

**Water and Sewerage Corporation Support Program
New Providence Water Supply and Sanitation Systems Upgrade
BH-L1028**

Environmental and Social Analysis

FINAL DRAFT

September 2011

**Prepared by
Stacey Moultrie
Environmental Consultant**

Table of Contents

Acronyms	4
Executive Summary	5
1.0 Introduction.....	6
1.1 Project Description	6
1.2 Objectives	10
2.0 Legal Framework	10
2.1 Water and Sewerage Corporation Act 1976 (Chapter 196).....	11
2.2 Out Islands Utilities Act 1965 (Chapter 28)	12
2.3 Water Supplies (Out Islands) Act 1953 (Chapter 197).....	12
2.4 Utilities Regulation and Competition Authority Act 2009.....	12
2.5 Environmental Health Services Act (Chapter 232).....	13
2.6 Building Regulations Act, 1971 (Chapter 200)	13
2.7 Hawksbill Creek, Grand Bahama (Deep Water Harbour and Industrial Area) (Amendment Agreement) (No. 2) Act (Chapter 263)	13
2.8 Planning and Subdivision Act 2010	13
2.9 Forestry Act 2010.....	14
2.10 Various Heads of Agreement	14
2.11 Various Franchise Agreements	14
2.12 Bill proposing the Environment Act of 2010.....	15
3.0 Institutional Framework.....	16
3.1 The Water Sewerage Corporation	16
3.2 Utilities Regulation and Competition Authority (URCA).....	17
3.3 Ministry of the Environment.....	19
3.3.1 Department of Environmental Health Services (DEHS)	19
3.3.2 Department of Physical Planning (DPP).....	21
3.3.3 Bahamas Environment, Science and Technology (BEST) Commission	21
3.4 Ministry of Finance	21
3.5 The Cabinet.....	22
4.0 Environmental and Social Conditions	22
4.1 Groundwater resources	22
4.2 Hydrogeology.....	24
4.3 Rainfall	25
4.4. Ecology	26

4.5 Water use	26
4.6 Sewage treatment	27
4.7 Water quality monitoring.....	36
4.8 Health and Safety	38
5.0 Environmental and Social Impacts.....	38
5.1 Current Threats.....	38
5.2 Project Impacts.....	40
6.0 Analysis of Alternatives	49
7.0 Mitigation Measures	49
8.0 Conclusion	53
Appendix 1: TORs for Preparation of the ESA.....	55
Appendix 2: Sewerage Asset Register	60
Bibliography	61

List of Figures and Tables

Figure 1: Map of New Providence Island	7
Figure 2: Water and Sewerage Corporation Organizational Structure	18
Figure 3: Diagram of Ghyben–Hertzberg Lens	23
Figure 4: Mean Annual Rainfall for The Bahamas.....	26
Figure 5: Coral Vista Wastewater Treatment Plant	28
Figure 6: Fox Hill Wastewater Treatment Plant.....	29
Figure 7: Fox Hill Wastewater Treatment Plant.....	30
Figure 8: Malcolm Park Wastewater Treatment Plant – Storage Tanks.....	31
Figure 9: Malcolm Park Wastewater Treatment Plant - Pumps	32
Figure 10: Flamingo Gardens Wastewater Treatment Plant	33
Figure 11: Lagoons at Septage and Sludge Facility.....	34
Figure 12: Lagoons at Septage and Sludge Facility.....	35
Table 1: Potential Negative Environmental and Social Impacts of the Construction Phase.....	42
Table 2: Potential Positive Environmental and Social Impacts of the Operational Phase.....	47
Table 3: Mitigation Measures.....	50

Acronyms

AMI	Automated meter intelligence
AMR	Automated meter reading
B\$	Bahamian Dollar
BEST	Bahamas Environment, Science and Technology Commission
BOD	Biological Oxygen Demand
CIS	Customer Information System
COD	Chemical Oxygen Demand
DBOO	Design, Build, Own and Operate
DEHS	Department of Environmental Health Services
DPP	Department of Physical Planning
EIA	Environmental Impact Assessment
EMRAD	Environmental Monitoring and Risk Assessment Division
ENR	Engineering News Record
ESA	Environmental and Social Analysis
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Strategy
GBPA	Grand Bahama Port Authority
GBUC	Grand Bahama Utility Company
GIS	Geographic Information System
GOBH	Government of The Bahamas
HR	Human Resources
IDB	Inter-American Development Bank
Migd	Million imperial gallons per day
MIS	Management Information System
Mn	Million
NP	New Providence
NRW	Non-Revenue Water
OP	Operating Procedure
psi	per square inch
RO	Reverse Osmosis
SCADA	Supervisory Control and Data Acquisition system
URCA	Utilities Regulation and Competition Authority
WHO	World Health Organization
WMC	Water Management Consultants
WSC	Water and Sewerage Corporation
WSSP	Water and Sanitation Strategic Sector Plan
WWTP	Wastewater Treatment Plant

**Water and Sewerage Corporation Support Program
New Providence Water Supply and Sanitation Systems Upgrade
BH-L1028**

Environmental and Social Analysis and Environmental and Social Management Plan

Executive Summary

The Inter-American Development Bank is preparing a US\$81 million Water and Sewerage Corporation (WSC) Support Program – New Providence Water Supply and Sanitation Systems Upgrade (BH-L1028). The program will include four components:

1. Non-revenue Water (NRW) Reduction
2. WSC Institutional Strengthening
3. Minimum Wastewater Infrastructure Upgrades and Preparation of a Wastewater Master Plan
4. Upgrade Legal and Regulatory Framework

In order to address the problems facing the WSC and move toward financial sustainability, a number of operational areas where WSC should reduce costs or improve revenues were identified in the Water and Sanitation Strategic Sector Plan (WSSP) completed in 2009.

The long-term aim of the WSSP is to ensure the financial and operational sustainability of the service provided by the WSC so that potential customers will turn to the WSC as their preferred service provider and, in so doing, move away from the use of small, shallow wells that are commonly found in New Providence but which are an inherent health risk due to groundwater contamination from septic tanks, cesspools and the like. A cornerstone to ensure the sustainability of the WSC will be to reduce the current high levels of NRW to lower levels of around 20% or 2.5mgd at current flow rates.

Historically, sewerage has not been given much attention due to its limited coverage (less than 7% and 10,000 customers), low revenue generation (~\$4Mn per annum), and the extreme challenges constantly faced with water supply. Consequently, infrastructure conditions have declined significantly over the years and more recently staffing levels have decreased by over 30%. Significant investments are therefore required to avoid complete failure, of several systems or parts thereof, to minimize operational emergencies, and to mitigate the associated health and environmental risks.

The Environmental and Social Analysis (ESA) provides an overview of the project, current conditions in the water and sanitation sector, potential impacts of the project and mitigation recommended for these impacts.

1.0 Introduction

1.1 Project Description

The Inter-American Development Bank is preparing a US\$81 million WSC Support Program – New Providence Water Supply and Sanitation Systems Upgrade (BH-L1028). The general objective of the proposed program is to improve the performance of the Water and Sewerage Corporation (WSC) and environmental conditions of The Bahamas by improving the operation and management of the waste water infrastructure. The specific objective is to reduce the high levels of non-revenue water (NRW) in New Providence and improve the existing wastewater management services in priority areas, through:

- (i) the implementation of a NRW program with the aim of reducing by half its current levels
- (ii) the implementation of an asset management plan, refurbishment, upgrade and improvement of malfunctioning wastewater network and treatment facilities
- (iii) the strengthening of WSC operational and maintenance performance; and
- (iv) upgrade of the legal and regulatory framework for the water sector

A map of New Providence is provided in Figure 1.

The Water and Sewerage Corporation (WSC) is the main provider of water and sewerage services in The Bahamas. Its service base includes about 66,000 customers on 13 islands that are spread over more than 200,000 square kilometres of territory, including the main population centre of New Providence.

Whilst approximately 98% of population in urban areas of New Providence has access to potable water, only 38% of properties regularly use water supplied by WSC. The number of live connections is considered to be 41,559, which with an occupancy rate of 3 people per house, corresponds to customer base of 124,667 people out of the total New Providence population of 328,097.

Figure 1: Map of New Providence Island¹



As a result of former customers ceasing to use a WSC supply, the Corporation considers that there may be as many as 20,000 dormant or inactive water connections.

WSC's service area has limited availability of naturally occurring freshwater resources. Demand for water exceeds the local groundwater resource and the WSC purchases water from contractor-operated reverse osmosis plants and contracted barging services. The supply from the reverse osmosis plants has grown by over 450 percent since 2000, increasing WSC's cost of water purchase by B\$20 million over the same period.

In this context of limited supply and high cost, water lost through non-revenue leakage at slightly above 50% , or 5mgd, is an unwanted strain on the finances of the WSC.

Government subsidies are presently \$11Mn annually for water purchases in New Providence based on its allocation for the fiscal year 2010-2011. The subsidy is equivalent to \$0.0056/gallon sold or \$33.5 per head of population, whether or not a customer of WSC.

In order to address the problems facing the WSC and move toward financial sustainability, a number of operational areas where WSC should reduce costs or improve revenues were identified in the Water and Sanitation Strategic Sector Plan (WSSP) completed in 2009. Additionally, procedural and structural improvements that should increase WSC's ability to implement the goals that it sets out within its corporate planning documents were identified.

¹ Loud, Peter, 1997 – 2006. http://www.peterloud.co.uk/bahamas/new_prov.html

The long-term aim of the WSSP is to ensure the financial and operational sustainability of the service provided by the WSC so that potential customers will turn to the WSC as their preferred service provider and, in so doing, move away from the use of small, shallow wells that are commonly found in New Providence but which are an inherent health risk due to groundwater contamination from septic tanks, cesspools and the like. A cornerstone to ensure the sustainability of the WSC will be to reduce the current high levels of NRW to lower levels of around 20% or 2.5mgd at current flow rates.

Historically, sewerage has not been given much attention due to its limited coverage (less than 7% and 10,000 customers), low revenue generation (~\$4Mn per annum), and the extreme challenges constantly faced with water supply. Consequently, infrastructure conditions have declined significantly over the years and more recently staffing levels have decreased by over 30%. Significant investments are therefore required to avoid complete failure, of several systems or parts thereof, to minimize operational emergencies, and to mitigate the associated health and environmental risks.

The WSC has recently updated its Sewerage Asset Register (see Appendix 2). It should be noted that the total sewerage assets on New Providence Island is now valued at \$162.6 Mn, however beyond inherited third party infrastructure, and emergencies, very little investment has occurred over the last decade. Having proposed a significant investment in NRW, the WSC is also proposing a component to rehabilitate selected sewage treatment plants in this Project in order to stabilize operations, and to deal with immediate and critical sewerage needs for New Providence over the next 2 – 3 years. Preparation of a Wastewater Master Plan to guide development of WWTPs is also contemplated.

The program will include four components:

Component 1: NRW Reduction (US\$50 million): This component will finance a NRW Reduction Contract to address water losses in New Providence. The goal is to reduce NRW to 2.5Migd (million imperial gallons per day) at an average annual system pressure of 25psi within a maximum of 5 years, and to maintain the savings achieved for the remainder of the project's 10-year duration. The contract's main targets will be:

- (i) completion of a Baseline Survey and preparation of a detailed NRW Reduction Strategy (\$3 Mn);
- (ii) leak detection and repairs (\$13.5 Mn)
- (iii) construction works and equipment, including mains and service lateral replacement, pressure control, data collection and monitoring (\$30 Mn);
- (iv) NRW asset management information system (MIS) that integrates key existing WSC systems such as GIS, Work Order Management, customer information, and network analysis (\$2 Mn)
- (v) training of WSC staff (\$0.5 Mn); and

(vi) consulting services to assist with execution (\$1 Mn).

