National Report
On
Integrating The
Management of
Watersheds and Coastal
Areas in St. Kitts and Nevis

APRIL 2001

Department of Environment
Ministry of Health and Environment
Church Street
Basseterre, St. Kitts and Nevis.

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

1.1 Geographic Location

St. Kitts and Nevis is a twin island country with a total landmass of just 269 square kilometers, and is part of the Eastern Caribbean chain of islands (Fig.1) The island of St. Kitts, the larger of the two, is 176 square kilometers (68 sq. mi) in size and is located at Latitude 17 degrees 15 minutes North and Longitude 62 degrees 45 minutes West. Nevis is 93 square kilometers (36 sq. mi) and located at Latitude 17 degrees 10 minutes North, Longitude 62 degrees 35 minutes West. The islands are separated by a channel, The Narrows, 3 kilometers wide. (Fig. 2)

The island of St. Kitts is roughly oval in shape with a narrow neck of land extending like a handle from the southeastern end. This handle like extension is usually referred to as the South East Peninsular (SEP). Nevis on the other hand is just roughly circular.

The country attained full political independence from Britain in 1983. The national capital is Basseterre located on St. Kitts.

1.2 Climate

The climate of St Kitts and Nevis is classified as tropical marine. Generally, steady northeast trade winds and tropical oceanic cyclonic movements influence it. Furthermore, the islands enjoy warm even temperatures with a mean of approximately 27^{O} Celsius. Seasonal and diurnal variations in temperature are small. Average minimum and maximum temperatures in Basseterre Valley stand at 22 and 29 degrees C in January, increasing to 25 and 32 degrees C in July (Kennedy and Robbins, 1988). Nevis temperatures and seasonal variations are similar (Darby, et al., 1987).

At lower elevations, maxima above 32 degrees C and minima below 18 degrees C are extremely rare. Only at higher elevations, where the rule of thumb is one degree Celsius ambient temperature drop per 100 meters in altitude above sea level, do temperatures drop below 17 degrees C. Halcrow (1966) computed the minimum temperature at Mt. Liamuiga at 7 degrees C. However, the near perpetual cloud cover, high humidity and wind chill factor at the peak would tend to make it feel much colder.

Rainfall is mainly orographic and increases in amount and frequency with altitude. On the island of St. Kitts, except for the Southeast Peninsula (SEP) which is very dry, mean annual rainfall ranges from about 16 cm in the coastal areas, to about 160 cm in the central mountain ranges. The situation at the SEP is quite different, with mean annual precipitation varying from 15.6 cm on the peaks to 13.6 cm at Cockleshell Bay, while on Nevis the average annual rainfall is 117cm. Mean annual on that island varies from 75cm. at New River on the windward side to131cm. at Hamilton estate on the slope of Nevis Peak.

Generally, rainfall is unevenly distributed between years and between months with a reliable wet period from August to November and driest months January to April. The relative humidity level is usually low in the dry season and high in the wet season. The mean value is 76 percent but ranges from 70 percent in March to 78 percent in September, October and November.

The prevailing wind is northeast trade with mean speeds ranging from 15- 30 kilometers per hour (kph). They hold fairly steady swinging seasonally between northeast and southeast The periods of seasonal low pressure from July to September have wind speeds of 30 – 45 kph. Land and sea breezes locally modify the regional pattern. The hurricane season extends June to November, and at this time there is a higher frequency of tropical disturbances that generate squalls and high wind velocities. With the exception of hurricanes the months with the higher wind speeds are the dry months from January to march. Cloud cover is more common than would be expected, averaging between 40 and 50%, which helps account for the relatively low evapo-transpiration rate of around 101cm. per year (Halcrow, 1966).

