Jamaica Country Profile

General Country Information

Jamaica was originally inhabited by the Arawaks (also called Tainos) who named the island Xaymaca meaning 'Land of wood and water'. The Arawak led a peaceful and quiet life until 1494 when Christopher Columbus discovered the island. By the early 16th century the Spanish had settled on the island and exterminated the Tainos and replacing them with African slaves. In 1655 the English invaded and seized the island from the British and established a plantation economy. Slavery was abolished in 1834 and Jamaica obtained its independence in 1962.

Jamaica is the third largest island of the Caribbean, spanning an area of 10,990km² and has a population of 2.9 million people. Jamaica lies south of Cuba and West of Hispaniola. The capital of Jamaica is Kingston with native language being English. The island is made up of coastal lowlands, a limestone plateau and the Blue Mountains.

Jamaica's National Symbols

Figure 1: Map of Jamaica

Figure 2: Flag of Jamaica

Figure 3: Coat of Arms

Figure 4: National Tree- Blue Mahoe

Figure 5: National Flower - Lignum Vitae

Figure 6: National Fruit - Ackee

Figure 7: National Bird - Doctor Bird

Economy of Jamaica

According to the World Bank Jamaica is a middle-income economy who in 2013 launched a reform program to stabilize its economy, reduce debt, fuel growth, gaining national and international support. Since

its implementation public debt fell below 100 percent of GDP, employment rate grew by 8.7% and the Jamaican economy grew 2% in the fourth quarter of 2018. This growth in the economy was possible due to growth in agriculture, manufacturing, mining and quarrying activities.

The following information is as obtained from the World Bank for the 2017 period:
Currency: Jamaican Dollar
Gross Domestic Product (GDP): 14.77 billion USD
GDP per capita: 5,109.55 USD
GDP growth rate: 0.5% annual change
GNI per capita: 8,690 PPP dollars
Gross national income: 25.11 billion PPP dollars

Background to Water and Waste Management
Jamaica has developed a National Water Sector Policy which is being used to guide in the achievement of SDG 6 by 2030 as such ninety percent (90%) of the information outlined below is extracted directly from the ***Draft National Water Sector Policy and Implementation Plan 2018*** and the ***State of the Environment Report 2013***. The objectives of the National Water Sector Policy are as follows:

1. To improve institutional arrangements for integrated management
2. To protect watershed areas, ecosystems, catchments and networks, and promote effective programmes for water conservations and protections
3. To include research, adaptation and implementation of scientific and technological innovation to sustain ecosystems services of water
4. To put in place the policy, programmes and physical structures for climate adaption and energy efficiency in the water sector
5. To allow for private sector participation in the water sector
6. To facilitate and increase investments in the water sector
7. To ensure economic efficiency by considering pricing and other economic incentives
8. To effectively manage water supply in Utility and Non-Utility Service Areas by ensuring equitable sharing of the water resources in the twenty-six (26) Watershed Management Units (WMUs)
9. To increase resilience to climate shocks, such as drought
10. To encourage rainwater harvesting, both as primary source of access and as a drought management mechanism
11. To ensure effective management if wastewater
12. To provide sufficient water for achieving food security by improving irrigation services
13. To ensure effective flood waste control

Water Resources
The major rivers are as follows:

Parish	**Name of River**
St. Thomas	Plantain Garden River, Yallahs River, Morant River
St. Mary	Wag Water, Dry River, Rio Nuevo, White River
St. Ann	Roaring River, Dunns River, Llandovery River, Rio Bueno

St. Elizabeth	Black River
Trelawny	Martha Brae, Hectors River
St. James	Great River, Montego River
Westmoreland	Cabaritta River
Hanover	Great River
Clarendon	Milk River, Rio Minho
St. Catherine	Rio Cobre, Ferry River
Portland	Rio Grande, Swift River, Buff Bay River, Spanish River

- The Black River is seventy-three kilometres (73km) (44 miles) long and is one of the longest river on the island. The Black River is so called because of the river bed which is lined with thick layers of decomposing vegetation.
- The Wag Water and Hope River both supply Kingston with water
- The Milk River supplies a system of canals for the irrigation of plains of Vere in Clarendon
- The Rio Minho river is the longest river in Jamaica and flows southwest reaching the Caribbean Sea at Carlisle Bay with the town of May Pen

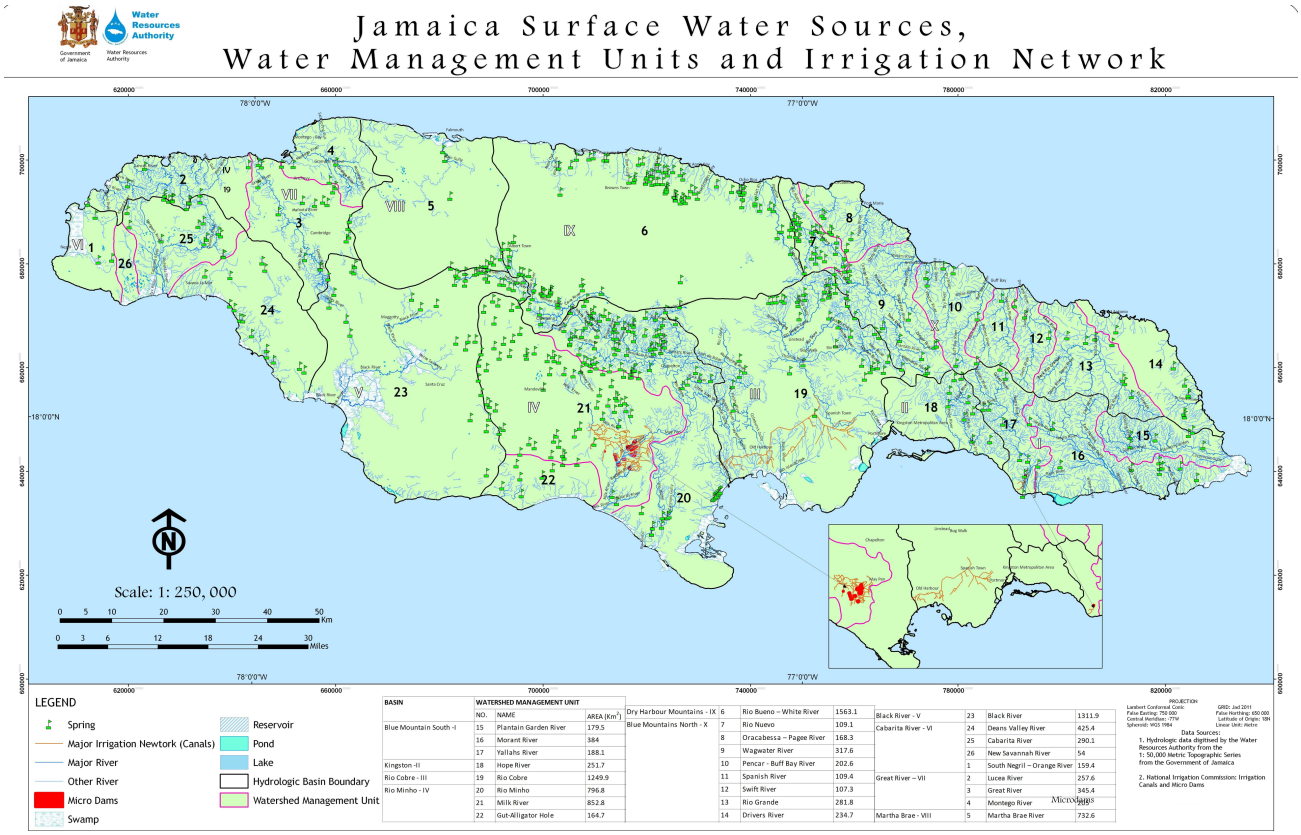


Figure 8: Jamaica Surface Water Sources

Water Quality and Quantity

According to the Water Resources Authority (WRA), average annual rainfall is reported as 21,526 Million Cubic Metres per year (MCM/y). Of this amount, 50 percent (10,703 MCM/y) is lost to evapotranspiration and the remainder or 'effective rainfall' is distributed in approximately equal proportions (25 percent each) as surface water (5,351 MCM/y) and groundwater (5,472 MCM/y). The limestone aquifer captures 97 percent (5,330 MCM/y) of the groundwater and alluvial aquifers three (3) percent (142 MCM/y). The limestone and alluvium aquifers provide eighty-four percent (84%) of Jamaica's freshwater resources, while the remaining 16 percent is provided by surface water. Approximately twenty-five percent (25%) of the water abstracted is used to meet the demand for potable water and the remaining seventy-five percent (75%) is used for irrigation. The water usage is reported as 1512 MCM/y.

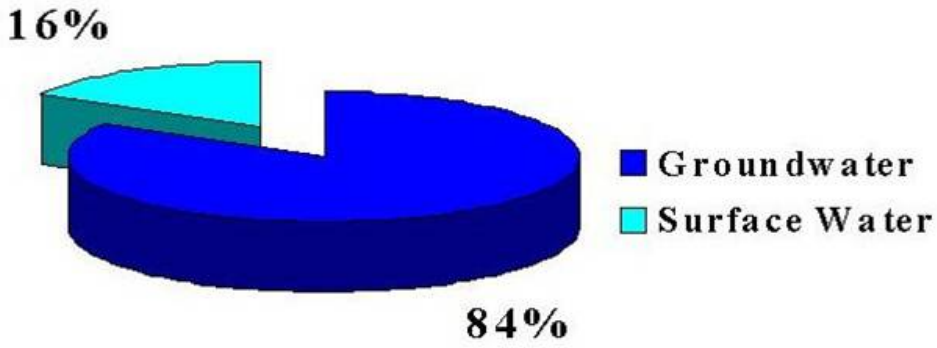


Figure 9: Groundwater to Surface Water Ratio

The exploitable water resource is estimated at 3930 MCM/y or six (6) percent of the effective rainfall. It is twice the current total demand of 1813 MCM/y (*which includes environmental demands*), hence is more than adequate to meet all demands.