Component 2: WSC Institutional Strengthening (US\$6 million): This component will finance:

- (i) improvement to management information systems (MIS) with supervisory control and data acquisition system (SCADA) (\$1 Mn);
- (ii) development of automated meter reading/intelligence (AMR/AMI) system for commercial accounts (\$0.5 Mn);
- (iii) public relations campaign for project and customer win-back campaign (\$2 Mn);
- (iv) training, development and implementation of the new organizational structure including , benchmark performance standards for preparation of WSC for sector regulatory reform (\$2 Mn); and
- (v) completion of a tariff study to prepare for sector economic regulation (\$0.5 Mn).

Component 3: Minimum Wastewater Infrastructure Upgrades and Preparation of a Wastewater Master Plan (US\$15.4 million): This component will finance:

Wastewater Treatment Plants (\$9.9 Mn) – Most of the major WWTPs on New Providence require upgrades. While there are varying levels of treatment, most only offer preliminary treatment, followed by deep well disposal. Many have also exceeded their design capacities. All of the sites require urgent and essential upgrades to stabilize the operations, and to mitigate health and environmental concerns. The sites include Fox Hill, Flamingo Gardens, Malcolm Park, and the Septage and Sludge Facility. New disposal wells and upgrades are also being proposed at several sites.

Lift Stations (\$0.9 Mn) – There are some 90 lift stations in New Providence, many of which require substantial rehabilitation to ensure all civil, electrical, mechanical, security, and aesthetic needs are addressed. Works also include the addition of screening systems and SCADA.

Sewers/Forcemains (\$3.6 Mn) – Several sewers dating back to the 1920s must be replaced as they are in constant danger of collapse along with other sewers that require cleaning and rehabilitation. Serious attention must also be given to grease control, and infiltration/exfiltration. It is estimated that some 13,000 ft. of gravity sewers must be replaced along with approximately 17,000 ft. of forcemains. The latter is required to either divert, or activate old systems that were never commissioned for various reasons, and to divert waste flows from isolated drainage areas without treatment (disposal wells only) or from plants that have been or will be abandoned to proper treatment and disposal facilities.

Wastewater Master Plan (\$1 Mn) – Under this project, an updated Wastewater Master Plan is also proposed to provide for longer term investment guidance, to address the wastewater needs of New Providence, and to identify options for improving wastewater treatment and reuse. The

plan will also prepare the necessary technical, social, environmental and financial documents, such as relevant environmental analysis, stakeholder awareness and tariff setting mechanisms related to wastewater.

Component 4: Upgrade legal and regulatory framework (US\$6 million): This component will finance:

- (i) establishment of the Utilities Regulation and Competition Authority (URCA) as the independent Economic Regulator for the water sector through new legislation and ensuring the readiness of URCA for sector regulation (\$3.5 Mn); and
- (ii) the reorganization of the institutional arrangements for water resources management and environmental protection in The Bahamas and establishment of an independent Environmental Regulator (\$2.5 Mn).

1.2 Objectives

In accordance with the IDB Environmental and Social Strategy (ESS), the program requires preparation of an Environmental and Social Analysis (ESA) and an Environmental and Social Management Plan (ESMP). The Terms of Reference for the consultancy to prepare these documents are detailed in Appendix 1.

The objectives of the ESA are to:

- Identify the positive and/or negative alterations of the human and natural environment which may affect the quality of life as well as present and future options for sustainable social and economic development in the operations area of influence;
- Identify preventive or mitigation measures to minimize the negative impacts and enhance the positive impacts of project design alternatives;
- Determine whether the proposed operation is the optimal or at least a viable solution to the development needs it addresses after the costs and benefits of impacts, mitigated or not, are internalized; and
- After comparing the alternatives, including that of no action, recommend a course of action including preventive or mitigation measures through preparation of an ESMP.

2.0 Legal Framework

The key Acts of Parliament and agreements which govern the water and sanitation sector in The Bahamas are²:

² Castalia Strategic Advisors, 2010. *Recommendations for Updating the Regulatory Framework for the Water and Sanitation Sector in The Bahamas*. Report to the Inter-American Development Bank and the Government of The Bahamas.

- Water and Sewerage Corporation Act, 1976 (Chapter 196)
- Out Islands Utilities Act, 1965 (Chapter 28)
- Water Supplies (Out Islands) Act, 1953 (Chapter 197)
- Utilities Regulation and Competition Authority Act, 2009.
- Environmental Health Services Act, 1987 (Chapter 232)
- Building Regulations Act, 1971 (Chapter 200)
- Hawksbill Creek, Grand Bahama (Deep Water Harbour and Industrial Area) (Amendment Agreement) (No. 2) Act (Chapter 263)
- Subdivisions and Planning Act 2011
- Forestry Act 2010
- Various Heads of Agreement
- Various Franchise Agreements

2.1 Water and Sewerage Corporation Act 1976 (Chapter 196)

The Water and Sewerage Corporation Act (WSC Act) establishes the WSC as both a service provider and a regulator. Article 5 of the WSC Act sets the WSC's role as a service provider:

- Providing “adequate supplies of suitable water for domestic use, for livestock, for irrigation and agricultural purposes, for urban and industrial use,” and
- Providing “adequate facilities for drainage the safe disposal of sewage and industrial effluents.”

Articles 5 and 6 of the Act set the WSC's regulatory responsibilities:

- Controlling and ensuring “the optimum development and use of the water resources of the Commonwealth of The Bahamas”
- Ensuring “the co-ordination of all activities which may influence the quality, quantity, distribution or use of water”
- Ensuring “the application of appropriate standards and techniques for the investigation, use, control, protection, management and administration of water”
- Determining “the allocation of available water between different users or types of use in any area within its jurisdiction,” and
- Prescribing and collecting “rates and service fees and deposits in respect of the distribution and supply of water and the disposal of sewerage.”

The Act assigns oversight of the WSC to the “Minister responsible for Water and Sewerage,” which is currently the Minister for the Environment, and also assigns control of key financial decisions regarding the WSC to the Minister of Finance.

2.2 Out Islands Utilities Act 1965 (Chapter 28)

The Out Islands Utilities Act encourages expansion of water and sanitation service in the Family Islands. Chapter 28 provides for refunds of customs duties and certain other concessions to developers of network providers. This Act allows any developer wishing to construct a utility project for the use of the public in any part of the Out Islands to make application to the Minister³ for approval of the project. The Minister may enter into a franchise agreement licensing the developer to construct, maintain and operate the utility project if satisfied that the construction and operation of the utility will be in the best interests of The Bahamas.

2.3 Water Supplies (Out Islands) Act 1953 (Chapter 197)

The Water Supplies (Out Islands) Act allows the Minister to gain access to public water supplies in the Out Islands for the purpose of extending them or maintaining them. The Act gives the Minister the power to maintain the existing water supply system within any district, and empowers the Minister and any person so authorized by the Minister to, from time to time, extend the service into, through, across, under or over any street or Crown land, or any land whatsoever located within that district.

Chapter 197 also empowers the Minister by giving notice in writing to require the owner of any building of a specified capital value and being situated in any district within two hundred yards of any service pipe or main, to connect the said building at his own expense to the water-supply system.

2.4 Utilities Regulation and Competition Authority Act 2009

The Utilities Regulation and Competition Authority Act (URCA Act) established URCA. In establishing URCA, this Act dissolved the Public Utilities Commission and the Television Regulatory Authority, transferring their legacy properties, contracts, functions and powers to the URCA.

Further, the Act grants URCA the power to issue regulatory measures over the sectors that it has been authorized to oversee, and to charge regulatory fees that are sufficient to allow it to meet the costs of carrying out its functions.

The Act does not authorize URCA to engage in economic regulation of the water and sanitation sector, but, in tandem with the enabling legislation for regulation of The Bahamas' communications sector (The Communications Act 2009), sets the legal context for how to draft legislation to enable URCA to begin regulating the water and sanitation sector.

³ This power currently resides with the Minister of the Environment

2.5 Environmental Health Services Act (Chapter 232)

The Environmental Health Services Act “promotes the conservation and maintenance of the environment in the interest of health and for proper sanitation.” It creates the Department of Environmental Health Services (DEHS) to oversee and enforce drinking water quality, discharges, and solid waste management. The Act also outlines regulations with respect to water supplies, solid and liquid waste, beaches, seaports, harbours and marinas. The Environmental Health Services Act is a key guide to designing environmental regulations.

2.6 Building Regulations Act, 1971 (Chapter 200)

The Building Regulations Act states that the Building Control Office within the Ministry of Works should regulate and monitor the construction of abstraction wells, disposal wells and septic tanks. The Building Regulations Act also makes it unlawful to dispose of sewage other than through an approved system.

2.7 Hawksbill Creek, Grand Bahama (Deep Water Harbour and Industrial Area) (Amendment Agreement) (No. 2) Act (Chapter 263)

The Hawksbill Creek Agreement established the city of Freeport and a free trade zone (the ‘Port Area’) on Grand Bahama Island in 1955. By the terms of the Hawksbill Creek Agreement, city management and economic development in the free trade zone are the mandates of a private corporation, the Grand Bahama Port Authority Limited (GBPA). The GBPA holds responsibility for provision, management, and administration of all infrastructure, municipal and community services in the Port Area. GBPA owns and operates Grand Bahama Utility Company (GBUC).

It is not clear whether the Hawksbill Creek Agreement gives the GBPA regulatory power over infrastructure and municipal services in the Port Area. A legal case to decide regulatory jurisdiction for communications in the Port Area (whether or GBPA or URCA is the regulator) is currently in court. The results of this case may well determine regulatory jurisdiction for water and sanitation in the Port Area, as well.

2.8 Planning and Subdivision Act 2010

The Subdivisions and Planning Act came into force in January 2011. This Act repeals the Town Planning Act (Chapter 255) and the Private Roads and Subdivisions Act (Chapter 256). The objectives and purposes of the Act include:

- Providing for a land use planning based development control system led by policy, land use designations and zoning;
- Preventing indiscriminate division and development of land;
- Ensuring the efficient and orderly provision of infrastructure and services to the built environment;

- Maintaining and improving the quality of the physical and natural environment;
- Protecting and conserving the natural and cultural heritage of The Bahamas;
- Providing for planning processes that are fair by making them open, accessible, timely and efficient;
- Planning for the development and maintenance of safe and viable communities; and
- Recognizing the decision making authority and accountability of the Government in land use planning.

2.9 Forestry Act 2010

The Forestry Bill enables the creation of forestry reserves from forested and/or water-bearing lands. A reserve system allows for long-term preservation of water resources, both to protect them from pollution hazards and to protect consumers as much as possible from costly alternatives.

2.10 Various Heads of Agreement

Like the Port Area and the Hawksbill Creek Agreement, other development areas with exclusivity in The Bahamas, including New Providence, have been established through various heads of agreement. These heads of agreement grant broad development and economic concessions to developers that usually include exclusive right to provide water and sanitation services.

The most well-known heads of agreement dictates Kerzner International's real estate development on Paradise Island and sets the terms that allow Paradise Utilities to operate without a franchise agreement from the WSC. Many similar heads of agreement exist for smaller developers that operate smaller network providers; for example, the gated community at Emerald Bay on the island of Exuma is served by a network utility that operates under a heads of agreement as does the New Providence Development Company (NPDC), which is in the process of formalizing a franchise agreement with WSC.

