Water Risk Filter

Country Overview - Jamaica

Water Indicators

Indicator	Value	Description	Source
Overall Basin Risk (score)	2.79	Overall Basin Risk (score)	
Overall Basin Risk (rank)	65	Overall Basin Risk (rank)	
Physical risk (score)	2.95	Physical risk (score)	
Physical risk (rank)	57	Physical risk (rank)	
Regulatory risk (score)	2.57	Regulatory risk (score)	
Regulatory risk (rank)	126	Regulatory risk (rank)	
Reputation risk (score)	2.51	Reputation risk (score)	
Reputation risk (rank)	110	Reputation risk (rank)	
1. Quantity - Scarcity (score)	2.35	1. Quantity - Scarcity (score)	
1. Quantity - Scarcity (rank)	81	1. Quantity - Scarcity (rank)	
2. Quantity - Flooding (score)	4.85	2. Quantity - Flooding (score)	
2. Quantity - Flooding (rank)	7	2. Quantity - Flooding (rank)	
3. Quality (score)	3.00	3. Quality (score)	
3. Quality (rank)	100	3. Quality (rank)	
4. Ecosystem Service Status (score)	2.25	4. Ecosystem Service Status (score)	
4. Ecosystem Service Status (rank)	107	4. Ecosystem Service Status (rank)	
5. Enabling Environment (Policy & Laws) (score)	3.00	5. Enabling Environment (Policy & Laws) (score)	
5. Enabling Environment (Policy & Laws) (rank)	71	5. Enabling Environment (Policy & Laws) (rank)	
6. Institutions and Governance (score)	2.50	6. Institutions and Governance (score)	
6. Institutions and Governance (rank)	134	6. Institutions and Governance (rank)	
7. Management Instruments (score)	2.15	7. Management Instruments (score)	
7. Management Instruments (rank)	141	7. Management Instruments (rank)	
8 - Infrastructure & Finance (score)	2.55	8 - Infrastructure & Finance (score)	
8 - Infrastructure & Finance (rank)	78	8 - Infrastructure & Finance (rank)	
9. Cultural Diversity (score)	3.00	9. Cultural importance (score)	
9. Cultural Diversity (rank)	47	9. Cultural importance (rank)	
10. Biodiversity Importance (score)	3.00	10. Biodiversity importance (score)	

Indicator	Value	Description	Source
10. Biodiversity Importance (rank)	129	10. Biodiversity importance (rank)	
11. Media Scrutiny (score)	2.55	11. Media Scrutiny (score)	
11. Media Scrutiny (rank)	103	11. Media Scrutiny (rank)	
12. Conflict (score)	2.00	12. Conflict (score)	
12. Conflict (rank)	147	12. Conflict (rank)	
1.0 - Aridity (score)	1.00	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geo-database. CGIAR consortium for spatial information.
1.0 - Aridity (rank)	134	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geo-database. CGIAR consortium for spatial information.
1.1 - Water Depletion (score)	4.00	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. Elem Sci Anth, 4.
1.1 - Water Depletion (rank)	6	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. Elem Sci Anth, 4.
1.2 - Baseline Water Stress (score)	1.00	World Resources Institute's Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). Aqueduct 3.0: Updated decision relevant global water risk indicators. Technical note. Washington, DC: World Resources Institute.

Country Overview - Jamaica

Indicator	Value	Description	Source
1.2 - Baseline Water Stress (rank)	166	World Resources Institute's Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). Aqueduct 3.0: Updated decision relevant global water risk indicators. Technical note. Washington, DC: World Resources Institute.
1.3 - Blue Water Scarcity (score)	2.00	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. Science advances, 2(2), e1500323.
1.3 - Blue Water Scarcity (rank)	118	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. Science advances, 2(2), e1500323.
1.4 - Projected Change in Water Discharge (by ~2050) (score)	2.00	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.
1.4 - Projected Change in Water Discharge (by ~2050) (rank)	83	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.

Indicator	Value	Description	Source
1.5 - Drought Frequency Probability (score)	3.00	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.5 - Drought Frequency Probability (rank)	68	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.6 - Projected Change in Drought Occurrence (by ~2050) (score)	3.00	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
1.6 - Projected Change in Drought Occurrence (by ~2050) (rank)	93	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.1 - Estimated Flood Occurrence (score)	5.00	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.
2.1 - Estimated Flood Occurrence (rank)	5	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.

Indicator	Value	Description	Source
2.2 - Projected Change in Flood Occurrence (by ~2050) (score)	2.00	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.2 - Projected Change in Flood Occurrence (by ~2050) (rank)	130	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
3.1 - Surface Water Contamination Index (score)	3.00	The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury). The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. Nature, 467(7315), 555.

Indicator	Value	Description	Source
3.1 - Surface Water Contamination Index (rank)	100	The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury). The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. Nature, 467(7315), 555.
4.1 - Fragmentation Status of Rivers (score)	2.00	This risk indicator is based on the data set by Grill et al. (2019) mapping the world's free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. Nature, 569(7755), 215.
4.1 - Fragmentation Status of Rivers (rank)	118	This risk indicator is based on the data set by Grill et al. (2019) mapping the world's free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world's free-flowing rivers. Nature, 569(7755), 215.
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (score)	3.00	For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control. The forest cover data is based on Hansen et al.'s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. science, 342(6160), 850-853.

Indicator	Value	Description	Source
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (rank)	46	For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control. The forest cover data is based on Hansen et al.'s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. science, 342(6160), 850-853.
4.3 - Projected Impacts on Freshwater Biodiversity (score)	2.00	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. Journal of Applied Ecology, 50(5), 1105-1115.
4.3 - Projected Impacts on Freshwater Biodiversity (rank)	132	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. Journal of Applied Ecology, 50(5), 1105-1115.
5.1 - Freshwater Policy Status (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.1 - Freshwater Policy Status (SDG 6.5.1) (rank)	56	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.2 - Freshwater Law Status (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Law(s)" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

Indicator	Value	Description	Source
5.2 - Freshwater Law Status (SDG 6.5.1) (rank)	67	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Law(s)" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National IWRM plans" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (rank)	71	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National IWRM plans" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.1 - Corruption Perceptions Index (score)	3.00	This risk Indicator is based on the latest Transparency International's data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.1 - Corruption Perceptions Index (rank)	111	This risk Indicator is based on the latest Transparency International's data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.2 - Freedom in the World Index (score)	1.00	This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.

