencies and Coastal Related Responsibilities

AGENCY	COASTAL RELATED RESPONSIBILITY
Jamaica Defense Force	National defense, search and rescue, control of oil spills
Jamaica Public Service	Power generation
Fisheries Division	Fisheries management
Forestry Department	Watershed management
Natural Resources Conservation Authority	Natural resource management, permitting and regulation
Office of Disaster Preparedness and Emergency Management	Natural hazards contingency planning, disaster response and recovery
Environmental Control Division	Water quality monitoring and testing
Office of the Harbour Master	Regulation and safety of shipping in harbours and ports
Petroleum Corporation of Jamaica	Petroleum shipments
Jamaica Tourist Board	Recreational areas/cruise ship terminals

Table 3.6A (Cont'd)	COASTAL RELATED RESPONSIBILITY
AGENCY	
Urban Development Corporation	Development and Planning
Jamaica Maritime Institute	Maritime education and training
Survey Department	Area wide mapping and boundary delineation
Ministry of Land And Environment	Policy related to environmental matters and land use
Planning Institute of Jamaica	Initiation and coordination of planning for economic, financial, social, cultural and physical development
Marine and Aviation Affairs Department	Coordination of the development of marine and aviation policy
Council on Ocean and Coastal Zone Management	Define national policy, promote coordination of administrative and operational functions, ensure compliance with enacted treaties and protocols.
Shipping Association of Jamaica	Provision of skilled labor to shipping industry operators
Airports Authority of Jamaica	Management of Norman Manley and Donald Sangster International Airports
Port Authority	Management of ports and port operations
Jamaica Fire Brigade	Control of fires
Jamaica National Heritage Trust	Buildings, landmarks and artifacts of historical or archaeological importance
Water Resources Authority	Groundwater and surfacewater quality and extraction

Table 3.6A (cont'd) Government Agencies and Coastal Related Responsibilities

AGENCIES	COASTAL RELATED RESPONSIBILITIES
Jamaica Constabulary Force	Enforcement of law and order
Attorney General's Office	Preparation of legal instruments
Ministry of Justice	Policy on matters of national justice
Tourism Product Development Company	Standards and regulations of tourism product

Source: Discussion Paper- Toward Developing A National Policy On Ocean and Coastal Zone Management

Table 3.6B Other Organization In Coastal Zone Management

Organization	Mandate
Jamaica Conservation Development Trust	National Parks Trust Fund, Blue and John Crow Mountains National Park
Jamaica National Parks Trust Fund	Raise and manage long term funding support for the system of national parks
Environmental Foundation of Jamaica	Management of debt-relief fund for protecting the environment
National Environmental Societies Trust	Umbrella organization for environmental NGOs
Montego Bay Marine Park Trust	Management of the Montego Bay Marine Park
Negril Area Environmental Protection Trust	Management of the Negril Area

Table 3.6B (cont'd)

Other Organization In Coastal Zone Management (cont'd)

Organization	Mandate
Jamaica Institute Of Environmental Professionals	Accreditation of environmental professionals and monitoring of performance standards
Civil Aviation Authority	Regulation and control of airports; development guidelines in the vicinity of airports

CHAPTER 4

INTEGRATING WATERSHED AND COASTAL AREA MANAGEMENT

Although coastal and watershed issues have been separated for the purpose of management by regulatory agencies and also for the purpose of discussion in this report, it is generally accepted that the integrity of coastal environments is to a large extent determined by how well watersheds are managed. Poor watershed management often leads to increased stress on coastal resources and effective watershed management will in turn, result in improved coastal environments.

The Integration of Watershed and Coastal Area Management

Integration of the management of these two areas; watershed and coastal area, recognizes and identifies the relationships, defines the level of impacts and devises strategies which are coordinated and mutually supporting.

After an overview of the current issues related to watersheds and coastal areas in Jamaica, it is apparent that there are weaknesses in both watershed and coastal area management. The implications for human health and the sustainability of economic sectors such as tourism (inland and coastal based) and agriculture are significant. The specific problem areas identified in this section, though apparently focused on watershed management, must be seen as integral to the management of coastal areas as well since there is a direct relationship between watersheds and coastal areas.

PROBLEM IDENTIFICATION

4.1 LEGISLATIVE AND POLICY ISSUES

4.1.2 Watershed Management

The legal mandate of watershed management (protection and conservation) is that of two government agencies, the Forestry Department and the Natural Resources Conservation Authority (NRCA).