2.11 Various Franchise Agreements

Many resort developers in The Bahamas provide potable water and sanitation services through their own network providers under franchise agreements signed with the Minister responsible for the Environment (acting on behalf of the Government)⁴. These franchise agreements are established pursuant to the Out Islands Utilities Act (Chapter 24). The Out Islands Utilities Act defines franchise agreements as agreements between private companies and the Minister

⁴ These were previously signed by the Minister responsible for Public Works, but the Ministry of the Environment is now responsible for water and sanitation. Signed agreements are in place for Walkers Cay, Chubb Cay, Emerald Bay, Bimini Bay, Cat Cay and Great Harbour Cay.

responsible for Public Works (in practice this Minister is currently the Minister of the Environment) granting leave and license to the private company:

to construct in accordance with plans and specifications... to maintain and operate a water supply system for the use of the general public in that part of the Commonwealth of the Bahamas (hereinafter called the Franchise Area) for the term of twenty years”

Separate agreements are required for commercial self-suppliers who also may provide potable water and sewage treatment systems.

2.12 Bill proposing the Environment Act of 2010

In addition to the legislation in place, a Bill proposing the Environment Act of 2010⁵ would have an impact on economic and environmental regulation of the water and sanitation sector. The Ministry of the Environment has been leading the preparation of a proposing “an Act to Establish the Bahamas Ministry of the Environment to Provide for Environmental Planning, Protection and Conservation and Matters Related Thereto” (hereafter, the “Environment Act of 2010”). This proposed Act would give the Ministry of the Environment the legislative authority and a remit to build the manpower and supporting bodies to implement a broad environmental protection strategy that would address, among other aspects, water resource management and protection from pollution of all types including sanitation and wastewater effluent, chemicals and other pollutants.

With regard to the water and sanitation sector, Section 18 of this Act would enable the Minister of the Environment to make regulations for environmental protection that could include:

- protection of water resources and the prevention and control of pollution of any waters;
- measures for monitoring and ensuring the safety of water supplies;
- prevention of the supply and use of unsafe water for human consumption;
- the setting of standards for, and the regulation and control of public and private liquid waste disposal systems and works including sanitary facilities;

The Act would also amend the Water and Sewerage Corporation Act (Chapter 196) by modifying Subsection 5.(a) [Functions of corporation] by the addition, immediately after the words, “to control and ensure the optimum development and use of the water resources of the Commonwealth of The Bahamas” of the words, “consistent with any land use plan, surface water management plan, groundwater management plan, forest management plan or natural resource management plan of the Ministry of the Environment and provided also that approval has been

⁵ Formally titled “an Act to Establish the Bahamas Ministry of the Environment to Provide for Environmental Planning, Protection and Conservation and Matters Related Thereto”.

obtained through the environmental impact assessment process established by the Minister of the Environment.”

3.0 Institutional Framework

The following bodies establish policy for the water and sanitation sector, or have regulatory responsibility for the sector⁶:

- The Water and Sewerage Corporation (WSC)
- Utilities Regulation and Competition Authority (URCA)
- Ministry of the Environment (including Department of Environmental Health Services, Department of Physical Planning and Bahamas Environment, Science and Technology Commission)
- Ministry of Finance
- The Cabinet

3.1 The Water Sewerage Corporation

The WSC is the de jure (and non-functioning) regulator of the water and sanitation sector. The WSC was established by the Water and Sewerage Corporation Act (WSC Act) as both a service provider and a regulator.

According to Sections 5 and 6 of the WSC Act, the WSC’s regulatory responsibilities are:

- Controlling and ensuring the optimum development and use of the water resources of the Commonwealth of the Bahamas
- Ensuring the co-ordination of all activities which may influence the quality, quantity, distribution or use of water
- Ensuring the application of appropriate standards and techniques for the investigation, use, control, protection, management and administration of water
- Determining the allocation of available water between different users or types of use in any area within its jurisdiction
- Prescribing and collecting rates and service fees and deposits in respect of the distribution and supply of water and the disposal of sewerage

In practice, the WSC does not perform these regulatory functions. It has neither the funding nor the regulatory expertise to do so. The WSC does not plan on performing regulatory functions in

⁶ Castalia Strategic Advisors, 2010. *Recommendations for Updating the Regulatory Framework for the Water and Sanitation Sector in The Bahamas*. Report to the Inter-American Development Bank and the Government of The Bahamas.

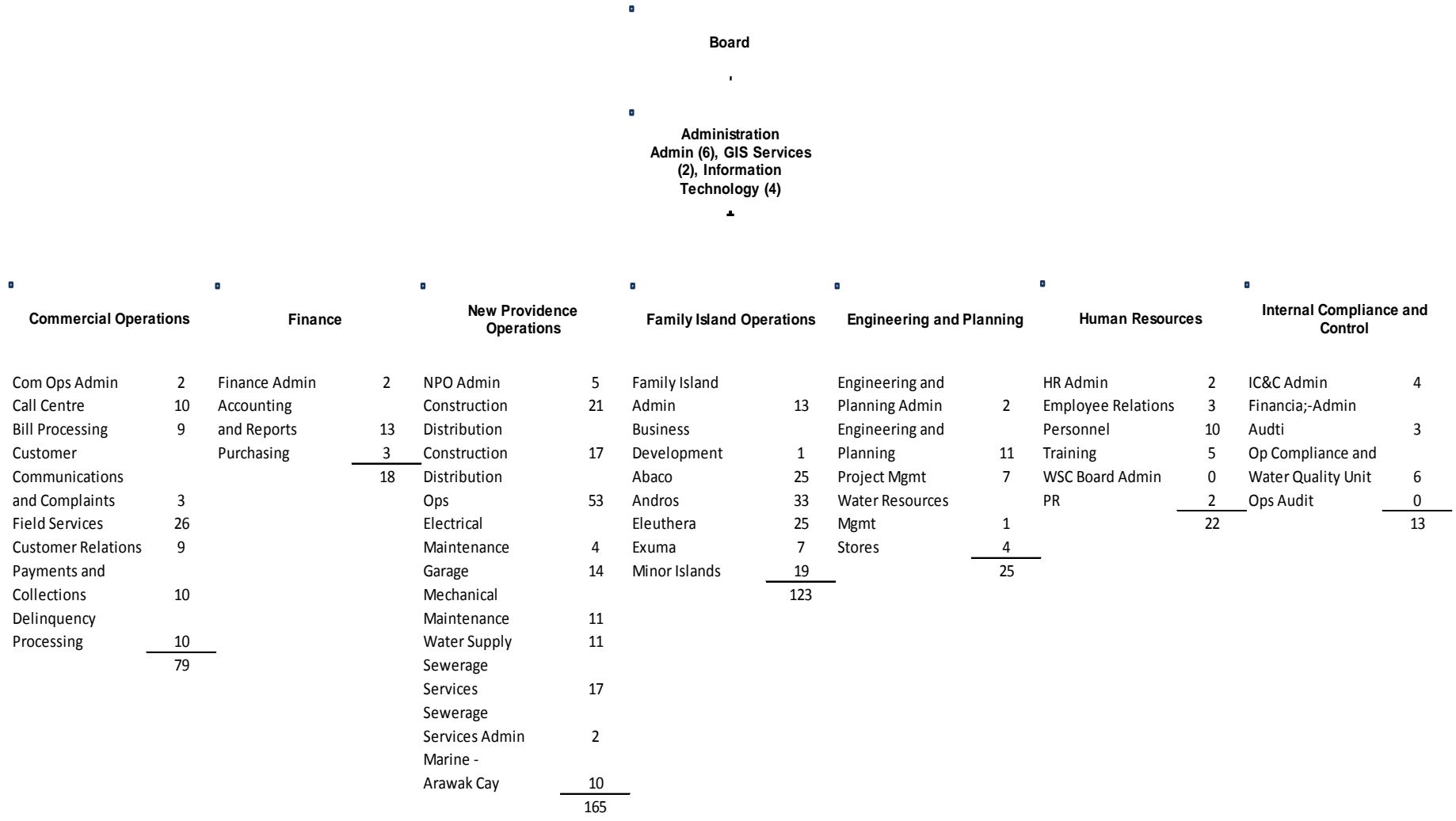
the future, and is actively seeking to have its regulatory responsibilities transferred to another entity. Figure 1 outlines the organizational structure and staff levels for WSC.

3.2 Utilities Regulation and Competition Authority (URCA)

The Utilities Regulation and Competition Authority (URCA) was created by the Utilities Regulation and Competition Authority Act, 2009 (URCA Act) as an independent, corporate body with statutory power to regulate sectors once authorized by sector-specific legislation. The first sector-specific legislation, the Communications Act, 2009, was passed at the same time as the URCA Act, authorizing URCA to regulate the communications sector.

URCA is the only independent regulator in The Bahamas, and the only entity with expertise in addressing the problem of monopoly power. URCA's website states, "In line with worldwide best practices, it is expected that URCA will eventually assume responsibility for other sectors as new sector-specific legislation is passed."

Figure 2: Water and Sewerage Corporation Organizational Structure



3.3 Ministry of the Environment

The Ministry of Environment was created in 2007 with a broad mandate for environmental management, but no statutory powers for regulating. As mentioned above, the Government is considering a bill (the Environment Act of 2010) that would provide the Ministry with the requisite statutory powers for environmental planning and protection.

The Minister for the Environment holds the powers specified by the WSC Act for the “Minister responsible for Water and Sewerage.” These powers include:

- Giving the WSC directions that are deemed to be in the public interest
- Approving all borrowings by the WSC
- Appointing no more than four members of the WSC’s Board
- Approving General Manager appointments by the WSC’s Board

Additionally, the Minister must consult with the WSC to:

- Coordinate activities that influence quality, distribution and use of water
- Set appropriate standards and techniques for investigation, use, control, protection, management and administration of water
- Provide sufficient water for domestic, agricultural, urban and industrial uses, and
- Provide adequate facilities for drainage and safe disposal of water.

The WSC is supposed to work in conjunction with the Ministry to develop sewerage infrastructure.

In addition to responsibilities for overseeing the WSC, the Ministry of the Environment contains the following bodies with mandates relevant to the environmental regulation and protection of groundwater:

- The Department of Environmental Health Services (DEHS)
- The Department of Physical Planning (DPP), and
- The Bahamas Environment, Science and Technology Commission (BEST).

3.3.1 Department of Environmental Health Services (DEHS)

The Department of Environmental Health Services (DEHS) was created under the Environmental Health Services Act of 1987 (Chapter 232). Through the Act, DEHS is responsible for the protection of public health through food safety monitoring and control and conservation and maintenance of the environment through the control and prevention of contamination of the air, water and soil, and solid waste management. DEHS is also responsible for setting food and environmental standards and monitoring the quality of water supplied to the public by WSC and private providers, including bottled water, sewage treatment and disposal, solid waste disposal and management including leachate, and air quality.

DEHS has approximately 1,500 staff and is organized into four main divisions:

- Health Inspectorate (Health Inspectors and Vector Control);
- Environmental Monitoring and Risk Assessment Division (EMRAD);
- Solid Waste Management;
- Grounds and Beautification; and
- Vehicle Maintenance.

The largest numbers of staff are in the Grounds and Beautification Division which is responsible for maintenance of public places, parks and roadsides.

Among the responsibilities of the Health Inspectorate Division are liaising with the Ministry of Public Works to support the review and approval of construction permit applications and occupancy permits. The Health Inspectorate and WSC review the permit applications in the areas of sanitation (septic tank design or sewer hookups) and water supply (hookups to the WSC supply) prior to the granting of construction permits. Post construction, they must assure that water and sanitation systems are in working order prior to sign off on occupancy permits. The house or other residential structure cannot be inhabited until an approved occupancy permit is in place. Groundwater pollution is a risk when septic tanks are not tested for leakage and soakaways are located in high water table areas.

Environmental Monitoring and Risk Assessment Division (EMRAD) is the main DEHS division for food and environmental monitoring and risk management services to protect public health and the environment. EMRAD has 2 laboratories for monitoring food products, potable water and wastewater, and 9 staff, including the Assistant Director and 7 support staff on New Providence, and 1 staff person at the Grand Bahama laboratory. In terms of qualifications, the Assistant Director has a MSc., four employees have undergraduate degrees, and four employees have high school diplomas.