In 2010, the volume of water resources allocated for industrial and domestic use amounted to 1203.0 MCM and the demand was 910.2 MCM, implying that there is an over-allocation of 292.8 MCM. Of note, is that a portion of the surface water is not exploitable, as flows of 902.6 MCM/y should be left in the rivers to meet ecological demands. Therefore, the proportion of total exploitable water resources that represented consumption (*i.e. demand*) in 2010 was 23.2 percent (NEPA, 2011).

Institutional and regulatory framework

The Institutions responsible for water in Jamaica and their respective responsibilities as extracted from the Draft National Water Sector Policy and Implementation Plan 2018, are as follows:

Agency & Regulators	Responsibility	Website
Water Resources Authority	Regulate abstraction of groundwater, use of surface water, and coordinate integrated water resources management. The WRA will also lead	http://www.wra.gov.jm)

	the establishment of IWRM Committees in each hydrological basin, along with the NEPA.	
National Water Commission	Provide piped water supply in all areas where it is economical to do so, and provide piped sewerage services in all major towns	https://www.nwcjamaica.com
Ministry of Health	Set and monitor standards for potable water supply, sanitation facilities and recreational bathing waters.	https://www.moh.gov.jm/environmental-health/
National Environment and Planning Agency	Responsibility for conservation, protection and proper use of land, water and other resources, and sets standards for treating and discharging effluent, along with the Ministry of Health.	http://nepa.gov.jm/index.php
National Irrigation Commission (NIC)	Provide irrigation services	http://www.nicjamaica.com
Ministry of Economic Growth and Job Creation	Implement the Policy nationwide by coordinating Agencies' efforts. The Ministry with portfolio responsibility for Water will also monitor and evaluate implementation efforts.	https://megjc.gov.jm
Forestry Department	Protect the forests and forest watersheds on crown lands managed by the Agency	http://www.forestry.gov.jm
Office of Disaster Preparedness & Emergency Management (ODPEM)	Provide disaster management, to include drought and major meteorological events	http://www.odpem.org.jm
Rural Water Supply Ltd. (RWSL)	Provide technical assistance to households and communities in rural areas and to build and maintain water supply and sanitation infrastructure	http://rwslja.com
National Works Agency (NWA)	Provide flood water control services around roads, settlements and agricultural lands	http://www.nwa.gov.jm
Municipal Corporations and Local Authorities	Provide water supply to the public, by operating and maintaining local systems	https://localauthorities.gov.jm
National Solid Waste Management Authority (NSWMA)	Manage solid waste island-wide	http://www.nswma.gov.jm
Private Providers	Provide water supply, sanitation, and irrigation services	
Office of Utilities Regulation	Set tariffs and regulate service standards for providers of piped water supply and sewerage systems, as well as, recommend licensees, providing policy advice and dispute resolution	https://www.our.org.jm/ourweb/

Legal Framework in the Water Sector

Currently, there is no industry specific legislation to address the changing future of the Jamaican water industry. However, the sector is governed by the following Legislations and Regulations:

- ***Parishes Water Supply Act (1889)*** - permits Municipal Corporations to supply water, but does not require them to do so. The Act also allows Municipal Corporations to enter into contracts with independent persons to supply water.
- ***Irrigation Act (1949, and amendments)*** - allows the Government of Jamaica to license an Irrigation Authority as the owner and operator of all public irrigation works. The National Irrigation Commission (NIC) is licensed as the Irrigation Authority under the Act.
- ***Flood-Water Control Act (1958)*** - gives responsibility for the construction, improvement, repair, and maintenance of works for flood water control. This responsibility is fragmented among a number of agencies.
- ***Town and Country Planning Act (1958)*** – This Act facilitates the preparation of Development Orders in urban and rural areas. The main objects are: development control; secure sanitation conditions; protect and extend amenities; and conserve and develop amenities.
- ***National Water Commission Act (1963, and amendments)*** - creates and governs the National Water Commission (NWC). The NWC is the primary provider of potable water supply and also owns and operates wastewater services.
- ***Watershed Protection Act (1963)*** – Under this Act, the NRCA is responsible for ensuring the proper, efficient and economic utilization of land in watershed areas with a view to promoting the conservation of water resources.
- ***Public Health Act (1985)*** - sets national standards for the collection and disposal of waste material and assigns the responsibility for monitoring and enforcing these standards to the MOH. The MOH is the primary regulator of drinking water quality.
- ***Natural Resources Conservation Authority Act (1991)*** – The Act binds the Crown. It provides for a system of permits and licences which assist the Natural Resources Conservation Authority to carry out its functions as set out in section 4 of the Act.
- ***Water Resources Act (1995)*** - establishes the Water Resources Authority (WRA) to regulate, allocate, conserve and manage water resources. The Act governs the abstraction and use of natural water resources.
- ***Office of Utilities Regulation Act (1995)*** - as amended by the Office of Utilities Regulation (amendment) Act (2015) - creates the Office of Utilities Regulation (OUR) and gives it permission to regulate water supply and sewerage, among other utility services. The Act empowers the OUR to issue licences and determine and monitor service charges, rates, or other fees payable by consumers for utility services.
- ***Public Bodies Management and Accountability Act (2001)*** - sets out the financial accountability and reporting standards that public bodies must meet. It also sets out processes for auditing public bodies.

The following policies and plans are inter-linked with the objectives of the National Water Sector Policy:

Vision 2030 Jamaica - National Development Plan

Vision 2030 Jamaica - National Development Plan sets out the national vision that Jamaica will be the "place of choice to live, work, raise families, and do business" by 2030. Achieving this vision includes four national goals:

- Jamaicans are empowered to meet their fullest potential;
- Jamaican society is secure, cohesive and just;
- Jamaica's economy is prosperous; and
- Jamaica has a healthy national environment.

The Plan also specifies objectives for the water sector. The Water Sector Policy will help realize all four national goals. Reliable services for all will help empower Jamaicans to meet their fullest potential, and will also bring about a more just society. Reliable services are also needed to ensure a prosperous economy. Finally, the Water Sector Policy sets out ways to conserve our natural environment and its water resources, even in the face of the global challenge of climate change.

The 2009-2030 Water Sector Plan

The 2009-2030 Water Sector Plan is part of Vision 2030. The Plan's vision is for "Integrated and sustainable water resources management and development; adequate and safe water supply and sanitation sewage to support the social and economic development of Jamaica."

The Plan outlines an updated Implementation Framework and Long-Term Action Plan for the sector to reach its vision statement. The targeted outcomes to reach this goal are outlined in the Long-Term Action Plan as:

- All water and sewage needs are met using modalities that are safe and sustainable;
- Capabilities to address hazards and climate change are 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; and
- The financial base for future water and sewage needs to be strengthened.

Two key actions identified in the Plan are to:

- Develop and implement a National Water Resources Master Plan; and
- Update the previous Water Sector Policy (2004). This is accomplished through this updated Water Sector Policy.

Medium Term Socio-Economic Policy Framework (MTF) 2015-2018

The MTF 2015-2018 is designed to support the attainment of the country's national goals and outcomes as outlined in the country's national development plans - Vision 2030 Jamaica. The four Medium Term Themes to be addressed under MTF 2015-2018 are:

- Development and Protection of Human Capital;
- National Security and Justice;
- Economic Stability, Growth and Employment; and
- Environmental Sustainability and Climate Change Response.

A range of issues and challenges still remain and need to be addressed to improve the state of the country's natural environment. Some of these include:

- Inadequate management of protected areas, other ecosystems and biodiversity;
- Conflicting socio-economic policies, that cause a negative impact on the natural environment;
- Increasing threats of climate change and climate variability;
- Insufficient integration of environment, social and economic issues at the national level;
- Increasing amounts of land based sources of pollution; and
- Insufficient environmental baseline data/information to support effective analysis and assessment of existing status and efficient management of environmental resources.

The MTF 2015-2018 therefore outlines a package of priorities designed to improve the state of the natural environment, thereby contributing to reduced vulnerabilities and advancing socio-economic development, and will focus on a number of key areas such as:

- Improving the governance structures for waste management;
- developing the frameworks to address unregulated sources of pollution;
- Increasing public awareness and education on environmental issues;
- Increasing the participation of NGOs, CBOs and school groups, and forging partnerships to advance environmental awareness;
- Improving environmental data collection including the frequency of data collection to better guide policy decisions;
- Enhancing private sector involvement in environmental management; and
- Enhancing climate resilience across economic sectors.

National Forest Policy (2016)

The National Forest Policy sets out primary goals and priorities pertaining to the conservation and protection of forests and the sustainable management of forest lands and watersheds. The Forestry Department has the responsibility to protect and preserve Forest Reserves and Forest Management Areas in the upper watersheds around water sources.

The Policy recognises the need for the Forestry Department to work in close collaboration with the relevant water sector agencies to:

- Continue to manage Forest Reserves and Forest Management Areas in upper watersheds in and around water sources across the island.
- Work with the Water Resources Authority to focus on using the best available tools to identify, map, and assess the condition of land around water sources and the banks of major rivers for reforestation potential.
- Work with the National Water Commission and other relevant agencies to prioritise rehabilitation of forests, which are degraded but important for the protection of water sources, and assess the various interventions that can be utilized to protect these areas.
- Liaise with the National Water Commission, National Environment and Planning Agency and the Water Resources Authority and other relevant agencies to share financial, management, and implementation costs for replanting of degraded watersheds which are near to and surround water sources.

Draft Watershed Policy for Jamaica (2003)

The overall goal of this Policy is to promote an integrated approach to protection, conservation and development of land and water resources for their sustainable use and for the benefit of the nation as a whole. It gives an overview of watershed problems, past interventions and highlights major challenges to be faced in watershed management, as well as key principles and strategies being employed to address these challenges.

National Land Policy (1996)

The goals and objectives of this Policy are to ensure the sustainable, productive and equitable development, use and management of the country's natural resources. The policy identifies the implementation of sustainable strategies, projects and programmes for the use of land resources in Jamaica's agenda for social and economic development.