Indicator	Value	Description	Source
6.2 - Freedom in the World Index (rank)	141	This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.
6.3 - Business Participation in Water Management (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Business Participation in Water Resources Development, Management and Use” indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.3 - Business Participation in Water Management (SDG 6.5.1) (rank)	69	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Business Participation in Water Resources Development, Management and Use” indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (score)	2.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Sustainable and efficient water use management” indicator, which corresponds to one of the five national level indicators under the Management Instruments category. For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (rank)	132	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Sustainable and efficient water use management” indicator, which corresponds to one of the five national level indicators under the Management Instruments category. For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

Indicator	Value	Description	Source
7.2 - Groundwater Monitoring Data Availability and Management (score)	3.00	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.2 - Groundwater Monitoring Data Availability and Management (rank)	67	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.3 - Density of Runoff Monitoring Stations (score)	2.00	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km2 of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
7.3 - Density of Runoff Monitoring Stations (rank)	178	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km2 of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
8.1 - Access to Safe Drinking Water (score)	2.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.1 - Access to Safe Drinking Water (rank)	78	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.2 - Access to Sanitation (score)	3.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.

Indicator	Value	Description	Source
8.2 - Access to Sanitation (rank)	79	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (score)	3.00	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (rank)	94	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
9.1 - Cultural Diversity (score)	3.00	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
9.1 - Cultural Diversity (rank)	47	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
10.1 - Freshwater Endemism (score)	4.00	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.

Indicator	Value	Description	Source
10.1 - Freshwater Endemism (rank)	80	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (score)	2.00	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (rank)	159	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
11.1 - National Media Coverage (score)	3.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnoma (TYPSA Group)
11.1 - National Media Coverage (rank)	94	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (score)	2.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (rank)	98	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnoma (TYPSA Group)

Country Overview - Jamaica

Indicator	Value	Description	Source
12.1 - Conflict News Events (RepRisk) (score)	1.00	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.1 - Conflict News Events (RepRisk) (rank)	164	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.2 - Hydro-political Risk (score)	3.00	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. Global environmental change, 52, 286-313.
12.2 - Hydro-political Risk (rank)	33	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. Global environmental change, 52, 286-313.
Population, total (#)	2881355	Population, total	The World Bank 2018, Data , hompage accessed 20/04/2018
GDP (current US$)	14056908749	GDP (current US$)	The World Bank 2018, Data , hompage accessed 20/04/2018
EPI 2018 score (0-100)	58.58	Environmental Performance Index	
WGI -Voice and Accountability (0-100)	54.76	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132

Indicator	Value	Description	Source
WGI -Political stability no violence (0-100)	70.44	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Government Effectiveness (0-100)	68.75	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Regulatory Quality (0-100)	59.62	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Rule of Law (0-100)	45.19	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Control of Corruption (0-100)	51.92	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132

Country Overview - Jamaica

Indicator	Value	Description	Source
WRI BWS all industries (0-5)	5.00	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at http://wri.org/publication/aqueduct-country-river-basin-rankings.
WRI BWS Ranking (1=very high)	1	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at http://wri.org/publication/aqueduct-country-river-basin-rankings.
Baseline Water Stress (BWS) - 2020 BAU (1=very high)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Optimistic (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Pessimistic (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Water Risk Filter

Country Overview - Jamaica

Indicator	Value	Description	Source
Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Optimistic (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Pessimistic (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 BAU (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Optimistic (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Pessimistic (increasing rank describes lower risk)	0	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Water Risk Filter

Country Overview - Jamaica

Indicator	Value	Description	Source
Total water footprint of national consumption (m3/a/cap)	1696.19	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Ratio external / total water footprint (%)	44.22	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Area equipped for full control irrigation: total (1000 ha)	30.68	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Area equipped for irrigation: total (1000 ha)	30.68	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
% of the area equipped for irrigation actually irrigated (%)	100.00	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Electricity production from hydroelectric sources (% of total)	3.30	World Development Indicators	The World Bank 2018, Data , hompage accessed 20/04/2018
Total internal renewable water resources (IRWR) (10^9 m3/year)	10.82	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total internal renewable water resources (IRWR) (10^9 m3/year)	0.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Water resources: total external renewable (10^9 m3/year)	10.82	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13

Water Risk Filter

Country Overview - Jamaica

Indicator	Value	Description	Source
Total renewable water resources (10^9 m3/year)	10.82	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Dependency ratio (%)	0.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total renewable water resources per capita (m3/inhab/year)	3874.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
World happiness [0-8]	5.89	WorldHappinessReport.org	World Happiness Report, homepage accessed 20/04/2018

Country Aspects

1. PHYSICAL ASPECTS

1.1. WATER RESOURCES

1.1.1. WATER RESOURCES

Fifty-six per cent of the average annual rainfall is lost to evapotranspiration. The internal renewable water resources (IRWR) are 9.4km3/year, with 5.5 and 3.9km3/year for surface and groundwater respectively.

Approximately 44 per cent of these IRWR are considered exploitable or reliable. Of the total reliable yield of 4.09km3/year, 80 per cent is contributed from limestone aquifers, 4 per cent from alluvial aquifers and 16 per cent from surface water runoff. About 20 per cent from the limestone aquifers is extracted through wells, mainly in the River Cobre and River Minho. However, in other basins, the water is generally available as base flow and is exploitable through run-of-river developments.

There are two major raw water storage facilities, both located in St. Andrew. The Mona Reservoir, with intakes at the Hope and Yallahs Rivers, has a storage capacity of 3.67 million m3. The Hermitage Reservoir, with intakes at Ginger River and Wag/Morsham River, has a storage capacity 1.78 million m3.

The last assessment of water resources in Jamaica in 1997 indicated total exploitable water resources of 4085 million m3/yr with groundwater providing 3419 million m3/yr and surface water providing 666 million m3/yr. In 1997, production from both sources totaled 939 million m3/yr leaving a balance of 3163 million m3/yr for development. However, the state-owned National Water Commission (NWC) is hampered in its commitment to make water accessible to every Jamaican because of the financial hardships being faced by the government. It is estimated that Jamaica is using less than one-fifth of total available water. Approximately 10 per cent of the island's water resources have been lost to saline intrusion and pollution (Springer, 2005).