The DEHS mandate, and in particular EMRAD's, align well with the needed groundwater resource management and protection program. EMRAD faces many challenges including insufficient resources, low staff morale and low staff retention. The EMRAD main offices and laboratory on New Providence are housed in a condemned building where plumbing leaks from the second floor compromise the accuracy of bacteriological testing results in the laboratory. The laboratory has limited testing capabilities, mainly bacteriological using agar plates, and Hach kits for basic chemistry. More sophisticated tests for hydrocarbons and metals are outsourced to private labs in the United States, delaying results and making sampling in the Family Islands challenging due to transit times for samples and chain of custody problems. As a result, EMRAD has over the years increasingly transferred responsibility for testing water quality to WSC, in particular for water quality monitoring on the Family Islands. Neither of the laboratories on New Providence nor Grand Bahama is accredited, and there is no initiative to attain accreditation given the primitive lab conditions and lack of equipment and budget.

3.3.2 Department of Physical Planning (DPP)

The Department of Physical Planning (DPP), formerly the Department of Town Planning, carries out mandates under the Public Works Act of 1964 (Chapter 26) and the Conservation and Protection of the Physical Landscape of the Bahamas Act of 1997 (Chapter 260). The Public Works Act addresses public works, building and roads, and the latter, the protection of landscapes and natural resources of The Bahamas from physical and environmental degradation related to land development and resource extraction such as grading of hills, filling of wetlands, quarrying sand from beaches and dunes, and removal of trees. Specifically, the DPP is responsible for permitting land use changes, development projects and landfills. The Department now administers the Planning and Subdivision Act of 2010.

3.3.3 Bahamas Environment, Science and Technology (BEST) Commission

The BEST Commission, formed by a directive from the Chief of State in 1994, has in effect been the country's environmental agency since 1995. BEST is responsible for developing the Government's environmental and natural resource management policies. As mandated, the BEST Commission is responsible for the administration of the EIA process, overseeing the technical review of EIAs, coordinating the public review of EIAs, and providing advice to Cabinet for consideration in their decision-making process.

BEST is also the lead agency in ensuring that the GOBH implements its requirements under the various international Conventions on environmental matters such as biodiversity, climate change, wetlands, and land degradation. In this role, BEST establishes committees, drawing on appropriate staff from different Government agencies, for promoting actions to implement the specific requirements of the various conventions. To date, committees have been established on wetlands, climate change and biodiversity.

The BEST Commission also collaborates closely with other agencies with responsibilities for environmental matters such as the Water and Sewerage Corporation, Ministry of Agriculture and Fisheries, Department of Meteorology, and The Bahamas National Trust.

If the EIA process in The Bahamas were strengthened to require all significant developments to carry out EIAs which addressed all environmental and social impacts, including potential effects on the groundwater resources and wastewater management, BEST would have a major advisory role in the protection and management of water resources.

3.4 Ministry of Finance

The Ministry of Finance exercises authority over WSC in several areas, but does not exercise any authority over the private utilities. In particular, the Minister of Finance must consent in order for WSC to borrow funds. According to the WSC Act, the Minister of Finance may also, at the request of the Minister responsible for WSC:

- Provide subsidies to WSC by making advances for the purposes of enabling WSC to defray expenditure properly chargeable to its capital account, including provision of working capital; and,
- On behalf of the Government, guarantee the repayment of principal and interest and other charges on any authorized borrowings of WSC after prior approval has been signified by the House of Assembly in accordance with the Financial Administration and Audit Act.

3.5 The Cabinet

The Cabinet is the highest decision making authority in The Bahamas. It is the body that decides on the level of financial support that Government will provide to the water and sanitation sector, particularly the WSC; but in most cases, the arrangements for such support require the concurrence of the Minister of the Environment and the Minister of Finance, and may also require ratification by the Parliament. Until an independent regulator is empowered with statutory powers to undertake economic regulation of the water and sanitation sector, by default, the Cabinet is the body responsible for setting tariffs for WSC. WSC's tariffs are set through legislation.

4.0 Environmental and Social Conditions

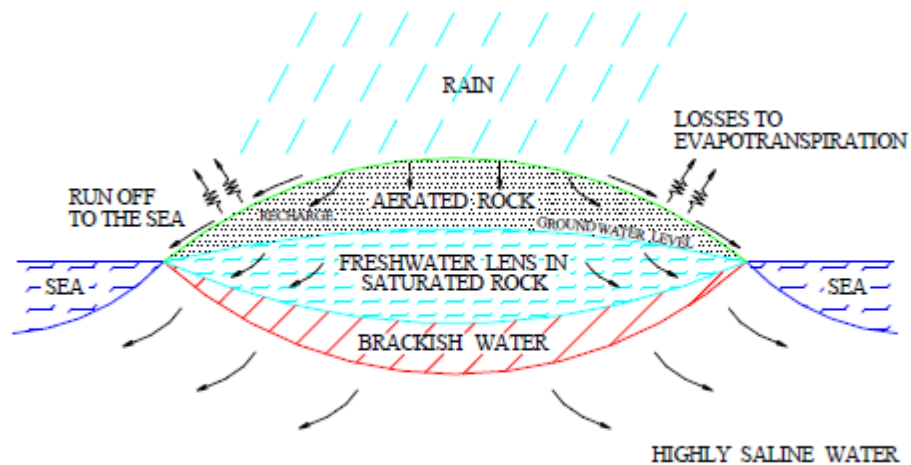
4.1 Groundwater resources

The groundwater resources of The Bahamas comprise the fresh, brackish, saline and hypersaline waters found in the near and deep subsurface and in the lakes and ponds that intercept the surface. The freshwater resources occur as three-dimensional lens-shaped bodies, which overlie brackish and saline water. Fresh water resources in The Bahamas occur only as groundwater; there are no rivers or other major surface sources of freshwater.

Generally, there is nowhere on the islands that groundwater cannot be met in holes that penetrate 10 feet (3 meters) below sea level. Water is always met in the range 0 to 3 feet (0 to 0.9 meters) above sea level. Tidal action induces an up and down movement to the entire groundwater table ranging from negligible amounts to about 3 feet (0.9 meters). The effect of tides decreases inland on the whole, but can be substantial inland if a well established cavern or other large opening directly connects the area to the sea. In many places inland, rise and fall of the water table is less than 1 foot (0.3 meters).

Groundwater saturates the rock and all its pores, fissures and interconnected cavities. The size, shape and orientation of the island, the subsurface geology and the amount of rainfall control the shape size and thickness of the freshwater bodies. In excess of 90% of the freshwater lenses are within five feet of the surface. It is inappropriate to conceive of these Ghyben-Hertzberg lenses as occurring in subterranean lakes, rivers or ponds. See **Figure 3** below:

Figure 3: Diagram of Ghyben–Hertzberg Lens



The physical geology, hydrogeology, and water resources are directly linked as there are no true rivers in The Bahamas. The only natural means of recharge for the freshwater resources is via rainfall. About 75% of precipitation that reaches the land is lost to the atmosphere through evapo-transpiration and as runoff from the surface back into the sea.

‘The remaining amount of rainfall is estimated to form the lens’⁷. Therefore, records of rainfall are pivotal in estimating the needed annual recharge of freshwater lenses from which water is extracted. The water in these lenses remains intact as long as the amount of water extracted does not exceed the amount of recharge through rainfall. ‘Over-extraction exceeding the amount of recharge leads to the shrinkage of freshwater lens and a rise in saline water’⁸.

The total volume of fresh groundwater available in The Bahamas would be sufficient to meet the demand if the country’s population were distributed according to the distribution of groundwater. Only Andros, Abaco, and Grand Bahama have adequate water resources to meet current demands. Therefore, since saline groundwater is a virtually infinite water resource for the production of potable water using reverse osmosis plants, this technology provides a reasonable and cost-effective approach to meeting the demand for potable water.

⁷ Sealey, Neil E., 1994. *Bahamian Landscapes: An Introduction to the Geography of the Bahamas*. Second Edition. Media Publishing, Nassau, Bahamas.

⁸ Ibid.

Aquifer monitoring is currently done on an ad hoc basis. The most recent monitoring was done in 2003 by Water Management Consultants, and similar exercises with external consultants have occurred in the past, going back as far as 1921 with Howard Humphries and Sons.

Climate change is a concern for the groundwater resources of The Bahamas as it relates to rising sea levels and storm surges from tropical storms and hurricanes. Rising sea levels and storm surges can result in saltwater inundation and thus loss of freshwater lenses.

4.2 Hydrogeology

The basic characteristics of the fresh groundwater water resource are the result of the geology and hydrogeology of the Bahamas. Geologically, the Bahamas are primarily Pleistocene marine carbonate banks of as much as 5 miles in thickness separated by oceanic canyons, with the islands being the highest areas projecting above the sea. In the interior of the islands, the carbonate bedrock is covered by a thin veneer of sandy soil⁹.

Carbonate geology, often referred to as Karst, is highly porous, meaning that rainfall and other surface discharges rapidly infiltrate. It is characterized by extensive, underground drainage networks of sinkholes, caves and caverns as a result of infiltrating rainfall dissolving the rock.¹⁰ The Bahamian carbonate bedrock is so permeable, that despite an annual rainfall of 58 inches in the northern islands, there is virtually no rainfall runoff and no surface stream or river features. In the Bahamas, the deeper rock is now saturated with seawater, and the freshwater resource or aquifers consists of shallow lenses of lower density freshwater “floating” on seawater. There is no distinct boundary between fresh and sea water, and in fact there is typically a gradient from fresh to brackish to sea water in the aquifers.¹¹ The freshwater lenses are accumulated rainfall that has percolated through the highly porous surface soil and bedrock.

At greater depths (for example, greater than 100 feet), there are zones of high transmissivity (exhibiting high permeability or flow rates) where there is a strong hydrologic and hydraulic exchange with the surrounding sea water. Deep wells drilled in the interior of the islands have shown a strong tidal connection illustrated by the water level in the well rising and falling with

⁹ Water Management Consultants Ltd, 2003. *Environmental Study, Loan No. LO 1112/OC-BH, Regulatory Framework for Integrated Groundwater Management and Pollution Control - Final Report.*

¹⁰ The formation of The Bahamian Karst features occurred during periods of much lower relative sea level in the Pleistocene when the carbonate bank upper surfaces were 300 to 400 feet or more above sea level.

¹¹ Historically, the upper freshwater lenses, and to a lesser extent the brackish water, were the potable water resource, but with the advent of reverse osmosis, the more saline groundwater now serves as an important resource.

the tide. This phenomenon is considered to allow the safe disposal of treated wastewater via deep injection wells in the Bahamas¹².

In fact, wastewater effluent from all major sources is disposed of by means of deep wells. Wastewater reuse is impossible where the effluent is too saline and is often too costly to implement, particularly where retrofit to an existing system is required. Even where the effluent can be reused, a deep well is provided for the purposes of emergency use. Waste effluents cannot be diluted in surface water bodies and the effluent can also not go directly into the sea. The subsurface (deep wells) is the only remaining option and fortunately the geology of The Bahamas is suited to this solution.

