VISION 2030 JAMAICA

WATER

A girl fills a bucket with water from a community standpipe in the town of Duckensfield, Jamaica

SECTOR PLAN
2009 - 2030

VISION 2030 JAMAICA: NATIONAL DEVELOPMENT PLAN

WATER SECTOR PLAN

A girl fills a bucket with water from a community standpipe in the town of Duckensfield, Jamaica

Prepared by the Water Task Force
June 2009

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Chapter 1: Setting the Context

Introduction

Water is the most important and probably the most widely known substance on earth. The availability of and access to water are basic aspects of human existence. Approximately 70% of the Earth's surface is covered by water however, only 2.5% is freshwater. Of this only a fraction, approximately less than 1% is accessible groundwater or surface water available for drinking. Ultimately, the freshwater available to a region depends upon the amounts of rainfall, local hydrology and the geology of a given area.

Freshwater is available for our use from two sources. Water that collects on the surface of the Earth in rivers and streams is referred to as surface water, while water that collects beneath the ground is called groundwater. Worldwide, groundwater is 40 times more abundant than fresh water, and is the primary source of drinking water for most people in the world.[1] And although groundwater is a renewable resource, its reserves replenish relatively slowly.

About 2 billion people, approximately one-third of the world's population, depend on groundwater supplies, withdrawing about 20 percent of global water (600- 700 km3) annually — much of it from shallow aquifers (UNDP and others 2000). Many rural dwellers depend entirely on groundwater.

On a global average, drinking and sanitation require approximately 10 percent of the fresh water supplies, while industry, recreation, and other uses comprise about 20 percent. Irrigation, which accounts for 70 percent of all the water extracted from rivers, lakes, and aquifers, is by far the most intensive use of the world's fresh water resources. In certain countries, especially in sub-Saharan and Sahelian Africa, irrigation comprises 90 percent of the water uses.[2]

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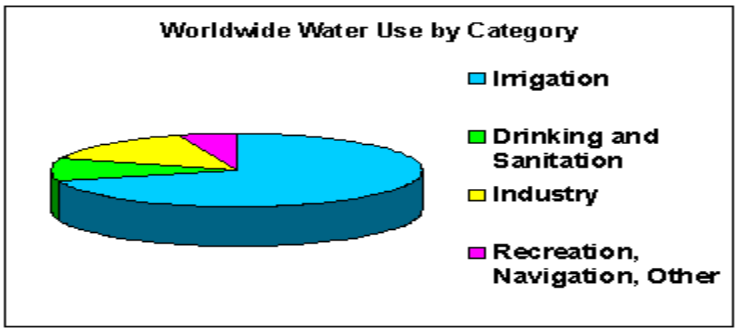
[1] "Groundwater & Surface Water Backgrounder," <http://www.lehigh.edu >

[2] Svadlenka, Robert, op cit.

Figure – Worldwide Water Use



The availability of and access to freshwater are basic aspects of human existence. According to Chapter 18 of Agenda 21 ***"all social and economic activities rely heavily on the supply and quality of freshwater."*** A limited resource with no substitute, water affects food supply, health, habitats, hygiene, transportation, climate, energy supplies, and industry. Poor water management can lead to disease, malnutrition, reduced economic growth, social instability, and war. Therefore, the conservation and proper use of freshwater are fundamental in order to assure the continuance of life on our planet.

This Sector Plan for Water is premised on a vision shared by key stakeholders in the water sector (both in the public and private), and state the important roles they collectively have to play in shaping the planning process to 2030.

Vision 2030 Sector Plan Planning Process

It is one of twenty-eight chapters that would form the foundation for the development of Jamaica 2030 – a 25-year plan designed to put Jamaica in a position to achieve developed country status by 2030. Jamaica 2030 is based on a fundamental vision Jamaica, *the place of choice to raise families, live, work and do business,'* and on guiding principles which put 'people' at the centre of Jamaica's transformation.

The preparation of the Plan is supported by a quantitative systems dynamics model – Threshold 21 (T21) – which supports comprehensive, integrated planning that would enable the consideration of a broad range of interconnected factors along economic, social and environmental considerations and will be used to project future consequences

of different strategies across a whole range of indicators. In addition, it enables planners to trace causes of changes in any variable or indicator back to the assumptions.

The sector plan was developed using the following processes:

- Task Force Meetings[3] workshops and working group meetings that were used to solicit ideas and views from members[4] on water issues and challenges facing Jamaica , identify a vision for the water sector in Jamaica, and determine key goals, outcomes strategies and actions for the sector from 2009 to 2030
- Research on international best practices related to water that could be adopted in the Jamaican context
- Strategic meetings between the Chair of the Task Force, the technical secretaries and the consultant of the PIOJ

This document is structured in the following chapters as follows:

- Chapter 1: Setting the Context
- Chapter 2: Situational Analysis
- Chapter 3: SWOT Analysis
- Chapter 4: Strategic Vision and Planning Framework for the Natural Resources & Environmental Management and Hazard Risk Reduction and Climate Change Sector Plans
- Chapter 5: Implementation Framework and Action Plan for the Natural Resources & Environmental Management and Hazard Risk Reduction & Climate Change Sectors
- Appendices

[3] See Appendix 2 for Listing of Task Force Meetings
[4] See Appendix 1 for List of Members of the Urban Planning and Regional Development Task Force

Chapter 2: Situational Analysis

Situational Analysis – Brief Overview

Rainfall is the sole source of water across Jamaica, yielding three basic water resource types, namely:

- Surface Water – rivers and streams;
- Groundwater – wells and springs; and
- Direct rainwater – evapotranspiration and rainwater harvesting,

Jamaica's water resources are quite extensive and support diverse ecosystems. However, despite having excellent and relatively abundant water sources, the areas of high water demand are often far away from the required water resources. This is because the demand for water and the exploitable water resources of the island are unevenly distributed, with the greatest demand for water occurring in the south and most of the available water being in the north. Seasonal variability of the rainfall is also high, creating additional water supply problems. However, despite the uneven and seasonal rainfall distribution, the water resources are adequate to supply the needs of the island for the foreseeable future. Yet, under the pressures of human development, many of these waters have had to be abandoned as sources of potable water, or are being threatened by pollution for various sources.

A girl fills a bucket with water from a community standpipe in the town of Duckensfield, Jamaica

Also, there is growing awareness and concern for the issues and problems in the water sector, which threaten the nation's health and which demand considerable sums for their resolution. Some of these issues include the deterioration and malfunction of municipal supply and sewage treatment infrastructure, management of industrial and toxic waste and its effect on water resources, rapidly increasing demand in water deficit areas, and the adverse effects of deforestation.

Notwithstanding the above, Jamaica has made significant progress in providing water to the population. Across the country as a whole, the percentage of households with piped water has risen from 61% in 1990 and 71% in 2001 to 67.8% in 2006. Over the period 2001 to 2006, the percentage of households relying on water from standpipes decreased

from 13.1% to 6.7%. Unfortunately though, the poorest quintile or the poorest 20% of the population has not shared in many of the improvements, with 26.8% relying on the outdoor private tap as their most important source of water, followed by indoor tap (15.8%) and public standpipe (13.4%).

ECONOMIC, SOCIAL AND ENVIRONMENTAL ISSUES ASSOCIATED WITH FRESHWATER MANAGEMENT

Jamaica's Water Resource Types

Rainfall is the sole source of water across Jamaica, yielding three basic water resource types, namely:

- Surface Water – rivers and streams;
- Groundwater – wells and springs; and,
- Direct rainwater – evapotranspiration and harvested rainwater.

The water resource type is dependent on the hydrostratigraphy (type rocks) and the classification as aquifers or aquicludes. The oldest rocks, the volcanics and volcanoclastics, are impermeable and are classified as aquicludes (do not readily yield water to wells and springs) and the water resource type is surface water. The limestones of the White Limestone Group are permeable with a high degree of karstification that has significantly increased permeability. They are classified as aquifers (readily yield water to wells and springs) and the main water resource type is groundwater. Groundwater is tapped by the drilling and construction of tube wells.

Agencies with Responsibilities

Since April 1996, the Water Resources Authority (WRA) has had responsibility for regulation, control and management of the nation's water resources. The National Water Commission (NWC) on the other hand has responsibility for the public supply of drinking water and sewage treatment. The NWC operates within the policy context of the Government of Jamaica's goal of universal access to potable water by the year 2010 and the establishment of sewerage systems in all major towns by 2020. The National Irrigation Commission (NIC) has responsibility for the supply of water for agricultural and irrigation uses while the Rural Water Supply Company has the responsibility for the execution of small rural projects.

The Water Resources Act (1995) established the Water Resources authority (WRA) as the

sole agency with responsibility for the regulation of water resources availability, including inter alia, the collection of water resources data (except rainfall), assessment, allocation, planning and management. Its main instrument of control is the issue of well drilling permits and abstraction licenses for both surface and ground water sources.