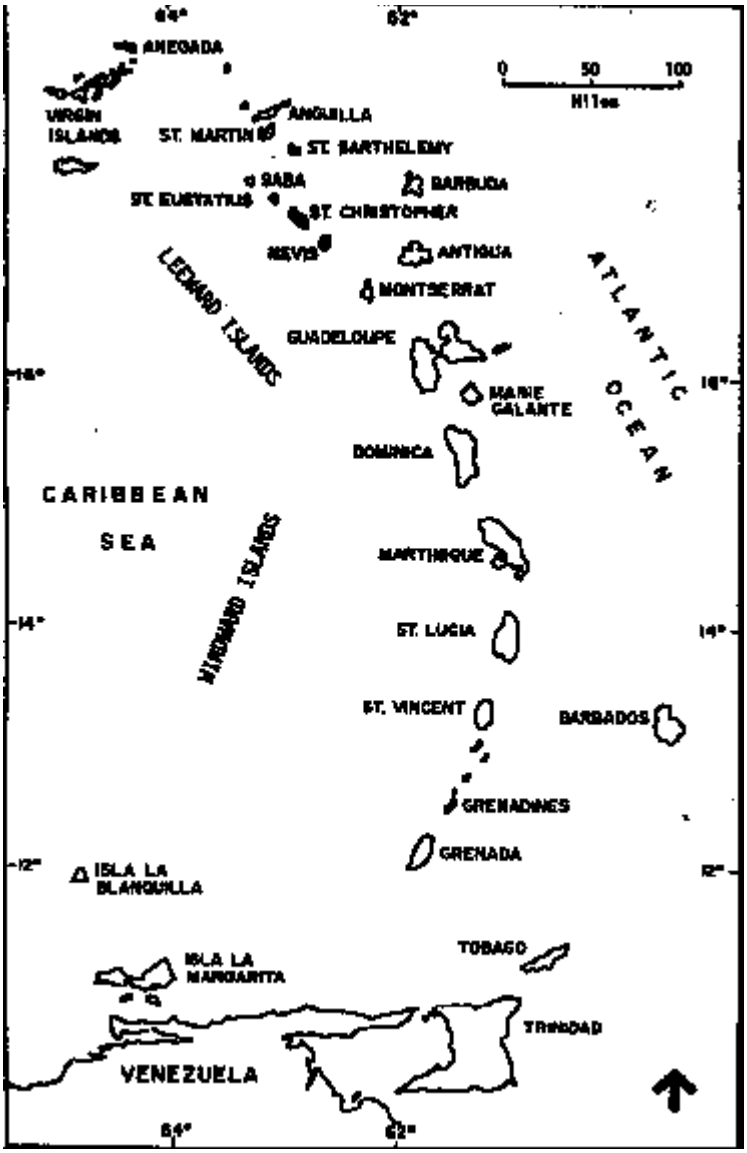


FIGURE 1

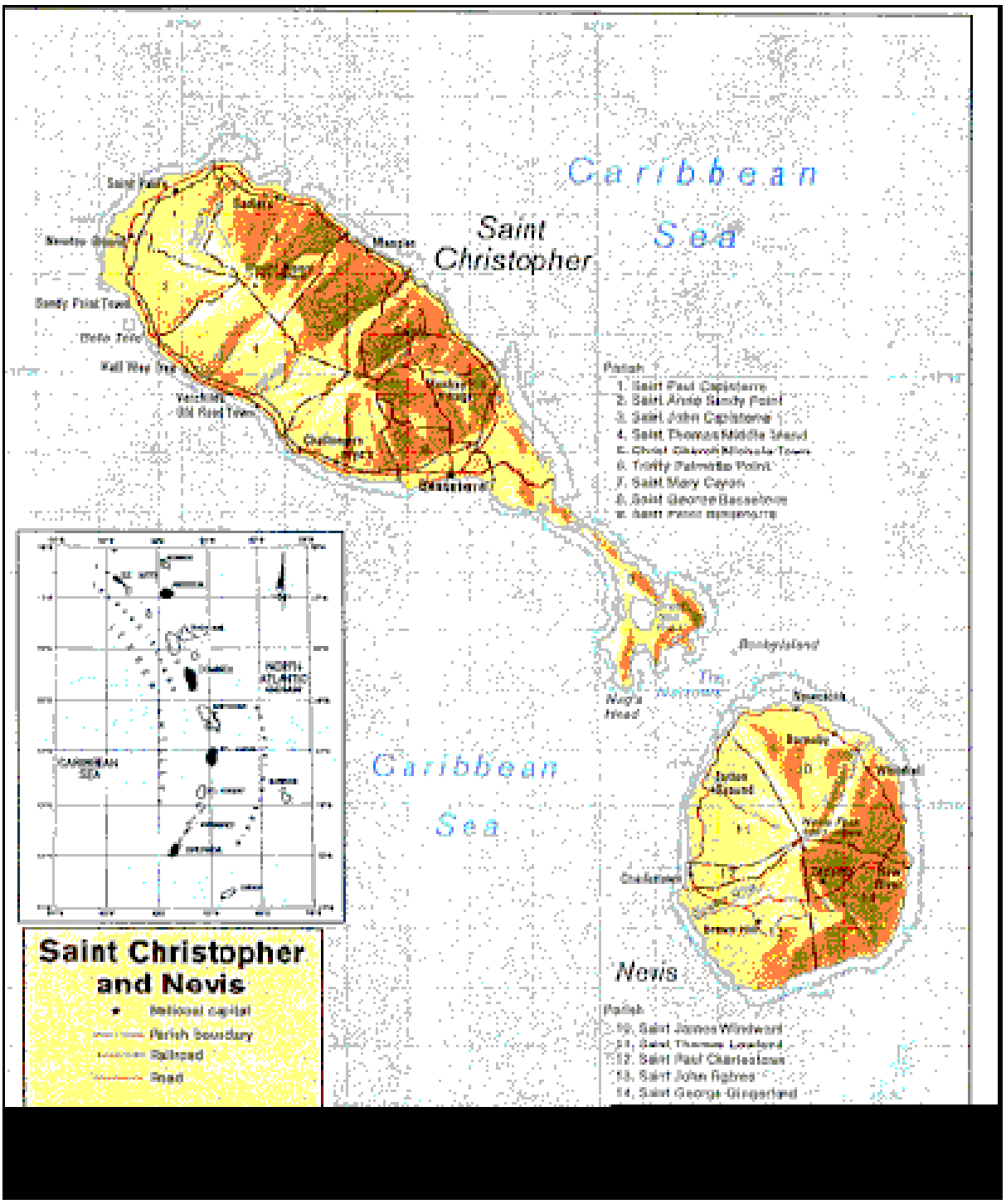
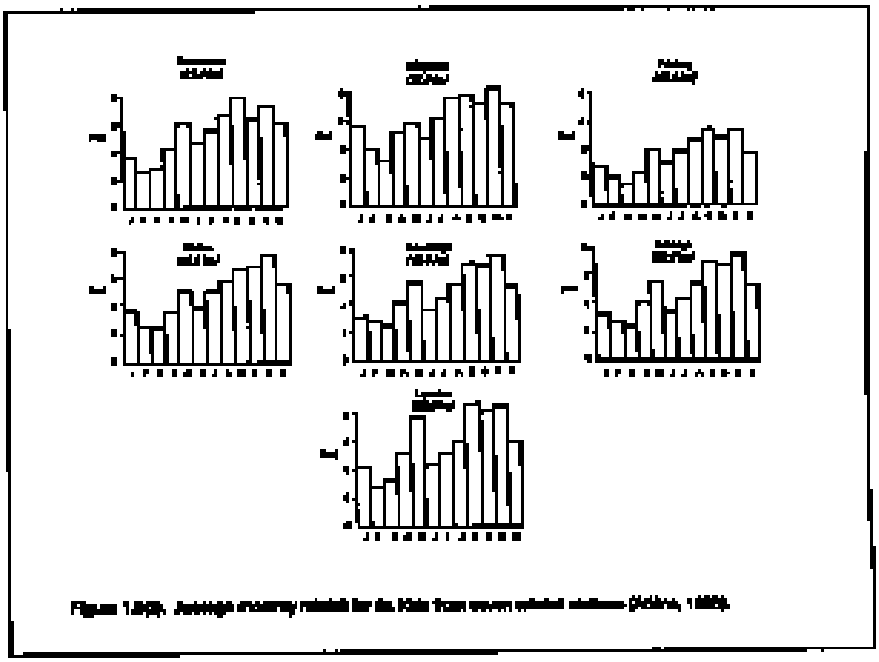


FIGURE 2



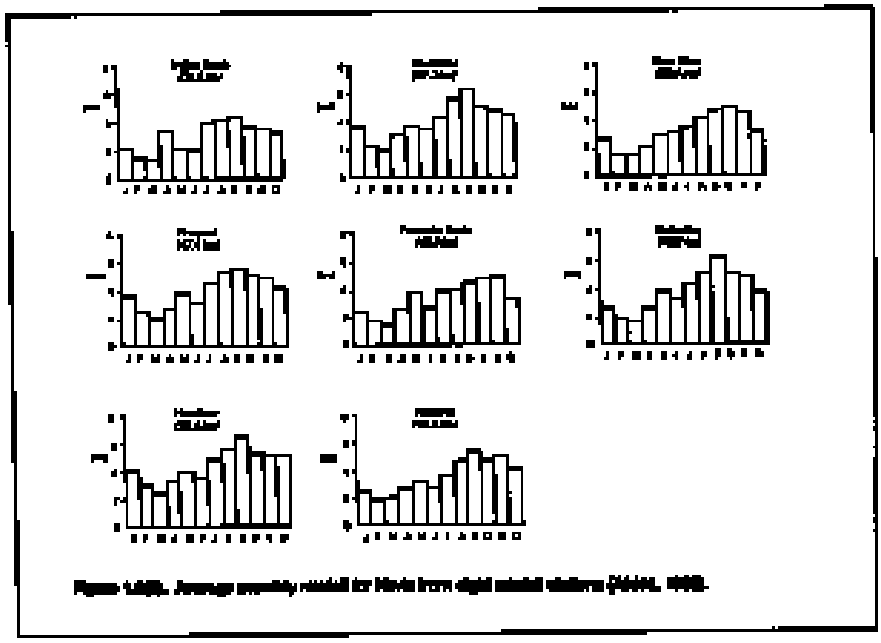


FIGURE 3

1.3 Topography

St Kitts is oriented northwest southeast, about 80 km long and 16 km wide. Generally it rises from the coastline towards its mountain cluster in the center.

The highest point is Mount Liamuiga, rising with a pronounced crater to 1,156 meters (m). Southeast of Mt. Liamuiga, the now dormant volcanic chain continues with the middle range and the southeast range. The summit of Verchild's Mountain is the highest point of the middle range with more than 976 m above sea level. A broad gently sloping saddle of about 457 m high known as Phillips, and Wingfield levels separate the middle range from the southeast range. The highest point of the southeast range is 900 m. Both ranges consist of a number of irregular related peaks, and their glacis slopes are steeper and shorter towards the leeward coast after which the land descends into the Basseterre valley. The Canada hills on the northeastern part of the island, rising to about 335 m are separated by a deep depression from the Morne and Conaree hills, which terminate in the neck of the Southeastern Peninsula (SEP).

Tied islands largely characterize the SEP; about one third of a mile wide and with peaks of up to 180- 213 m. The southern extremity has hills with elevation up to 335 m. The peaks of all of these mountains are less than seven kilometers from the sea, an indication of the island's high relief which in turn, has had and will continue to have an important orographic influence on the climate, on land use, and on the general physical development of the island.