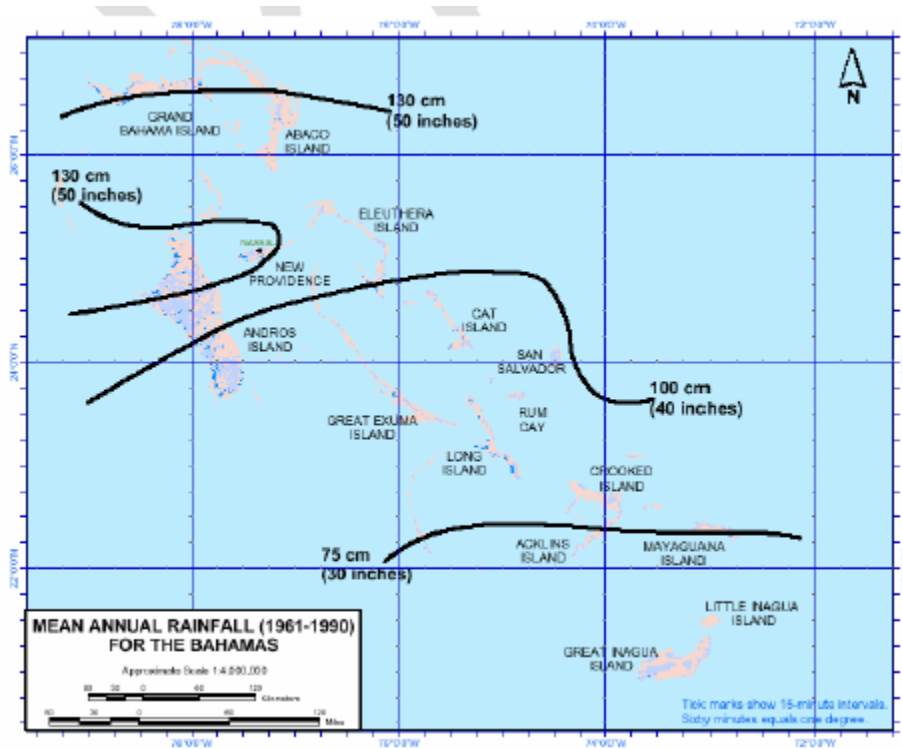
4.3 Rainfall

Rainfall is unevenly distributed across The Bahamas. **Figure 4** below shows distribution of rainfall for the Commonwealth of the Bahamas.

The north and north central Bahamas receives annually some 50 to 60 inches (1270 to 1524 millimeters) of rainfall annually while in the southeast Bahamas, the rainfall decreases to some 36 inches (914 millimeters) annually. There is a distinct dry season (November to April) and a pronounced wet season (May to October). The seasonal effects of tropical cyclones have a pronounced effect on annual rainfalls across the Bahamas. Additionally, winter storms flowing off the North American continent also impact rainfall during the normally dry period. This effect however rarely extends into the central and southern Bahamas.

¹² Cant, Richard V., 1996. *Water Supply & Sewerage in a Small Island Environment*. "The Bahamian Experience". Small Islands: Marine Science and Sustainable Development. Coastal and Estuarine Studies.

Figure 4: Mean Annual Rainfall for The Bahamas



4.4. Ecology

All project sites are in urban areas that are already disturbed. Vegetation is mainly grasses with weeds and limited trees. No protected trees were observed at the sites visited. No birds were observed at any of the sites. Once the Gladstone WWTP site is selected, it is recommended that the ecology of this area be assessed as it may be utilized by birds and reptiles. Potential sites identified during the site visit for preparation of the ESA are in one of the few green spaces along the south side of Gladstone Road.

4.5 Water use

WMC (2003) listed the following main uses of water on New Providence, the most populated island, which were considered generally representative for The Bahamas as a whole (this includes use of desalinated brackish and salt water):

- Potable uses (drinking and food preparation);
- Domestic uses (clothes washing, bathing, sanitation, garden watering, and car washing);
- Hotels (bathing, sanitation, swimming pools, garden and golf course irrigation);
- Industrial (cooling, process washing, etc);
- Government institutions; and
- Agriculture (irrigation, non-specific farm use).

WMC (2003) also analyzed use of groundwater abstracted on New Providence. This was a mass balance analysis of supply, demand and losses in 2002. The numbers were based largely on deduction as hard data was limited but present a snap shot of water uses and sources.

4.6 Sewage treatment¹³

Sewage treatment infrastructure managed and operated by the WSC includes WWTPs, lift stations, forcemains, deep disposal wells and sewer connections. WSC currently utilizes varying levels of sewage treatment, ranging from preliminary, or pre-treatment, to primary and secondary treatment, followed by deep well disposal.

The current state of the WWTPs is described below:

1. **Coral Vista** – This is one of only two WWTPs managed by the WSC which currently provide full secondary treatment. It provides treatment for 50,000 gallons of wastewater per day. One 600-foot deep disposal well is operational at this WWTP. The plant services various subdivisions including Coral Vista and Via del Rosa. The neighbouring community of Coral Harbour is not sewered and homes are serviced by septic tanks. There is no immediate plan to expand this plant as it is suitably sized for any growth in the subdivisions it services.

¹³ Information gathered during site visits to the plants and information provided by WSC staff.

Figure 5: Coral Vista Wastewater Treatment Plant



2. **Yellow Elder** – This plant is not fully functional at this time and is in urgent need of upgrades. Two 600-foot deep disposal wells are operational at this site. It services Yellow Elder Gardens and Pride Estates. The GOBH has allocated funds to expand this plant and upgrade it to tertiary treatment as part of a Government project to enhance an adjacent sporting complex.
3. **Airport** – This plant is functional. It provides secondary treatment for the Lynden Pindling International Airport and neighbouring subdivisions including Indigo and Serenity. Yuma Estates will be added to the plant. The future of this plant will be considered under the proposed Wastewater Master Plan.

4. **Fox Hill** – Currently, this plant is not fully functional. Its capacity is 0.25 Million gallons. There is only preliminary sewage treatment being provided with waste then disposed of in a deep disposal well. The 600-foot disposal well is operational at this site. The intent is to expand it to 0.5 Million gallons. Expansion will involve construction of new tanks and upgrading the plant from primary to secondary treatment. The lift station at this facility is in need of repair. In the past, untreated sewage was being chlorinated and sent to the disposal well, which results in creation of halogenated compounds which are extremely hazardous; this practice has since been stopped by WSC. This plant serves communities of Fox Hill, Elizabeth Estates, Yamacraw Shores and Twynam.

Figure 6: Fox Hill Wastewater Treatment Plant



Figure 7: Fox Hill Wastewater Treatment Plant



5. **Malcolm Park** – This plant is not fully functional. Its capacity is 3.1 Million ga/day. This volume of untreated sewage is currently being disposed of daily into the 800-foot deep disposal well. The plant was built for secondary treatment, but has not been in full operation for more than 10 years. This plant services residences and commercial establishments from Montagu (in the east to Vista Marina/Saunders Beach (in the west), including the downtown area (all of Bay Street).

Figure 8: Malcolm Park Wastewater Treatment Plant – Storage Tanks



Figure 9: Malcolm Park Wastewater Treatment Plant - Pumps



6. **Pinewood Gardens** – A full plant has never been operational at this site. It relies on pre-screening and a deep disposal well. Recently the deep disposal well ceased to work properly and sewage spilled over onto the land surface. The well was constructed to 300 feet deep, and more than 30 years of untreated sewage going into the well has resulted in repeated failures. Consequently, as much as 0.25 Million ga/day of raw sewage can end up on the ground whenever failures occur. WSC is currently trying to manage the waste from by this area by having sewage pump trucks constantly collecting and transporting sewage out of the area to the Septage and Sludge site at the Harrold Road landfill. During Hurricane Irene with additional rainfall, trucks had to be employed on a 24-hour basis for several days to keep the situation manageable. A 600-foot disposal well has been recently constructed and is operational at the site. The intent is to have this plant taken over by a private company to rehabilitate and maintain it; requests for bids have already gone out.

7. **Flamingo Gardens** – This plant was originally constructed to serve only Flamingo Gardens. Misty Gardens, Silver Gates and Faith Gardens have since been added and waste coming into the plant now substantially exceeds its capacity of 0.25 Million gallons. There are 4 lift stations associated with the plant. One 300-foot disposal well is in use at the site. The plant is not fully functional and as such, only partially screened sewage is going into the deep disposal well. The intent is to expand the capacity to 0.5 Million gallons.

Figure 10: Flamingo Gardens Wastewater Treatment Plant



There is no treatment plant in the Gladstone Road area, but there is a 600-foot deep disposal well which receives partially screened sewage from Destini Lakes, Victoria Gardens 1 and 2, Emerald Coast and Dignity Gardens. Again, only partially screened sewage is going into the disposal well. WSC has signed a Letter of Intent with the Baha Mar development to treat its flows and provide reuse water from a new facility at this location. This will be done within the next 12 – 18 months under a design, build, own and operate (DBOO) contract.

The collection sewers and forcemains in many areas of downtown are very old and collapsing. A large section recently had to be replaced. Older mains are made from concrete and clay, having been laid, in some cases, in the early 1930's.

The **Septage and Sludge Facility** at the Harrold Road Landfill site is not functional. When originally commissioned in May 1996, it consisted of an aeration pond to the south and 3 anaerobic lagoons. The third lagoon can no longer be accessed and is overgrown with sawgrass. There is one 300-foot deep disposal well in use at the site. The site is in dire need of cleaning and re-design. It has never been cleaned since it was commissioned. Part of the challenge in accomplishing this is that no heavy equipment, such as cranes, can access the lagoons or the aeration ponds as there are no stable staging areas in close enough proximity.

Figure 11: Lagoons at Septage and Sludge Facility



Figure 12: Lagoons at Septage and Sludge Facility



Once trucks would dispose of the wastewater in the receiving area, it was supposed to flow hydraulically through the lagoons while being treated, prior to effluent disposal via deep well. This never happened and thus the waste just builds up and sits in the lagoons. The lagoons are also clogged with grease and have little to no water in them.

The situation is so critical that the waste periodically drains into commercial properties adjacent to the facility and impact their land (e.g. Bahamas Waste).

If this facility can be rehabilitated to function properly, WSC engineers have indicated that it would be sufficient to deal with the current waste received. There are 20 – 25 trucks emptying waste at the facility. At a volume range of 2,000 – 4,000 gallons per truck, waste going into the lagoons on a daily basis is estimated at 40,000 – 75,000 gallons. There is a need to address the tariff structure for allowing the trucks to empty at the facility. Currently it is \$12 per load per truck whether it is a 2,000-gallon or 4,000-gallon truck. The card system for trucks to swipe when they entered the facility is down and in need of repair. Because of this, there are trucks entering the facility to empty waste and not paying for use of the facility as the gate is left open. While WSC staff monitors trucks using the facility, some companies have been difficult to

obtain payment from. These companies are still allowed to use the facility as it is partially contained rather than have them dump the waste all over the island where no one knows what they are doing or where the waste is going.

Many of the **lift stations** on New Providence are in varying need of repair, particularly the older ones. Some require the entire base to be replaced while others need pumps replaced.

The Sewerage Section of the WSC currently consists of 17 staff members which is insufficient to handle the workload, resulting from the current condition of the wastewater infrastructure. The technicians monitor all 90 lift stations on a regular basis to ensure they are functioning properly. This approach is preventive with the effort made not to have sewage backing up into residences and then reacting to customer calls when the situation is already critical. New Providence has been split into east and west and the staff work in two teams in an effort to complete all the monitoring.

When the treatment plants were functional, the technicians would also collect samples from the plants for testing at the WSC Lab to ensure the plants were working properly. Samples were collected for raw sewage and treated effluent, and some on-site testing was also conducted where the facilities existed. Sampling is currently only occurring at Coral Vista once per week.

4.7 Water quality monitoring

The Water Quality Unit at WSC is responsible for water quality monitoring of potable water supply of the Corporation. The currently monitor for the following parameters:

- Chlorides
- Fluorides
- Nitrates
- Sulfates
- Phosphates
- Hardness
- pH
- Total coliform
- E. coli
- Total plate count
- Faecal strep
- Yeast and mold

Monitoring of potable water is done for all pumping stations on a weekly basis and monitoring of the distribution network in New Providence is done on a monthly basis.