The Watershed Protection Act of 1963 gives the NRCA legal jurisdiction over lands which the Forestry Department, through the Forest Act of 1996, has management responsibility. Both agencies have legal responsibilities for conservation, protection and proper use of the same lands. Consequently, both agencies can act as lead agencies in the preparation of detailed plans and programmes for watershed management. Despite this, both Acts (Forestry Act of 1996 and NRCA Act) provide for the establishment of Memoranda Of Understanding.

Goal: To reduce inefficiencies associated with the duplication of efforts and to achieve complimentary functioning of the two government agencies.

Constraints: There are no fundamental constraints to achieving this goal. Dialogue and mutual agreement among the most senior managers of these organizations is required. *As of March 2000, a Co-Management Agreement has been drafted, agreed to and signed by the heads of the Forestry Department, Natural Resources Conservation Authority and the Jamaica Conservation Development Trust (JCDT) regarding the joint management of the Blue and John Crow Mountain National Park. This document defines the role of each agency and provides guidelines to coordinate activities and collaborate in the management of this watershed area.*

4.1.3 Water Quality Monitoring

There are presently four different government agencies with legal responsibility for water quality monitoring; Water Resources Authority, Natural Resources Conservation Authority (NRCA/NEPA), Ministry of Health (Environmental Health Unit) and Office of Disaster Preparedness and Emergency Management (ODPEM). Though the objective of water quality monitoring are different for some of these agencies, for others the differences are not clear and the could result in duplication of efforts.

Goal: To reduce inefficiencies (human resource and financial) that may be occurring due to inadequate communication and collaboration on monitoring programme objectives and network designs. To develop a policy which will define the collaborative process.

Constraints: The lack of priority placed on the need to collaborate and coordinate.

In addition, it is also evident that the freshwater monitoring programme for the island is inadequate. There are several large areas which are of importance, but are presently not being monitored, presenting large spatial gaps in the data set which in turn translates to weakness the water quality management system of the government regulatory agencies. The responsible agencies will need to expand their monitoring programme as well as rationalize the programme.

4.1.4 Water Quality Data Management

The cost of laboratory analyses is high and therefore the cost of generating the quality of data necessary to adequately monitor and manage water quality throughout the island is beyond the budget of any one government agency. The result has been a piece-meal effort to monitor water quality in areas of the island considered most critical. Each agency with a mandate to monitor water quality, collects its own set of water quality data and stores this data in separate storage systems, both paper and computer based formats. Although the Water Resources Authority over the last five years has made an effort to collect water quality data from several other agencies, there is no established coordinated system to ensure the pooling of data generated by government agencies. The result is that any attempt to make island wide evaluations of Jamaica's water quality is often inadequate ie. not as comprehensive as it could be if those making the evaluations had access to all the data generated and the range of parameters tested.

Goal: To establish a central data base in which data gathered from certain government agencies is stored and made available to those agencies for official use in performing their duties. To develop a policy which will define the coordination of water quality data management among government agencies.

Constraints: There is a strong belief that data belongs to individual agencies and unfair advantages may be gained by other agencies through the exchange of data.

4.2 INSTITUTIONAL

4.2.1 Capacity Building

An important aspect of any watershed management strategy is being able account for the water resources being used. The Water Resources Authority with the legal mandate to manage the nations water resources through controlled allocation, has been making efforts to gather the quantitative data needed from licensed abstractors and to license 65% of the abstractors who are presently unlicensed. The efforts however yield very slow gains and are hampered by inadequate staff specifically dedicated to this task.

Goal: To license all commercial abstractors in Jamaica and establish an effective system of obtaining abstraction data from all licensees in a timely manner.

Constraint: Insufficient administrative and technical staff dedicated to this task.

4.2.2 Research

Agency Dedicated To Serving The Research Needs of Government Agencies

There are several government regulatory agencies, primarily the New Environment and Planning Agency (NEPA) which are required to develop scientifically based guidelines and standards, but are not organized or mandated to conduct the research necessary to support guidelines and standards. Often the result is that the necessary research is not done and interim measures are applied, such as adopting international guidelines or standards.

Although there is a government agency whose mandate is purely to conduct research, the areas of work selected are not determined by the research needs of other government agencies.

Pesticide Study

Very few studies have been undertaken to assess the levels of selected pesticides in the Hope River Watershed, and these have covered short time periods and are presently outdated. The Hope River Watershed is a major source of drinking water to the nation's largest metropolitan area, Kingston and St. Andrew. Some sections of the upper watershed are agricultural lands where pesticides are applied. It is recognized by all the relevant government agencies involved with water quality monitoring, that there is the need for current pesticide studies in watersheds which provide major drinking water sources. Despite recognition of this need, the costs associated with conducting such studies are prohibitive to most government agencies.

Goal: To conduct pesticide studies of important (those which provide drinking water) watersheds eg. Hope River and Yallahs.