According to CEPAL (2005), some 87 per cent of Jamaica's water supply is obtained from groundwater sources. Even so, only 25 per cent of the available resources is actually in use. Despite the attention given to abstraction wells, contamination of groundwater is evident. Associated with this phenomenon are saline contamination as a result of the withdrawal of groundwater in quantities in excess of the safe yield; poor well-head designs; caustic soda contamination from ponding of red mud wastes from the bauxite/alumina industry; nitrate contamination from soak-aways built for sewage disposal; and organic and bacteriological contamination from disposal of dunder and other effluent from the sugar/rum industry.

1.1.2. WATER USE

Annual water withdrawal in 1993 was estimated at 928 million m3 and the agricultural sector was the major user of water (75 per cent). The other major water users were domestic water supply (17 per cent), industry (7 per cent) and tourism (1 per cent). About 92 per cent of the water was withdrawn from groundwater sources and the remainder from surface water.

Only 11 per cent of the surface water and 25 per cent of the groundwater of the exploitable water resources are currently utilized. The National Water Commission (NWC) provides water to various supply systems from wells, rivers and springs. A total of 500 water supply facilities are operated by the NWC to supply 78 per cent of total demand.

Access to water supply in 1998 was available to 75 per cent of the rural population and to 95 per cent of those residing in urban areas. Access to water supply via house connections was available to approximately 65 per cent of the population. The remaining 35 per cent of the population were supplied through a variety of means: standpipes, rainwater collection systems, water trucks, wayside tanks and community catchment tanks.

The NWC operates sewerage facilities which serve about 15 per cent of the population. Centralized systems are located in Kingston and St. Andrew, southeast St. Catherine and Montego Bay in St. James. The NWC is also responsible for a number of small sewerage systems, utilizing package plants, which are associated with housing developments in various locations throughout the country. Treatment is given to secondary level for 50 per cent of waters. For the remainder of the population, sewage disposal is accomplished via septic tanks, soak-away pits, tile fields and pit latrines.

Of the 900km3 or potential irrigable area, approximately 250km3 or 10 per cent of Jamaica's cultivated lands are currently irrigated. The main irrigated crop is sugar cane, which accounts for 70-80 per cent of the irrigated land area (Springer, 2005).

In 1985 it was estimated that 75 per cent of the nation's total water demand went to agriculture (WRDMP, 1990). In 1997, the NIDP estimated that the demand of the agricultural sector was 60 per cent (645 million m3/yr) of the total water demand. This decline in sector demand is also confirmed by preliminary in-house evaluations conducted by the Water Resources Authority. Fifty per cent of the 10 per cent (250km3) of irrigated lands are served by public irrigation systems managed by the National Irrigation Commission, the other 50 per cent are irrigated by private individuals (Springer, 2005).

Studies of the surface irrigation systems indicate that between on-farm and conveyance, 32 per cent irrigation efficiency is achieved. It is expected that with physical improvements of the system and training of farmers as water managers, irrigation efficiencies could increase to 57 per cent (Springer, 2005).

The agriculture sector is a major user of water resources for irrigation. However, the prospects for cost recovery in the sector are extremely poor. Further, operating efficiencies are low with high levels of wastage due to inadequate irrigation infrastructure on farms. Presently the sector does not generate enough funds to finance its expansion (Springer, 2005).

1.2. WATER QUALITY, ECOSYSTEMS AND HUMAN HEALTH

There is concern that over-exploitation, sewage effluents and industrial wastes are affecting aquifers and surface waters at an alarming rate. As much as 10 per cent of the groundwater resource has been either abandoned or use is restricted due to saline intrusion or pollution. Wastewater reuse is included in the National Irrigation Development Plan (NIDP), as an expensive source of irrigation water which nonetheless should be investigated as a pilot research project. Fifty per cent of the unused water resources in the Liguanea Basin serving the Kingston and St. Andrew area are contaminated with nitrates.

In an effort to ensure the purity of the water supply, the Pesticide Control Authority has added dangerous agricultural chemicals to the list of prohibited imports. In addition, draft ambient and recreational water quality standards have been developed by the Water Quality Standards Committee and are currently being reviewed. Mention might also be made of the NRCA's Permits and License System which covers effluents and discharges from agricultural production. This system was introduced in 1997 (CEPAL, 2005).

A study published in 2010 by a researcher at Missouri State University raises some concern, however, about the quality of Jamaica's water in an important region of Jamaica, the Bluefields Bay watershed. The research indicates that water supplies for drinking water and ecological support in Jamaica are threatened due to poverty and poor infrastructure. Domestic and commercial activities pollute rivers and coastal waters as well. The report goes on to say that the best water quality is found at sites where stream systems filter water through healthy wetland environments, and at sites further away from settled areas and lined with larger riparian corridors. The worst water quality is normally located in streams that have little or no riparian zones and are heavily used for washing clothes (Ebert, 2010).

2. GOVERNANCE ASPECTS

2.1. WATER INSTITUTIONS

Potable water supplies are the responsibility of the National Water Commission (NWC), the major supplier, the Urban Development Corporation and the Parish Councils. The NWC's responsibilities include the provision of potable water supply services and the collection, treatment and disposal of wastewater.

The NIC is responsible for the management, operation and maintenance of all the public irrigation systems in Jamaica. Activities include the harnessing and distribution of groundwater and surface water for allocation to farmers and also non-agricultural users. The NIC's primary mission is to maximize effective use of irrigation through improved conveyance and distribution, and to provide guidance and training in on-farm water management techniques in an effort to increase productivity and profitability in the agricultural sector and so achieve and maintain self-sustainability of the irrigation industry.

The Water Resources Authority (WRA) was established by statute to regulate the island's water resources. The WRA has responsibility for management, protection and controlled allocation and use of Jamaica's water resources. This is achieved through the development and administration of a long-term comprehensive "Water Resources Development Master Plan for Jamaica", necessary to enable rational decision-making on current and future water use and allocation which provides economic and environmentally sound development options. The WRA was established by the Water Resources Act of 1995 enacted in April 1996. This Act repealed the Underground Water Control Act and the Water Act. The WRA replaces Jamaica's previous hydrological agency, the Underground Water Authority.