Nationally the provision of domestic water supply to the public is shared between the following institutions: -

- National Water Commission - Islandwide (urban and rural) by Statue
- Parish Councils - Rural areas by Statute
- GoJ Enterprises - Specific supply areas by License
- Private Enterprises - Specific supply areas by License
- ODPEM - Islandwide under conditions of disaster

The National Water Commission Act (1980) gave the NWC authority over the water supply districts prescribed by the Minister under the National Water Authority Act (1963) and those of the Kingston and St. Andrew Water Commission. However in practise the NWC has interpreted its mandate to extend beyond those areas specified by Statute, to all areas except those supplied by the Parish Councils.

The liberalisation of the Water Services Sub-sector to include the participation of Private Enterprises as set out in the National Water Policy (1999) has resulted in housing developers who develop their own water supply system to support their respective housing developments opting to operate private water supply systems rather than handing them over to the NWC, as was previously required. The OUR has licensed five such private water utilities across the island – Four Rivers Ltd, Dairy Springs Ltd, Runaway Bay Water Company, Can-Cara Environment Ltd and Dynamic Environmental Management Ltd. Nationally the NWC Act (1980) authorizes the NWC to provide sewerage services to areas specified by the Minister.

The National Irrigation Commission (NIC) is mandated by Statute to provide irrigation water nationally. Across the island it operates the Rio Cobre, St. Dorothy, Mid-Clarendon, Hounslow, Pedro Plains, Braco and Yallahs irrigation systems providing irrigation to 8,222 and 4,562 ha of land on the St. Catherine and Clarendon Plains respectively. The NIC is presently promoting the handover of these systems to Water

Users Associations (i.e. the farmers themselves). It also supplies untreated water to the NWC for the Spanish Town Water Treatment Plant.

Several large farms operate their own well sources, irrigating 1,498 and 6,239 ha of land in St. Catherine and Clarendon, respectively and also to supplement the water obtained from the NIC whenever there is a shortfall in the public supply. Most of these large farms are Government owned/operated (i.e. Caymanas Estate, Bernard Lodge Estate, Innswood Estate and Frome/Monymusk) although there are large private farms with their own well sources, such as the stud farms on the Grange Estate in St. Catherine and New Yarmouth Estate in Clarendon.

Large scale industrial enterprises all provide their own independent water supply services, including the bauxite/alumina plants at Halse Hall, Ewarton, Kirkvine and Nain; the Red Stripe Brewery; Seprod Ltd; the sugar factories at Bernard Lodge, Worthy Park, Appleton, Frome and Monymusk and the JPSCo. They all rely on ground or surface water sources to meet their demend.

Water Supply

Reliable and safe yields[5] of freshwater in Jamaica have been estimated at 4085 million cubic metres per year, with groundwater accounting for 84 percent and surface water 16 percent. In 1999, 92 percent of the National Water Commission's (NWC) annual water production came from groundwater sources.[6]

Table - Exploitable Water Resources (Million cubic metres per year)
Source: WRA [online], "Exploitable Water," www.wra-ja.org

	Volume	Percentage
Exploitable surface water runoff (reliable yield)	666	16 %

[5] The *reliable yield* or exploitable surface water is the daily water flow that is exceeded 90 percent of the time. The *safe yield* or exploitable groundwater is the quantity of groundwater that can be withdrawn over a long period without impairing the aquifer as a water source. WRA, [online], Glossary, <www.wra-ja.org>

[6] STATIN and NEPA, 2002, Jamaica's Environment 2001.

Table - Exploitable Water Resources (Million cubic metres per year) **Source:** WRA [online], "Exploitable Water," www.wra-ja.org		
	Volume	**Percentage**
Exploitable groundwater (safe yield)	3,419	84 %
Total exploitable water	4,085	100 %

Present production from both ground and surface water resources totals 920 million cubic metres per year – 22.5 percent of the current reliable safe yield. This leaves a balance of 3163 million cubic metres per year (over 77 percent of the total) available for development.

The Demand for Water

Worldwide, 54 percent of the annual available freshwater is being used.[7] If consumption per person remains steady, by 2025 the demand for water could be 70 percent of the total water available because of population growth alone. However if per capita consumption reaches the level of more developed countries, water demand could be 90 percent of the available water by 2025, making the supply of this vital resource a problem. It is imperative that water conservation be implemented as a matter of priority.

As populations and economic activities grow, many countries are rapidly reaching conditions of water scarcity.8 Water scare countries have fewer than 1,000 cubic metres per year and at this level, there may not be enough water to provide adequate food.9 Global population has tripled over the past 70 years and water consumption has grown six-fold because of industrial development and increased irrigation.

For example, in 2000, more than 8 percent of the world's population was living in countries affected by water stress or scarcity. It is expected that by 2050, over 45 percent of the global population will be living in countries that cannot meet the requirement of 50

[7] Brown, *et al.*, The State of the World Population 2001.

[8] Water stress is defined as areas where water consumption is more than 10 percent of renewable freshwater resources. Mayell, op. cit.

[9] Brown, *et al.*, op. cit.

litres of water per person per day to meet basic human needs. Thus, population size and growth rate, as well as its consumption patterns, will determine the onset and severity of water scarcity.

In Jamaica 75 percent of the total volume of water currently produced is used for agricultural purposes, with 17 percent being used for domestic consumption.

Table - Estimated Water Use in Jamaica (Million cubic metres per year)
Source: WRA [online], "Water Use (Present & Future)," www.wra-ja.org

Sectors	Present (1990)	Future (2015)	% Change
Non-agricultural	231 (25%)	346 (21%)	50%
Agricultural	682 (75%)	1,338 (79 %)	96%
TOTAL	913 (100%)	1,684 (100%)	85%

New water required for the year 2015 has been estimated at 790 million cubic metres per year by the Water Resources Authority (WRA). Of this total, 172 million cubic metres is required for non-agricultural purposes and 618 million cubic metres for agricultural purposes. Though water demand for domestic and commercial purposes is rising, the expansion of the water supply is occurring at a slower rate.

If the above predictions hold true, Jamaica would be using over 41 percent of its reliable safe yield of freshwater in 12 years, meaning that an additional 20 percent of current water sources would need to be developed to meet this demand. In essence, the utilities would have to almost double the amount of water that is supplied between 2003 and 2015.

Problems Affecting Water Availability

Several problems affect water availability in Jamaica. First, the levels of non-revenue water are high due to aging infrastructure and the under metering for 15 percent of the

population, who therefore have no incentive to conserve water or repair internal leaks.[10] While the NWC has a programme to discover the destination of water that is normally listed as non-revenue water (NRW), NRW still stands at 60 percent of the total amount of water distributed.[11]

Second, there is inadequate storage capacity in many parishes to increase the reliable yield and to ensure that there are sufficient supplies of water during the dry season. For example, in St. Mary, the absence of raw water storage makes the entire output susceptible to wide fluctuations during the year.

Third, the infrastructure to move water to the areas where it is needed is inadequate in some parts of the country. For example:

- In Trelawny, inadequate transfer facilities to sections of the parish result in these areas being poorly served; and,
- In St. Ann, the level of service outside of the parish capital varies markedly as a result of the inadequacy of source and transmission facilities.

Significant investment and operational improvements are needed in these areas.

Urban Water and Sewage

The National Water Commission is responsible for urban water supply throughout the island. It is also the largest provider of sewerage services. Other major sewerage providers include the Urban Development Corporation, and private and public housing developers. The great majority of urban residents have access to safe piped potable water. In the KMA around 97% of households have piped water, and in other towns 79% of households have this facility.

While coverage is good, reliability of supply to urban households and industrial users is often erratic. As stated in the introduction, sufficient water exists on the island to meet all water demands, but the water resources are not necessarily located close to the major centers of water demand. The infrastructure to move the water to the areas where it is needed is absent or inadequate.

[10] National Water Commission [online], "Water Distribution," <http://www.nwcjamaica.com >
[11] Ministry of Water and Housing [online], <http://www.mwh.gov.jm>

Sanitation services exist in most major urban areas, and are being improved. In the KMA, 92% of households have flush toilets, while in other towns 60% of households have this facility. In the KMA, 60% (check this figure) of households are linked to sewer systems, while in other towns the figure is 11% (check this as not many towns have a sewer system). The great majority of urban households without flush toilets use pit latrines. While sanitation services has increased significantly in recent years, it is less extensive than the coverage of water services. Sewage disposal practices are also often inadequate. Significant investments and operational improvements are needed in this area.

The average household in the KMA spends 1.9% of its income on water services, while in other towns the figure is 2.3%. For most households, their expenditure on water is about half their expenditure on electricity.