When the WWTPs were operational, the Unit staff would do analysis of input and output once a week. Currently, sampling is only occurring at Coral Vista and not on a regular basis. Parameters analyzed for WWTP samples are:

- Biological oxygen demand (BOD)
- Chemical oxygen demand (COD)
- pH
- Chlorides

- Nitrates
- Phosphates
- Total dissolved solids
- Suspended solids
- Settleability¹⁴

In analyzing results, the Water Quality Unit follows World Health Organization (WHO) standards for potable water and treated wastewater. Testing is done following global standard methods.

The Unit currently has 6 staff members. 2 staff members have left and their positions have not been filled. Additionally, the workload of the Unit has increased since these positions became vacant due to system expansions on the Family Islands. The Unit is responsible for monitoring for all the Family Islands in addition to New Providence.

The Unit staff confirmed that to date there have been no issues with potable water from WSC supply having increased coliform levels due to non-functional WWTPs in New Providence. The Unit does not monitor groundwater resources in areas surrounding the WWTPs to determine if these resources are being impacted. They do test private wells for a fee and there have been incidences of wells contaminated with sewage in New Providence. This is primarily due to septic tank discharges. However, wells adjacent to the Pinewood Gardens WWTP have also shown contamination, possibly resulting from the failed disposal well. Residents all have access to the municipal supply and WSC has lead a vigorous campaign to stop residents from using wells for domestic needs.

The Unit staff noted that in an ideal setting, all WWTPs would have basic lab facilities for certain analyses to occur on site. Plant operators would then monitor on a daily basis for parameters like chlorides, chlorine levels, dissolved oxygen and settleability. Alternatively, technicians could do monitoring at the WWTPs if operators are unable to do so. The advantage of doing certain tests on site is that transport time to get the samples from the plant to the lab results in degrading of the sample and this can cause errors in test results. Many of the parameters for monitoring are also good candidates for remote monitoring. The Unit laboratory could then focus on more complex analyses.

It was also noted that DEHS should be monitoring WSC through regular sampling and testing of pumping stations for the same parameters that the Water Quality Unit uses. DEHS division responsible for this is EMRAD. EMRAD should also be monitoring around the WWTPs as well as groundwater in these areas.

¹⁴ Settleability is a measure of how long solids take to settle out of a liquid and it is an indication of treatment plant efficiency.

The Surveillance Unit at the Department of Public Health would notify WSC if illnesses are occurring which are thought to be due to the city water supply. Such a notification has not been issued in over 15 years. The results of all weekly analyses completed by the Unit are sent to the Assistant Director for EMRAD.

If there are issues with city water supply, a protocol exists outlining public notification. Public is notified to boil water when there are issues at the pumping station, such as chlorine not entering the supply to treat the water. Similar advisories would sometimes go out during hurricanes when there is flooding and potential contamination of wells from septic tank overflow.

4.8 Health and Safety

WSC is in the process of developing and approving health and safety policies in accordance with Health and Safety at Work Act of 2002. Policies and regulations cover the following areas:

- i. **Welding and burning** - this policy outlines safety procedures for WSC employees involved in welding and burning activities.
- ii. **Compressed gas** – this policy establishes guidelines for the safe storage, handling and use of compressed gas cylinders including those containing oxygen, acetylene, nitrogen, carbon dioxide, hydrogen and liquefied petroleum.
- iii. **Hazard communication** – this policy is to ensure that hazards related to chemical and materials used at WSC are evaluated and information concerning the dangers of handling them is communicated to relevant employees. Information is to be communicated through signage, material safety data sheets, hazardous materials inventory forms, training and container labeling.
- iv. **Fueling** – this policy is to safeguard WSC employees while fueling vehicles, equipment and containers, and engaged any other activity that requires direct use of fuel.
- v. **Working in confined spaces** – this policy is to safeguard WSC employees that are required to work in confined spaces as well as what protocols to follow in the event an employee needs to be rescued from a confined space.
- vi. **Utility road works** – the objective of this policy is to upgrade safety practices at all WSC road work sites and to evaluate and control any unforeseen hazards that may arise as a result of the works. Procedures include securing the site, use of signage, safety equipment to be used and site layout guidelines.
- vii. **Chlorine safety** – this policy is to ensure the safe handling and deployment of this highly toxic and corrosive gas, including emergency response procedures in the event of a chlorine spill.

5.0 Environmental and Social Impacts

5.1 Current Threats

There are a number of environmental and social impacts that currently exist due to various threats:

- i. **Lack of chemical treatment** – current treatment of potable water and wastewater is confined to biological factors and there is no treatment for chemicals which may be carcinogenic; there is a risk that such chemicals are ending up in freshwater lenses or private wells. This is a data gap due to lack of monitoring. It is noted that in many cases it is not economical to treat for chemicals.
- ii. **Proliferation of private wells** – only about 30% of the population of New Providence is using WSC water supply on a regular basis, which means most households are using private wells. In light of the statements above about contamination of groundwater in New Providence, this is a public health concern.
- iii. **Proliferation of septic tanks** – less than 7% of the population of New Providence is sewerred, meaning most households are on septic tanks. As long as the tanks are used within their capacity and are properly constructed, they function well. When things go wrong, they can add to contamination of groundwater resources. It was noted that it is possible that 65% of the water being recharged to the freshwater lens in Pinewood Gardens, Phase B is going through a septic tank as this community has no sewerage and no piped water – just wells and septic tanks¹⁵.
- iv. **Lack of monitoring for public health issues** – there is limited to no coordination between WSC, DEHS and Department of Public Health to determine whether the disposal of raw, untreated sewage on the ground or where deep wells have failed in New Providence is resulting in increased incidences of gastrointestinal diseases, Hepatitis A and tetanus. Historically, illnesses have usually occurred where septic tanks have failed in close proximity to private wells being used by residents. It should be noted that where deep disposal wells are functional, this risk is negligible as sewage is being disposed of at depths of 600 – 800 feet below the surface, and thus, does not come in contact with freshwater lenses or wells which are at shallower depths (usually within 50 feet of the surface). This threat represents another strong argument for use of municipal water supply.

Illnesses that arise from contact with sewage are caused by pathogens. The most common in sewage are bacteria, parasites and viruses. Modes of infection from raw sewage include oral contact (most common) and skin contact if an open wound exists. Illnesses from exposure to raw sewage include:

- *Giardia* and *Cryptosporidium* (protozoan parasites) – can result in diarrhea, fever, stomach cramps and vomiting. Severe cases can result in stunted physical and mental development in children (*Giardia*) and death (*Cryptosporidium*)
- Gram-negative bacteria (like *E. coli*) – can cause gastrointestinal diseases, headaches, fatigue and nausea
- Hepatitis A
- Tetanus

¹⁵ Interview with Dr. Richard Cant (hydrologist and consultant) of the WSC.

- Weil's disease (Leptospirosis) – flu-like illness with persistent and severe headache; it is transmitted by rat urine and results in damage to liver, kidneys and blood. It can be fatal.
- Occupational asthma

It is important to monitor freshwater aquifers in order to protect them for future use in the event they are needed (i.e. precautionary approach). Various layers within the geology of the island are also important to protect:

- Lucayan limestone – down to 65 feet in the northern Bahamas and 100 feet in the central Bahamas
- Feed water horizon – down to approximately 150 feet

Protection of these layers is one of the reasons for the minimum depths set for deep disposal wells by the WSC:

- 200 – 400 feet deep for small volumes and brine waste from RO plants
- 400 feet and deeper for treated sewage (mainly untreated sewage is being disposed in these wells on New Providence at present; thus far most of the wells have not failed though they will as Pinewood's did if action is not taken soon).

5.2 Project Impacts

The severity of an environmental or social impact is a measure of the magnitude of impact an event has on the environment or on society. Severity is measured by such factors as toxicity to humans, the negative effect on flora and fauna, impact on wildlife habitat, the reduction of natural resources, contamination of air and water, the potential for reversible versus irreversible damage, and short-term versus long-term recovery of the environment. Other factors such as noise, heat, odour, and visuals are also used to determine severity.

Severity is given a numerical rating of 1 for low impact, 3 for medium impact and 5 for high impact:

1. Low Impact (score 1) - There is little or no impact on the environment.
2. Medium Impact (score 3) - There is impact on the environment that falls within regulatory guidelines. The impact is considered short-term and reversible.
3. High Impact (score 5) – There is high and lasting impact on the environment.

Most of the potential negative impacts from the project will be related to construction activities for NRW reduction and wastewater infrastructure upgrades. Wastewater infrastructure to be upgraded or rehabilitated through this project includes:

- Airport
- Fox Hill
- Malcolm Park

- Flamingo Gardens
- Septage and Sludge Facility

Coral Vista is functional. Yellow Elder and Pinewood Gardens are being addressed through other funding mechanisms as is the Gladstone Road area as noted above in section 4.5.

Table 1 below outlines the potential negative environmental and social impacts that can result from the construction phase of the New Providence Water Supply and Sanitation Systems Upgrade project.

Table 1: Potential Negative Environmental and Social Impacts of the Construction Phase

Project Component	Impact	Severity of Impact	Environmental and Social Impacts
NRW Reduction: <ul style="list-style-type: none"> • Leak detection and repairs • Construction works (including mains and service lateral replacement, pressure control, data collection and monitoring) 	Materials	3	Construction materials can potentially be toxic or hazardous to the environment and human health if not managed properly.
	Air quality and dust	3	Illegal construction activities, such as burning of waste, can negatively impact air quality. Poorly maintained construction equipment can also impair air quality, such as diesel fumes emissions. Construction activities can generate significant quantities of dust that impair air quality and negatively impact human health if proper management techniques are not employed.
	Construction waste management	5	Improperly managed waste can negatively impact the environment and human health, through attracting pests which are disease vectors, introducing toxic/hazardous substances into the air, soil or groundwater and posing safety hazards to small children.
	Landscape and visual	5	Construction will result in removal of trees and plants during land clearing. Construction of new infrastructure or repair of existing infrastructure can impair visual or aesthetic aspects of the site during and after active construction.
	Worker health and safety	3	Worker health and safety can be negatively impacted if proper health and safety procedures are not followed at construction sites.
	Public health and safety	3	Public health and safety can be negatively impacts if proper health and safety procedures are not employed at the construction site. Persons traversing the site can be hurt by heavy equipment or falling construction materials as well as falling into unmarked holes or

			ditches.
	Water resources	5	Groundwater resources can be polluted by fuel or chemical spills at construction sites.
	Avifauna	1	The proposed construction sites are in already developed and impacted areas. It is not expected that there will be direct loss of terrestrial vegetation communities which represent important habitat for the bird species in New Providence.
	Noise and vibration	3	Construction activities can raise noise to levels that disturb bird and animal species at the project site and in its vicinity where these species nest or find shelter. This can result in displacement of these species which may leave the area. Prolonged, elevated noise levels from construction activities can also negatively impact human health.
	Traffic and transport	3	Traffic and transport during construction can introduce invasive species to a project site and result in spills/accidents at the site if proper care and precaution are not taken inclusive of safe handling of equipment and vehicles. Construction can also interrupt normal traffic flow and result in traffic delays in communities and on main thoroughfares.
	Contaminated land	5	During construction, there is the potential to contaminate lands from spills of oil and other hazardous materials.
Minimum Wastewater Infrastructure Upgrades:	Materials	3	Construction materials can potentially be toxic or hazardous to the environment and human health if not managed properly.
<ul style="list-style-type: none"> • WWTPs upgrades and rehabilitation • Lift station rehabilitation • Sewer and forcemains replacement 			
	Air quality and dust	3	Illegal construction activities, such as burning of waste, can negatively impact air quality. Poorly

			maintained construction equipment can also impair air quality, such as diesel fumes emissions. Construction activities can generate significant quantities of dust that impair air quality and negatively impact human health if proper management techniques are not employed.
	Construction waste management	5	Improperly managed waste can negatively impact the environment and human health, through attracting pests which are disease vectors, introducing toxic/hazardous substances into the air, soil or groundwater and posing safety hazards to small children.
	Landscape and visual	5	Construction will result in removal of trees and plants during land clearing. Construction of new infrastructure or repair of existing infrastructure can impair visual or aesthetic aspects of the site during and after active construction.
	Worker health and safety	3	Worker health and safety can be negatively impacted if proper health and safety procedures are not followed at construction sites.
	Public health and safety	3	Public health and safety can be negatively impacts if proper health and safety procedures are not employed at the construction site. Persons traversing the site can be hurt by heavy equipment or falling construction materials as well as falling into unmarked holes or ditches.
	Water resources	5	Groundwater resources can be polluted by fuel or chemical spills at construction sites.
	Avifauna	1	The proposed construction sites are in already developed and impacted areas. It is not expected that there will be direct loss of terrestrial vegetation communities which represent important habitat for the bird species in New Providence.
	Noise and vibration	3	Construction activities can raise noise to levels that disturb bird and animal species at the project site and in its vicinity where these species nest or find shelter.