The terrain slopes down steeply from the central peaks, flattening out to gentle slopes and low cliffs towards the coastal fringe. Thus, most flat or moderately sloped land occurs near the coastal area, so most urban and agricultural developments have occurred on these areas. Minor domes protrude from these lower slopes at Brimstone Hill, Ottley's Mountain, Sandy Point Hill and Monkey Hill. Furthermore, the slopes are characterized by deeply incised ghauts with steep sides. These act as the primary channels for drainage.

Nevis lies on the inner volcanic arc of the Lesser Antilles and is comprised of nine distinct volcanic centers strung out southwest to northwest along a parallel of the inner volcanic arc. The central Nevis Peak is the most imposing of these centers, rising to 985 meters in altitude, giving the island a conical appearance. Mount Lily (Windy Hill) to the north climbs to 309 meters with Saddle Hill in the south rising to 381 meters. The other subsidiary peak of note is Butlers Mountain (578 meters), which thickens the range in the central east of the island.

The terrain slopes down steeply from these peaks, at approximately 40%, but it flattens out to gentle slopes and low cliffs towards the coastal fringe. These slopes are characterized by deeply incised ghauts with steep sides, which act as primary channels for drainage. Most of the runoff through these ghauts end up in the near-shore marine area, the rest either infiltrates downward to recharge the underground aquifers or collects in coastal lagoons.

1.4 Geology

A comprehensive literature review of the geology of St Kitts and Nevis was compiled by Lang and Carroll (1964) and appears in their publications "Soil and Land Use Survey," and by Granger (1995) under the Agricultural Diversification Project. Modified extracts of those reviews are presented below.

The island of St Kitts is composed almost exclusively of volcanic rocks of andesite or dacite mineralogy. Its geology is similar to that of other volcanic islands in the Lesser Antillean Archipelago. The islands are the summits of a submerged mountain range that forms the eastern boundary of what is known as the Caribbean Tectonic Plate. The entire island archipelago is geologically young, having begun to form probably less than 50 million years ago, during the Miocene era and has continued since.

St Kitts had since undergone numerous and considerable changes in elevation but is now relatively stable. Newer volcanics rest on a basement of older rocks, now only exposed where the newer deposits have been denuded. Evidence of older volcanic basement rocks can be seen on the face of the SEP and its extension to the Morne, Conaree and Canada hills. These volcanics are generally course agglomerate and intrusive andesites with subsidiary turfs. More recent volcanic centers along the island's central spine. Middle range and Mount Olivees range appear similar in age. Mt. Liamuiga, the most northerly volcano has a youth appearance and was active in recent (geologic) time.

Nevis is a volcanic island that began its formation in mid-Pliocene times (approximately 3.45 million years ago). However, the island comprises a number of discrete eruptive centers that range in age from mid-Pliocene to Pleistocene. These prevent any single model of the island's geological evolution. The geology of Nevis can be subdivided into four informal units: Volcanic of the eruptive centers, volcanigenic rocks –pyroclastics and lahars, fluviatile and lacustrine deposits, and raised beaches.

1.5 Drainage and Water Resources

In St. Kitts, water drains in a radial pattern from the central mountain range to the ocean, interrupted only by the relatively minor volcanic cones at Brimstone Hill, Ottley's mountain, Sandy Point Hill and Monkey Hill. Most of the water channels are deep and steep-sided, and are usually dry along all or most of their stretches. Only the relatively large Wingfield and Cayon rivers flow almost to the sea for much of the wettest part of the year.

Water also drains in a radial pattern from Nevis Peak to the ocean through ten (10) major drainage basins and is interrupted only by the smaller volcanic cones of Hurricane, Saddle and Round Hills. These basins comprise ephemeral ghauts that may consist of up to three streams orders namely Camps River, Barns Ghaut and Kitt Ghaut. In some basins water is channeled

from 457 m above sea level through relatively straight ghauts with steep but not extended sides of the ghauts and these favor rapid run-off that causes a quick flow of water to the island's coastal areas. This is coupled with the fact that the rain forest is very small and readily exposes any run-off to open evaporation, thereby reducing the amount of available recharge. In addition, the gently sloping peripheral coastal section of Nevis is not extensive enough to allow for substantial recharge. Almost all of the ghauts are ephemeral except the Bath Stream, which flow year-round to the sea from springs less than 1.6 km inland. Most of the other ghauts flow intermittently, about 3 to 4 times annually, but more extensively after rainfall.

The primary source of fresh water in the islands is rainfall. St Kitts is the recipient of an average of about 1625mm of rainfall annually ranging from an estimated 2000mm in the higher elevations with arid conditions in the SEP. Annual average rainfall on Nevis is about 1170mm.

CHAPTER 2

CURRENT WATERSHED/WATER RESOURCES MANAGEMENT ISSUES

2.0 CURRENT WATERSHED/ WATER RESOURSES MANAGEMENT ISSUES.

2.1 Watershed Management

In St. Kitts and Nevis there is no single agency that has overall responsibility for the management of Watersheds. Traditionally, there is a sort of division of labour whereby several governmental departments are responsible for the management of their respective sectors. These include the following:

- Water department – which is responsible for the identification, upkeep and protection of water supply sources for human consumption
- The Environmental Health Department - has responsibility to monitor the quality of water harnessed for human consumption.
- The department of Agriculture - traditionally held responsibility for the preservation of the forest which serves for the protection of surface and ground water resources.
- The department of planning - is responsible for regulating land use practices.
- Public Works Department – responsible for building and maintaining roads roads.

On the island of St Kitts most of the arable land is owned and utilized by the St Kitts Sugar Manufacturing Corporation (SSMC) for sugar cane cultivation. SSMC has the responsibility for managing these lands. Sugar cane cultivation takes place in most of the watersheds on the island. Thus, the management of these lands, which includes conservation practices, complements the aforementioned government agencies in the management of watersheds on the island.

A legal framework has been in place and has functioned as a useful tool for the respective bodies that manage the watersheds. However, it is recognized that some of the laws are currently outdated. Others need to be improved and to be amended to be more effective. Some are current but need to be enforced. These include:

- Water Courses and Water Works Ordinance 1956
- Public Health Act , 1969.
- Agricultural Development Act No. 18 of 1973
- Watercourses and Water Works Regulations, 1973
- Fisheries Act 1984
- National Conservation and Environment Protection Act (NCEPA), 1987
- Litter (Abatement) Act,1989
- Fisheries Regulations, 1995
- Physical Planning Act 2000.
- Pesticides Act 2000.
- Litter (Abatement) Amendment Act 2001

Although the NCEPA Act makes allowances for important watersheds to be legally protected areas no watershed in St Kitts and Nevis currently has such status. The 1956 Water Courses and Water Works Ordinance, however gives authority to the Water Department to protect certain fresh water supply sources or intake areas within watersheds. These water intake areas are declared out of bounds to the public by the water department.

Proper mechanisms for guaranteeing absolute protection of these fresh water habitats are not in place. Currently, members of the public, including tourists visit these areas regularly and in most cases without the knowledge of officials of the water department. The potential for severe pollution therefore exists.

2.2 The Wingfield Watershed

Potable water resources in Wingfield supplies water to more people than that of resources from any other watershed in the Federation. Water from Wingfield is supplied to Old Road town through Sandy Point in the West; and as far afield east to that relatively urban sprawl, Basseterre.

The Department of Environment, supported by the O.E.C.S. (Organisation of Eastern Caribbean States) Natural Resource Management Unit(N.R.M.U.) has initiated a pilot project in the management of the Wingfield watershed. It started with a study of the said watershed in which the status was determined. Strengths and deficiencies in the watershed were identified and a plan was put in place to manage it. Programs of activities with resultant effects, carried out there would serve as strong teaching points for persons, organizations, governmental departments in St. Kitts and Nevis and in other O.E.C.S. territories.