Constraint: Adequate funding to cover the cost of pesticide analyses.

Sustainability of Watershed Projects

Generally, there is agreement on the statement: *short term watershed management is a waste of resources*, - both financial and human. It is therefore critical to conduct post project evaluations to determine weaknesses and strengths, successes and failures with a view to increasing the effectiveness of future watershed projects. Generally, the post project evaluations are not comprehensive and objective and therefore do not provide the necessary instruction or correction that would inform and improve the success levels of subsequent projects.

Many millions of dollars have been spent on major watershed projects in Jamaica within the last few years and it is essential that at this stage of Jamaica's watershed management experience, that a comprehensive evaluation of the relative success of these major projects and the level of sustainability achieved after these projects be undertaken.

Goal: To maximize the benefits of watershed project investments in Jamaica and the sustainability of these benefits.

Constraints: There may be low priority placed on post project evaluation by donors as the focus is often expenditure.

4.2.3 Information and Decision Support Systems

Recreational Water Quality – Rapid Assessment of Suitability

Natural waters (untreated) are used for recreational (primary contact) purposes; rivers, waterfalls, ponds, lakes and beaches. For some of these water bodies, there are instances when the water quality becomes unsuitable for recreational use. For example, after heavy rainfall events, some rivers and beaches used for recreation are influenced by surface runoff, which leads to the occurrence of elevated total and fecal coliform counts. At these more vulnerable sites, there is the need to develop a system of monitoring to determine suitability for recreation with a view to warning the public and closing the facility (if privately owned) for a period until the quality is restored.

Goal: To develop a method of generating information to determine the suitability of natural waters for recreation. The information generated will support the decision of when to close and reopen the water based recreational facility.

Constraints: There are no clear constraints to achieving this goal. There is need to identify the responsible agency and establish this as being among the priority issues of preserving public health.

4.3 FINANCIAL

4.3.1 Cost Recovery

The National Water Policy speaks to the need to identify and implement cost recovery mechanisms. However there are no targets or guidelines to indicate the extent to which this objective should be pursued. The government institutions which currently depend on government subventions to fund their operations are being hampered by the reduction in the level of funding allocated each year. In this context, environmental management, ie. watershed and water quality, are often the first areas to be curtailed.

Although the concept of cost recovery in the provision of water services is not new to Jamaica, the target of some agencies of recovering costs for at least operations and maintenance will continue to be difficult to achieve, if the price controls imposed on rates do not support the objective of cost recovery.

Goal: To generate the funds necessary to cover costs of operation and maintenance associated with providing the relevant watershed management and deliver services.

Constraint: The role of government as price regulator in the water sector could be a constraint to efforts to recover costs. The inadequacies in organizational capacity to perform the function of collecting outstanding abstraction license fees.

CHAPTER 5

NATIONAL ACTION PROGRAMME TO IMPROVE INTEGRATED MANAGEMENT OF WATERSHEDS AND COASTAL AREAS

5.1 LEGISLATIVE AND POLICY ISSUES

5.1.2 Improving Agency Collaboration - Water Quality Monitoring

GOAL To Reduce Inefficiencies and Maximize The Benefits Of Government Agency Expenditures on Water Quality Monitoring Programmes.	
KEY AGENCIES	ACTIONS
Water Resources Authority Natural Resources Conservation Authority Environmental Health Unit National Water Commission	<ol style="list-style-type: none">1. Table the matter for discussion among key agencies2. Arrive at a concensus on the procedure for reporting on a regular basis on agency programmes being implemented.3. Draft a policy to define the information sharing requirement among government agencies

5.1.3 Improving Agency Collaboration - Water Quality Data Management

GOAL To develop a policy which will facilitate the reduce Inefficiencies and Maximize The Benefits Of Government Agency Expenditures on Generating Water Quality Data.	
KEY AGENCIES	ACTIONS
Natural Resources and Conservation Authority Water Resources Authority Environmental Health Unit Parish Health Departments, Ministry Of Health	<ol style="list-style-type: none"> 1. Table the matter for discussion among relevant agencies 2. Identify the agency most suited to function as the water quality data center 3. Agree on the logistics related to the format of data to be submitted and the frequency and the data requirements of each agency 4. Draft a policy outlining the establishment of a water quality pooling system

5.2 INSTITUTIONAL

5.2.3 Data, Information Management and Research

Pesticide Study

GOAL To conduct pesticide studies of important (those which provide drinking water) watersheds eg. Hope River and Yallahs.	
KEY AGENCIES	ACTIONS
Natural Resources Conservation Authority Water Resources Authority Environmental Health Unit	<ol style="list-style-type: none"> 1. Table the matter for discussion. 2. Take a decision on the agency(ies) to implement the study 3. Select the Watersheds to be studied, the members of the team to undertake the study and the TORs.