Rural Water & Sewage

In rural areas, 39% of households have piped water. A quarter of rural households get water from stand-pipes, and 22% use rain-water tanks. Eight percent of rural households obtain water from rivers, streams and ponds. Of those rural households which rely on standpipes, more than half have to travel over 50 yards, and 13% need to go more than 1000 yards. The NWC and the Parish Councils trucks water to its customers when systems breakdown or supply is intermittent. Both parties contract with the Rapid Response Unit of the Ministry of Water and Housing which provides the trucks and water.

Sewerage is not generally provided in rural areas, except in housing developments. In total, 9% of rural households are connected to a sewer system. The percentage of rural households with flush toilets has increased from 28% in 1990 to 31% in 1991. The commonest form of rural sanitation is the pit latrine, used by 68% of rural households. Septic tanks, pit latrines and other types of onsite sanitation systems can be effective and safe. However if not constructed, used and maintained properly they can pose a threat to health and the quality of ground and surface waters.

Lower population densities mean that the cost of water provision in rural areas is often higher than in urban areas, while lower incomes in many rural areas make it hard for

some customers to meet the full cost of high quality services.

Threats to Freshwater Resources

Water is not only becoming scarce because of increased demand, but also because of higher pollution levels and habitat degradation. Global freshwater resources are threatened by various factors, including:

- Overexploitation
- Poor Management
- Watershed degradation
- Pollution

The Water Resources Authority (WRA) reports that about 10 percent of the island's water resources has been lost as a result of pollution, saline intrusion (from overexploitation), and watershed degradation.

Overexploitation

In many regions of the world, freshwater, both ground and surface water, is being used faster than it can be replaced. In the United States, 400 million m3 of groundwater is being removed from aquifers annually – about double the amount being replaced by recharge from rainfall. In Spain, more than half of the nearly 100 aquifers are overexploited.12 While water is a renewable resource, if exploited beyond its capacity to replenish itself, future water availability may be jeopardized.

In Jamaica, water quality in some areas is compromised by excessive chloride levels due to saltwater intrusion. The intrusion is caused by over-pumping in many wells, particularly in coastal aquifers which are in direct hydraulic continuity with the sea. Over-pumping from coastal aquifers in the Liguanea Plain and the lower reaches of the Rio Cobre, Rio Minho, Black River and Montego River Basins has caused saltwater intrusion both localized (upconing) and frontal. A number of wells in the Kingston area have been shut down due to poor water quality resulting in high nitrates from sewage infiltration from soakaway absorption pits

[12] Mayell, Hillary 2003, "UN Highlights World Water Crisis," <http://news.nationalgeographic.com/>

Poor Management[13]

"The water crisis is one of water governance, essentially caused by the ways in which we mismanage water," conclude the authors of the UN's World Water Development Report (WWDR). Freshwater resources are being squandered due to pollution and the way in which water is used.

Water quality problems can often be as severe as those of water availability but less attention has been paid to them, particularly in developing regions. Some two million tonnes of waste per day are disposed of in receiving waters, including industrial wastes and chemicals, human and agricultural wastes, according to the report. World Watch Institute (WWI) estimates that every minute, 1.1 million litres (300,000 gallons) of raw sewage are dumped into the Ganges River, the primary source of water for many Indians. More than half of the world's major rivers are "seriously depleted and polluted, degrading and poisoning the surrounding ecosystems, threatening the health and livelihood of people who depend on them" (World Commission on Water 1999).

Agriculture accounts for over 70 percent of world water consumption, and yet around 60 percent of the water used for irrigation is wasted, lost to leaky canals, evaporation, and mismanagement. Fertilizer and pesticide residues from agricultural activities also contribute to contamination of fresh water resources. In large cities of developing countries, the percentage of non-revenue water is also very high, around 40 percent. Poor water management has led to water availability and pollution problems, and can jeopardize future water availability as much as overexploitation.

Pollution

The main sources of water pollution in Jamaica are:

- Inadequate sewage disposal
- Soil erosion
- Agricultural and industrial discharges

[13] ibid.

Ground and surface waters in Jamaica are generally of a high quality However mans influence affects the quality of the water resources. Surface water is more susceptible to contamination and is used to transport waste from industrial complexes and human settlements.. The absence of sewage treatment facilities and the onsite disposal of wastes lead to contamination of groundwater In some instances the sewage treatment facility discharges the poorly treated waste into the river. Slightly less than two thirds (61.8 percent) of households have access to flush toilets; however, of this number, only 18.9 percent of these are linked to a sewer system[12]

About 33 percent of Jamaicans use pit latrines, this is about 4 percent lower than in 2000. People building on flood plains using this disposal method increase the amount of waste entering the stream. Generally, surface water quality is poor around and downstream of industrial and populated centres. The nutrient-rich industrial and sewage effluent encourages the growth of algae and other plants, and increases faecal coliform levels. This is evident in the Black River which is contaminated by the discharge of dunder from Appleton sugar factory and distillery.[14] Ground water near soak-away pits may also have high coliform levels. For example, several supply wells in the Liguanea Plain that supplied water for Kingston have been abandoned due to nutrient (nitrate and phosphate) contamination, which results from seepages from sewage soak-away pits

Soil Erosion and Siltation

Jamaica is divided into 26 watershed management units, each of which are being degraded and are in critical condition to different extents. High erosion rates continue to be experienced in 19 of the 26 watershed management units. In these degraded watersheds, higher levels of soil erosion are experienced, increasing siltation and turbidity, and reducing the quality of water.[15] Jamaica continues to experience the direct impacts of forest loss on water availability and quality. For example, siltation due to reduced tree cover has caused storage losses of 85 million gallons (22 percent of reservoir

[12] U.S. Army Corps of Engineers, 2001op. cit.

[15] The function of trees/forests in maintaining water quality is discussed in "Freshwater Management – Economic, Social, and Environmental Issues."

capacity) in Kingston.[16] Islandwide, about 10 out of the 15 reservoirs in the country are significantly silted.[17]

Agricultural, Industrial, and Mining Discharges

Discharges from the agricultural, industrial, and mining sectors contribute significantly to water pollution. Most of the industrial wastewater generated in Jamaica is from agro-based industries – breweries, coffee and sugar processing, distilleries, dairy producers and slaughterhouses. Effluent from these sources contains high concentrations of nitrates and phosphates, which can cause eutrophication when discharged into surface water bodies.[18] These industries account for the generation of over 50 million m^3 of wastewater per annum.[19]

Table - Discharges to Water from Selected Economic Activities

Emissions and Discharges to Water Sectors							
BOD	Phosphorus	Nitrogen	Suspended particles	Chlorinated organic compounds	Oil and fat	Metals	**Activity**
*	*	*	*	*			**Agriculture and Forestry**
*	*	*	*				**Fishing**
*	*	*	*		*		**Food, beverages, tobacco**
*	*	*	*				**Petroleum products**
			*				**Cement, concrete**
			*			*	**Mining and Quarrying**

In terms of mining, the bauxite/alumina industry (the largest subsector) in the early days of the industry disposed of residues, which contain caustic soda and sodium carbonate, into mined out pits. The ponding of these caustic "red mud" wastes has leached sodium

[16] PIOJ and STATIN, 2002, Jamaica Survey of Living Condition 2001.
[17] U.S. Army Corps of Engineers, 2001, op. cit.
[18] Eutrophication can be defined as the disruption of ecological processes caused by an excess of nutrients.
[19] PIOJ and STATIN, 2002, Jamaica Survey of Living Condition 2001.

into the underground water system and has contaminated ground water resources. For example, groundwater near Moneague and Nain has been contaminated by leachate from red mud ponds used to store sodium-rich waste from bauxite refining[20] However, new attempts are being made to reduce the extent of contamination of underground and surface water caused by these "mud lakes." New thickened mud and dry stacking disposal systems have led to reductions of sodium leaching to the water table and there has been improvements in water quality around the bauxite/alumina plants

Watershed Degradation

Watershed conditions affect both the quantity and quality of underground and surface water sources in Jamaica. Deforestation and increased turbidity of streams are a major cause and indicator of watershed degradation. Deforestation originates from four major actions: improper infrastructure development; charcoal burning; bauxite mining; and, unsustainable agricultural practices. Natural forests are usually located within the upper reaches of watersheds, therefore, loss of forest cover has had severe impacts on low-lying areas resulting in an increase in sedimentation, rapid runoff, flooding and altering of river courses. The rapid runoff reduces the infiltration into the aquifers leading to a reduction in recharge and available water resources. Forest cover loss can also lead to reduced dry season flow of many rivers, as is evident in some parishes in Jamaica.[21]

In recent years, deforestation has led to the deterioration of more than a third of Jamaica's watersheds, significantly affecting the ability to supply reliable and high quality water to some towns across the island..

There is significant degradation of forests and watersheds in mining areas in the parishes of Trelawny and St. Ann on the island's north coast and St. Elizabeth, Manchester, Clarendon, and St. Catherine on the south coast.