Some of the objectives of this pilot project include:

- Building capacity for managing watersheds
- Regulate access into sensitive ecological areas.
- Promote sustainable use of resources in watershed.
- Sensitize the public to the need for protecting resources in the watershed.
- Protection of forests which in turn protects the water resources.

2.3 Water Resources

2.3.1 Supply and Demand

Rainfall is the only source of water in St. Kitts and Nevis. This water is retrieved via three water resource types namely, surface water, ground water and direct rainfall. Surface water is tapped into at six intake areas in St. Kitts and four on Nevis. On St. Kitts these water intake areas are at

Wingfield, Frankland, Stonefort, Lodge, Phillip's and Greenhill. On Nevis the intake areas are at Nevis Peak, Prison Farm, Camps Spring and Jessups.

It was in 1987 that a thorough analysis of the water sector was carried out by Ker, Priestman and Associates, under the sponsorship of CIDA (KPA, 1987). This analysis looked into a variety of factors relevant to water resources management and planning, such as per capita consumption, population growth and distribution, industrial development and tourism. A water supply balance up to the year 2010 was calculated.

Until the early 1970's, groundwater on St. Kittswas "virtually a virgin resource" as the island's needs were satisfied entirely by surface water from springs and streams (Christmas, 1977). Attention was turned increasingly to the island's groundwater resources as a source of supply, necessitated, according to Oelsner (1986), by a then growing water deficit and because surface water resources were fully developed. Stanley (1985) points out, however, that surface water sources could provide the island with all of its water , but that these sources are susceptible to hurricane damage.

It was claimed that ground water sources were developed then on reliability grounds. Table 1 shows water consumption for St. Kitts by type of source. It was from 1993 that groundwater consumption overtook surface water consumption. A CIDA sponsored exploratory drilling project in 1988 confirmed that the coastal aquifer which contains seven major groundwater basins, is the location of the island's best yielding potential wells. The aquifer materials belong to two main geological deposits – the Basseterre Tuffs and the Later Tuffs of Mount Liamuiga. The aquifer occurs where these two deposits exist within a zone approximately between sea level and 15 meters below mean sea level. The main untapped reserve is located beneath the north flank of Mount Liamuiga, between Sandy Point and Saddlers (Ker, Priestman and Associates, 1988).

Because of its high recharge rates and high transmissivity, the coastal aquifer is a favorable unit for wells. An estimated 20% of all rainfall on the island becomes groundwater flow (Ker, Priestman and Associates, 1988). Some 11.75 million gallons per day (MGD) is the estimated total amount of water that ultimately can be tapped by tube wells (Ker, Priestman and Associates, 1988). No wonder that the primary conclusion of the CIDA sponsored drilling study in the 1980's was that "St. Kitts possesses a good groundwater resource for a small Caribbean island, with the capacity to meet present and projected future domestic demand, in conjunction with the surface sources." (Ker, Priestman and Associates, 1988).

Nevis is somewhat drier than its sister island of St. Kitts and this is primarily a function of the lower elevation of its central mountain. In addition at least three quarters of the land area is covered by very shallow clay soils underlain by a silica pan that severely limits infiltration. This is in stark contrast to the St. Kitts soils which are predominantly sandy loam.

Nevis draws heavily on rain and groundwater as well as some surface water for its water supply.Up until the 1980's surface water , in the form of high elevation springs (carrying off water from the peak) constituted the major source of fresh water for domestic, agricultural and industrial purposes. This was inadequate. The CIDA sponsored project referred to earlier resulted

in the identification of three coastal aquifers.This is highlighted in Fig2. Data showing domestic water demand for Nevis in 1990 is shown in Table 2.

TABLE 1 WATER CONSUMPTION FOR ST.KITTS BY TYPE OF SOURCE 1977-1995

Year	Ground Water 000 gals	Surface Water 000 gals	Total 000 gals
1977	128641	361957	490598
1978	91623	419734	511357
1979	83906	602292	686198
1980	77611	596496	674107
1981	62225	600945	663170
1982	97645	655040	752785
1983	160948	676933	837881
1984	171686	645086	816772
1985	187234	595507	782741
1986	286734	463522	750256
1987	280560	698423	978983
1988	242288	599969	842257
1989	362990	584188	947178
1990	361459	597879	959338
1991	423353	500963	924316
1992	522261	535667	1057928
1993	537756	498200	1035956
1994	570454	433733	1004187
1995	754875	463375	1218250

Source: Statistics division (June 1997)

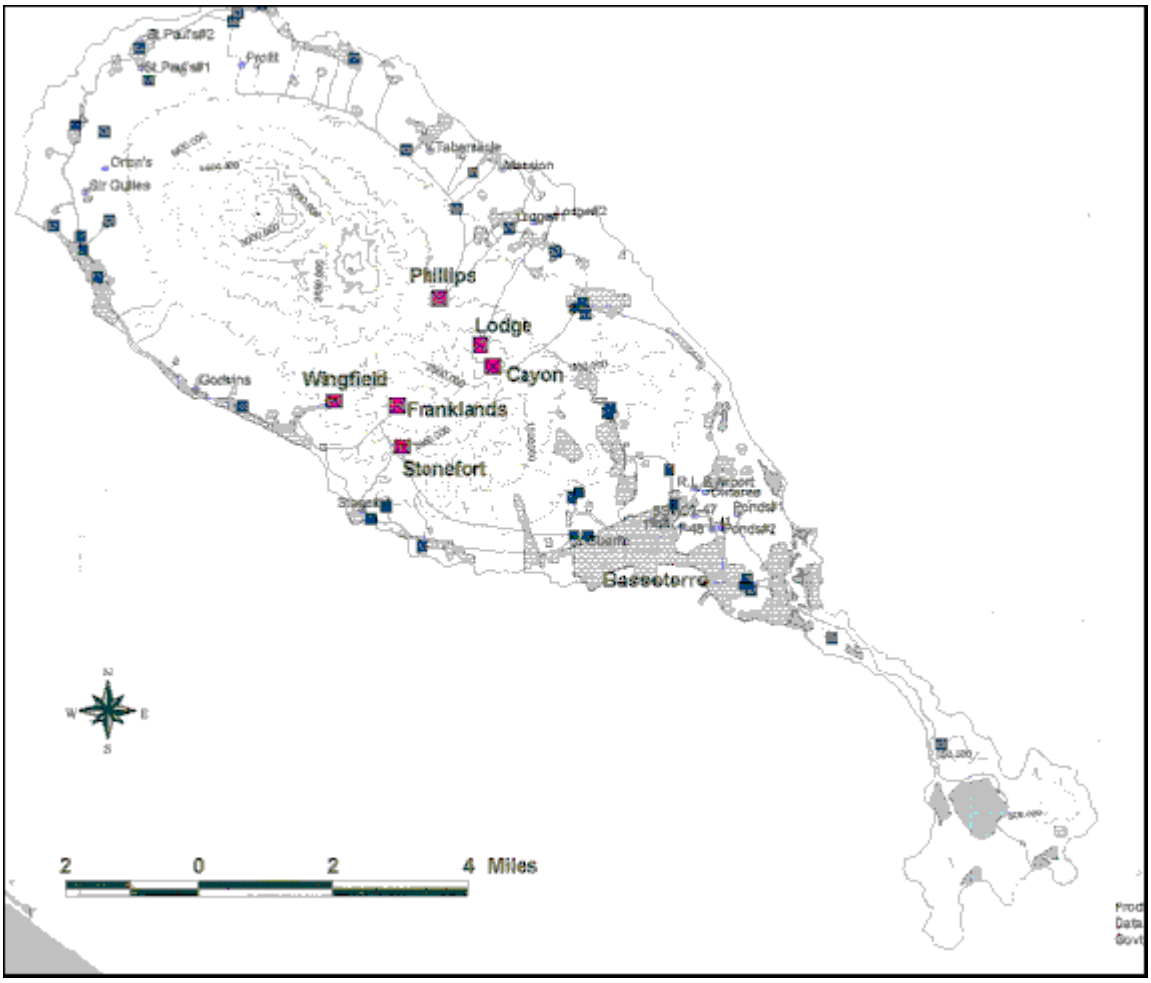

Phillips
Lodge
Cayon
Wingfield
Franklands
Stonefort
Basseterre
Godsins
2 0 2 4 Miles