The responsibility for formulating and implementing the government's policy on environmental management is vested in the Natural Resources Conservation Authority. Its responsibilities include watershed protection and management, environmental monitoring and enforcement, promoting industry compliance for the consistent meeting of effluent and waste standards by companies, development of a system of national parks and protected areas, coastal zones management, environmental education, increasing public awareness of environmental issues and promoting the use of environmental impact assessments.

The management of Jamaica's water sector is shared by (Springer, 2005):

a)The Water Resources Agency (WRA)

b)The National Water Commission (NWC)

c)The Office of Utility Regulation (OUR)

d)National Environmental Protection Agency (NEPA) and

e)The National Irrigation Commission Limited (NICL)

The Water Resources Agency

The WRA was established under the Water Resources Act of 1995 which became law on April 1 1996. The WRA operates under the portfolio of the Ministry of Water and Housing. The Act gives to the WRA the responsibility for (Springer, 2005):

a)management of water resources;

b)maintenance of a timely, updated and comprehensive database;

c)undertaking raw water quality and monitoring assessments;

d)planning and approval for water resources development;

e)issuing and enforcing permits for well drilling and water abstraction; and

f)public education, as appropriate.

The WRA interprets its mission broadly as ensuring the sustainability of the island's water resources through continual assessment and proper management, promotion and conservation, and protection and optimal development of these resources; and to ensure rational and equitable allocation of the nation's water resources and to reduce conflicts among water users.

The National Water Commission (NWC)The National Water Commission (NWC)

The NWC is responsible for the Urban Water Supply. It is also the largest provider of sewerage services. The NWC has been plagued with financial difficulties which have constrained its ability to perform its mandate (Springer, 2005).The NWC is responsible for the Urban Water Supply. It is also the largest provider of sewerage services. The NWC has been plagued with financial difficulties which have constrained its ability to perform its mandate (Springer, 2005).

While the Commission has been able to cover its operating costs, it has not been able to generate an adequate operating surplus to enable it to finance new investments in the water sector, and has had to rely heavily on government support. However, competing demands on government have meant that its assistance has been limited and sporadic. Efforts by the government to improve the NWC's financial performance have met with only limited success, due mainly to the absence of timely and adequate adjustments in the water tariff and the expansion of the areas covered by the NWC, without a commensurate increase in operating revenue; and the insufficiency of capital to upgrade the infrastructure inherited from the Parish Councils (Springer, 2005).While the Commission has been able to cover its operating costs, it has not been able to generate an adequate operating surplus to enable it to finance new investments in the water sector, and has had to rely heavily on government support. However, competing demands on government have meant that its assistance has been limited and sporadic. Efforts by the government to improve the NWC's financial performance have met with only limited success, due mainly to the absence of timely and adequate adjustments in the water tariff and the expansion of the areas covered by the NWC, without a commensurate increase in operating revenue; and the insufficiency of capital to upgrade the infrastructure inherited from the Parish Councils (Springer, 2005).

The GOJ intends that the NWC will be able to access a wider range of sources of finance including (Springer, 2005):The GOJ intends that the NWC will be able to access a wider range of sources of finance including (Springer, 2005):

-Charges levied on new customers in addition to the tariff to fund new projects from which they will benefit;-Charges levied on new customers in addition to the tariff to fund new projects from which they will benefit;

-Finance provided by the private sector; and-Finance provided by the private sector; and

-Government grants for specific works with a high social or environmental value.-Government grants for specific works with a high social or environmental value.

Developers of new discrete housing projects are required to meet the full costs of infrastructure provision and to recover these costs from the selling price of the units. The policy allows the cost of off-site infrastructure serving new or existing housing development and/or neighbouring communities to be recovered, via nominal tariffs (Springer, 2005).Developers of new discrete housing projects are required to meet the full costs of infrastructure provision and to recover these costs from the selling price of the units. The policy allows the cost of off-site infrastructure serving new or existing housing development and/or neighbouring communities to be recovered, via nominal tariffs (Springer, 2005).

Office of Utility Regulation (OUR)Office of Utility Regulation (OUR)

The OUR is responsible for the approval of tariffs and fees based on the prescribed/approved water quality and service quality standards; minimum quality of approved sewerage services and other appropriate parameters for urban potable water and sewerage service offered to urban users. The tariffs set by OUR must allow the NWC to fully recover efficient cost levels, including capital and operating costs. The NWC is fully responsible for increasing the efficiency of its operations and thus to reduce its cost to the lowest efficiency levels. Whenever tariffs are adjusted, the NWC and the OUR are required to implement a public education campaign including information on ways of reducing water bills through increased water conservation by consumers (Springer, 2005).The OUR is responsible for the approval of tariffs and fees based on the prescribed/approved water quality and service quality standards; minimum quality of approved sewerage services and other appropriate parameters for urban potable water and sewerage service offered to urban users. The tariffs set by OUR must allow the NWC to fully recover efficient cost levels, including capital and operating costs. The NWC is fully responsible for increasing the efficiency of its operations and thus to reduce its cost to the lowest efficiency levels. Whenever tariffs are adjusted, the NWC and the OUR are required to implement a public education campaign including information on ways of reducing water bills through increased water conservation by consumers (Springer, 2005).

The general principles that apply to the urban water sector also apply to those parts of the rural water sector served by the NWC. In particular, the policy on the tariff structure and the recovery of costs of infrastructure for new development are the same. However, the higher cost of serving the rural sector and the lower revenues and thus lower cost recovery prospects, demand higher subsidies than in the urban sector (Springer, 2005).The general principles that apply to the urban water sector also apply to those parts of the rural water sector served by the NWC. In particular, the policy on the tariff structure and the recovery of costs of infrastructure for new development are the same. However, the higher cost of serving the rural sector and the lower revenues and thus lower cost recovery prospects, demand higher subsidies than in the urban sector (Springer, 2005).