The Policy acknowledges the important nexus between land use policies and water resource management and identifies the following among the issues affecting watersheds:

a) The need to preserve and re-afforest watersheds, in particular, the upper watersheds, to ensure recharging of aquifers and to control water flows to reduce problems, such as flooding and turbidity.
b) Severe watershed degradation.
c) The lack of a national plan to manage watersheds.
d) The lack of adequate co-ordinated efforts to manage watersheds, forests and protected areas.

Policy statements and strategies outlined are consistent with the goals and objectives of the Watershed Policy, which is currently being reviewed.

Agricultural Sector Plan (2009)

Agriculture is the major user of the island's water resources, accounting for 75 percent of annual water consumption, compared to 15 percent for urban domestic water supply, and 10 percent for other uses, including industrial use, rural domestic water supply and tourism. Additionally, approximately 25,000 hectares, or 10 percent of cultivated lands are currently irrigated. Of these irrigated lands, 50 percent is served by public irrigation systems managed by the NIC; the other half are on commercial estates, such as banana, papaya and sugarcane, as well as individual private systems.

The Sector Plan for Agriculture is one of the strategic priority areas of the Vision 2030 Jamaica – National Development Plan. The Agriculture Sector Plan seeks to transform the Jamaican agricultural sector through a sustained, research-oriented, technological, market-driven and private sector-led revolution, which revitalizes rural communities and creates strong linkages with other sectors. The plan recognizes that the widespread application of modern technology outside the traditional export agriculture has been limited. However, efficient and competitive commercial agriculture will require the systematic application of modern technology in all areas of agricultural production including crop development, disease control, irrigation, crop/land yields, security, farm management and marketing. As such, successful practices will be adapted to the Jamaican condition; for example, hydroponics and other water management systems that are not dependent on seasonal rainfall.

Climate Change Policy Framework and Action Plan (2015)

The Climate Change Policy Framework and Action Plan is intended primarily to support the goals of Vision 2030 by reducing the risks posed by climate change to all of Jamaica's sectors and development goals. It outlines the strategies that the country will employ in order to effectively respond to the impacts and challenges of climate change, through measures which are appropriate for varying scales and magnitudes of climate change impacts.

The specific objectives are to:

I. Mainstream climate change considerations into sectoral and financial planning, and build the capacity of sectors to develop and implement their own climate change adaptation and mitigation plans.
II. Support the institutions responsible for research and data collection at the national level on climate change impacts to Jamaica, to improve decision-making and prioritisation of sectoral action planning.
III. Improve communication of climate change impacts so that decision makers and the general public will be better informed.

National Energy Policy (2009)

The National Energy Policy includes goals for energy conservation and efficiency in the water sector. The Policy identifies public water supply and irrigation as two areas where energy efficiency improvements are needed. The Policy seeks to develop "a specific programme of energy management for the National Water Commission, the single largest consumer of energy in the public sector, focusing on intensification of loss reduction, improvement in pumping efficiency and the introduction of a distributed storage programme which will facilitate better management of pumping operations."

Food and Nutrition Security Policy (2013)

Food security plays a major role in the nutrition status of Jamaica's population. It requires an available and reliable food supply at all times. Therefore, the overall objectives of the Food and Nutrition Security Policy is to ensure that all persons have continued access to sufficient supplies of safe foods for a nutritionally adequate diet, so as to achieve and maintain a healthy and nutritional wellbeing.

The Policy highlights the need for special attention to be given to the adequate provision of water resources by:

- Increasing investment in water infrastructure and supply for the agricultural sector;
- Funding increased water use efficiency across irrigated agriculture;
- Developing sustainable land, water, forest and fishery management systems to address shortages and excessive rainfall, and protect the natural resource base in the face of climate change;
- Providing a holistic water management plan for water allocation in the wet and dry seasons; and
- Providing incentives for increased water harvesting on farms and in the residential sector, and for the provision of retention ponds and adequate drainage to reduce/avoid flood damage.

Draft National Housing Policy (2018)

The National Housing Policy is being developed out of the recognition that housing is inextricably linked to people's physical and emotional survival and security. The policy promotes sustainable and inclusive development of housing in Jamaica to ensure an equitable distribution of land, shelter and services at affordable prices.

As part of its policy on the construction services sector, it will seek to:

- Promote eco-housing, low energy-consuming construction and water efficient services;
- Set clear guidelines regarding regularizing land tenure; and
- Install and upgrade physical infrastructure (roads, water, electricity, drainage, and sewerage).

National Policy for Gender Equality (2011)

The Gender Policy will seek to:

- Ensure that women and girls have access to sanitation and potable water;
- Ensure that housing solutions are equitably distributed;
- Address water and sanitation issues as they impact severely on the capacity of rural women to survive on a daily basis; and
- Disaggregate data on the social sector - national statistics on the basis of urban/rural location, and to ensure that specific health and social needs of men/women (e.g. access to safe water and sanitation) identified are met.

Draft National Building Code

The National Building Code Bill will facilitate the adoption and efficient application of national building standards, to be called the National Building Code of Jamaica, for ensuring safety in the built environment, enhancing amenities and promoting sustainable development. The new National Building Code, based on the International Building Code, considers issues of water resources management, including resistance to

floods and hurricanes, and the need for adequate water supply and sewage disposal in newly constructed buildings.

Draft National Spatial Plan

The National Spatial Plan, which is currently being developed, will seek to:

- Identify priorities for the improvement of infrastructure to support long-term development that promotes more sustainable land use;
- Promote development which will help to regenerate communities and enable disadvantaged communities to access opportunities; and
- Address the major challenges of global competition, disaster risk reduction and climate change response, while protecting the environment.

Local Sustainable Development Planning Framework

Local sustainable development requires an integrated view of development in which connections between social, economic and environmental systems are taken into account. Social and economic development must work in harmony with environmental systems within which they exist, and upon which they depend. Achieving sustainable development requires a unifying multi-agency national framework in which local sustainable development can take place. The framework is designed to integrate and harmonize the goals and roles of various stakeholders at national, regional and local levels.

The following goals underline the framework for local sustainable development planning:

- Create an enabling, supportive and responsive environment for local sustainable development planning within and across national state agencies.
- Build a common vision and culture that leads to a shared commitment to the process of sustainable development at all levels.
- Institutionalize opportunities for local government, citizens, business and all other community members to participate in local sustainable development planning and the building of sustainable parishes and communities.
- Integrate local sustainable development planning within official planning processes at parish and community levels.
- Establish parish-based sustainable development frameworks to guide development interventions in parishes throughout Jamaica.

Draft National Drinking Water Quality Management Programme (2015)

The National Drinking Water Management Plan (NDWMP) is a plan that documents procedures for the provision of safe drinking water through the assessment of water supplies, operational monitoring and verification. It describes actions in both normal operation and during incidents where a loss of control of the system may occur. This plan also outlines the roles and responsibilities of stakeholders and procedures for special circumstances required to ensure safe drinking water for public consumption.

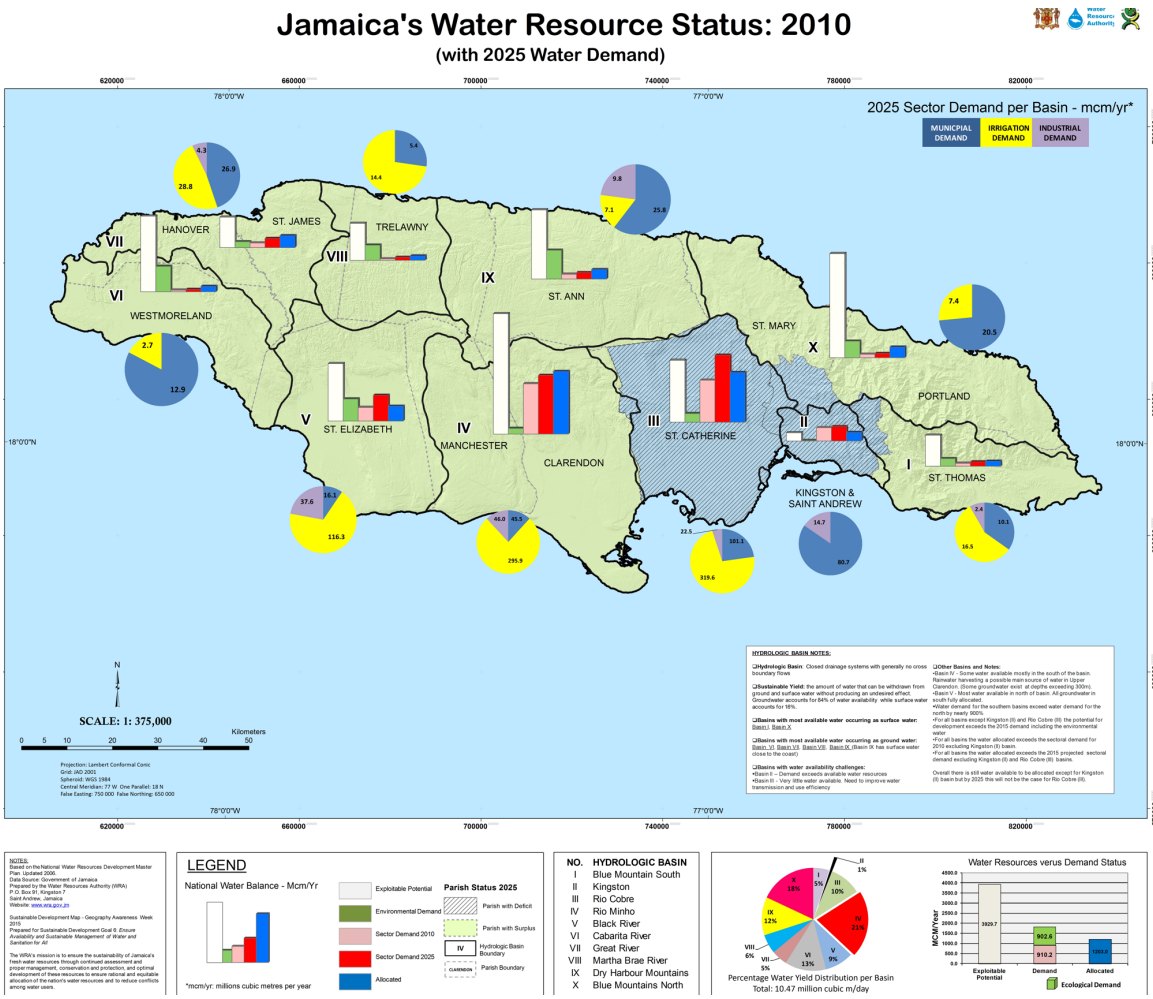


Figure 10: Jamaica Future water demand

A draft/new legislation to regulate the operation of water supply and sewerage services by public, private and civil society is available, and discussions on the document are far advanced among the Ministry with portfolio responsibility for Water, the OUR and the NWC.