FIGURE 4

TABLE 2 Nevis Water Supply System

System	Period	GPM	GPD
Maddens System			
Maddens Spring	1990	13	18720
Maddens' Well #1		125	180000
		Current Total	198720
Maddens Well #2	By 1991	50	72000
Butler's Well		70	100800
		1991 Total	371520
Camp's Spring-Jessup System			
Camp's Spring	Current	50	72000
Jessup's Spring		3	4320
		Current Total	76320
Paradise Well	By 1991	25	36000
		1991 Total	112320
Nevis Peak-New River System			
Nevis Peak Spring	1990	40	57600
Zion Well		150	216000
		Current Total	273600
Padlock Well		80	115200
*Hickman's Well	By 1991	48	69120
			388800 (*457920)
Charlestown System			
CSS Well		50	72000
Government Road Well	1990	70	100000
		Current Total	172800
Hospital Well	By 1991	45	64800
		1991 Total	237600
Current supply for entire island	……	……..	721440

1991 projected supply for entire island 1110240

Note:* Undetermined operation date

TABLE 3

Nevis domestic water demand by zone.

ZONE	POPULATION	DEMAND AT 65 gpd
Newcastle	250	16,250
Westbury	95	6,175
Cotton Ground-Jessups	1,247	81,055
Charlestown	2,392	155,480
Morning Star	1,010	65,650
Stoney Hill	1,767	114,855
Hardtimes	1,241	80,665
Butlers	344	22,360
Brick Kiln	362	23,530
Camps	407	26,455
Mt. Lily	333	21,645
Total Population:	9,448	Total Demand: 614,120

Source: Nevis Water Department,1990

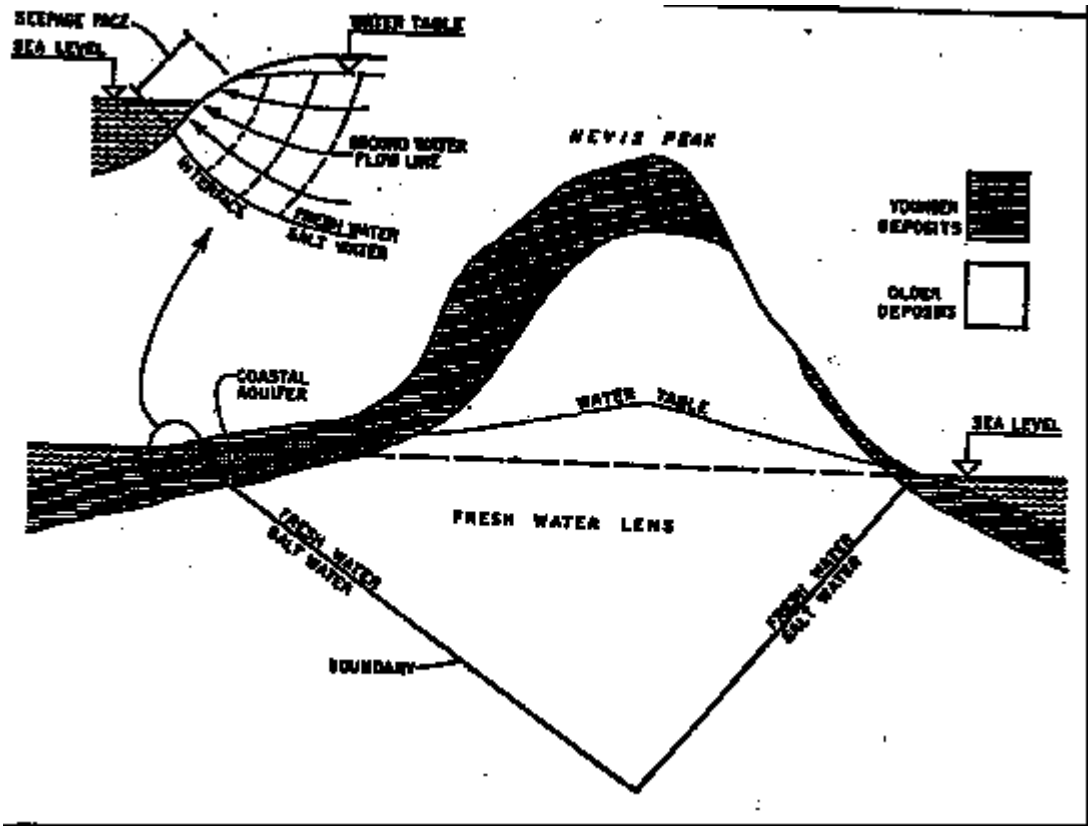


FIGURE 5

TABLE 4

Location	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Lodge	13,286	7,436	9,286	6,659	8,495	25,519	11,539	13,119	12,365	14,547	10,253	18,690	16,722
Fraaldands	194,884	184,434	244,851	253,463	209,853	120,809	175,200	114,300	100,068	93,761	87,891	98,009	96,131
Phillips	62,014	65,241	65,644	67,797	72,083	46,933	89,848	78,278	108,485	89,932	72,961	88,650	66,131
Wingfield	315,235	379,304	340,227	302,189	298,603	256,815	373,513	379,787	358,134	377,406	309,056	307,806	296,806
Stonefort	15,521	18,625	16,925	15,063	14,461	13,448	16,323	14,485	13,136	22,247	20,802	23,114	22,536
Total	600,940	655,040	676,933	645,081	595,587	463,572	668,423	599,969	584,188	597,873	500,963	535,668	498,326

2.3.2 Water Resources Management Strategy

Water Departments on St. Kitts and on Nevis manage the water resources on the respective islands. Rates on St. Kitts are different from rates on the island of Nevis. On St. Kitts there are two categories for the purpose of affixing rates namely metered and unmetered clients. Metered are divided into two groups, domestic and non domestic. The non domestic subscribers pay at a rate of 20 cents per hundred gallons.

There are two categories of domestic subscribers. The category dwelling house/church pays at a rate of 12 cents per gallon for the first 5000 gallons, 16 cents per 100 gallons for 5001 gals. – 7000 gals., 20 cents per 100 gals. For 7001 – 8000 gals. And there is a minimum monthly charge of $3.00

The other domestic category, any school, house, office, store, shop or building other than a dwelling house or church is 20 cents per 100 gals.

Unmetered dwelling house/church category pays at a rate of 70 cents on every $5.00 of the annual assessed rental value of the premises , with a minimum monthly charge of $3.00 The other domestic category pays $1.15 on every $5.00 of the annual assessed rental value of the premises, with a minimum charge of $3.30 Non domestic unmetered category pays $1.15 on every $5.00 of the annual assessed rental value of the premises with a minimum monthly charge of $3.30

On Nevis there are 9 categories of paying subscribers. (Note that in both St. Kitts and Nevis Government departments are not charged). Domestic pays $8.00 for the first 3000 gals. And $10.00 per 3000 gals. thereafter. There is a category of domestic who gets the first 2000 gals. free while another pays a flat $3.00 fee. A category known as domestic farming pays $5.00 for 1000 – 10000 gals. and $10.00 for more than 10000 gals. Hotels pay $25.00 per 1000 gals., ships $20.00 per 1000 gals. and $20.00 per 1000 gals for non domestic.