The National Environmental Protection Agency (NEPA)The National Environmental Protection Agency (NEPA)

NEPA, formerly the Natural Resources Conservation Agency (NRCA) is responsible for the management, conservation and protection of the natural resources of Jamaica. NEPA operates under the Watersheds Protection Act of 1963 which provides for the protection of watersheds and areas adjoining watersheds and the conservation of water resources. The Act provides for conservation of watersheds through the implementation of provisional improvement schemes whereby soil conservation schemes are carried out on the land. The Act has not been substantially revised since its promulgation and is deemed to be outdated especially in respect of the participatory approach currently being utilized in watershed management (Springer, 2005).NEPA, formerly the Natural Resources Conservation Agency (NRCA) is responsible for the management, conservation and protection of the natural resources of Jamaica. NEPA operates under the Watersheds Protection Act of 1963 which provides for the protection of watersheds and areas adjoining watersheds and the conservation of water resources. The Act provides for conservation of watersheds through the implementation of provisional improvement schemes whereby soil conservation schemes are carried out on the land. The Act has not been substantially revised since its promulgation and is deemed to be outdated especially in respect of the participatory approach

currently being utilized in watershed management (Springer, 2005).
There is considerable overlap in the authority of agencies engaged in watershed protection. In addition to the need for rationalization of the functions of these agencies, there is also the need for these institutions to receive adequate levels of funding (Springer, 2005).There is considerable overlap in the authority of agencies engaged in watershed protection. In addition to the need for rationalization of the functions of these agencies, there is also the need for these institutions to receive adequate levels of funding (Springer, 2005).
The need for a National Watershed Action Plan to systematically and strategically implement the protection of Jamaica's watersheds has been recognized (Springer, 2005).The need for a National Watershed Action Plan to systematically and strategically implement the protection of Jamaica's watersheds has been recognized (Springer, 2005).
In 2001, a new funding mechanism – The Forest Management and Conservation Fund – was established as a supplement to the resources provided by the government to provide long-term funding for re-forestation and forest conservation. The Fund is used exclusively for activities in the Forest Management and Conservation Plan. Another mechanism, the Tropical Forest Conservation Fund, was created to receive funds from a planned debt-for-nature swap (Springer, 2005).In 2001, a new funding mechanism – The Forest Management and Conservation Fund – was established as a supplement to the resources provided by the government to provide long-term funding for re-forestation and forest conservation. The Fund is used exclusively for activities in the Forest Management and Conservation Plan. Another mechanism, the Tropical Forest Conservation Fund, was created to receive funds from a planned debt-for-nature swap (Springer, 2005).
The National Irrigation Commission Limited (NICL)The National Irrigation Commission Limited (NICL)
The NICL is charged with the responsibility of operating irrigation systems through the use of Water Users Associations (WUAs) comprising farmers who benefit from the system. The intention is that these WUAs will operate as legal entities (e.g. cooperatives or limited liability companies). Farmers will be members and shareholders with the power to govern these organizations. The intention is that over time, the WUAs will assume full responsibility for operating the irrigation systems, with the NIC assuming responsibility for planning, regulating, monitoring and evaluating the irrigation sub-sector (Springer, 2005).The NICL is charged with the responsibility of operating irrigation systems through the use of Water Users Associations (WUAs) comprising farmers who benefit from the system. The intention is that these WUAs will operate as legal entities (e.g. cooperatives or limited liability companies). Farmers will be members and shareholders with the power to govern these organizations. The intention is that over time, the WUAs will assume full responsibility for operating the irrigation systems, with the NIC assuming responsibility for planning, regulating, monitoring and evaluating the irrigation sub-sector (Springer, 2005).
The NICL is pursuing the implementation of Phase 1 of its National Irrigation Development Programme (NIDP). The Programme is expected to complement the GOJ's long-term agricultural development plan to the year 2015 and advance the government's plan to increase farmer participation in irrigation and thus make the NICL more efficient. As part of the NIDP exercise, over 125 projects island-wide were evaluated. Fifty-one of these projects were selected for implementation by 2015, at a cost of US$106.3 million. The Programme also proposes that the presently irrigated area of 250km3 be increased by 60 per cent to 400km3 (Springer, 2005).The NICL is pursuing the implementation of Phase 1 of its National Irrigation Development Programme (NIDP). The Programme is expected to complement the GOJ's long-term agricultural development plan to the year 2015 and advance the government's plan to increase farmer participation in irrigation and thus make the NICL more efficient. As part of the NIDP exercise, over 125 projects island-wide were evaluated. Fifty-one of these projects were selected for implementation by 2015, at a cost of US$106.3 million. The Programme also proposes that the presently irrigated area of 250km3 be increased by 60 per cent to 400km3 (Springer, 2005).
A new major irrigation scheme is under construction in Pedro Plains, St. Elizabeth. Work on two additional flagship projects in Seven Rivers and Hounslow areas is to start by the end of the 2005/2006 financial year . A second phase of the NIDP (estimated to cost J$21 million) is planned which will bring total investment by the NICL to over J$2 billion (US$33 million) (Springer, 2005).A new major irrigation scheme is under construction in Pedro Plains, St. Elizabeth. Work on two additional flagship projects in Seven Rivers and Hounslow areas is to start by the end of the 2005/2006 financial year . A second phase of the NIDP (estimated to cost J$21 million) is planned which will bring total investment by the NICL to over J$2 billion (US$33 million) (Springer, 2005).
At the end of the 2004/2005 financial year, the Commission generated a net surplus of approximately J$21 million and increased its gross operating surplus to J$91.9 million (NICL, 1990). This performance was achieved through a combination of revenue enhancement and expenditure control measures including the sale of non-serviceable equipment and a reduction in energy costs; the latter was informed by a comprehensive energy audit on the irrigation system. NICL applies a single rate structure for all its irrigation systems, which does not reflect the differential costs associated with delivering irrigation water to farms. Generally, the rates charged do not provide the necessary funds to fully cover the operational, maintenance or capital costs (Springer, 2005).At the end of the 2004/2005 financial year, the Commission generated a net surplus of approximately J$21 million and increased its gross operating surplus to J$91.9 million (NICL, 1990). This performance was achieved through a combination of revenue enhancement and expenditure control measures including the sale of non-serviceable equipment and a reduction in energy costs; the latter was informed by a comprehensive energy audit on the irrigation system. NICL applies a single rate structure for all its irrigation systems, which does not reflect the differential costs associated with delivering irrigation water to farms. Generally, the rates charged do not provide the necessary funds to fully cover the operational, maintenance or capital costs (Springer, 2005).
The NICL applied to the OUR for a full rate and tariff review and expected to be able to introduce incremental increases in irrigation rates to allow the full recovery of operational and maintenance costs by the year 2010 , as stipulated in the National Water Policy. In an attempt at boosting the financial viability of irrigation systems, the government requires that operation and maintenance costs of existing irrigation systems should be met from user charges. In the case of new systems built under the National Irrigation Development Plan, users are required to pay a reasonable