Multilateral Environmental Agreements (MEA) play a critical role in achieving the Sustainable Development Goals. They complement national legislation and bilateral or regional agreements, and form the overarching international legal basis for global efforts to address particular environmental issues and the country's obligations related to IWRM.

In 2003, harmonization of interagency responsibility for water quality was done through the development and signing of the MOU between WRA, ODPEM, NRCA/NEPA and Ministry of Health. A revised MOU was signed by WRA, NRCA/NEPA and the Ministry of Health in 2016.

There is improvement in data and information accessibility, for example, through the Spatial Data Management Division and the WRA's web-based hydrological database. However, there is still a challenge in timely access to meteorological data. Establishment of the Development Approval System, which is guided by the IWRM principles of social and economic benefits, equity among all stakeholders, and environmental protection, has been effected.

The National Spatial Plan is needed to facilitate a more efficient and effective approval process that will arrest further water resource and watershed degradation, and promote greater growth in the economy.

Legislative gaps identified under the previous IWRM for Jamaica study included:

- Absence of an industry specific legislation for the water sector;
- Absence of a Meteorological Services Act;
- Lack of regulations for the Watersheds Protection Act (1963); and
- Need for legislation to address certain needs in the water sector. These include the:

    I. Office of Utilities Regulation Act (1996);
    II. National Water Commission Act (1980);
    III. Irrigation Amendment Act (1998); and
    IV. Floodwater Control Act (1958).

Integrated Water Resources Management Council (IWRMC)

The Government of Jamaica (GOJ) will establish the Integrated Water Resources Management Council (IWRMC) by expanding its role to replace the National Integrated Watershed Management Council. The IWRMC will be a multi-disciplinary and multi-sectoral body led by the Ministry with portfolio responsibility for Land and Water and reporting to the Cabinet. It will involve key stakeholders in the land and water sectors.

Structure and Responsibilities of the IWRMC

The IWRMC will take into account GOJ policies, and develop a Terms of Reference (TOR) on their processes for decision-making and reporting (Figure 3.1). The TOR will include specific ways that the IWRMC will involve community members in decision-making.

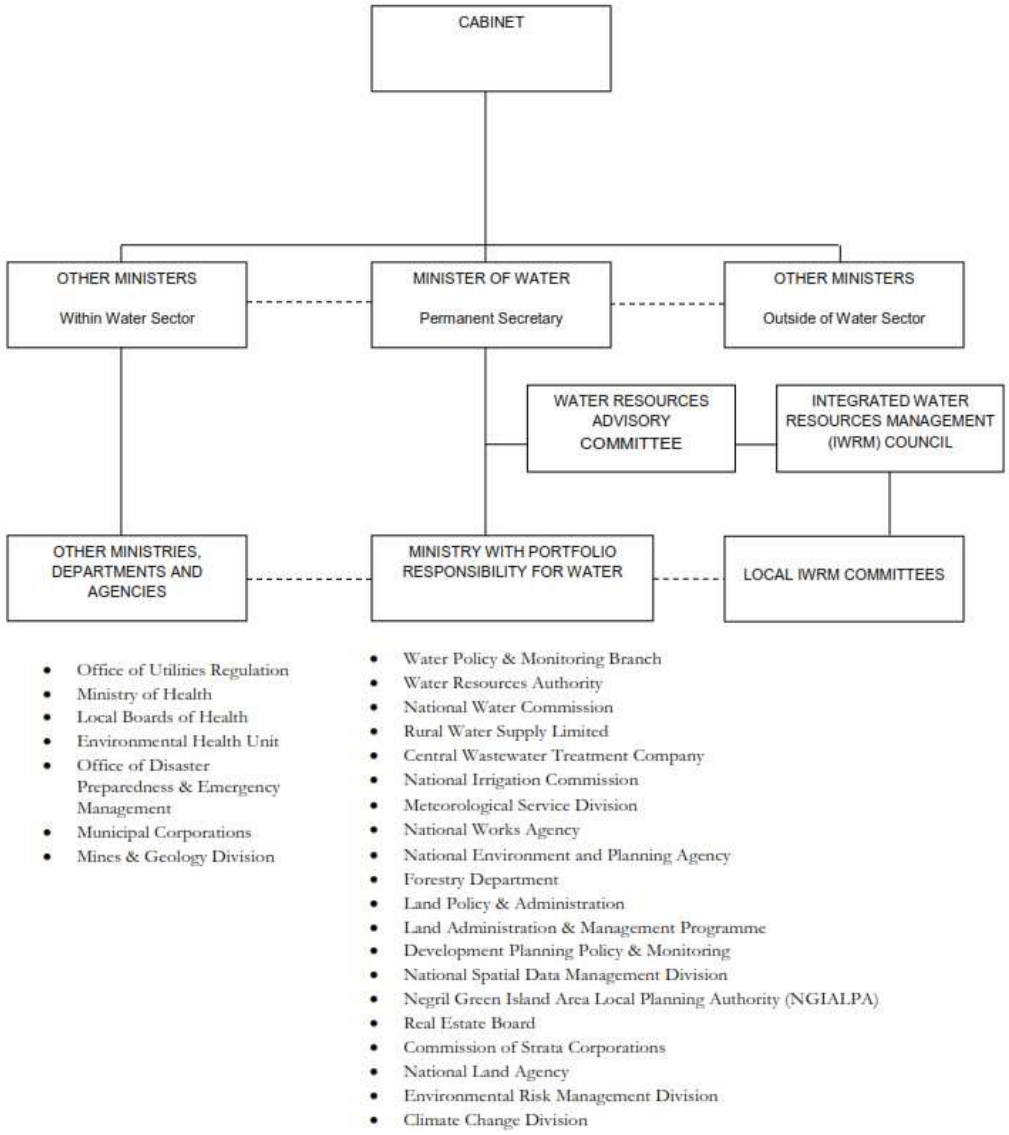


Figure 11: Structure of the IWRMC

Water Quality

The ambient water quality standards are as outlined below and may be obtained from the Nation Environmental and Planning Agency's website. (http://nepa.gov.jm/new/legal_matters/policies_standards/index.php):

Table 1: Draft Jamaica National Ambient Water Quality Standard –Freshwater, 2009

Parameter	Measured as	Standard Range	Unit
Calcium	**(Ca)**	**40.0-101.0**	**mg/L**
Chloride	**(CI-)**	**5.0- 20.0**	**mg/L**
Magnesium	**(Mg2+)**	**3.6- 27.0**	**mg/L**

Nitrate	**(NO3-)**	**0.1- 7.5**	**mg/L**
Phosphate	**(PO43-)**	**0.01 - 0.8**	**mg/L**
Potassium	**(K+)**	**0.74- 5.0**	**mg/L**
Silica	**(SiO2)**	**5.0- 39.0**	**mg/L**
Sodium	**(Na+)**	**4.5- 12.0**	**mg/L**
Sulfate	**(SO42-)**	**3.0- 10.0**	**mg/L**
Hardness	**(CaCO3)**	**127.0-381.0**	**mg/L (as CaCO3**
Biochemical Oxygen Demand	**(O)**	**0.8- 1.7**	**mg/L**
Total Dissolved Solids		**120.0-300**	**mg/L**
pH		**7.00- 8.40**	
Conductivity		**150.0-600**	**µS/cm**

Table 2: Draft Jamaica National Ambient Water Quality Standard - Marine Water, 2009

Parameter	Measured as	Standard Range	Unit
Phosphate	**P***	**0.001-0.003**	**mg/L**
Nitrate	**N****	**0.007-0.014**	**mg/L**
BOD5	**O**	**0.0-1.16**	**mg/L**
pH		**8.00-8.40**	
Total Coliform		**2-256**	**MPN/100mL**
Faecal Coliform		**<2-13**	**MPN/100mL**

The Standards for wastewater emissions in Jamaica are as obtained from the Natural Resources Conservation Authority (NRCA) Wastewater & Sludge Regulations (http://nepa.gov.jm/new/legal_matters/policies_standards/index.php) and are outlined below:

Table 3: NRCA SEWAGE EFFLUENT STANDARDS

(Extracted from the Jamaican National Sewage Effluent Standards, 1996)

PARAMETER	EFFLUENT LIMIT
Biological Oxygen Demand (BOD)	20 mg/l
Total Suspended Solids (TSS)	20 mg/l

Total Nitrogen	10 mg/l
Phosphates	4 mg/l
Chemical Oxygen Demand (COD)	100 mg/l
pH	6-9
Faecal Coliform	200 MPN/100ml
Residual Chlorine	1.5 mg/l

Table 4: NRCA TRADE EFFLUENT STANDARDS
(Jamaican National Trade Effluent Standards, 1995)