2.4 Land Policy And Watershed Management

There is no formal national land use plan. The department of planning indicates that there is a draft land use plan which has not yet reached the public. This has resulted in problems.

Most of the lands within a mile from the coast is relatively flat and is utilized by the sugar industry. Over the years and even currently lands are taken out of sugarcane and utilized for a variety of developmental projects without the guidance of a scientific land use plan.

In some cases, however, the following land use situations do occur, namely

The forest is restricted to avoid deforestation by the public

The management and extraction of ground water is under the control of the water department.

Bay Sand mining on beaches is prohibited on Nevis. On St. Kitts it is also illegal unless permission is sought to mine only at Belle Tete, Sandy Point.

Local tour guide entrepreneurs take tourists through the rainforest on tours.

There is need for the following to be in place:

The need to preserve and reforest watersheds to ensure the recharge of aquifers.

The need to manage ghauts, include the revegetation of their sides, to reduce erosion and the resulting turbidity in the near sure marine environs.

The institution of programs, to eliminate the pollution of groundwater by pesticides, and other pollutants.

Preservation of vegetation and/or revegetation of dunes along the coast.

CHAPTER 3

CURRENT COASTAL AREA MANAGEMENT ISSUES

3.0 CURRENT COASTAL AREA MANAGEMENT ISSUES

3.1 Coastal Habitats and Ecosystems

The Federation's coastal areas comprise several ecosystems both marine and land based. Marine ecosystems are chiefly reefs and sea grass beds while land based systems are made up of mangroves and salt marsh. There are no marine protected areas; however there are several proposed protected areas that are managed to minimize adverse impacts from development activities.

St. Kitts:

Proposed Protected Area	**Impact**
Frigate Bay	• Sand mining which results in damages to the primary dune • Pollution caused by improper disposal sewage, oils and agrochemicals
Nags head	• Pollution caused by improper waste disposal from recreational activities
Sandy Point (specific areas)	• Damages to reefs caused by the anchoring of vessels • Over fishing and the trauma of poor management of recreational dives. • Pollution caused by improper disposal sewage and oils along with the excessive use of agrochemicals
South East Peninsula (SEP)	• Pollution caused by improper disposal waste from recreational activities
Black Rock Natural Monument	None noted

Nevis:

Area	Impacts
Cades Bay	• Pollution caused by improper disposal of sewage and the excessive use of agrochemicals • Damages to reefs caused by the anchoring of vessels • Over fishing and the trauma caused by poor management of recreational dives.
Longhaul	• Over fishing along with trauma caused by poor management of recreational dives • Increased turbidity due to the poor development activities which result in soil erosion
New Castle Marine Park	• Over fishing along with trauma caused by poor management of recreational dives • Increased turbidity due to the poor development activities which result in soil erosion • Damages to reefs caused by the anchoring of vessels

3.1.2 Significant Coastal Habitats & Ecosystems Their Management Issues

Coastal habitats and ecosystems are generally three types namely reef, sea grass meadows and wetlands. These systems support to a variety organism such as fin & shellfish as well as nurseries for juvenile fish. The following management threats have been identified for coastal systems in St. Kitts and Nevis

- Inadequate institutionalization of coastal area management
- Inadequate legislation and enforcement of existing laws
- Limited financial resources and poor prioritization in financial planning
- Minimal public interest and familiarity with coastal management issues
- Increase in the intensity and frequency of hurricane
- Poor country development planning
- Pollution from land based and marine activities
- Absence of legally designated protected areas and management plans

Significant coastal habitats and ecosystems in St. Kitts	Significant coastal habitats and ecosystems in Nevis
Dieppe Bay Reef	Cades Bay reef
Belle Tete	Bath Boggs mangrove system
Frigate Bay sand Dune	Nisbett's pond
Salt Ponds	Nelson spring salt marsh
Black Rock natural monument	Newcastle reef
Conaree mangrove system	

3.2 Living and Non-Living Marine Resource Exploitation

The predominant marine resources exploited in St. Kitts and Nevis are reef fish, pelagic species, turtles, conch, sea moss, lobsters mangrove plants, beach sand and beaches. Despite regulations and policies to manage the hunting of turtles and conchs and to prevent the unmanaged mining of beach sand, illegal activities continue. The absence of regulatory measures to manage the trapping of lobsters and the accidental potting and netting of juvenile reef fish is a serious concern.

Exploitation of Marine Resources and Their Impacts

Resources	Use	Impacts
Beach Sand	Building construction	Beach degradation and increased erosion
Beaches	- Recreational activities such as sun bathing and volleyball. - Landing site for fishermen - Hotels and beach bars for tourist accommodation	- Beach degradation due to unmanaged use and possible overload - User conflicts caused by the difference in recreational practices between user groups i.e. nationals vs. tourists - Pollution caused by the improper disposal of garbage from campsites and beach bars, the introduction of agrochemicals tainted runoff from lawns and gulf courses as well as the inadequate disposal and of sewage from development facilities.
Shell and finfish	Foreign and domestic trade, a significant portion of the domestic trade is done within the hotel industry.	- Over fishing of reef fish hence a marked decrease in their availability
Mangrove plants	Cutting of mangroves for fence posts.	- Loss of habitat and sediment trapping systems hence increased turbidity in coastal waters.
Sea moss	Sea moss is harvested to support growing demand for health drinks, though they are only prepared in micro industries the increase in number of producers is a concern	- Specie reduction
Coral reefs	Mooring of vessels and dive tours.	- Deterioration of reef caused by the dropping of anchor

3.2.1 Aquaculture

There are no existing aquaculture facilities on the islands.

3.3 Climate Change and Natural Disasters

St. Kitts & Nevis are signatories to the United Nation Frame Convention on Climate Change (UNFCCC) and are members of Caribbean Planning for the Adaptation to Climate Change (CPACC), however, despite these initiatives there is no comprehensive plan aimed at dealing with the impacts, which are considered to be a product of climate change. The post George Mitigation Project being introduced (funded by USAID) attempts to deal with the preparedness and response to disasters caused by hurricanes, through the improvement of techniques for building construction and inspection as well as the identification and management of shelters. The Proposed Post Lenny Mitigation Projects (OECS-NRMU) is aimed at improving stakeholder participation in planning initiatives for specific location and to provide measures through which informed decisions can be made. Rushed / inadequately planned development is being discouraged to ensure human safety, however development which were introduced a decade ago did not respond to coastal setbacks and so still pose threats to human safety and the economic viability of their area.

3.3.1 Impacts of Sea level Rise

Sea level rise has had significant impacts on the coastline and bordering land based ecosystems. Impacts which are generally caused by extreme weather occurrences includes beach erosion and the changing of beach profile, loss of coastal vegetation, intrusion of salt water into low lying aquifers, damage to coastal infrastructure, temporary loss of economic base and marine degradation.