Freshwater Management

Freshwater management has four aspects:

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[20] ibid.

[21] STATIN and NEPA. Jamaica's Environment 2001.

- Water Conservation – activities geared towards reducing water demand and wastewater generation;
- Pollution Prevention and Control – including the proper treatment and disposal of potential water contaminants, regulating discharge of pollutants through the issuance of permits, setting standards, etc.;
- Integrated Watershed Management – protection of water resources by preventing deforestation, soil erosion, etc; and,
- Sustainable Abstraction – ensuring that production and agricultural practices are sustainable.

Water Conservation

Due to the constantly increasing levels of water consumption and the requisite generation of wastewater, for which wastewater treatment systems cannot be developed at a pace consistent with its production, it is necessary to put in place water conservation measures to complement the development and strengthening of present water management practices. Water conservation can positively affect the economy, the environment, and the society as a whole, including:

- Reduced water demand – generally faster, cheaper, and easier than supply-side programmes;
- Water and wastewater treatment savings – reduces cost and defers plant expansion and new source development costs;
- Less environmental impact – due to less surface and subsurface withdrawals; and,
- Sustained water quality – reduces groundwater contaminant intrusion and curtails demand for new supplies that are of lower quality.

Pollution Prevention and Control

Pollution may make water unsuitable for human consumption, recreation, agriculture, and industry and it may eventually diminish the aesthetic quality of lakes and rivers. Contaminated water can destroy aquatic life and threaten human health. The contamination of water resources may also affect economic activity by increasing the cost of treating water and reducing the quality and quantity of water available for domestic, agricultural and industrial use. By preventing and controlling water pollution, we can ensure that we have clean water available to adequately support economic and social activities of present and future generations, and sustain the natural environment.

Watershed Management

Watershed management is an iterative process of integrated decision-making regarding sustainable uses and modifications of lands and waters within a watershed. It

encompasses the entire watershed system, and focuses on the processing of energy and materials. Integrated watershed management must also address the sources of pollution affecting the watershed and the practices within the watershed, such as farming, housing, fertilizer and pesticide use, as well as all of the other stressors that adversely affect water quality. While water conservation and pollution prevention and control may be done independent of a watershed management plan, any integrated system of watershed management must include these aspects.

Freshwater Management – Economic Issues

The availability of freshwater is a prerequisite for most socioeconomic development, including agriculture, industry, infrastructure, aquaculture, and power generation. The quality and quantity of freshwater available to a country affects the economy by affecting water supply and treatment costs, public healthcare costs, and the viability of those economic activities dependent upon freshwater, such as agriculture, food and beverage processing, and tourism.

Commercial Uses of Freshwater

The availability of freshwater is a prerequisite for economic development and is necessary for agriculture and industry – including food and beverage processing and power generation. Water scarcity and pollution would adversely affect production and productivity in all sectors of the Jamaican economy. Three major industries that stand to lose heavily if water supplies become scarce or polluted are bauxite/alumina, agriculture and tourism. The health industry also has to incur major costs as a result of treating illness due to water pollution.

Importance to Industry

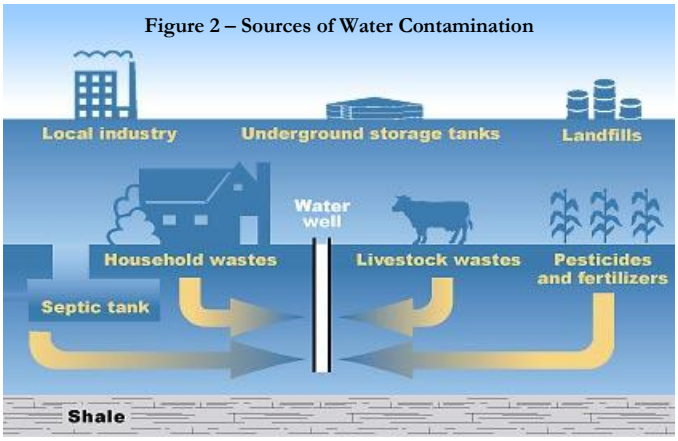
Industry, a category that includes energy production, uses approximately 21 percent of the world's freshwater for cooling, processing, cleaning, and removing industrial wastes. Industries are inevitably affected by any decrease in water quality. This is manifested in a change in productivity or output of activities that use environmental resources, resulting from a change in environmental conditions or quality. Water scarcity and water pollution would, therefore, adversely affect production and productivity in these industrial sectors.

Economic growth in territories such as China, India, and Indonesia is constrained by the prevailing water conditions. For example, the impact of China's dual problem of water scarcity and water pollution exacts a costly toll on productivity. Water shortages in China's cities cause a loss of an estimated US$11.2 billion in industrial output each year.[22] Productivity losses of this magnitude can stifle an economy, and cost the society more than implementing pollution prevention and water conservation measures.

Importance to Agriculture

Agriculture is the single largest user of freshwater resources in the world (see Figure below). Globally, some 70 percent of all water resources are used for agriculture, and the bulk of global food production depends on water. [23] However, over the next 30 years, water for agriculture will come under increasing pressure from the highly profitable household and industrial sectors, which will increase their share in water use.[24]

Figure 2 – Sources of Water Contamination



The value of world agricultural trade, including fishery and forestry products, has more than doubled since 1980, reaching close to US$661 billion in 1995-99. The share of farm products in merchandise trade has fallen over time and currently stands at about 12 percent at the world level. However, this average conceals the much greater dependence on agricultural trade of many individual developing countries, both as exporters and as importers. Given the important role of agriculture and trade in agricultural products for many developing countries, proper management of freshwater resources is essential to ensure the sustainability of agriculture, and thus the sustainability of many developing economies.[25]

[22] World Resources Institute, " China's Health and the Environment: Water Scarcity, Water Pollution, and Health," <http://www.wri.org>
[23] The Right to Water, 2003.
[24] "Water: Source of Food Security (WSFS): Enhancing Productivity of Water in Agriculture."
[25] FAO, 2002, "The State of Food and Agriculture 2002," <http://www.fao.org>

In 2006, the Agriculture, Forestry, and Fishing sector of the economy accounted for 33 percent of Jamaica's GDP.[26] Agricultural use currently accounts for 75 percent of the freshwater used in Jamaica, and is set to increase its use to 79 percent of the total by 2015. Any decrease in the quality and quantity of water available for this sector would have serious adverse effects on the Jamaican economy. It is ironic that agriculture has been a major culprit in the reduction of quality and quantity of the resource upon which it is so dependent.

Fisheries

Both aquaculture and freshwater fisheries depend on a steady supply of high quality freshwater to make them viable. These activities can only be sustained if there is an adequate supply of clean water. Commercial fish farming in Jamaica has grown significantly, producing more than 25,000 metric tonnes in 1997, three times the amount landed from the sea. Aquaculture can only continue to increase if there is access to clean freshwater.

At the same time, it has the potential to be a major pollutant of this essential commodity. Aquaculture is on the increase and has grown significantly since it begun in Jamaica in 1976. It is a major consumer of freshwater. Nutrient rich effluent from aquaculture facilities increases the potential for surface water pollution and eutrophication. However wise use of the discharges from aquaculture ponds, such as for irrigation, can be beneficial to agriculture by reducing the demand for freshwater and fertilizers.

Tourism

Many Caribbean islands are highly dependent on the tourism industry, which requires reliable supplies of water for a number of purposes, such as golf courses, which absorb considerable amounts. In Jamaica, the Hotels, Restaurants, and Clubs sub-sector accounted for 11 percent of GDP in 2000. Many tourists are attracted to countries where there is access to clean water for drinking and recreational/aesthetic purposes.

In addition, cruise ships may also favour ports where they have access to clean water. In port cities and embarkation points throughout the Caribbean, there is a competition for

[26] PIOJ, 2006, Economic and Social Survey Jamaica.

access to water resources. Cruise ships must use a large quantity of fresh water to process wastes. The amount and availability of drinking water and water used in a sanitary procedure to dispose of human waste could be a literal "drain" for some Caribbean nations, especially those with more arid climates that are subject to periods of water scarcity.

According to NWC, most cruise lines and cargo ships travelling the region only take water in Jamaica because of the high quality standard. Letters of commendation on the quality and availability of freshwater has been sent to the NWC by the shipping By virtue of the quality and quantity of water that Jamaica possesses, we are in a better position than many of our Caribbean counterparts to supply cruise ships with water. However, it is only by keeping both the quality and quantity high that the cruise ship industry in Jamaica can continue to compete successfully.