proportion of the capital cost in addition to the operation and maintenance costs. Despite these requirements, water for irrigation is generally provided below cost to ensure food security (Springer, 2005).The NICL applied to the OUR for a full rate and tariff review and expected to be able to introduce incremental increases in irrigation rates to allow the full recovery of operational and maintenance costs by the year 2010 , as stipulated in the National Water Policy. In an attempt at boosting the financial viability of irrigation systems, the government requires that operation and maintenance costs of existing irrigation systems should be met from user charges. In the case of new systems built under the National Irrigation Development Plan, users are required to pay a reasonable proportion of the capital cost in addition to the operation and maintenance costs. Despite these requirements, water for irrigation is generally provided below cost to ensure food security (Springer, 2005).

There are plans in place to continue expanding water supply to communities, through rehabilitation of the existing system (the level of unaccounted-for water is currently at 63 per cent) and expansion of capital infrastructure.There are plans in place to continue expanding water supply to communities, through rehabilitation of the existing system (the level of unaccounted-for water is currently at 63 per cent) and expansion of capital infrastructure.

With respect to irrigated agriculture, the National Irrigation Development Plan (1998) proposes a total of 51 irrigation projects for implementation over a 17-year period. This plan is aimed at increasing agricultural production to benefit individual farm families and the economy as a whole. Some of the possibilities for developing additional water for irrigation include the export of surplus water from one basin to another; construction, where feasible, of additional storage reservoirs and micro dams; implementation of a groundwater recharge programme; and a review of the irrigation policy.With respect to irrigated agriculture, the National Irrigation Development Plan (1998) proposes a total of 51 irrigation projects for implementation over a 17-year period. This plan is aimed at increasing agricultural production to benefit individual farm families and the economy as a whole. Some of the possibilities for developing additional water for irrigation include the export of surplus water from one basin to another; construction, where feasible, of additional storage reservoirs and micro dams; implementation of a groundwater recharge programme; and a review of the irrigation policy.

Some of the issues to be examined with respect to irrigation policy include:Some of the issues to be examined with respect to irrigation policy include:

-water pricing to ensure improved cost recovery;-water pricing to ensure improved cost recovery;

-the establishment of water users' associations with a view to thereby improving system maintenance and performance and flexibility in operation;-the establishment of water users' associations with a view to thereby improving system maintenance and performance and flexibility in operation;

-incentive policies to improve irrigated agriculture productivity;-incentive policies to improve irrigated agriculture productivity;

-review of a number of pertinent laws and regulations;-review of a number of pertinent laws and regulations;

-placing of greater emphasis on economic benefits and financial returns in the planning of government-financed projects;-placing of greater emphasis on economic benefits and financial returns in the planning of government-financed projects;

-improved management strategy to enable more economical and sustainable use of water resources.-improved management strategy to enable more economical and sustainable use of water resources.

For water management purposes, Jamaica is divided into 26 Watershed Management Units (WMUs) comprising all the land from the mountains to the sea and containing over 100 rivers and streams. These watersheds are essentially composites of river basins which fall within 10 hydrological basins (regions). Surface water predominates on the outcrops of basement rocks and interior valley alluviums and groundwater dominates in karstic limestone and coastal alluvium. The geology of Jamaica plays an important role in determining the occurrence of water resources and their availability. The rock formations of Jamaica are grouped into six hydrostratigraphic units. The three dominant units are Basement Aquiclude, Limestone Aquifer and Alluvium Aquifer/Aquiclude (Springer, 2005).For water management purposes, Jamaica is divided into 26 Watershed Management Units (WMUs) comprising all the land from the mountains to the sea and containing over 100 rivers and streams. These watersheds are essentially composites of river basins which fall within 10 hydrological basins (regions). Surface water predominates on the outcrops of basement rocks and interior valley alluviums and groundwater dominates in karstic limestone and coastal alluvium. The geology of Jamaica plays an important role in determining the occurrence of water resources and their availability. The rock formations of Jamaica are grouped into six hydrostratigraphic units. The three dominant units are Basement Aquiclude, Limestone Aquifer and Alluvium Aquifer/Aquiclude (Springer, 2005).

Jamaica’s Water Resources Development Master Plan 1990 (in the final stages of redesign), identifies two main water demand sectors; agricultural and non-agricultural. It further divides the non-agricultural sector into domestic urban, domestic rural, industrial and tourism. Water used for hydro-electricity or recreation is not quantified as these are considered non-consumptive uses. Regular water shortages occur during the annual drought period in Jamaica, and this points to the need to develop new water supplies. The demand assessment of 1985 indicated a water shortage of 216 million m3 year and the projected shortage for 2015 was 813 million m3 year if no new water supplies are constructed. This shortage was based on the following projections (Springer, 2005):Jamaica’s Water Resources Development Master Plan 1990 (in the final stages of redesign), identifies two main water demand sectors; agricultural and non-agricultural. It further divides the non-agricultural sector into domestic urban, domestic rural, industrial and tourism. Water used for hydro-electricity or recreation is not quantified as these are considered non-consumptive uses. Regular water shortages occur during the annual drought period in Jamaica, and this points to the need to develop new water supplies. The demand assessment of 1985 indicated a water shortage of 216 million m3 year and the projected shortage for 2015 was 813 million m3 year if no new water supplies are constructed. This shortage was based on the following projections (Springer, 2005):

a)an increase in rural demand is based on a projected increase in population of 14 per cent;a)an increase in rural demand is based on a projected increase in population of 14 per cent;

b)an increase in urban demand including tourism based on a projected 22 per cent increase in urban population and a plan to improve the service to 15 per cent of the population now receiving less than 100m3/year per capita;b)an increase in urban demand including tourism based on a projected 22 per cent increase in urban population and a plan to improve the service to 15 per cent of the population now receiving less than 100m3/year per capita;

c)an increase in industrial demand was due to expected industrial development;c)an increase in industrial demand was due to expected industrial development;

d)an increase in agricultural demand was based on a projected increase in irrigated area of 100 per cent.d)an increase in agricultural demand was based on a projected increase in irrigated area of 100 per cent.