Occurrences	Measures
Beach erosion and the changing of beach profile	- Beach profiling on a quarterly basis (a UNESCO project) - The legislation of development setbacks from high-water mark - Introduction of guidelines for development setbacks for specific beaches, cliffs and the mouth of ghauts. **(This was only done for Nevis)** - Proposed development plan to incorporate hotspots on the northwest coasts. Collaborative efforts among NGOs and Government agencies for beach profiling initiatives.
Loss of coastal vegetation	None
Intrusion of salt water into low lying aquifers	None
Damage to coastal infrastructure	- Proposed development plan for the northwest coast - Passage of St. Kitts & Nevis Physical Planning Act Physical Planning Act - Introduction of an informal EIA procedures - Installation of weather station at Coast Guard base in St. Kitts - 1998 - Collaborative efforts between Coast Guards, Met Office and Department of Environment where data collection is concerned
Temporary loss of economic base	Introduction of an informal EIA procedures
Marine degradation	None

3.3.2 Impacts of Flood on Marine Ecosystem

Though 9% and 4% of St. Kitts and Nevis respectively is classified as $< 2^0$ in slope flooding is a rear occurrence. In 1998 a flash flood caused by five inches of rainfall in two days buried Basseterre under five feet of mud. Due to the location of Basseterre away from significant coastal marine and ecosystems impacts were expected to be minimal. However it should be noted that no assessment of marine systems was done after the flood to determine possible impacts of:

- Pesticides (herbicides, biocides) in storm water run-offs
- Increased siltation - turbidity (torrent effect)
- Fresh water intrusion
- Loss of marine life
- Introduction of other chemicals from storm water run-off (torrent effects)

3.3.3 Trans-boundary Threats

Trans-boundary threats to coastal areas are usually caused by the movement of debris to the east coast of Nevis and the contamination of coastal waters with bilge from contiguous waters. Wastes washed ashore on the east coast in Nevis are predominantly fishermen's gear and refuse. Though no research has been done in this area it was deduced from reporting made by fishermen and Fisheries Officers that current occurrences pose the following threats to the islands:

- Pollution of coastal and marine ecosystems
- Loss of biodiversity

3.4 Land-based Pollution

Increased development activity and the growth of the tourism industry have significant cumulative adverse impacts on coastal areas. Among these are the over sedimentation of estuarine mangrove systems and increased turbidity in coastal waters caused by poor development practices at high elevation and deforestation of land, point source pollution from industrial activities and none point source pollution from urban settings, large agricultural holdings and gulf courses. The cost of managing coastal areas is a primary concern as management measures required to deal with these issues are generally above the skills of resource persons on the islands.

3.4.1 Sources and Impacts of Land-Based Pollution

Sources of pollution	Areas affected	Impacts
Unregulated building and road construction on steep slopes.	**Nevis** All coastal areas fed by ghauts or channel zed out falls **St. Kitts** South East Peninsular an	Over sedimentation of mangroves and increased turbidity in bays. (Not monitored but observed)
None point source pollution from agricultural activities, gulf courses, urban runoff	**St. Kitts** Basseterre port, South East Peninsular and Frigate Bay area. **Nevis** While testing of coastal waters is not undertaken in Nevis concerns are for Charlestown, Mosquito bay, Gallows Bay and Pinneys Beach.	Scientific research not done Scientific research not done
Industrial activities – draining of oily water into coastal waters by bulk storage facilities.	Nevis Areas observed are Charlestown and long point St. Kitts -	Scientific research not done
Indiscriminate dumping of Solid Waste	Along ghauts in St. Kitts and Nevis	Scientific research not done
Indiscriminate disposal of sewage – though continued monitoring of coastal waters for chemical pollution in the waters of St. Kitts and Nevis is not done, the introduction of inadequate septic systems makes this a serious concern	**Nevis** Charlestown, Mosquito bay, Gallows Bay and Pinney's Beach. **St. Kitts** Basseterre port, South East Peninsular and Frigate Bay area	Scientific research not done Scientific research not done
Deforestation of land by unmitigated quarrying and agricultural activities	**Nevis** Increased sedimentation of ghauts boarding quarries, and the subsequent siltation of reef offshore from ghauts	Thorough scientific research is not done, reef degradation observed on east

	mouth. Agricultural activities are minimal **St. Kitts** Over sedimentation of Basseterre harbor. Quarrying is minimal	coast. Research not done

3.5 Concerns of Tourism Coastal areas

Concerns related to tourism developments are as follows

- Building too close to high water mark, which affects beach stability
- Mooring of vessels on reefs and sea-grass beds destroying ecosystems
- Crowding of visitors which causes deterioration and loss of vegetation
- Lack of clear definition, demarcations of roles and responsibility of stakeholders

3.6 Concerns of Health in Coastal Areas

Health concerns include lack of proper sanitary facilities and the indiscriminate disposal of solid waste from beach bars and campsites, and the absence of lifeguards on popular beaches. Food safety issues linked to coastal areas include human resource /staff constraint for the monitoring food handling practices at beach bars, the unavailability of potable water at some beach bars and occasional poisoning by the ingestion of toxic fish.

3.7 Data Information Management and Research

3.7.1 Monitoring Programmes

Monitoring programs are executed by various agencies. Greater collaboration among these agencies is necessary:

- Bacteriological analysis (water quality) – the environmental health department in collaboration with the Bureau of standards
- Rainfall – SSMC, Meteorological Department and Department of Agriculture (Nevis).
- Beach profiling – Department of Environment, Department of Planning (Nevis) and an N.G.O.
- Sea level rise - Meteorological Department and Department of Environment.

3.7.2 Availability of Equipment

- Laboratory equipment - multi-purpose lab
- SSMC and Agriculture Department 41 rainfall gauges
- Weather station at Coast Guard

3.7.3 External Data Collection

- UPRC Programme
- CPACC Programme
- OECS/NRMU quarterly reports
- CEHI/OECS

Existing Data and Information on Watershed Management

- Inventory of Flora and Fauna
- Studies/reports on Wingfield watershed
- Biodiversity profile for St. Kitts and Nevis
- Development of GIS at the Department of Planning.

3.7.4 Specific Roles Of Some Agencies.

Agencies	**Role**
St. Kitts, Nevis Fisheries Department	Manage fishing industry through the enforcement of St. Kitts & Nevis Fisheries Act and its supporting regulation
St. Kitts & Nevis Department of Environment	Enforce National Conservation Environmental and Protection Act of Kitts and Nevis

Nevis Department of Planning	Management of development according to St. National Conservation Environmental and Protection Act of Kitts and Nevis and Nevis Zoning Plan Ordinance of 1991
St. Kitts, Nevis Public Health (Environmental Health)	Monitoring of waste disposal according to Health Act of 1959
St. Kitts & Nevis Multi-purpose Lab	Research and testing
St. Kitts, Nevis Department of Agriculture	Area management according to National Conservation Environmental and Protection Act of Kitts and Nevis
St. Christopher Heritage Society	Research and educational center
Nevis Historical and Conservation Society	Research and educational center
Jessups Community Improvement Club (Nevis)	Polling and managing interest of general public
St. Kitts & Nevis Conservation Commission	Enforcement of National Conservation Environmental and Protection Act of Kitts and Nevis

3.7.5 Additional Needs Required to Improving Watershed Management

- Watershed monitoring equipment/system
- Vehicles for appropriate and efficient monitoring
- Training at all levels - new and advanced technology
- Institutional strengthening
- Strengthening of linkages between CBOs, NGOs, Pos and GOs
- Effective legislation and enforcement
- Introduction and updating land use maps
- Exchanging of experts and technical expertise
- Continued public awareness and education programmes
- Effective dissemination of available information
- Effective and efficient development plan

Main research needs includes additional collection of data on biodiversity, economic valuation of coastal and marine resources and the environment impacts of activities on watersheds.

3.8 Stake Holder Participation

Agency Involved In Public Education	Responsibility
Department of Development and Planning, Nevis	Educational initiatives targeting specific groups, manage development, foster stakeholder participation in environmental management
St. Kitts & Nevis Department of Environment	Institutionalization of environmental polices, watershed management, management of protected areas, public education.
St. Christopher Heritage Society – NGO	Beach clean-up, public awareness, beach profiling, research
Anglican young People association (St. Kitts)	Beach cleanup
Nevis Historical and Conservation Society	Beach cleanup, public awareness, beach profiling, research
Fisheries Department	Beach cleanup

3.9 Institutional Framework

3.9.1 Characteristics and Mandates of Government

The Government makes the major decision on the negotiation of loan agreements with international donor agencies, the making of policies, design tariff structure and draft legislation.