Healthcare Industry

The lack of adequate water and sanitation services has led to health problems in several parts of the island, especially in the rural areas where water is sometimes drawn directly from rivers and streams. Even worse, when these streams are the recipients of sewage and other pollutants, the probability of the spread of disease is increased. Over twenty-five thousand cases of gastroenteritis were reported in 2000, up from 16,369 cases in 1998. There were also 289 cases of food-borne illness, up from 12 in the previous year.[27]

In St. Catherine, public health authorities have declared the Rio Cobre a health hazard. Diseases such as gastroenteritis are on the increase in the parish because of the pollution of the river. A growing number of people who live in the vicinity of the Rio Cobre are being treated at health centres in the parish after drinking river water without boiling it first. According to the Chief Public Health Inspector for the parish, Samuel Cameron, the river is the only source of water for many residents.[28]

These water-related illnesses are costly to the Government as they are a burden on the public healthcare sector. Jamaica currently spends roughly 3 percent of GDP on public

[27] PIOJ and STATIN, 2002, Jamaica Survey of Living Condition 2001.
[28] Jamaica Observer [online], 2001, "Rio Cobre Health Hazard," <http://www.jamaica-gleaner.com>

healthcare.[29] The incidence of these preventable illnesses can be minimized by providing clean water and proper sanitation to the population, which would decrease the amount of money spent in this area of the healthcare budget.

Water Supply and Treatment Costs

In many countries around the world, people get their water from water treatment facilities, which are usually served by one or more sources. Due to a multiplicity of factors, these sources may be at risk of contamination.

Water contamination occurs when products such as gasoline, oil, sewage, animal waste, and chemicals get into the water and may cause it to become unsafe and unfit for human use. Water pollution originates from both point and non-point sources. Some of the major sources of these contaminants are storage tanks, septic systems, hazardous waste sites, and landfills (see Figure below).

If the water sources are contaminated, then the cost of treating that water to make it safe for human consumption escalates. In São Paulo, the Bilings and Guarapiranga reservoirs, which account for 21 percent of the water in the metropolitan region of Brazil's largest city, are becoming more and more polluted. As a result, the cost of water treatment chemicals rocketed from US$11.7 million in 1998 to US$20.5 million in 2002.[30] While water production increased by 8 percent in the four years, the volume of chemicals used in the water treatment process increased 40 percent, hitting 170,000 tonnes per year – the equivalent of 17,000 truckloads – just to make it safe to drink.[31]

There are several other costs associated with the supply and treatment of water. The more apparent costs relate to accessing, treating (purification), and pumping water, including source development and energy costs.

While enough water exists on the island to meet Jamaica's demands, the country's water resources are not necessarily located close to the major centres of water use. Currently,

[29] PIOJ and STATIN, 2002, Jamaica Survey of Living Condition 2001.
[30] Galvão, Luís Eduardo, 2003, "A Water Pollution Crisis in the Americas," in Habitat Debate, vol. 9, no. 3, 10.
[31] ibid.

the NWC pays between $270-$320 million a month to Jamaica Public Service Company (JPSCo.) in energy for the pumping and treatment of water. However, as water sources become more polluted and less accessible, the NWC will have to incur higher costs for pumping and treatment. These costs can only be avoided by implementing freshwater management programmes that deal with water conservation, pollution prevention and control, and watershed management.

Energy Costs

Pumping and transporting water from its source and treating water for use often require significant amounts of energy. It is estimated that 2-3 percent of the world's energy is used to pump and treat water for consumption. In developing countries, the cost of energy to supply water may easily consume half a municipality's total budget.[32] By conserving water, less energy would be consumed in its treatment and distribution.

In addition, the burning of fossil fuel to generate the energy used to supply water contributes to global climate change. Global climate change has the potential to reduce recharge to aquifers, reduce river flows and disrupt water supplies in many areas, making water even more costly and energy intensive to obtain in the future. This is another compelling reason for us to conserve on our use of water.

Water Purification and Wastewater Treatment Costs

Wetlands help maintain and improve the water quality of streams, rivers, lakes, and estuaries. As runoff and surface water pass through, wetlands remove or transform pollutants through physical, chemical, and biological processes. The pollution and destruction of these wetlands means that their water purification and wastewater treatment functions are affected and may not be available in the future. Replacing these services would prove to be very expensive. For example, the Congareee Bottomland Hardwood Swamp in South Carolina removes a quantity of pollutants from water sources equivalent to that which would be removed by a US$5 million water treatment plant.

In another case, scientists estimate that a 2,500-acre wetland in Georgia saves US$1 million in water pollution control costs annually. Thus, by maintaining the integrity of

[32] "Water: Exploring and Developing the Relationship Between Water and Energy Efficiency,"< www.ase.org>

these wetland areas, we can decrease the amount of money spent on water purification and wastewater treatment.

The cost of providing safe water affects productivity, and water shortages constrain economic activity. Degradation of water quality and water sources has direct economic costs, one of which is that households must spend time and energy to boil water for drinking or retrieve water from distant standpipes. In Jakarta, more than US$50 million is spent annual to boil water – an amount equal to 1 percent of the city's GDP.

Pollution Costs

In addition to increased water purification and energy costs, water pollution may make some water sources unsuitable for human use to the extent that new sources have to be developed, including expensive desalination technologies. Additionally, pollution may impose costs on a society by way of increased healthcare expenditures resulting from increased waterborne illnesses.

Funding for New/Alternative Sources

As the most productive aquifers and surface sources become polluted or are overexploited, new sources of water will have to be found. These sources are likely to be less accessible and less desirable, making water more costly to access and treat. A World Bank report states that, "Anecdotal evidence suggests that deep wells [drilled] around Beijing now have to reach 1,000 metres (more than half a mile) to tap fresh water, adding dramatically to the cost of supply."33 Water conservation is a viable alternative to developing new water supplies and expanding treatment facilities, and often a far less expensive one.

Many water scarce nations have had to turn to desalination as a means of supplementing their supplies of freshwater. The single greatest impact of this alternative is the energy required for desalination. The cost of this energy, plus the cost of the desalination infrastructure, makes desalination very expensive. For example, in 1994, a Southern California water district, using local groundwater spent about US$78 an acre-foot.

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[33] Brown, Lester R., 2001, "Worsening Water Shortages Threaten China's Food Security," <http://www.earth-policy.org>

Desalinated seawater cost from US$1,200 to US$2,000 an acre-foot. In addition, a 2 million gallons-per-day facility was estimated to cost US$50-US$70 million to construct.

Over a decade, the price of desalinated water has fallen by more than 100 percent, to between US$700 and US$1,100 making it much more affordable. And as desalination technologies become more efficient and cost effective, it may become an option for even more nations. However, freshwater from ground and surface sources will continue to be the least expensive option.

On many Caribbean islands, desalinated water has become the main source of drinking water. However, the expansion of this technology remains limited due to the high energy costs involved. In Barbados, the St Michael plant contributes around 20 percent of the country's total water supply. This new plant has a capacity of about 30,000 cubic metres per day, apparently making it one of the biggest desalination plants of its kind in the world. The plant itself cost an estimated US$15 million, and a further US$5.5 million was needed to connect it with the rest of the island's water supply system.

Costs vary from island to island and depend on the location, plant size, and type of water being desalinated (seawater being the most expensive). Other major costs, apart from the high initial capital investment, include energy, replacement parts, treatment materials and skilled labour to operate the plants. In the Bahamas, production cost ranges between US$4.60 per cubic metre and US$5.10 per cubic metre. In The Netherlands Antilles, production costs are roughly US$4.31 per cubic metre.

Given its high cost, desalination should only be considered an option by countries that have historically been plagued with water shortages. Nations that currently have little or no problem obtaining water from freshwater sources will not have to incur the costs of infrastructure and energy if they ensure that their water management practices are sustainable.

New Source Development Costs in Jamaica

With the projected increase in water demand, required new water to the year 2015 is estimated at 790 million m^3 per year. Related expenditure to expand water supply is

estimated at US$2.2 billion: the non-agricultural sector is estimated to require US$1.3 billion; the agricultural sector US$0.3 billion; and sewage systems US$0.6 billion. To avoid incurring these costs, a programme of water conservation needs to be launched throughout the entire island.

New sources have also had to be developed as sources are abandoned due to pollution, saline intrusion, and watershed degradation. In addition to the estimated 104.3 million m^3 of underground water has been abandoned in the past 40 years, 40 percent of groundwater sources are currently at risk of contamination. In the Kingston Metropolitan Area (KMA), over 60 percent of available groundwater is contaminated by high nitrate concentrations. If these trends continue, more of our currently available water sources will be unavailable in the future, meaning additional costs must be incurred for the development of new sources.

Ferry Desalination Plant[34]

NWC is looking at converting brackish, salty river water to potable supply for the Kingston Metropolitan Area, under a multi-million dollar plan for a desalination plant. The short-term plan involves adding an initial 5 imperial million gallons more of daily supply to the 11-12 imgd that is now fed to the KMA from the Rio Cobre and its supporting systems. The virgin supply will be tapped at Ferry Spring, a source that before now had been discounted because of the high salt content. (The Ferry Spring was used by the NWC in the past through mixing with fresher NWC water at Ferry station and pumped into Kingston.)