			This can result in displacement of these species which may leave the area. Prolonged, elevated noise levels from construction activities can also negatively impact human health.
	Traffic and transport	3	Traffic and transport during construction can introduce invasive species to a project site and result in spills/accidents at the site if proper care and precaution are not taken inclusive of safe handling of equipment and vehicles. Construction can also interrupt normal traffic flow and result in traffic delays in communities and on main thoroughfares. This can result in loss of productivity for other sectors as well as loss of revenue for commercial establishments in the vicinity of the project's construction sites.
	Contaminated land	5	During construction, there is the potential to contaminate lands from spills of oil and other hazardous materials.

No negative impacts are expected from the implementation of the following project components:

Component 1 NRW Reduction	Completion of baseline survey and preparation of NRW Reduction Strategy
	NRW asset management information system (MIS) development
	Training of WSC staff
Component 2: WSC Institutional Strengthening	Improvement to MIS with SCADA
	Development of AMR/AMI for commercial accounts
	Public relations campaign
	Training, development and implementation of the new organizational structure
	Completion of tariff study
Component 3: Minimum Wastewater Infrastructure Upgrades	Development of Wastewater Master Plan
Component 4: Upgrade Legal and Regulatory Framework	Establishment of URCA as the independent Economic Regulator
	Establishment of an independent Environmental Regulator

Impacts of the operational phase of the project should be positive once repairs to potable water supply lines, rehabilitation and construction of WWTPs and associated infrastructure are maintained. Positive impacts will include:

1. **Staff Productivity** – WSC may increase staff productivity as the rehabilitation of infrastructure and introduction of SCADA will: (i) improve service; (ii) minimize failures; and (iii) allow staff to respond more quickly to and restore service where failures do occur.
2. **Reduction in NRW** – Implementation of procedures in accordance with repairs to water supply lines will result in reduced losses of water which is a precious commodity in The Bahamas. Increased revenue should assist the WSC in achieving financial sustainability and make Government funding available to other sectors that were previously used to subsidize WSC.
3. **Proper collection and treatment of wastewater** – Rehabilitation and construction of WWTPs, lift stations, forcemains and sewer connections should result in proper collection and treatment of wastewater from all sewered communities. This eliminates environmental and health risks currently faced in these neighbourhoods. Clean up and redesign of the Septage and Sludge Facility will result in proper disposal and treatment of septic waste as well as economic efficiency in collection of tariffs for this facility.

Potential positive environmental and social impacts of the operational phase of the New Providence Water Supply and Sanitation Systems Upgrade project are outlined in Table 2 below.

Table 2: Potential Positive Environmental and Social Impacts of the Operational Phase

Project Component	Project Activities	Positive Impacts
NRW Reduction	Leak detection and repairs	Reduced loss of water from the municipal water supply. Increased revenue for WSC to assist in achieving financial sustainability. WSC subsidies no longer needed and monies available for other sectors.
	Construction works (including mains and service lateral replacement, pressure control, data collection and monitoring)	Reduced loss of water from the municipal water supply. Increased efficiency of WSC staff. Improved WSC customer service.
	Completion of baseline survey and preparation of NRW Reduction Strategy	Defined strategy for addressing NRW reduction, providing clear guidance for WSC management and staff.
	NRW asset management information system (MIS) development	Quicker response time to leaks and other problems with the municipal supply system.

		Increased efficiency of WSC staff. Improved WSC customer service.
	Training of WSC staff	Increased technical capacity and efficiency of WSC staff. Improved WSC customer service.
WSC Institutional Strengthening	Improvement to MIS with SCADA	Improved data gathering capabilities for WSC. Quicker response times and increases efficiency of WSC staff. Improved WSC customer service.
	Development of AMR/AMI for commercial accounts	Increased efficiency of WSC staff. Improved WSC customer service.
	Public relations campaign	Increased customer base for WSC. Increased revenue for WSC to assist in achieving financial sustainability.
	Training, development and implementation of the new organizational structure	Increased technical capacity and efficiency of WSC staff. Improved WSC customer service.
	Completion of tariff study	Review of sector tariffs towards improving financial sustainability of WSC.
Minimum Wastewater Infrastructure Upgrades	WWTPs upgrades and rehabilitation	Proper collection and treatment of wastewater from all sewered communities. Environmental and health risks associated with untreated sewage or improper disposal significantly minimized or eliminated.
	Lift station rehabilitation	Proper collection and treatment of wastewater from all sewered communities. Environmental and health risks associated with untreated sewage or improper disposal significantly minimized or eliminated.
	Sewer and forcemains replacement	Proper collection and treatment of wastewater from all sewered communities. Environmental and health risks associated with untreated sewage or improper disposal significantly minimized or eliminated.
	Development of Wastewater Master Plan	WSC management and staff have long-term guidance for wastewater sector improvements.
Upgrade Legal and	Establishment of URCA as	Separation of production and

Regulatory Framework	the independent Economic Regulator	economic regulation duties for the water and sanitation sector, resulting in improved efficiency of WSC and improved consumer protection for Bahamian public.
	Establishment of an independent Environmental Regulator	Separation of production and environmental regulation duties for the water and sanitation sector, resulting in improved efficiency of WSC, and improved environmental protection and management of water resources.

While no negative environmental and social impacts are expected during the operational phase of the project, this will only remain so if proper maintenance and monitoring of water supply and wastewater infrastructure occurs on a continuous basis. Any failures in either of these systems can result in negative environmental and social impacts.

6.0 Analysis of Alternatives

The alternatives explored include those proposed under the project and the no-action alternative. The target activities under the project will lead to improvement in the water and sanitation sector in New Providence. If the no-action alternative is taken, the already critical situation will only worsen and lead to more incidences as are currently happening at Pinewood Gardens and the Septage and Sludge Facility. The worsening situation is accompanied by increased environmental degradation and increased risks to human health. NRW would not be addressed and the status quo would remain at WSC. The high levels of NRW would continue to require larger quantities of water (purchased from desalination plants), and increased use of electricity with associated burning of fossil fuels.

7.0 Mitigation Measures

Table 3 below details the mitigation measures that are recommended to minimize or eliminate the potential negative environment and social impacts from the project outlined in Table 1. Mitigation measures should be included, as appropriate, in clauses of agreements with contractors working on the project, particularly related to review and approval of workplans by WSC to ensure work is properly phased.

Table 3: Mitigation Measures

Project Component	Impact	Mitigation Measures
NRW Reduction: <ul style="list-style-type: none"> • Leak detection and repairs • Construction works (including mains and service lateral replacement, pressure control, data collection and monitoring) 	Materials	Any toxic or hazardous chemicals to be utilized on site can be done so according to Material Safety Data Sheet (MSDS) guidance and safety protocols should be established by project management.
	Air quality and dust	Construction equipment should be properly maintained to ensure they do not impair air quality. Construction methodologies and best practices can be employed to minimize generation of quantities of dust that can impair air quality including watering of the site.
	Waste management	All waste can be properly disposed of according to regulations and standards of the Department of Environmental Health Services (DEHS) and the Water and Sewerage Corporation (WSC).
	Landscape and visual	Any protected trees removed should be replaced at a ratio of 2:1 as per the Conservation and Protection of the Physical Landscape Act or as directed by the Department of Physical Planning. Any landscaping for this project should only involve use of native plant species. No invasive or potential invasive species as identified in the National Invasive Species Strategy should be utilized for landscaping. The design and landscaping of the site can minimize or eliminate this impairment on completion of construction.
	Worker health and safety	Workers should be trained in proper procedures. Safety information and appropriate personal protective equipment (PPE) should be readily available.
	Public health and safety	Public health and safety must be a priority. Securing the site to ensure it is not open to pedestrian traffic, posting visible and adequate signage warning of potential dangers on the site and public outreach into neighbouring communities about the impacts of the project on their daily lives should be employed.
	Water resources	Chemical and fuel management of the site can ensure that groundwater and freshwater resources are not negatively impacted. Spill response protocols can be established for effectively dealing with spills in the event of an accident to minimize any pollution of water resources.
	Noise and vibration	Construction activities should be for a limited

		time period to minimize disturbance to birds and other animals on project sites. Once construction is completed in as short a timeframe as possible, the animals should return to habitats they normally utilize. Noise levels should be monitored to ensure they do not approach those that may be harmful to humans.
	Traffic and transport	All workers utilizing vehicles and equipment should have adequate training and skills in their proper and safe handling. Equipment to be utilized for this project moving from other sites should be inspected and cleaned, as necessary, to ensure they do not introduce invasive plant material, such as seeds. Public consultation is key in assuring the Bahamian public that proper phasing of the project will occur to ensure minimal disruption to traffic flows to guard against associated potential negative impacts, including those to other sectors and commercial establishments in the vicinity of project's construction sites.
	Contaminated land	Any toxic or hazardous chemicals to be utilized on site will be done so according to Material Safety Data Sheet guidance and safety protocols as established by project management. Staff should be trained in spill response measures to effectively handle such incidents.
Minimum Wastewater Infrastructure Upgrades: <ul style="list-style-type: none"> • WWTPs upgrades and rehabilitation • Lift station rehabilitation • Sewer and forcemains replacement 	Materials	Any toxic or hazardous chemicals to be utilized on site can be done so according to Material Safety Data Sheet (MSDS) guidance and safety protocols should be established by project management.
	Air quality and dust	Construction equipment should be properly maintained to ensure they do not impair air quality. Construction methodologies and best practices can be employed to minimize generation of quantities of dust that can impair air quality including watering of the site.
	Waste management	All waste can be properly disposed of according to regulations and standards of the Department of Environmental Health Services (DEHS) and the Water and Sewerage Corporation (WSC).
	Landscape and visual	Any protected trees removed should be replaced at a ratio of 2:1 as per the Conservation and Protection of the Physical Landscape Act or as directed by the Department of Physical Planning. Any landscaping for this project should only involve use of native plant species. No invasive or potential invasive species as identified in the National Invasive Species Strategy should be

		utilized for landscaping. The design and landscaping of the site can minimize or eliminate this impairment on completion of construction.
	Worker health and safety	Workers should be trained in proper procedures. Safety information and appropriate personal protective equipment (PPE) should be readily available.
	Public health and safety	Public health and safety must be a priority. Securing the site to ensure it is not open to pedestrian traffic, posting visible and adequate signage warning of potential dangers on the site and public outreach into neighbouring communities about the impacts of the project on their daily lives should be employed.
	Water resources	Chemical and fuel management of the site can ensure that groundwater and freshwater resources are not negatively impacted. Spill response protocols can be established for effectively dealing with spills in the event of an accident to minimize any pollution of water resources.
	Noise and vibration	Construction activities should be for a limited time period to minimize disturbance to birds and other animals on project sites. Once construction is completed in as short a timeframe as possible, the animals should return to habitats they normally utilize. Noise levels should be monitored to ensure they do not approach those that may be harmful to humans.
	Traffic and transport	All workers utilizing vehicles and equipment should have adequate training and skills in their proper and safe handling. Equipment to be utilized for this project moving from other sites should be inspected and cleaned, as necessary, to ensure they do not introduce invasive plant material, such as seeds. Public consultation is key in assuring the Bahamian public that proper phasing of the project will occur to ensure minimal disruption to traffic flows to guard against associated potential negative impacts, including those to other sectors and commercial establishments in the vicinity of project's construction sites.
	Contaminated land	Any toxic or hazardous chemicals to be utilized on site will be done so according to Material Safety Data Sheet guidance and safety protocols as established by project management. Staff should be trained in spill response measures to effectively handle such incidents.