Over the past decade, Jamaica has recorded significant progress in providing water services to its people. Nearly 81.2 per cent of households have access to safe water, compared with 61 per cent in 1990. The percentage of persons relying on water from rivers, streams and ponds has dropped to under 3 per cent from 5.7 per cent in 1990 (Springer, 2005).Over the past decade, Jamaica has recorded significant progress in providing water services to its people. Nearly 81.2 per cent of households have access to safe water, compared with 61 per cent in 1990. The percentage of persons relying on water from rivers, streams and ponds has dropped to under 3 per cent from 5.7 per cent in 1990 (Springer, 2005).

The poorest 20 per cent of the population are still not adequately served with piped water. One-third of the poorest households rely on standpipes; 30 per cent get their water from untreated sources such as rivers (Springer, 2005).The poorest 20 per cent of the population are still not adequately served with piped water. One-third of the poorest households rely on standpipes; 30 per cent get their water from untreated sources such as rivers (Springer, 2005).

Access to pipe-borne water by urban households is relatively good. Nearly 98 per cent of households within the Kingston Metropolitan Area (KMA) and 85 per cent of households in other towns have access to piped water. Those urban households without piped water rely predominantly on standpipes. About half of standpipe users in urban areas travel 50 yards or less to collect water. However, the reliability of the water supply within the urban setting is described as “erratic”. This is mainly due to the fact that the major water resources are not located in close proximity to the major population centres, necessitating costly investments in installing and maintaining the distribution system (Springer, 2005).Access to pipe-borne water by urban households is relatively good. Nearly 98 per cent of households within the Kingston Metropolitan Area (KMA) and 85 per cent of households in other towns have access to piped water. Those urban households without piped water rely predominantly on standpipes. About half of standpipe users in urban areas travel 50 yards or less to collect water. However, the reliability of the water supply within the urban setting is described as “erratic”. This is mainly due to the fact that the major water resources are not located in close proximity to the major population centres, necessitating costly investments in installing and maintaining the distribution system (Springer, 2005).

Further, the lack of spare parts combined with blocked, leaking and rusty pipes and infrastructure is hampering the work of the Commission. The water storage system for the KMA is no longer able to serve the almost 1 million people living in the area. The government has been striving to expand access to water in new housing developments. However, the Office of Utilities Regulation (OUR) has questioned the sustainability of this programme and regards it as an added burden on existing operations and as minimizing the NWC’s quality of service, unless there is a rate increase to take care of additional expenses (Springer, 2005).Further, the lack of spare parts combined with blocked, leaking and rusty pipes and infrastructure is hampering the work of the Commission. The water storage system for the KMA is no longer able to serve the almost 1 million people living in the area. The government has been striving to expand access to water in new housing developments. However, the Office of Utilities Regulation (OUR) has questioned the sustainability of this programme and regards it as an added burden on existing operations and as minimizing the NWC’s quality of service, unless there is a rate increase to take care of additional expenses (Springer, 2005).

In the rural areas, less than 40 per cent of households have access to piped water. Approximately 25 per cent of rural households get water from standpipes and there is little use of rainwater stored in tanks. Sewerage is not normally provided in rural areas. Less than 15 per cent of rural households are connected to the sewerage supply. The predominant form of sewerage disposal is the pit latrine which is used by about 65 per cent of rural households (Springer, 2005).In the rural areas, less than 40 per cent of households have access to piped water. Approximately 25 per cent of rural households get water from standpipes and there is little use of rainwater stored in tanks. Sewerage is not normally provided in rural areas. Less than 15 per cent of rural households are connected to the sewerage supply. The predominant form of sewerage disposal is the pit latrine which is used by about 65 per cent of rural households (Springer, 2005).

The Water Resources Act (1995) was declared as a new statute in the Jamaican Parliament in September 1995 and enacted into law on April 1 1996. This marked a 25-year effort to address the deficiencies in legislation for the proper administration, development, and optimal use of the island's water resources. The Act gives the Water Resources Authority (WRA) the responsibility for planning. A National Water Plan recommends projects and programmes that should be undertaken in respect of the development, control, usage, and storage of water as well as its supply, distribution and disposal (WRA, 2010).The Water Resources Act (1995) was declared as a new statute in the Jamaican Parliament in September 1995 and enacted into law on April 1 1996. This marked a 25-year effort to address the deficiencies in legislation for the proper administration, development, and optimal use of the island's water resources. The Act gives the Water Resources Authority (WRA) the responsibility for planning. A National Water Plan recommends projects and programmes that should be undertaken in respect of the development, control, usage, and storage of water as well as its supply, distribution and disposal (WRA, 2010).

The Watersheds Protection Act (1963) is the law governing watersheds in Jamaica and is administered by the Natural Resources Conservation Authority. The primary focus of the Act is the conservation of water resources by protecting lands and riparian zones along the watersheds. The

Act is intended to ensure proper land use in vital watershed areas, reduce soil erosion, maintain optimum levels of groundwater, and promote regular flows in waterways (NEPA, 1963).The Watersheds Protection Act (1963) is the law governing watersheds in Jamaica and is administered by the Natural Resources Conservation Authority. The primary focus of the Act is the conservation of water resources by protecting lands and riparian zones along the watersheds. The Act is intended to ensure proper land use in vital watershed areas, reduce soil erosion, maintain optimum levels of groundwater, and promote regular flows in waterways (NEPA, 1963).

The National Water Policy speaks of the government's commitment to achieve cost efficiencies, mobilize additional sources of funding for investment support and to introduce cost recovery mechanisms to ensure that the direct beneficiary pays and that the supply of services can be maintained and expanded (Springer, 2005).The National Water Policy speaks of the government's commitment to achieve cost efficiencies, mobilize additional sources of funding for investment support and to introduce cost recovery mechanisms to ensure that the direct beneficiary pays and that the supply of services can be maintained and expanded (Springer, 2005).