The desalination programme represents new ground for NWC, even though some private sector entities, one of the first being Beaches Negril, have installed small plants for private use. If it works, it would ease the yearly water shortages, and lock-offs faced by the capital. It is also contemplated as a source of new water for housing schemes coming up in St. Catherine.

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[34] Clarke, Lavern D., 2001, Jamaica Gleaner [online], "Breaking the Back of Kingston's Water Shortage," <http://www.jamaica-gleaner.coml>

Public Healthcare Costs

In many developing countries, water scarcity has been exacerbated and human health gravely damaged by accelerating contamination of usable water supplies, especially in rapidly urbanizing areas. The most serious immediate challenge is the fact that more than 1 billion people lack access to safe drinking water. In many developing countries, rivers downstream from large cities are little cleaner than open sewers. The health impact is devastating. Unsafe water and poor sanitation cause an estimated 80 percent of all diseases in the developing world. No single measure would do more to reduce disease and save lives in the developing world than bringing safe water and adequate sanitation to all.

Countries spend anywhere between 0.2 percent (Myanmar) and 9.5 percent (Croatia) of their GDP on public healthcare.[35] Given that many waterborne illnesses can be easily avoided if clean water and proper sanitation services are available, nations could save on public healthcare expenditure, funds which could be channeled in other functions. And the cost of public healthcare is only a fraction of the total cost to a nation. Other direct and indirect costs include the cost of private treatment, the loss of workdays – leading to productivity losses – and the loss of life due to water-related diseases.

Benefits of Water Conservation

The treatment and distribution of water is costly, therefore wise water use is good business. Even when pursued on an individual basis, water conservation can add up to major savings in water, energy, and money. For the average household, reductions in water use as high as 40 percent or more are feasible. In addition, by reducing water intake, we reduce wastewater pre- and post-treatment expenses that can be many times the water's original cost. The American government, for example, spends as much as US $1 billion per year on water and sewage costs. However, almost US$40 million of that amount could be saved every year, simply by using more water-conserving products and practices.[36]

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[35] Demographic, Economic, and Social Indicators, <Demographic, Social and Economic Indicators.pdf>

[36] "Federal Energy Management Programme: Using Effective Water Conservation Measures can Save Millions of Taxpayer Dollars," <http://www.eere.energy.gov>

Water conservation will also result in municipal water plants reducing the amount of water they have to pump to homes and businesses and on the amount of wastewater that has to be treated at sewage treatment plants. Water conservation can therefore extend the useful life of municipal water supply and treatment plants, and will benefit the operating efficiency and life expectancy of sewage disposal systems. The importance of water conservation should therefore be an integral part of the management of freshwater resources and needs to be given prominence in freshwater resources planning.

Costs of Overexploitation of Water Resources

Water is a renewable resource. However, these resources will not be available indefinitely if they are not used sustainably. Water, too, can be "mined," and there are costs attendant to its overexploitation, as are outlined below.

Over-extraction of Groundwater

Groundwater is said to be "mined" when water is removed from an underground reservoir at a rate faster than it is naturally being replenished. Groundwater mining is a significant problem because it causes the decline of water tables as well as saltwater intrusion, which result in land subsidence and desertification.

When use exceeds natural recharge over a long period, groundwater levels drop. Parts of India, China, West Asia, the former Soviet Union, the western United States, and the Arabian Peninsula are experiencing declining water tables, limiting the amount of water that can be used and raising the costs of pumping to farmers (Postel 1997, UNEP 1999).

Over-pumping of groundwater can also lead to saltwater intrusion in coastal areas. In Madras, India, for example, saltwater intrusion has moved 10 km inland, contaminating wells (UNEP 1996). Over-extraction of groundwater is most acute in the Near East, where it is leading to saltwater intrusions that ultimately make the water unsuitable for crop production. But it is also a problem in large areas of South Asia, where food security is heavily dependent on irrigation. Over-pumping in these areas is causing water levels to

fall beyond the reach of shallow tube wells[37] with the risk that irrigation may eventually become too expensive or physically impractical.[38]

In Arizona, USA, land subsidence due to groundwater over-pumping is a serious problem because the water supporting the land is being mined. Land subsidence in Arizona has resulted in more than 75 cracks in the earth, and some fissures have been measured to as much as 25 ft wide and 60 ft deep. The picture to the right shows a crack in the earth in Arizona caused by the overdraft of groundwater. This crack is at least 50 feet deep.[39]

The mining of groundwater will eventually result in the abandonment of irrigated cropland when the water runs out, resulting in desertification. Abandoned fields lack any natural ground cover, and soil erosion on abandoned fields is a very common problem. Saline intrusion may also cause desertification when salinity becomes high enough. David Sheridan in his book Desertification of the United States calls soil salinization one of the "deadliest" forms of desertification. The United States Bureau of Reclamation estimates that salinity caused US$91 million in total damages in 1983 and predicts a US$267 million annual loss by 2010.[40]

The Cost of Diversion/Damming

Water, the most highly demanded resource on earth, is unequally distributed around the globe, both among and within countries. Water is often diverted from one are where it is in abundant supply to other areas where supply is inadequate (or nonexistent). One of the major reasons dams and reservoirs are built is to facilitate the diversion of water for irrigation.

However, water diversion and damming projects often fail to value fully other watershed services. For example, an intact Nigerian floodplain supports tens of thousands of people through fishing, agriculture, fuelwood and fodder production, livestock, and tourism, and recharges groundwater supplies. When the floodplain's current uses were compared with

[37] A tube well is a well made by driving a tube into the earth to a water-bearing level.
[38] "Pressures on the Environment from Agriculture,"< http://www.fao.org>
[39] "The Impacts of Irrigated Agriculture in the Southwestern United States," <http://www.earlham.edu>
[40] ibid.

the alternative of a water diversion plan, the value of water maintained in the floodplain for those existing uses was worth US$45 per 1,000 cubic metres while the value of diverted water for increasing crop output was only US$0.04. As this example clearly shows, the value of an intact watershed can greatly outweigh the value of any water diversion scheme.

Unfortunately, oftentimes the value of an intact watershed or a water body is not fully appreciated until that value is lost. The withdrawal or diversion of water from surface and ground water sources for agriculture, industry, and municipal use has costs, which are usually borne by other industries, in particular fisheries. The amount of freshwater withdrawn has risen 35-fold in the past 300 years; over half of that increase has occurred since 1950. In many areas, groundwater is now withdrawn far faster than it can be recharged – mining what was once a renewable resource.

Central Asia's Aral Sea is one of the most graphic examples of excess diversion of inland waters. Since 1960, this massive lake (once the fourth largest) has lost three-fourths of its volume. Today, 94 percent of the river flow that once fed the Aral Sea is diverted to irrigate thirsty crops such as cotton in this arid region. The sea's salinity levels have tripled and 20 of its 24 fish species have disappeared. The fish catch, which once measured 44,000 tons and supported 60,000 jobs, is now nonexistent. By reducing our water use in all sectors, we can reduce the need to divert water from its original uses, preserving plant and animal life, as well as livelihoods. Water management must involve sustainable practices for distributing water among different sources.

Urban Drainage

In urban areas, the high proportion of land space covered with hard nonabsorbent materials such as asphalt and concrete means that rain water cannot soak into the ground. The runoff from these areas increase as the area of pavement increases leading to flooding and overtopping of natural drainage systems. Special systems are needed to collect, channel and dispose of rainwater in urban areas. This is referred to as urban drainage.

Up to now in Jamaica responsibility for provision of urban drainage has been shared in a fairly ill-defined way between the Ministry of Works and Parish Councils. It has been treated largely as

an adjunct to road construction. The Water Resources Authority is seeking to take responsibility for the regulation of floodwater control while the NWA will retain the implementation of works associated with drainage. The Ministry of Works is involved in planning to ensure that drainage is sufficient to prevent flooding, and taking remedial action when flooding occurs.

The Government is aware of a number of problems and missed opportunities in the area of urban drainage. Institutional responsibilities are poorly defined, and co-ordination between institutions is often less than optimal. Provision for drainage, and maintenance of drainage systems, is often inadequate. This results in deterioration of road surfaces and flooding in some cases. The impact of drainage on the quality of the receiving waters is often over-looked, while at the same time opportunities to re-use drainage water, for example for aquifer recharge, are seldom considered.