8.0 Conclusion

The New Providence Water Supply and Sanitation Systems Upgrade project has four project components with various associated activities. It is the construction aspects of the project that are expected to have potential negative environmental and social impacts. These impacts can be minimized or eliminated through the mitigation measures outlined in this ESA. Overall impacts of the project will be positive as the resulting improvements in the water and sanitation sector will be significant improvements over the current conditions in the sector.

Appendices

Appendix 1: TORs for Preparation of the ESA

OBJECTIVE

The objective of the consultancy is to prepare an Environmental and Social Analysis (ESA) and an Environmental and Social Management Plan (ESMP) for the IDB WSC Support Program. The final output, among others, will provide a framework for environmental and social management detailing the existing regulation, the processes to obtain environmental permits and other requirements.

More in-depth impact assessments, if needed, will be financed through additional resources from the aforementioned operation.

The Consultancy will be strongly coordinated with the WSC and the IDB team.

The output of this assignment does not constitute and do not have to be considered a full Environmental Impact Assessment (EIA) Also, the output of this assignment does not constitute and do not have to be considered an environmental permit or certificate application. However, the consultant will have to work with local Environmental Authority and WSC to identify the typologies of interventions to be financed through the IDB program that will require authorization/permits or a full scale EIA.

Key policies and directives triggered in this project include B.04 (other risks), B.05 (environmental assessment requirements), B.06 (consultation), B.07 (supervision and compliance), B.10 (hazardous materials), and B.11 (pollution prevention and abatement), of the Environment Safeguards Policy (OP-703), IDB Access to Information Policy (OP-102), and the Natural Disaster Policy (OP-704). The Project has been classified as Category “B” under IDB Safeguard Policies.

It is not likely that Involuntary Resettlement Policy (OP-710) will be triggered as the project will not include new construction. However, this will be assessed during the Environmental and Social process.

Also, it will be assessed if B.9 of OP-703 (Natural Habitats and Cultural Sites) and OP-761 (Women in Development) applies.

SCOPE OF WORK

In accordance with the Category “B” classification (B.3 and B.5), the Environmental and Social Strategy (ESS) involves the preparation of an Environmental and Social Analysis (ESA) and the preparation of an Environmental and Social Management Plan (ESMP). In compliance with OP-

102, this document will be disclosed in the The Bahamas local offices and on the IDB external website.

The Consultant will:

- Assess potential impacts, risks, and mitigation requirements and evaluate Project's direct, indirect and cumulative negative environmental and social impacts have been properly identified and evaluated.
- Assess compliance with applicable IDB Bank environmental and social policies, including specifically the Environmental and Safeguard Compliance Policy, Access to Information Policy, Disaster Risk Management Policy.
- Assess compliance with the applicable environmental, social, health and safety, and labor legal requirements in The Bahamas (e.g., laws, regulations, standards, permits, authorizations, applicable international treaties/conventions, etc.).
- Prepare a project ESMP which will involve water infrastructure replacement and improvement (NRW program), refurbishment of wastewater treatment facilities, connections to the sewerage system, operation. Definition of impacts for the different phase and of the environmental and social control, management and mitigation measures, monitoring programs (including costs, schedule of implementation, designated responsibilities).¹⁶
- Assess the existing health and safety policies and procedures at WSC, and propose additional measures, if needed, to ensure adequate health and safety and contingency plans for accidental events (e.g. fires, spills) and procedures (including for sub-contractors) are in place.
- Assess the environmental and social management procedures at WSC and propose, if needed, additional measures.
- Assess the WSC's capacity to mitigate and monitor environmental, social, health and safety and labor aspects.
- Assist WSC in disclosure and public consultation activities and propose future actions to provide adequate ongoing information disclosure and public consultation with the local population is in compliance with IDB policies.
- The consultant will work with the Environmental Authority the typologies of interventions to be financed through the IDB program that will require permit or a full scale EIA. The assessment will be based on the review of past related projects approved by the Environmental Authority in the past.
- Propose a water quality (aquifer impact) monitoring and evaluation program, including institutional responsibilities and resources, equipment needs and budget. The development of the baseline should start as soon as the interventions have been identified.

¹⁶ It is expected that the main interventions will be defined in mid-June.

(1) ESA

Key issues to be addressed within the ESA will include the following:

1. **Impacts and Risks** - The ESA report should present the potential impacts and risk in order of the different project phases (preparation, construction, operation). Impacts need to be qualified as (i) minor / moderate to significant and (ii) with an indication of the duration BEFORE as well as AFTER mitigation. This is essential as some mitigation measures may not be adequately implemented.
2. **Climate Change / vulnerability assessment and Disaster Risk Management** - The ESA should include a reference to the IDB Disaster Risk Management Policy and the risks assessments that would be required. Also, the ESA should include a preliminary evaluation of possible changes in the water pattern and a vulnerability/risk assessment of Climate change (esp. to infrastructure investment, e.g. change in water aquifer, higher risk of flooding, etc.). Given the complexity of such an evaluation, this assessment should rely mainly on the existing literature and on researches already completed by the IDB and other organizations, when available.
3. **Wastewater effluents** - This will take into account an assessment of national standards and legislation on water and wastewater and IDB Policies, esp. B.11 and B.4. with reference to international standards and international agreements (e.g. Cartagena Protocol) and the development of a timeline to reach these standards.
4. **Analysis for Alternatives** (where possible) – e.g. siting, design, technology, no-action alternative. This activity will be performed in close coordination with WSC and the IDB team. The appraising system will include at least: Population affected, environmental impacts (water, air, soil, landscape, etc), social impacts and economic impacts (truism, commerce, etc). The environmental and social impact criteria will be developed with the support of the environmental-social consultant selected through this Consultancy.
5. **Institutional Assessment** - Include an institutional assessment of key players (e.g. local capacity for implementation of mitigation measures, monitoring and supervision of the execution of the proposed environmental management plans) and, if needed, institutional strengthening measures. The capacity of the company to implement the ESMP should also be assessed. Institutional arrangements for implementation and monitoring of the different activities and plans and costs / budget should be included in the EMP.
6. **Legal Section** - The legal section should not only include local requirements, but also refer explicitly to international, especially IDB Policies, and World Bank Group standards and International Conventions.
7. **Associated Facilities** – If applicable: an assessment of associated facilities ("...new or additional works and/or infrastructure, irrespective of the source of financing, essential for a Bank-financed project to function... ") (Environment Safeguards Compliance Policy; Definitions) should be included.

(2) ESMP

Proposed activities could include, but will not be limited to: (i) environmental and social mitigation activities in the project cycle, (ii) capacity building measures and training; (iii) monitoring and evaluation arrangements and activities; and (iv) improvement of the environmental and social management framework and system.

If not all project activities have been identified during project preparation, the consultant will describe the process for an ESA and preparation of site-specific ESMPs during project implementation (including reporting approval process, budget for implementation of mitigation activities, monitoring and devaluation, etc.).

The consultant will have to identify and propose project-specific indicators to monitor compliance with environmental and social provisions.

(3) Consultation, Disclosure and Project Approval Process

The Consultant will:

- Assist the WSC with the consultation and disclosure process of the ESA/ESMP. A list with consulted stakeholders and key discussion points will be summarized in an Annex. The draft ESA/ESMP should be discussed and shared with relevant stakeholders for comments.
- Outline the process for public consultation, disclosure and approval process for sub-activities and information sharing process during project information. Describe the mechanism for feedback and remediation actions and indicate costs, if applicable.

OUTCOME / REPORTING

The outcome of this assignment will be an (i) Environmental and Social Analysis/ Environmental and Social Management Plan (ESA / ESMP) and (ii) stakeholder consultation workshop.

The main body of the Synthesis ESA/ESMP should not exceed 40 pages. Generic information and references to Government, WB, IDB policies and regulations, etc. will be annexed.

The final report will be presented in English. The products will be delivered in WORD and PDF electronic format.

CHARACTERISTICS OF THE CONSULTANCY

Type of Consultancy: Individual.

Duration: Duties will be performed during a period of 20 non-consecutive working days starting from August 15th, 2011 and ending on September 15th.

Place of work: The Bahamas

Qualifications: The Consultant will have the following qualifications and skills:

- University Degree in Environmental Engineering, Management, Water Supply and Sanitation;
- At least 8 years of experience in water and sanitation project, in preparation and evaluation of environmental assessments and environmental management;
- Excellent experience in preparing Environmental Analyses, Environment Impact Assessments and Environmental and Social Management Plans;
- Previous work for the IDB, World Bank or other international organizations is a plus;
- Excellent English language skills.

SUPERVISION

Coordination of this consultancy will be conducted by the Inter-American Development Bank.

Appendix 2: Sewerage Asset Register

	Value	Historical	Accumulated	Book
	New	Cost	Depreciation	Value
By Asset Class				
Sewerage Disposal Sites	11,485,000	9,100,149	3,134,173	5,949,329
Sewer Lift Stations	8,140,000	4,951,658	2,875,030	2,073,229
Sewer Mains (Gravity and Force)	135,584,247	88,325,170	29,104,741	59,220,429
Sewer Connections	7,362,700	4,293,731	1,852,129	2,441,603
	162,571,947	106,670,708	36,966,073	69,684,590

Bibliography

American Rivers. *Health Factsheet: The Health Risks of Untreated Sewage*.
www.AmericanRivers.org

Bowleg, John A., 2011. *Water Resources Management: Vulnerability of Coastal Aquifers to Climate Change and Human Effects*. UNESCO-IHP Graphic Project Meeting. Dominican Republic.

Brown, Nellie J., 1997. *Health Hazard Manual: Wastewater Treatment Plant and Sewer Workers*. Cornell Univeristy ILR School, USA.

Cant, Richard V., 1996. *Water Supply & Sewerage in a Small Island Environment. "The Bahamian Experience"*. Small Islands: Marine Science and Sustainable Development. Coastal and Estuarine Studies.

Castalia Strategic Advisors, 2010. *Recommendations for Updating the Regulatory Framework for the Water and Sanitation Sector in The Bahamas*. Report to the Inter-American Development Bank and the Government of The Bahamas.

Dorfman, Mark, 2004. *Swimming in Sewage: The Growing Problem of Sewage Pollution and How the Bush Administration is Putting Our Health and Environment at Risk*. Natural Resources Defense Council. USA

Health and Safety Executive, 2009. *Working with sewage. The health hazards: A guide for employers*. United Kingdom.

Sealey, Neil E., 1994. *Bahamian Landscapes: An Introduction to the Geography of the Bahamas*. Second Edition. Media Publishing, Nassau, Bahamas.

Water Management Consultants Ltd, 2003. *Environmental Study, Loan No. LO 1112/OC-BH, Regulatory Framework for Integrated Groundwater Management and Pollution Control - Final Report*.

Water and Sewerage Corporation, 2011. *Draft Health and Safety Regulations*. Nassau, The Bahamas.