The framework for the management of Jamaica's water resources and for future water development and related capital expenditure is provided in the Water Sector Policy which was prepared by the Ministry of Water in January 1999. The policy was developed to complement and be consistent with Jamaica's Industrial Policy, the National Land Policy, the Green Paper on Parks and Protected Areas, the National Environmental Protection Plan and the National Policy on Science and Technology. This has helped to promote an integrated approach to policy implementation and has allowed for the knock-on effects of the respective policies to be carefully assessed (Springer, 2005).The framework for the management of Jamaica's water resources and for future water development and related capital expenditure is provided in the Water Sector Policy which was prepared by the Ministry of Water in January 1999. The policy was developed to complement and be consistent with Jamaica's Industrial Policy, the National Land Policy, the Green Paper on Parks and Protected Areas, the National Environmental Protection Plan and the National Policy on Science and Technology. This has helped to promote an integrated approach to policy implementation and has allowed for the knock-on effects of the respective policies to be carefully assessed (Springer, 2005).

The policy emphasizes water use efficiency and conservation. It promotes, among other things, a shift of national priorities from water resources development to the restoration of existing resources and enhancement of water quality. The policy seeks to (Springer, 2005):The policy emphasizes water use efficiency and conservation. It promotes, among other things, a shift of national priorities from water resources development to the restoration of existing resources and enhancement of water quality. The policy seeks to (Springer, 2005):

a)ensure integrated and informed management of water resources;a)ensure integrated and informed management of water resources;

b)ensure water for public supply received priority in the allocation of resources;b)ensure water for public supply received priority in the allocation of resources;

c)ensure that water is used as efficiently as possible;c)ensure that water is used as efficiently as possible;

d)ensure implementation measures to restore and enhance the quality and quantity of usable water and protect the aquifers, watersheds and other sources of water.d)ensure implementation measures to restore and enhance the quality and quantity of usable water and protect the aquifers, watersheds and other sources of water.

In respect of the prevention and control of water pollution, the policy outlines the following specific strategies (Springer, 2005):In respect of the prevention and control of water pollution, the policy outlines the following specific strategies (Springer, 2005):

•maintenance of ecosystem integrity through the protection of aquatic resources from the negative impacts of development and natural processes;•maintenance of ecosystem integrity through the protection of aquatic resources from the negative impacts of development and natural processes;

•protection of public health against disease vectors from pathogens;•protection of public health against disease vectors from pathogens;

•ensuring sustainable water use and ecosystem protection on a long term basis; and•ensuring sustainable water use and ecosystem protection on a long term basis; and

•enforcing the "polluter pays" principle.•enforcing the "polluter pays" principle.

The policy also focuses on developing mechanisms to ensure compliance, including public education, incentives and sanctions. There are several other pieces of legislation which govern some aspect of watershed management. They include (Springer, 2005):The policy also focuses on developing mechanisms to ensure compliance, including public education, incentives and sanctions. There are several other pieces of legislation which govern some aspect of watershed management. They include (Springer, 2005):

•Natural Resources Conservation Authority Act (1991)•Natural Resources Conservation Authority Act (1991)

•Forest Act(1996)•Forest Act(1996)

•Rural Agricultural Development Act(1990)•Rural Agricultural Development Act(1990)

•Water Resources Act(1995)•Water Resources Act(1995)

•Town and Country Planning Act(1988)•Town and Country Planning Act(1988)

•Land Development and Utilization Act(1966)•Land Development and Utilization Act(1966)

•The Mining Act(1947)•The Mining Act(1947)

•Wildlife Protection Act (1945)•Wildlife Protection Act (1945)

Reviews of these Acts have indicated areas of overlap or duplication, which highlights the need for further clarification and agreement on roles and areas of jurisdiction, as well as the need to review and update some pieces of legislation (Springer, 2005).Reviews of these Acts have indicated areas of overlap or duplication, which highlights the need for further clarification and agreement on roles and areas of jurisdiction, as well as the need to review and update some pieces of legislation (Springer, 2005).

In November 1997, the government of Jamaica approved a policy framework for the National System of Protected Areas. The policy defines a protected area as 'an area of land or water that is managed for the protection and maintenance of its ecological systems, biodiversity and/or specific natural, cultural or aesthetic resources' (Springer, 2005).In November 1997, the government of Jamaica approved a policy framework for the National System of Protected Areas. The policy defines a protected area as 'an area of land or water that is managed for the protection and maintenance of its ecological systems, biodiversity and/or specific natural, cultural or aesthetic resources' (Springer, 2005).

The policy recognizes that with the 'diversity of flora and fauna, land and water habitats, and wild and human landscapes', Jamaica needs a system of protected areas as part of its national development strategy. Goal 1 of the policy is Economic Development, followed by Environmental Conservation, Sustainable Resource Use, Recreation and Public Education, Public Participation and Local Responsibility, and Financial Sustainability. Jamaica presently has two designated protected areas; national park and marine park (Springer, 2005).The policy recognizes that with the 'diversity of flora and fauna, land and water habitats, and wild and human landscapes', Jamaica needs a system of protected areas as part of its national development strategy. Goal 1 of the policy is Economic Development, followed by Environmental Conservation, Sustainable Resource Use, Recreation and Public Education, Public Participation and Local Responsibility, and Financial Sustainability. Jamaica presently has two designated protected areas; national park and marine park (Springer, 2005).

Other types of protected areas will include (Springer, 2005):Other types of protected areas will include (Springer, 2005):

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

<h2>2.2.WATER MANAGEMENT2.2.WATER MANAGEMENT<h2>2.3.WATER POLICY AND LEGAL FRAMEWORK2.3.WATER POLICY AND LEGAL FRAMEWORK

3. GEOPOLITICAL ASPECTS

Jamaica is located to the south of Cuba and forms part of the Greater Antilles. The largest island of the English-speaking Caribbean, it boasts a total land area of 10,990km2.

Jamaica is an island state and therefore does not share common watershed boundaries with any other country (CEHI-UNEP, 2001).

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