Chapter 3: SWOT Analysis of the Water Sector

SWOT Analysis

STRENGTHS

Adequate and surplus water resources

Good quality water (WHO standard)

High access to potable water (>71%)

Recognition of the link between sanitation and water supply

Sector Policy and Framework focusing on all aspects of water (WRMP/NIDP/RWMP/WSP)

WEAKNESSES

Poorly maintained parish council water systems

Fragmentation of water supplies especially for the rural population

Lack of adequate funding

Lack of understanding of the pivotal role of water in planning and development

Lack of strong leadership in the coordination of the work of the sector

Lack of coordination of water and sanitation programmes, human settlements development and urban and regional planning

Poor enforcement of regulatory framework

Attrition of professional staff

Aged Infrastructure and high non revenue water

High inefficiencies in transmission and use

OPPORTUNITIES

A water policy exists which needs to be updated, improved and expanded

Stated commitment to local government reform can rationalize water supplies

International funding to deal with adaptation to climate change for water resources and water supplies

High Global attention to water and sanitation

New modalities for rural water management involving communities

Inclusion of IWRM in national development plansIncreased PSP in water and sanitation services

Increased conservation of water (reuse, recycle)

Implement demand management

THREATS

Deforestation and increased runoff/erosion

Climate Change - impacts on natural hazards (flood, drought, hurricanes) and coastal aquifers

Informal Settlements and poor waste practices

Safety/Social Pressures

Old infrastructure and impact on water quality

Expanding urbanization into upper watershed areas

Poor agricultural practices and contamination of water

Rising energy costs

Chapter 4:

Strategic Vision and Planning Framework for Water Sector

Vision Statement

Integrated and sustainable water resources management and development; adequate and safe water supply and sanitation to support the social and economic development of Jamaica.

To ensure the provision of adequate and safe water supply and sanitation services, Vision 2030 Jamaica will strengthen the nation's infrastructure for storage, treatment, distribution and disposal of water. This will be achieved through a range of strategies including strengthening national capacities to make decisions among competing demands for the allocation of limited water resources; increasing financing for infrastructural development; and the creation of an institutional framework to allow for efficient and effective water resources management.

Strengthening the country's infrastructure is particularly important as new water required by the country by the year 2015 has been estimated at 790 million cubic metres per year by the Water Resources Authority (WRA), with 172 million cubic metres for non-agricultural purposes and 618 million cubic metres for agricultural purposes.

Based on these estimates, Jamaica will be using more than 41 per cent of its reliable safe yield of freshwater by 2015, and the water supply system would have to almost double its delivery between 2003 and 2015. Currently, reliable and safe yields168 of freshwater in Jamaica are estimated at 4,085 million cubic metres per year, with groundwater accounting for 84 per cent and surface water 16 per cent. Present production from both ground and 6surface water resources totals 920 million cubic metres per year – 22.5 per cent of the current reliable safe yield.

This leaves a balance of 3,165 million cubic metres per year (over 77% of the total) available for development. Under Vision 2030 Jamaica, water, sanitation and hygiene will be linked to support human health, protect ecosystems and reduce poverty. We will provide stronger coordination between the planning and development of water supply, sanitation services and human settlements.

Goals and Outcomes

Adequate and safe water supply and sanitation to support the social and economic development of Jamaica

- All water and sanitation needs are met using modalities that are safe and sustainable
- Capabilities to address hazards and climate change improved
- Stakeholders participate in the planning and managing of the development and use of the island's water resources
- Capacity enhanced to effectively plan and manage the development and use of the island's water resources
- The financial base for future water and sanitation needs strengthened

Sector Indicators and Targets

Table : Water Sector – Indicators and Targets

Sector Indicators	Baseline	Targets			Comments
	2007 or Most Current	2012	2015	2030	
1 2 3 4					

Chapter 5: Implementation Framework and Action Plan

Implementation Framework and Action Plan

for the

Water Sector

Implementation Framework

The implementation of the Water Sector Plan is an essential component of the implementation, monitoring and evaluation framework for the Vision 2030 Jamaica – National Development Plan. The Plan is implemented at the sectoral level by ministries, departments and agencies (MDAs) of Government as well as non-state stakeholders including the private sector, NGOs and CBOs. The involvement of stakeholders is fundamental to the successful implementation of the National Development Plan and Water Sector Plan.

Accountability for Implementation and Coordination

The Cabinet, as the principal body with responsibility for policy and the direction of the Government, has ultimate responsibility for implementation of the National Development Plan. Each ministry and agency will be accountable for implementing the National Development Plan (NDP) through various policies, programmes and interventions that are aligned with the strategies and actions of the NDP and the sector plans. A robust results-based

Components of Vision 2030 Jamaica: National Development Plan

The Vision 2030 Jamaica National Development Plan has three (3) components:

1. **Integrated National Development Plan:**

The integrated National Development Plan presents the overall plan for Vision 2030 Jamaica, integrating all 31 sector plans into a single comprehensive plan for long-term national development. The integrated National Development Plan presents the National Vision, the four National Goals and fifteen National Outcomes, and the National Strategies required to achieve the national goals and outcomes.

2. **Medium Term Socio-Economic Policy Framework (MTF):**

The Medium Term Socio-Economic Policy Framework (MTF), is a 3-yearly plan which summarizes the national priorities and targets for the country and identifies the key actions to achieve those targets over each 3-year period from FY2009/2010 to FY2029/2030.

3. **Thirty-one (31) Sector Plans:**

At the sectoral level Vision 2030 Jamaica will be implemented through the strategic frameworks and action plans for each sector as contained in the respective sector plans. Vision 2030 Jamaica includes a total of thirty-one (31) sector plans covering the main economic, social, environmental and governance sectors relevant to national development.

monitoring and evaluation system will be established to ensure that goals and outcomes of the Plan are achieved. This system will build on existing national and sectoral monitoring and evaluation frameworks and will be highly participatory.

Resource Allocation for Implementation

Vision 2030 Jamaica places great emphasis on ensuring that resource allocation mechanisms are successfully aligned and integrated with the implementation phase of the National Development Plan and sector plans. The requirements to ensure resource allocation for implementation will include alignment of organizational plans in the public sector, private sector and civil society with the National Development Plan, MTF and sector plans; coherence between the various agency plans with the National Budget; rationalization of the prioritisation process for public sector expenditure; and increased coordination between corporate planners, project managers and financial officers across ministries and agencies.

Action Plan

The Action Plan represents the main framework for the implementation of the Water Sector Plan for Vision 2030 Jamaica. The tracking of implementation of the Water Sector Plan will take place through the Action Plan as well as the framework of sector indicators and targets.

The Action Plan contains the following elements:

i. Sector Goals
ii. Sector Outcomes
iii. Sector Strategies
iv. Sector Actions
v. Responsible Agencies
vi. Timeframe

LONG TERM ACTION PLAN
2009 – 2030

Goal # 1 - Adequate and safe water supply and sanitation to support the social and economic development of Jamaica

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
All water and sanitation needs are met using modalities that are safe and sustainable			
Implementation of IWRM in an established institutional framework anchored in the Dublin and other related principles and informed by regional and national research findings	Promulgate and implement the National Water Resources Master Plan	2009 onwards	WRA, MoWH, NIC, NWC, RWSL
	Review mandates of agencies involved in water resources management with a view to creating an institutional framework that will allow more effective coordination for efficient and effective water resources management	2010 onwards	Ministry of Water and Housing
	Establish a process for inclusion, consultation and training with stakeholders to develop IWRM plans and policies	2011 - 2014	WRA, MoWH, NIC, NWC, RWSL
	Improve timely access to and sharing of available data and research on water resources management and the dissemination & implementation of good practice guidelines for	2009	Ministry of Water and Housing, STATIN, PIOJ, WRA, Meteorology Dept

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	all water related projects		
	Establish mechanisms and guidelines for sex disagregated data collection and maintenance of database on water and waste water management (capacity, standards, regulations and monitoring) to guide planning and investment in the sector	2009 to 2015	WRA, NWC, NEPA
	Prepare a list of national projects for meeting water demands in accordance with criteria for IWRM and on the basis of impact, financial needs, feasibility, execution time and social function.	2009	WRA
Ensure that Millennium Development Goals for safe and adequate water and sanitation are met and surpassed	Establish a roadmap for achieving the targets of the MDGs to ensure vulnerable and poor communities receive adequate services through appropriate means such as social water.	2009 to 2010	PIOJ, Ministry of Water and Housing
	Implement mechanisms to utilize appropriate methods and technologies on water supply and sanitation systems and approaches for rural and poor communities and review and update standards regularly	2009 onwards	Ministry of Water and Housing, PIOJ
	Develop Rural Water Master Plan to guide expansion of domestic	2009 - 2012	Rural Water Supply ltd Ministry of Water and Housing, NGOs, CBOs.