PARAMETER	STANDARD LIMIT
Ammonia /Ammonium	1.0 mg/l
Barium	5.0 mg/l
Beryllium	0.5 mg/l
Boron	5.0 mg/l
Calcium	No Standard
Chloride	300 mg/l
Colour	100 TCU
Detergent	15 mg/l or <0.015 kg/ 1000 kg product
Fluoride	3.0 mg/l
Iron	3.0 mg/l
Magnesium	No standard
Manganese	1.0 mg/l
Nitrate (as Nitrate and Nitrite)	10 mg/l
Oil and grease	10 mg/l or <0.01kg/ 1000 kg product
pH	6.5 – 8.5
Phenols	0.1 mg/l
Phosphate	5.0 mg/l
Sodium	100 mg/l
Sulphate	250 mg/l
Sulphide	0.2 mg/l
TDS	1000 mg/l
Temperature	2 °C +/- average ambient temperature
TOC	100 mg/l
TSS	All times <150 mg/l Monthly average 50 mg/l
Heavy Metals	
Arsenic	0.5 mg/l
Cadmium	0.1 mg/l
Chromium	1.0 mg/l
Copper	0.1 mg/l

Cyanide (Free HCN) (Total CN)	0.1 mg/l 0.2 mg/l
Lead	0.1 mg/l
Mercury	0.02 mg/l
Nickel	1.0 mg/l
Selenium	0.5 mg/l
Silver	0.1 mg/l
Tin	No standard
Zinc	1.5 mg/l
Total Heavy Metals	2.0 mg/l
STREAM LOADING	
BOD5	< 30 mg/l
COD	< 0.1kg/ 1000kg product or < 100 mg/l
DO	> 4 mg/l
BACTERIOLOGY	
Total Coliform	< 500 MPN/ 100ml
Faecal Coliform	<100 MPN/ 100ml

WATER MANAGEMENT

Hydrological Monitoring Network

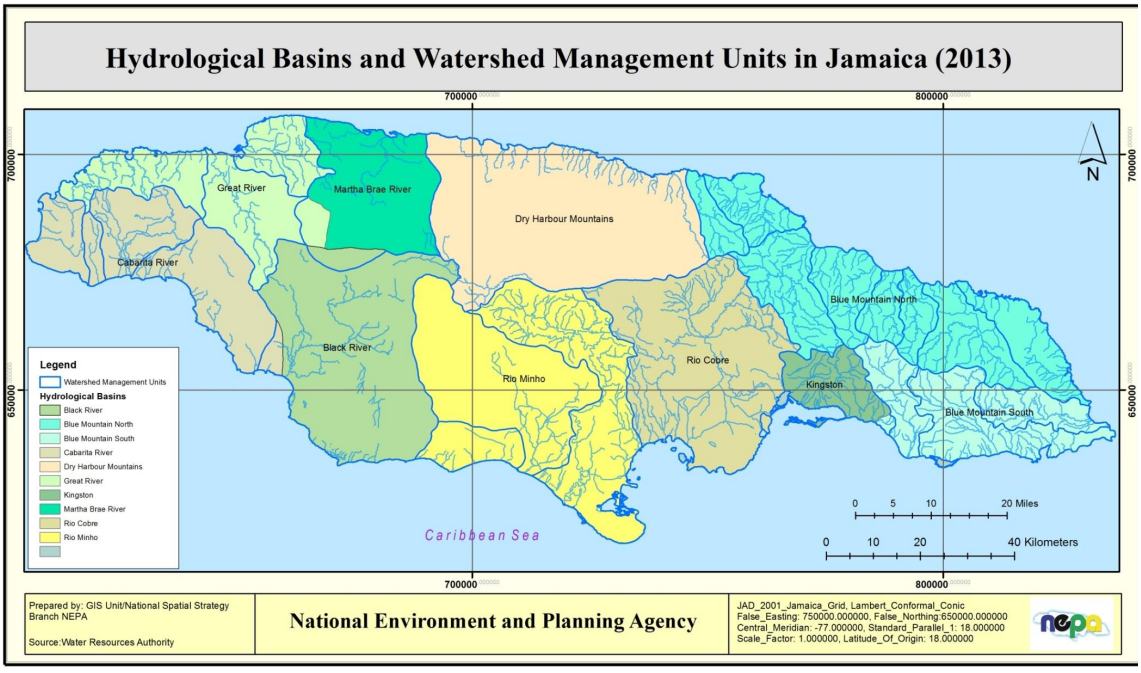


Figure 12: Hydrological Monitoring Network

WRA monitors the country's freshwater supply within the country's 10 main hydrological basins, within which there are 26 Watershed Management Units or WMUs. Figure 12 shows the geographical location of the 26 WMUs in Jamaica and the 10 hydrological basins within which they fall. The country's 26 WMUs cover one or more river catchments (*sub-watersheds*). Because of Jamaica's land formation the Blue

and John Crow Mountains divide most of the Eastern part of the country into river drainage systems that flow either north or south into the sea. Likewise the Cockpit Country divides the western part of the country into river drainage systems that also flow north or south. Due to the limestone geology of the Cockpit Country a large part of the drainage system takes place underground (through conduits and caverns), supplying water to wells to the north and south as well as maintaining base flow for rivers such as Rio Bueno, Martha Brae and Black River among others. WRA estimates that approximately 84% of Jamaica's freshwater is provided by underground sources, while about 16% comes from surface water. (*State of the Environment 2013, NEPA)*

Table 5: Total Exploitable Water, Allocations and Abstractions for All Sectors (2010 and 2013) (*State of the Environment 2013, NEPA)*

Exploitable Water& Allocation	**2010 (million m³)**	**2013 (million m³)**
Total exploitable potential water (in Master Plan)	3,929.7	3,929.7
Water resources deducted for ecological demand	902.6	902.6
Total exploitable potential deducting ecological demand	**3,027.1**	**3,027.1**
Allocations to sectors (from all 10 hydrological basins)		
Residential (domestic)	306.43	364.93
Commercial (including bottling)	1.14	1.11
Industrial	267.88	1,151.63
Agricultural (irrigation)	348.24	405.32
Tourism	28.17	29.62
Total water resources allocated	**951.86**	**1,952.61**
Reported water quantity abstraction*		
Residential (Domestic)	236.0	No data
Commercial	57.0	No data
Industrial	91.0	No data
Agricultural	521.2	No data
Tourism	5.0	No data
Total water resources supplied	**910.2**	**-**
Balance of water allocation after supply	**292.8**	**-**

*Source: WRA;*does not include non-revenue water (leaks, illegal abstraction or authorised non-billed abstraction); Note: some sources have multiple usages so primary usage was assessed and placed as main usage.*

Water Supply

The National Water Commission (NWC) is the main provider of potable water and sewerage services island-wide. In addition, the Local Government Authority, through the Municipal Corporations, provide potable water in most rural areas, using entombed springs, rainwater catchments and wayside tanks. Private utility providers of water, as well as some private entities, account for only a small portion of potable water produced.

Approximately seventy percent (70%) of Jamaica's population is supplied via house connections from the NWC and the remaining thirty percent (30%) obtain water from standpipes, water trucks, wayside tanks, community catchment tanks, rainwater catchment tanks and direct access to rivers and streams. About 30 percent of the population is served by sewerage facilities operated by the NWC. This includes some small sewerage systems, utilizing package plants, which are associated with housing developments in various locations throughout the country. The disposal of the sewage generated in the remainder of the population

is by means of various types of on-site systems such as septic tanks, soak-away pits, tile fields, pit latrines or other systems operated by private entities.

According to the 2011 Population Census, seventy-three percent (73%) of households had access to piped water. The majority (56%) of which had water piped into the dwelling unit; sixteen percent (16%) had water piped into the yard, and seven percent (7%) received water from a public standpipe. Catchment tanks were the main source of water for twelve percent (12%) of households; three percent (3%) obtained water from springs or rivers, while trucked water was the main source of water for two percent (2%).

Piped water was the most common source of drinking water for all regions, with the Kingston Metropolitan Area (KMA) having ninety-four percent (94%) access and Other Towns seventy-nine percent (79%). Rural Areas continued to lag in access to piped water, accounting for forty-seven percent (47%) (PIOJ, 2017). Some rural communities obtained their water from minor water supply systems, which consisted of rainwater catchments; wayside tanks filled by water trucks and entombed springs. Most of the entombed springs and rainwater catchments are aged and have not been upgraded to meet the growing needs of the communities they serve.

Public water sources include River/Spring/Pond and Public Standpipe. The use of these sources, and the distance travelled to access them, are often indicative of consumption status and environmental health. Overall, 11 percent of households used a public water source as their main source of drinking water, most of whom used standpipes. Of the total households accessing water from a public source, one third travelled 500 metres or more to obtain water, including 26 percent travelling over 1000 metres, the majority of whom are usually women and children (*PIOJ, 2017*).

In 2015, there was universal access to an improved sanitation facility. Exclusive use was reported by 82.8 per cent of households. Water closet (77.7 per cent) remained the predominant improved sanitation facility reported, with 20.4 per cent of these connected to a sewerage network. Over the period 2006–2015, the percentage of households reporting connection to a sewerage network remained below 30.0 per cent. About 55 per cent of the households with water closet in the KMA were connected to a sewerage network, compared with 7.9 per cent and 2.5 per cent in Other Towns and Rural Areas, respectively (PIOJ, 2017). The low percentage of households linked to a sewerage system suggests a high use of soil absorption systems. The use of such systems has resulted in the pollution of ground and surface water sources, threatening drinking water sources, especially in densely populated urban areas, as well as in rural areas which are most dependent on unimproved water sources.