Study of The Sustainability Of Watershed Projects

Sustainability Mechanisms

<p>GOAL To identify the strengths and weaknesses in the design and implementation of watershed projects with a view to maximizing the long term benefits of watershed project investments in Jamaica and the sustainability of these benefits.</p>	
<p>KEY AGENCIES</p>	<p>ACTIONS</p>
<p>Natural Resources Conservation Authority</p> <p>Forestry Department</p>	<ol style="list-style-type: none"> 1. Table the matter for discussion. 2. Take a decision on the agency(ies) to conduct the study 3. Select the Watershed projects to be studied, the members of the team to undertake the study and the TORs.

Recreational Water Quality – Rapid Assessment of Suitability

<p>GOAL To develop a method of generating data/information to determine the suitability of natural waters, beaches and rivers, for recreation. The information generated will support the decision of when to close and reopen the water based recreational facility.</p>	
<p>KEY AGENCIES</p>	<p>ACTIONS</p>
<p>Natural Resources Conservation Authority</p> <p>Beach owners and operators</p>	<ol style="list-style-type: none"> 1. Table the matter for discussion 2. Identify pilot sites 3. Select the team to develop the warning system for the sites selected

5.3 FINANCIAL

5.3.1 Cost Recovery

GOAL To have government agencies as far as is legal and reasonable, generate the funds necessary to cover costs of operation and maintenance associated with providing the relevant watershed management and water deliver/supply services.	
FOCUS AGENCIES	ACTIONS
Ministry of Water and Housing National Irrigation Commission National Water Commission Water Resources Authority Farming Community	1. Table the matter for discussion 2. Develop a strategy which will address the key issues, priorities and conflicts.

CHAPTER 6

RECOMMENDED INPUTS TO REGIONAL ACTION PROGRAMME

The interventions outlined in Chapter 5 are generally designed to address very specific situations within the Jamaican watershed management system. There are however, some areas of need, which if addressed at the regional level, could prove efficient and effective.

6.1. RESEARCH IN SUPPORT OF WATERSHED AND COASTAL AREA MANAGEMENT

The development of water quality standards, minimum streamflow requirements and other standards and guidelines are all part of watershed management. If these standards and guidelines are to be relevant and effective, they should be based on data and research done locally or in areas with similar characteristics. At present there are gaps in the research necessary to support the establishment of national standards. At a regional level there could be coordination of research efforts which could benefit several territories within the region.

6.2 APPLICATION OF GEOGRAPHICAL INFORMATION SYSTEMS (GIS) IN WATERSHED AND COASTAL AREA MANAGEMENT

The application of GIS in watershed and coastal area management is an opportunity to increase efficiency and generally to improve management. This tool though accepted as important needs to be developed to address the specific management needs of the relevant agency and the design and establishment of applicable and user-friendly GIS programmes is a challenge to several agencies. A regional evaluation of GIS needs and progress made throughout the region, with a view to sharing methods and techniques could go a far way in speeding up the move towards effective watershed and coastal area management.

6.3 SUSTAINABILITY MECHANISMS FOR WATERSHED AND COASTAL AREA MANAGEMENT PROJECTS

For several years Jamaica, not unlike other territories in the region, has received external support with watershed and coastal area projects. The common experience has been that at the end of the life of the project, most of the work ends and in some instances the progress made becomes undone. The need to develop appropriate and creative mechanisms to ensure continuity after the donor agency projects have ended is a major challenge. Instances throughout the region where projects have successfully continued after the *project life* should be examined and used as examples for the region. At the regional level there could be a focused effort to develop and promote *continuity strategies* which could be applied throughout the region.

6.4 PESTICIDES IN WATERSHEDS STUDY – USE OF PESTICIDE TESTING CAPABILITIES

The laboratory equipment necessary to conduct pesticide analyses is available at the Caribbean Environmental Health Institute (CEHI). This may be an opportunity for collaboration between the Natural Resources Conservation Authority in Jamaica, the agency likely to spearhead the pesticide study and CEHI.

6.5 TRAINING OF KEY STAKEHOLDER GROUPS

With the current emphasis on public participation and multi-stakeholder involvement in the implementation and management of environmental projects, it is important that government regulators, private business, community leaders, community members, non-government environmental agencies and the other relevant groups be trained in non-technical skills. These skills include; group facilitation, non traditional problem solving strategies, techniques which facilitate and encourage co-operation, collaboration and tolerance for differences. The training should also provide insight into and understanding of the perspectives of each stakeholder group

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APPENDIX A

TERMS OF REFERENCE