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	water access and management.		Local Government
Ensure equitable allocation of water resources in each hydrological basin	Ensure all hydrological basin plans give due consideration to the sustainable allocation of water for environmental management. This may include the establishment of watershed management, protection and buffer zones	2009 to 2015	WRA, Ministry of Water and Housing, Local, Regional and International bodies, CBOs and NGOs
	Conduct effective water resources planning and implement sustainable water resources development taking into consideration technical, economic, social and environmental factors	2009 to 2015	WRA, Ministry of Water and Housing, Local, Regional and International bodies, CBOs and NGOs
	Review and implement guidelines for conducting water resources assessment and monitoring in each hydrological basin on a continuous basis to guide allocation	2009 to 2015	WRA, Ministry of Water and Housing, Local, Regional and International bodies, CBOs and NGOs
1.1.4 Institute efficient water use all sub-sectors-irrigation, domestic, hydropower, industry, environment and tourism	Implement measures to ensure multi-purpose use of water resources	2009-onwards	NIC, WRA, RADA, Ministry of Agriculture
	Utilize extensions services and appropriate technology to improve water efficiency in the agricultural and domestic water sub-sectors	2009-onwards	NIC, WRA, RADA, Ministry of Agriculture
	Establish appropriate guidelines and systems for key agencies to report on water management (capacity, standards, regulation	2009	OPM, MDAs,

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	conservation and monitoring)		
	Conduct EIAs as an integral part of planning for development projects to ensure environmental values and objectives are properly considered	2010 onwards	NEPA, Forestry, WRA, RADA
	Continue and increase green practices in the tourism sector	2008	TPDCo, JTB, Ministry of Tourism, JHTA
	Identify water pollution sources and vulnerability and take necessary mitigative actions	2009 onwards	NEPA, MoH, WRA.
	Review existing wastewater technologies and infrastructure and recommend strategies for improvement and reuse.	2009 to 2015	NEPA, NWC, Ministry of Water and Housing
	Apply best management practices to minimize impacts from activities such as logging, cultivation and mining	2010	NEPA, Forestry, RADA
Capabilities to address hazards and climate change improved			
Provide sufficient water for achieving food security	Identify and upgrade water supply systems to support implementation of NIDP projects to increase agricultural production	2009 to 2015	NIC, Ministry of Agriculture, WRA
	Increase investment in micro-irrigation systems and develop innovative mechanisms and give greater responsibility for the management of these systems to farmers and communities	2009 to 2015	NIC, Ministry of Agriculture, RADA

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	Design & implement community education and awareness programmes for waters resources protection and water conservation	2009 onwards	WRA, NEPA, NIC, RADA
	Improve the application of climate information and develop and implement 'drought, flood and desertification strategies' in long term hydrological basin plans	2009 onwards	ODPEM, WRA, NIC, RADA, Meteorological Dept
Increase public awareness of the advantages of rainwater harvesting and introduce measures to implement this modality.	Analyze rainfall data and identify areas where rainwater harvesting is feasible.	2009 - 2014	WRA, NEPA
	Review and amend rainwater harvesting guidelines and modify building codes .	2009 to 2010	WRA, NEPA, JBS, Cabinet Office, OPM
	Disseminate relevant information through public education programmes	2011 – 2015	WRA, NEPA, NEEC,
	Encourage households to install cisterns/tanks for rainwater harvesting through financial incentives	2009 to 2010	Government
Stakeholders participate in the planning and managing of the development and use of the island's water resources			
Using participatory approaches to desogn, manage, maintain and protect watershed areas, catchments and networks and promote effective programmes for water conservation and prevention of contamination	Establish a process for the inclusion and consultation with all stakeholders in preparation of policies and plans for water resources management within watershed areas including the establishment of management committees	2009 to 2015	NEPA, WRA, Ministry of Water and Housing, Forestry Department

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	Implement community education and awareness programmes for watershed protection and water conservation	2009 onwards	WRA, NEPA, Forestry, NIC, RADA
	Improve education and training to ensure effective community participation in sustainable water management	2009	NEPA, MIND, Ministry of Water and Housing, Local, Regional and International bodies, CBOs and NGOs
	Support community participation in appropriate water quality monitoring programmes targeted at environmental education and awareness of communities		WRA, NEPA, MoH, Rural Water Supply, SDC, JSIF, CBOs, EFJ, NGOs.
	Continue multi-stakeholders discussions and dialogues on relevant solutions for water supply		NWC, NIC, Rural Water Supply
Foster the protection of the natural resources of the basin as a means of conserving water resources	Strengthen community based institutions and resource user groups for the management of common property resources and instilling a stewardship ethic	2009 to 2015	Government
	Address land tenure systems in order to provide incentives for the sustainable management of natural resources & investments in land improvements	2009 to 2015	Government
	Adopt and implement measures that guarantee access to technology and research, in particular women, disadvantaged groups and people living	2009 to 2015	Government

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	in poverty in order to ensure sustainable use of land and water resources		
Build capacity for community management and for mainstreaming gender into water resources management	Strengthen PDCs, CBOs and NGOs to undertake participatory and community-based development processes for infrastructure management	2009 to 2015	Government
	Strengthen the capacity of CBOs and NGOs and government agencies to disseminate information on sustainable water management	2009	Ministry of Water and Housing, Local, Regional and International bodies, CBOs and NGOs
	Establish multi-level partnerships between central and local governments, NGOs, CBOs and communities in the provision of water	2009 to 2015	Government
	Support the concept of subsidiarity with regard to the delivery of infrastructure services	2009 to 2015	Government
	Develop and Implement training modules on gender in IWRM in tertiary institutions		Ministries, WRA, UNESCO, Teachers Colleges
Capacity enhanced to effectively plan and manage the development and use of the island's water resources			
Strengthen national capacities to achieve effective integrated water resources management	Review and update National Water Sector Policy and water legislation and guidelines	2009 to 2015	Ministry of Water and Housing
	Improve awareness of water resources management and supply issues among all stakeholders		

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	Define responsibilities for all stakeholder organizations in water and wastewater management to eliminate fragmented and uncoordinated plans and actions and improve linkages to other sectors		
	Enhance education and career development opportunities in the water sector with special emphasis on women and communities, including: • Scholarships for advanced training courses; • Local and regional training workshops; • Applied research and implementation projects • Technology transfer	2009-2030	Ministries, CBOs, NGOs,
	Strengthen and enhance communication and information exchange between national agencies involved in meteorology, hydrology and water supply	2009 onwards	WRA, NIC, RADA, Meteorological Dept, NWC, NEPA
	Improve regulatory oversight and sector governance	2009 onwards	Ministries involved in the water sector
	Design and use gender sensitive indicators to monitor impacts of water and sanitation policies and programmes		
	Increase sector and community capacity to implement appropriate water quality testing and associated activities	2009 onwards	WRA, Ministry of Water and Housing, Local, Regional and International bodies,

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
Develop water use/allocation policies and plans	Review existing mechanisms and identify gaps in national planning, water resource, land use planning and development with a view to	2009 to 2015	PIOJ, NEPA WRA, Ministry of Water & Housing, Parish Councils
Establish monitoring and enforcement mechanisms to protect water resources	Implement mechanisms to strengthen national capacity to undertake monitoring and protection of water resources	2009 to 2015	Ministry of Water and Housing
The financial base for future water and sanitation needs strengthened			
Ensure water and sanitation are costed and financed to promote equity, efficiency and sustainability	Mobilize finance from national and international sources		Ministry of Water and Housing, PIOJ
	Introduce acceptable water and sanitation pricing and cost recovery mechanisms		Ministry of Water and Housing,
Implement appropriate compliance measures	Improve billing and collection procedures and legislate disconnection policies	2010 – 2012	OUR, NWC
	Raise public awareness through public education, behavioural change and other appropriate measures to recognize that this is indispensable for the efficiency of services and the continued capacity for re-investment		
Introduce mechanisms towards equitable water allocation and to encourage recycling of industrial effluent and domestic wastewater	Implement demand management and water conservation measures	2009 to 2015	NWC, WRA
	Identify water pollution sources and review existing wastewater	2009 to 2015	NWC, Ministry of Water and Housing

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY
	technologies and infrastructure and recommend strategies for improvement through incentive schemes		
	Develop national guidelines on best practice approaches to managing industrial effluent and domestic wastewater that incorporate tax incentives for compliance	2009 to 2015	NWC, Ministry of Water and Housing
Review current subsidies for water services from the social standpoint establishing subsidies in the sphere of demand rather than supply and making water available to the weakest sectors of society.	Develop and implement policy for transparent, sustainable and targeted subsidies	2009	Government
	Consider Trust funds, cess and community contributions as sources of finance for community and rural water supply and establish clear framework for participation by the poor	2009	Government
Allow for increased private/public sector partnership preferably in denser populated areas and leave low density areas for government systems	Encourage partnerships or project-based joint ventures from the outsourcing of design and construction to the granting of operating concessions	2009 to 2015	Government
	Create public-private partnerships for financing infrastructure by developing strategic plans that identify funding and cost recovery requirements and benefits in terms of improved health and poverty alleviation.	2009 to 2015	Government

STRATEGIES	SPECIFIC ACTIONS	TIMEFRAME	RESPONSIBILITY