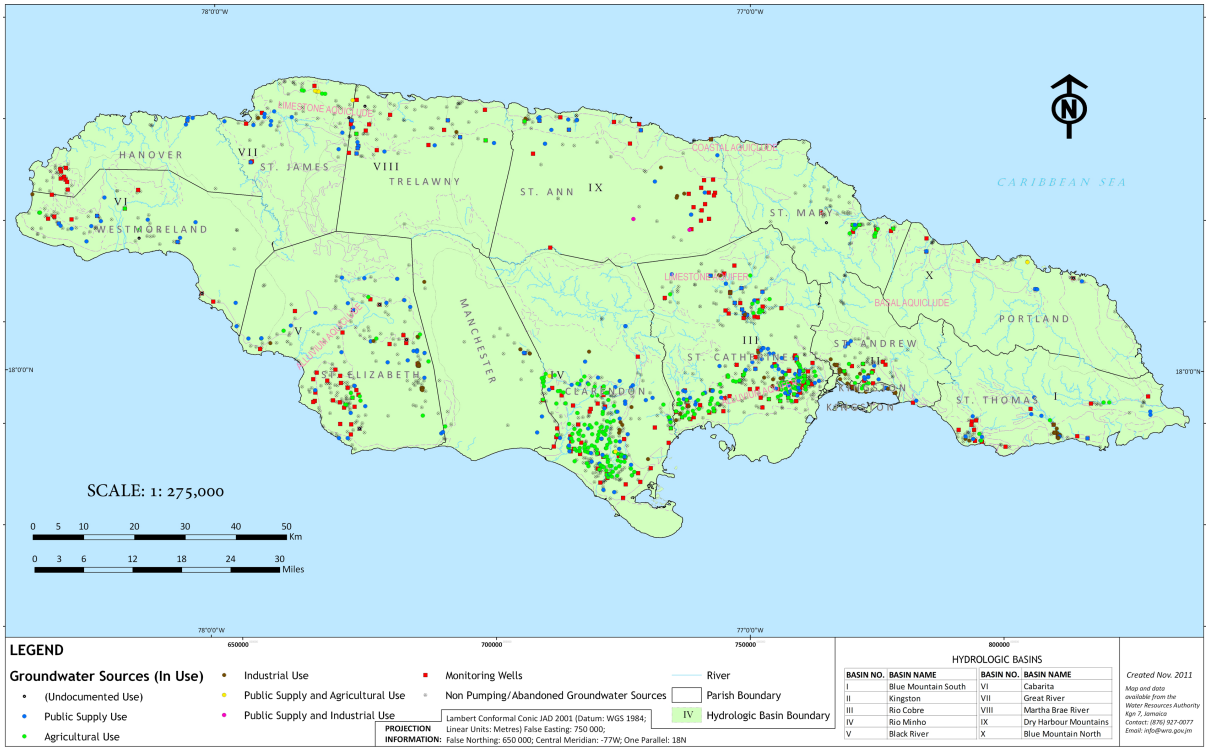
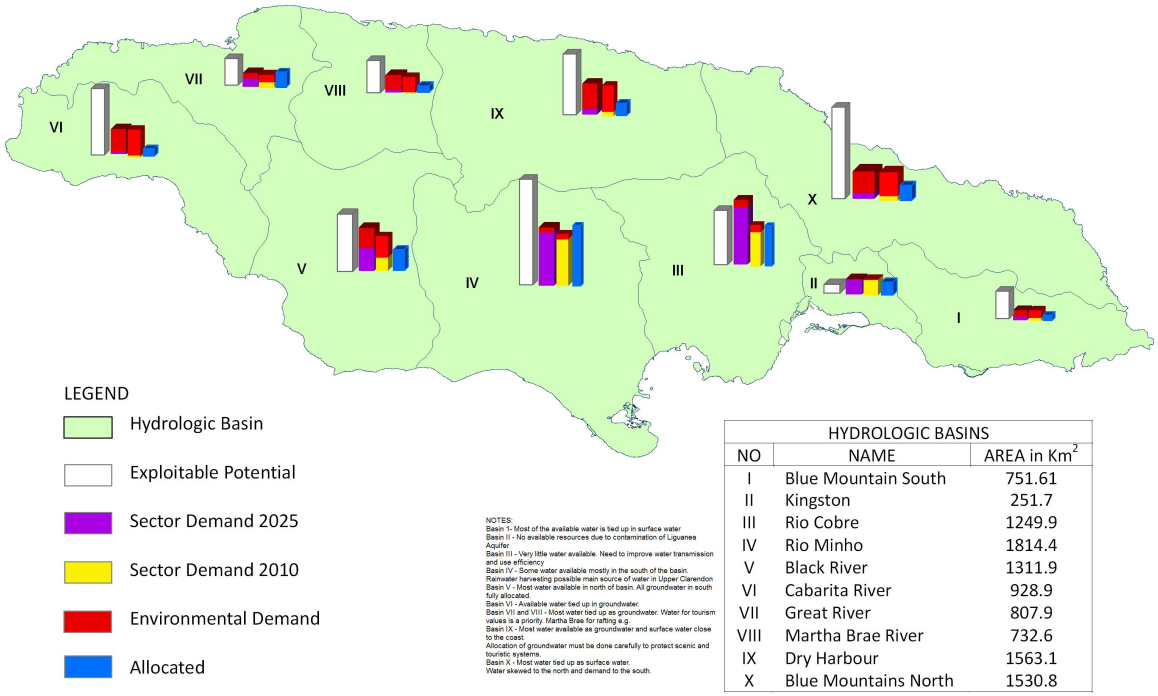


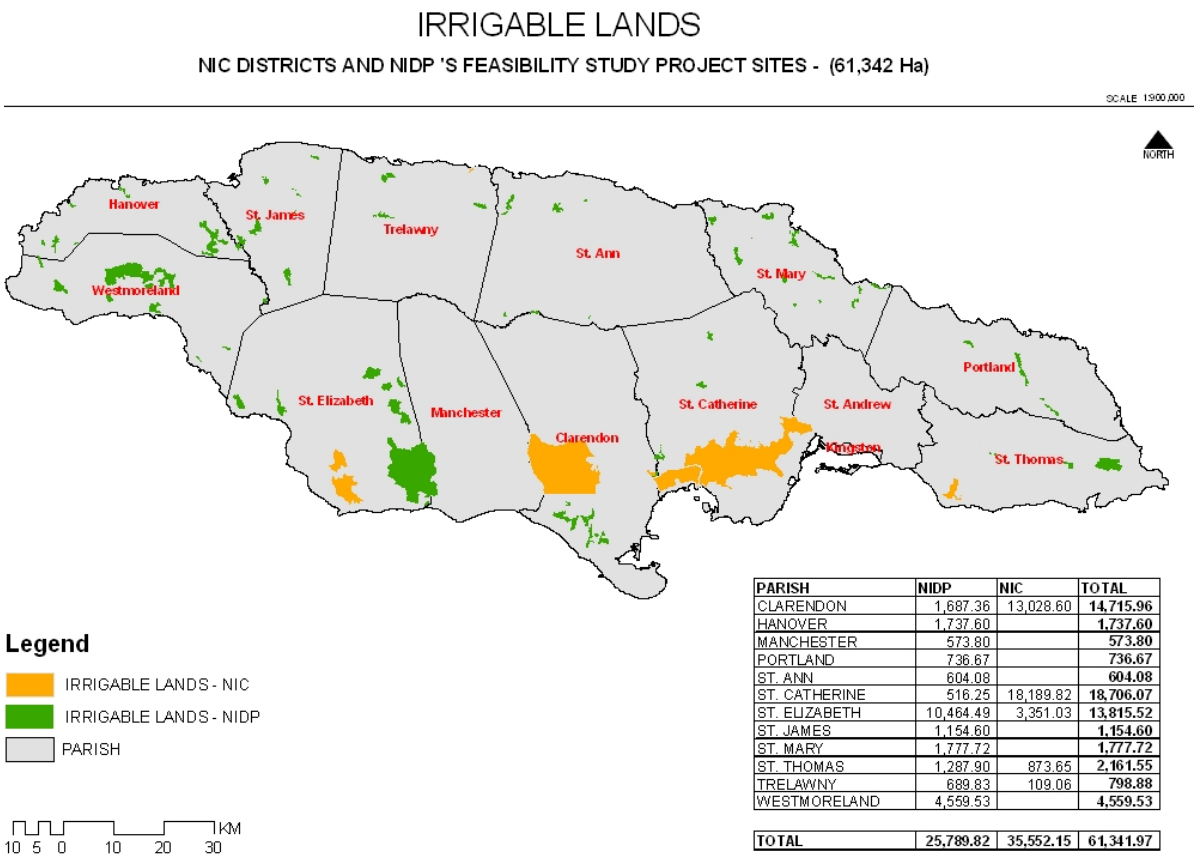
Figure 13: Water Sources in Jamaica



HYDROLOGIC BASINS

NO	NAME	AREA in Km^2
I	Blue Mountain South	751.61
II	Kingston	251.7
III	Rio Cobre	1249.9
IV	Rio Minho	1814.4
V	Black River	1311.9
VI	Cabarita River	928.9
VII	Great River	807.9
VIII	Martha Brae River	732.6
IX	Dry Harbour	1563.1
X	Blue Mountains North	1530.8

Figure 14: Water Balance in Jamaica



PARISH	NIDP	NIC	TOTAL
CLARENDON	1,687.36	13,028.60	**14,715.96**
HANOVER	1,737.60		**1,737.60**
MANCHESTER	573.80		**573.80**
PORTLAND	736.67		**736.67**
ST. ANN	604.08		**604.08**
ST. CATHERINE	516.25	18,189.82	**18,706.07**
ST. ELIZABETH	10,464.49	3,351.03	**13,815.52**
ST. JAMES	1,154.60		**1,154.60**
ST. MARY	1,777.72		**1,777.72**
ST. THOMAS	1,287.90	873.65	**2,161.55**
TRELAWNY	689.83	109.06	**798.88**
WESTMORELAND	4,559.53		**4,559.53**
TOTAL	**25,789.82**	**35,552.15**	**61,341.97**

Figure 15: Irrigable lands

Challenges in the Water Sector

Several problems affect water supply reliability in Jamaica. These include:

- High levels of Non-Revenue Water (NRW) – water that is collected, treated and supplied, but is either wasted due to aging infrastructure or stolen and, therefore, earns no revenue for the NWC or the Government. In the KMA, for example, water theft and widespread illegal connections have limited the revenue earnings for the NWC, and NRW has remained one of the more pressing issues affecting the water service delivery system. As a result, NRW is estimated (due to inadequate metering) to be approximately 65 percent. Similarly, within the irrigated water sector, the largest consumptive user of water in Jamaica, losses in irrigation water are approximately forty percent (40%).
- High energy consumption - The NWC's energy consumption is high and is approximately thirty percent (30%) of total operating costs. The energy/water nexus is a critical one, and these two resources are inextricably and reciprocally linked. The production of energy requires large volumes of water, while the treatment and distribution of water is equally dependent upon readily available low-cost energy.
- Inadequate storage capacity - Many parishes require additional storage to increase the reliable yield, and to ensure that there is sufficient supply of water during the dry season.
- Inadequate infrastructure – Distribution pipelines to move water to the areas where it is needed are inadequate in some parts of the country.