The Water Department carries out the policies of Government in that they implement the designed tariffs, install and manage water systems, construct service reservoirs, conduits and maintain the same. They are also responsible for the implementation of water restrictions, rationing, disconnections and reconnections of service, the making of necessary recommendations to Government and also to provide adequate water supply.

The Public Health Department is the monitoring agency for water quality. It conducts bacteriological analysis of the water supply.

The Agriculture and Planning Departments are responsible for land conservation and prevention of deforestation.

The Physical Planning Units are responsible for the zoning of development to prevent the encroachment of human settlements/habitation on water shed areas.

The Department of Environment is responsible for protection and preservation of the natural environment, which would include watersheds and ground water supply.

3.9.2 Legislation Governing the Agencies

- Watercourses and Water works Ordinance 1956
- Public Health Act Chapter 226
- Agriculture Department Act No. 18 of 1973
- Physical Planning Act 2000
- Department of Environment - National Conservation and Environment Protection Act No. 5 of 1987

3.9.3 Policy Formulation

Policies are formulated by Government Departments in consultation with stakeholder groups and Permanent Secretaries, after which they are taken to Cabinet. If necessary they are taken to the house of assembly for passage. Upon completion of the policy it is the responsibility of the Permanent Secretary to initiate its administration.

CHAPTER 4

INTEGRATING WATERSHED AND COASTAL AREA MANAGEMENT

4.0 Integrating Watershed and Coastal Area Management

The status of coastal areas is influenced by the way the watersheds are managed. Sound management practices in the watershed usually result in quality coastal areas, while poor watershed management leads to degraded coasts and coastal resources.

From the overview of current issues related to watersheds and coastal areas in St. Kitts and Nevis it is quite apparent that there are serious weaknesses. These make significant implications for human health and the sustainable use of limited natural resources. Specific problems are hereby identified. These are integral to the management of coastal areas by virtue of the direct relationship of the management of watersheds and the status of their coastal zones.

4.1 Legislative and Policy Issues

4.1.1 Watershed Management

The National Conservation and Environmental Protection Act (NCEPA) 1987, makes provisions for the efficient management of watersheds in St. Kitts and Nevis. It must be appreciated, however, that additional regulations must be drafted and enacted to "give teeth " to the said Act. These have not yet been forthcoming. A recurring explanation from the legal department is that there are insufficient legal draftspersons to take care of overwhelming volumes of work in timely manner.

A pilot watershed management project is currently underway at the Wingfield watershed in St. Kitts. This is facilitated by the Department of Environment and the Natural Resource Management Unit (NRMU) of the Organization of Eastern Caribbean States (O.E.C.S.) The local island team leader for that project is a member of staff of the department of environment who does not have formal training in natural resource management or forestry. In fact he is just a high school graduate who later acquired a certificate in teacher training.

In this pilot project laboring work is supplied by workers from the Parks and Beaches unit. This unit is part of the Department of Environment. There is also an awful lack of training in this unit.

4.1.2 Waste Disposal

There is a serious problem with regards to waste disposal and its deleterious effect on the St. Kitts and Nevis environment. Many ghauts, through which rainwater drains to the sea or absorbed into underground aquifers, are littered with waste. Most of these wastes are solid wastes but chemical wastes are also part of the problem. There is thus the threat to human health as well as the sustainable use of terrestrial, as well as, marine resources.

Updated legislation plus the devising of mechanisms for enforcement are necessary for resolving this problem. Public outreach, awareness and sensitization must be an integral component of the suggested mechanism.

4.1.3 Water Quality Monitoring

Monitoring of water quality is carried out by the environmental health department and the water department. Inadequacies in this area have been identified. Firstly there is a lack of data showing regular adequate monitoring and testing. There is evidence too that the piece meal data collected by one agency are not always readily available to other agencies for a variety of reasons. Lack of proper management of relevant data then is a serious deficiency.

4.2 Institutional

4.2.1 Capacity Building

There is a severe shortage of trained technical staff among the various agencies that contribute towards the management of various sectors of the watershed – water resources management, water quality monitoring, coastal areas management - This in itself contributes to deficiencies in the management of related resources.

4.2.2 Research

Very limited scientific studies have been undertaken to determine the effect of decades of chemical herbicide use on the water quality in the Basseterre aquifer. Sugarcane has been cultivated for four hundred years on top of an important aquifer that supplies water to most of the people in the Federation.

Waste water flows into the near shore marine environment and there is no reliable scientific data on the effects on the marine environ. These are essential for proper planning.

Adequate financing and trained personnel are essential for capacity building, research and institutional development.

4.3 Financial

It should be noted that international lending agencies such as the World Bank and Caribbean Development Bank view utility cost recovery as critical to the sustainability of capital works and as a major indicator of institutional capacity. Annual estimates to date have shown that the water department is operating at a deficit. (Maxim, 1996). This means that added financing to improve efficiency could only be accessed from lending institutions if cost recovery rates are increased.

4.4 Multilateral Environmental Agreements

St. Kitts and Nevis is party to several environmental conventions. Among some of the requirements as party are the framing of various environmental regulations and the enforcement of such would contribute tremendously to effective management of watersheds, water resources and coastal areas. Many of these required legislations are not yet in place.

4.5 Public Outreach.

There is a serious deficiency with regards to public awareness. Creative programs need to be designed to educate the public. Financing would also be required for this.

REFERENCES

Christmas, J., 1977. Hydrogeology of an unconfined coastal aquifer system, Basseterre Valley, St. Kitts. Ph. D. thesis, Univ. of West Indies.

Darby, G., et al., 1987. Soil conservation planning guide and handbook. St. Kitts and Nevis. Prepared for Min. of Ag, Lands, Housing, Labor and Tourism by Devres, Inc., Washington, DC.

Halcrow, Sir William and Partners, 1983. Report on the water resources of St. Kitts, Nevis, and Anguilla and their development. Overseas Development Administration, UK.

Kennedy, T. and Robins, N., 1988. Contributions to the UNESCO hydrogeological atlas of the Caribbean islands. Vol. 4: St. Christopher and Nevis. Report prepared by the British Geological Survey for the Overseas Development Administration. Brit. Geol. Surv. Hydrogeol. Series, report WD/88/30.

Ker, Priestman and Associates Ltd. (KPA), 1986. Nevis hydrogeology report. Prepared for CIDA.

Ker, Priestman and Associates Ltd. (KPA), 1987. St. Kitts water sector analysis report. Second draft. Prepared for CIDA.

Ker, Priestman and Associates Ltd. (KPA). 1988. St. Kitts –Nevis exploratory drilling project no. 866-11044. Final hydrogeology report. Vol.1: St. Kitts. Prepared for CIDA.

Lang, D. and Carroll, D., 1966. St. Kitts and Nevis soil and land use survey no. 16. Imp. Coll. Trop. Agri., St. Augustine,Trinidad.

(Maxim, 1996) Organisation of Eastern Caribbean States Waste management Project Sewerage and Sewage treatment component by Maxim Engineering In. 1996

N.C.E.P.A. 1987. St. Kitts and Nevis National Conservation and Environmental Protection Act, 1987.

Oelsner, J., 1986. Water management in St. Kitts. Water supply options for the leeward region. OAS/Government of St. Kitts and Nevis.

Stanley International Enterprises Ltd., 1985. St. Kitts and Nevis water utility and tariff restructuring study, final report.