Water supply within the Kingston Metropolitan Area (KMA) is maintained by flows from the Hope, Yallahs/Negro, Moresham, Boar and Wagwater Rivers. During extended dry periods/drought conditions, the KMA experiences water shortages. Implementing rationing, through lock-offs, has been one of the methods utilized by the NWC during periods of scarcity. The severity of these events may be exacerbated by poorly maintained and operated infrastructure, which may not allow the full potential of these sources to be used, even under drought conditions. This situation is unfortunately repeated in other parts of the island.

The water sector is also vulnerable to the existing climate and climate variability. The impacts of climate change on water availability and water quality will affect many sectors, including energy production, infrastructure, human health, agriculture and ecosystems. Changes in weather patterns will affect water supply, resulting in less rain to supply the reservoirs.

Sea level is projected to rise by between 0.18m and 0.59m by the 2090s (IPCC, 2007). Other projections have estimated up to 1.4m over the same period. This increase, with the likely increase in the severity of hurricanes and tropical storms, will lead to an increase in potential storm surge elevations, thus putting the population at risk from coastal flooding. Given the coastal location of many of Jamaica's wells, sea level rise will increase the vulnerability of these wells to saline intrusion and thus reduce water quality.

Approximately ten percent (10%) of surface water quality and groundwater quality have been negatively affected by poor waste management practices, including inadequate treatment and disposal from domestic, industrial and commercial activities. Nutrient and faecal pollution are major issues that affect the island's ground and surface water resources. Groundwater pollution includes:

- Nitrate contamination of the Liguanea alluvium aquifer, through the use of absorption pits and poorly built and/or maintained septic tanks for sewage disposal;
- Leaching and occasional flood washout from pit latrines in the flood prone areas of the island;
- Discharge of industrial effluent from bauxite/alumina operations into unsealed mined out limestone pits;
- Discharge of dunder from rum distilleries into sinkholes; and
- Over pumping of coastal aquifers, leading to declining groundwater elevations, and increasing saline intrusion.

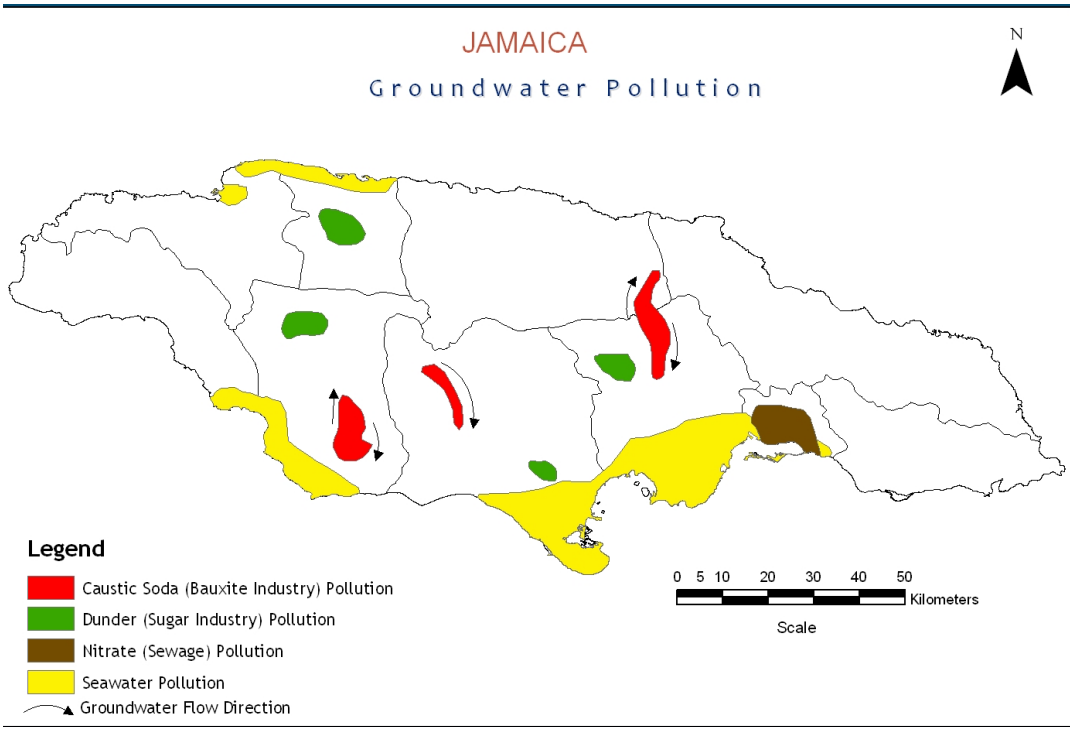


Figure 16: Jamaica – Ground Water Pollution

The island is divided into twenty-six (26) Watershed Management Units (WMUs), which contain over one hundred (100) streams and rivers. These WMUs are essentially composites of river basins that fall within ten (10) hydrological basins. Four (4) of the 26 WMUs are considered severely degraded and affect both the quantity and quality of underground and surface water sources.

In recent years, deforestation has led to the deterioration of more than a third of Jamaica's watersheds, significantly affecting the government's ability to supply reliable and good quality water to some areas across the island. Deforestation and increased turbidity of streams are a major cause and indicator of watershed degradation. 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 (NEPA, 2011).

WASTEWATER TREATMENT AND DISPOSAL

There are currently a total of two hundred and thirty four (234) sewage treatment plants (STP) monitored by NEPA throughout the country (2013). A total of seventy-three (73) STP were under the management of National Water Commission (NWC), the statutory body responsible for providing water supply and wastewater services to the majority of the population of Jamaica. The remaining STP are owned and/or operated by the hotel sector, other government agencies, hospitals, private companies and public housing development agencies.

NWC treatment plants have capacities ranging from 0.53 million litres per day (MLD) to 39.7 MLD at the Soapberry Wastewater Plant (St. Catherine), which is the largest STP in Jamaica. Currently, NWC provides services to domestic, industrial, rainwater and infiltration purposes. NWC confirms approximately 500,000 Jamaicans are connected to their sewerage systems.

NEPA is responsible for regulating the effluent and sludge discharged from all sewage plants. In 2012 NEPA issued eighty-two (82) law enforcement actions on sewage plant contractors and in 2013 this rose to one hundred and one (101). To support the regulatory process, GOJ gazetted the Natural Resources Conservation Authority (Wastewater and Sludge, Regulations (2013). After the gazetted Regulations, enforcement actions forty-one percent (41%) in 2014. The new regulations provide more powers to NEPA to apply the polluter pays principle (from 2014). Important new powers include the capacity to:

- Issue warnings to start the enforcement process and encourage sewage plant operators to produce a compliance plan (which would allow the temporary suspension of the enforcement process during the time it takes to improve the plant);
- Issue larger fines when warnings and compliance are not adhered to by STP owners;
- Revoke permits of sewage plant operators who continue to allow poorly treated effluent to enter river systems, which in extreme cases may also lead to prosecution in the courts for endangering public health and/or damaging the natural environment.

The regulations represent an important commitment to meeting the Protocol Concerning Pollution from Land-Based Sources and Activities (LBS Protocol), which came into force in 2010 under the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention). NEPA also plans to increase its effluent monitoring capacity from 2 to 4 times a year. However, this will depend on forthcoming public investment reviews agreeing to cover the additional costs involved.

In terms of reported improvements to the STPs, the main progress was as follows:

- Overhaul of the Port Antonio (Portland) sewage and drainage systems was agreed in 2012 with a contract valued at J$1.65 billion over three phases. Work has been completed on the Port Antonio Wastewater Treatment Plant since 2018.
- A new sewage treatment plant at Turtle Crawl (Portland) has been agreed. It will be connected to the Port Antonio system. The cost is included under the J$41.66 billion contract just mentioned. Work is in progress.
- An agreement was signed in 2014 to improve the Harbour View sewage treatment plant, this improvement has since been completed.
- Road, sewerage improvements have been on going in Kingston and St. Andrew and other towns islandwide.
- The new Soapberry sewage treatment facility has continued to work efficiently since its inauguration in 2007. However, the NSWMA has reported regular abuse through the illegal dumping of hazardous liquids into the system, which requires a communication response together with improved enforcement.

Disposal of sewage sludge: The disposal of sewage effluent and sludge following treatment is now regulated by NEPA under the Natural Resources Conservation (Wastewater and Sludge Regulations, 2013). The Regulations make it mandatory for anyone who wishes to dispose of sewage sludge, or discharge trade or sewage effluent into rivers or the sea to have a licence. The issuing of licences enables NEPA to enforce the taking of samples of effluent and sludge at the end of the treatment process by operators and to ensure adequate operation and maintenance of treatment plants. Where there is consistent non-compliance of a wastewater treatment plant, the operator will be required to compose and implement a compliance plan.

Sludge to energy: NEPA is looking at reviewing current policy and regulations in the interest of promoting public-private partnerships in sludge-to-energy projects given that there is a rise in the use of sludge by some industries, such as the cement industry. This would also help meet international obligations such as the LBS Protocol and reduce the disposal of treated sludge at the country's landfill sites.

These regulations supported the national efforts from 2014 to upgrade the sewage treatment system applying, where necessary, compliance plans as part of its application of the polluter pays principle.

From the findings in the ***National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper)*** concerning wastewater management policy the following conclusions and recommendations were made:

1) **In terms of sampling and there is no index in place to rank the best and worst performing STPs in the current monitoring of wastewater effluent and sludge by NEPA is based on bi-annual country.**

Recommendations

1. Establish quarterly sampling of treated effluent at all priority sites.
2. Establish a centralised database on all water quality monitoring and establish an index to rank the country's sewage systems and identify priority sites where quarterly monitoring is needed.
3. Provide training of trainers to develop the enforcement arm of NEPA in the interests of applying the polluter pays principle more effectively. The aim should be to secure new investment in wastewater treatment as an alternative to the revocation of licences (where there is compliance by the operator.

2) **There remains a low level of public awareness on the effects of poor waste management and the benefits of applying the waste hierarchy, in particular the need to reduce, reuse and recycle waste.**

Recommendations

1. Support the development of a national communication strategy to promote waste prevention, reduction and reuse/recycling based on the waste hierarchy and lifecycle thinking in the case of hazardous substances and waste.
2. Focus the communication strategy on the commercial sector and youths aged 12 to 25 years at schools and higher education establishments.
3. Assess ways of establishing sustained partnerships with civil society and the private sector for reducing waste generation, promoting recycling and the reuse of waste through initiatives (such as producing knick-knack jewellery); and training community wardens to help stop illegal dumping and burning of waste.

SOLID WASTE

Background on Solid Waste management

The National Solid Waste Management Authority (NSWMA) (http://www.nswma.gov.jm) has a broad mandate that includes public cleansing; environmental monitoring; providing standards, regulations and

expertise with regard to solid waste management; participating in inter- institutional efforts concerning pollution and environmental control; allocating limited financial resources to priority actions; educating the public on solid waste management and; supporting enforcement of the NSWMA Act and pertinent regulations.

Responsibilities of the NSWMA includes waste reduction activities, improvement in waste collection systems and improving services relating to recycling, storage, transportation, treatment, disposal and curtailment of illegal dumping of waste.

Since the launch of Vision 2030 Jamaica in 2011 the vision of the authority is to be recognised as a model waste management entity by 2030 that provides services and standards comparable to developed countries. Currently, the NSWMA manages the country's solid waste under four "wastesheds" in which there is one or more solid waste disposal sites (see Figure 35 at the end of this Chapter). In summary they are:

- Riverton Wasteshed, managed by MPM waste Management Ltd. (MPM Wasteshed);
- North Eastern Wasteshed, managed by NEPM Waste Management Ltd. (NEPM Wasteshed);
- Retirement Wasteshed, managed by WPM Waste Management Ltd. (WPM Wasteshed);
- West Kirkvine Wasteshed, managed by SPM Waste Management Ltd. (SPM Wasteshed).

The following sub-sections assess the current state of waste generation, characterisation, collection and disposal in Jamaica for the period 2010-2013 (*State of the Environment 2013*).

NEPA issues licences and regulates the NSWMA and its thirteen official solid waste disposal sites. Regulatory activities at the waste disposal sites includes, among other things, monitoring to control the access of only legally accepted waste into the disposal sites; checking for seepage of waste residues into water sources or neighbouring areas and; and enforcing strict rules on the burning of waste. Meanwhile, NSWMA is responsible for ensuring that persons do not enter its sites without authorisation.

Over the reporting period, both regulators and operators faced some major challenges with respect to the implementation and enforcement of the National Solid Waste Management Act. None of the NSWMA sites had an environmental permit during 2011-2013.

A major challenge for the NWSMA is that many of its solid waste disposal sites are at a critical state of capacity due to the lack of a national waste management policy that promotes the waste hierarchy. Table 45 shows the planned and current state of waste disposal capacity at these sites. The NSWMA confirms that a number of sites are in a critical state, especially as waste generation is increasing in most parishes and municipal areas.

Other significant challenges facing the NSWMA include:

- None of the solid waste disposal sites are sanitary landfills meaning there is no systematic sorting of waste categories for recycling, re-use, confined storage of hazardous waste, or to support the development of energy from waste;
- Limited resources to generate income from waste, such as the sale of compost bags, or wood chippings at the sites;
- Direct involvement in domestic waste collection operations as the NSWMA does not have a clear mandate;
- None of the sites have adequate equipment to help extend

the life of the landfill sites. For example, the NSWMA is not equipped with:

i. Compacting equipment to compress waste in the landfill;
ii. Tyre and plastic shredders to reduce waste volume and enhance recycling opportunities;
iii. Waste oil receptors to accept oil that is not collected by operators licensed by NEPA;

- Inappropriate location of some landfill sites in socially and environmentally sensitive areas, such as Doctor's Wood and Church Corner waste disposal sites, confirmed in a study conducted by IDB in 1999.

The 2011 to 2013 period has witnessed some important developments in addressing Jamaica's need to improve the management of solid, hazardous and liquid waste. Most significant has been the move to introduce more licences and permits to control the way waste is managed and transported. For example, the ban on scrap metal recycling for export in 2011 allowed time to prepare new regulations that require all scrap metal merchants to be licensed to handle scrap metal and undergo inspections.

Nevertheless, GoJ recognises there is still a need to do a lot more to improve the way waste is managed in Jamaica, especially solid waste given that the trend in waste generation is up and several landfills have limited spare capacity. The PCA is also making preparations to export of the country's stockpile of obsolete pesticides for incineration and safe disposal abroad with support from FAO and ULAB exports continue of – both under the terms and regulations of the Basel Convention.

Also of significance is the preparation of the ***National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper)*** in December 2017.

Based on the findings in this report and developments concerning solid waste management policy the following conclusions and recommendations were made:

1) **The current policy framework for solid waste management does not establish a fully integrated approach to the way the waste hierarchy should be applied, managed, monitored and controlled.**

Recommendations

1. Draft an integrated solid waste management policy and introduce appropriate regulations as a government priority to support the application of the waste hierarchy in which targets are established on the percentage of total solid waste that is to be reused, recycled and disposed by 2030.
2. Ensure that the policy provides clear provisions on the involvement of citizens in preventing, reusing and recycling of waste based on the sorting of waste at source.
3. Ensure the new policy is supported by new provisions in the Containerisation Act to guide citizens on the storing of waste in appropriate containers that are colour coded.
4. Establish the national provisions necessary to allow for the privatization of all solid waste collection, starting with pilot projects to identify lessons learned and best practice to consolidate the legal and regulatory framework for private solid waste collection services in all areas, including informal settlement areas (squatter settlements).
5. Ensure a sustainable financial mechanism is in place to implement the proposed integrated solid waste management policy and apply effective enforcement to help improve the quality of public service delivery.

2) **The current state of many of Jamaica's solid waste disposal sites is critical and there is currently no sanitary landfill site in Jamaica.**

Recommendations

2. Along with the development of the proposed integrated waste management policy, identify new sanitary landfill sites to replace the solid waste disposal sites and identify external donor finance to support the establishment of at least one sanitary landfill site to manage all aspects of the solid waste hierarchy. This should be, focused on prevention, reuse and recycling, with the latter developed as a means to generate income for the NSWMA. Such income streams include the production of compost, wood chippings and the sale of valuable metals, high-density Polyethylene plastics and paper to the recycling industry.
3. Assess the opportunities for establishing a public-private partnership to manage the new sanitary landfill site proposed as well as improve the current management of the country´s other solid waste management sites that are in a critical state.
4. Identify a suitable donor or donors to provide co-finance to implement the new sanitary landfill project and finance the purchase of a priority list of equipment to improve the management of waste. This includes waste oil (specific containers), tyre and other voluminous waste that needs to be broken down (shredders and compacters etc). Income could also be generated from recycling (compost boxes, scrap metal containers, etc.) to help offset costs of operation and maintenance at the sites.
5. Assess the feasibility of developing a waste to energy project based on a reliable organic waste stream in one of the country´s wasteshed in order to reduce the country´s dependency on oil imports to generate energy.

3) **There is limited capacity and investment in the management of hazardous wastes in Jamaica, especially concerning the commercial sector.**

Recommendations

1. Ensure the National Hazardous Substances and Hazardous Waste Management Policy is in keeping with the provisions in the proposed integrated solid waste management policy proposed above, and focuses on applying lifecycle thinking to hazardous waste streams such as pesticides and cleaning agents.
2. Support the implementation of the National Hazardous Substances and Hazardous Waste Management Policy by providing specific training of trainers and the provision of equipment necessary to develop lifecycle thinking and storage of hazardous waste. This includes the separation, safe packaging and storage of hazardous wastes to be exported abroad for recycling or high temperature incineration.
3. Identify the most sustainable financial option available to implement lifecycle thinking within the private sector (industrial and commercial), including the introduction of incentives to apply cost effective solutions to implement lifecycle thinking.
4. Ensure adequate financing is in place to apply the polluter pays principle to commercial operators who fail to clean up their act on hazardous waste management.

In 2013 the NSWMA conducted a waste characterisation and generation study to reassess the waste streams generated and collected from households within the Riverton wasteshed. The aim of the study was to support local government and non-government entities engaged in solid waste management to improve their waste collection, recovery and disposal services as well as guide the development of

strategies to improve efficiency, set up recycling of waste and promote other actions designed to reduce waste at disposal sites. The main findings from the study are as follows:

1. The average mass of waste sorted per community was 409.25 kg;
2. Households in urban areas generated an average of 18.29 kg. each collection day (3.5 days);
3. Households in rural areas generated an average of 12.53 kg. each collection day (3.5 days);
4. If 12.35 kg. is divided by the mean household size of 3.5 persons and then divided by 3.5 days for each collection day, the generation of domestic waste per person is approximately 1kg./person/day;
5. The total kilograms of waste generated by the selected communities in 2013 (2,456 kg.) was less than in 2006 (3,040 kg.);
6. Organic waste accounted for approximately 62% of all waste generated in rural and urban communities in 2013 down from 69% in 2006.

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