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Guyana Water Incorporated (GWI)

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Consultancy Services for Update of Master Plan for the Georgetown Sewerage System & Designs for the Rehabilitation of the Production and Distribution of Water Supply Systems in Linden



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GEORGETOWN
PRELIMINARY DESIGN
REPORT – Volume 2

Environmental and
Social Assessment

EXECUTIVE SUMMARY

*The **Preliminary Design Report** presents the proposals for implementation of urgent rehabilitation works for the improvement of **Georgetown Sewerage System**. The technical proposals contained in “Volume 1- Technical Study” are supported by the environmental analyses documented in this **Environmental and Social Assessment** representing the second volume of the Report. The results of the socio-economic study are reported in “Volume 3 - Cost-Benefit Analysis”.*

*This **Environmental and Social Assessment** has been prepared in compliance with the **IDB** and **GWI** policies concerning environmental protection.*

*An overall description of present condition of infrastructures and proposed project features is given in **Chapter 1**.*

Further details on the design of recommended interventions are given in “Volume 1 – Technical Study”

*The institutional and legal framework governing the environmental sector in Guyana is thoroughly described in **Chapter 2**, while the main characteristics of study area, with particular attention to the environmental and social conditions in Georgetown central area, are shown in **Chapter 3**.*

***Chapter 4** provides a comprehensive assessment of the environmental and social impacts consequent to the implementation of the project, considering both temporary and permanent impacts. Impacts have been evaluated using the **Environmental Screening Checklist** required by GWI Environmental Guidelines.*

***Chapter 5** gives a comparison between the two proposed alternatives, in terms of technical advantages and disadvantages, as well as investment costs and O&M annual costs.*

*A draft structure for the future **Environmental and Social Management Plan** to be elaborated by contractors according to GWI Environmental Guidelines is given in **Chapter 6**.*

***Chapter 7** proposes actions to be taken for the implementation of awareness campaigns and public disclosure of the project objectives.*

The report is complemented with annexes incorporating the Environmental Screening Checklists for both options.

VOLUME 2: ENVIRONMENTAL AND SOCIAL ASSESSMENT

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LIST OF ACRONYMS

EAB	Environmental Assessment Board
EAP	Environmental Action Plan
EAT	Environmental Appeals Tribunal
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESA	Environmental and Social Assessment
ESC	Environmental Screening Checklist
ESMP	Environmental and Social Management Plan
GPL	Guyana Power and Light
GNBS	Guyana National Bureau of Standards
GT&T	Guyana Telephone and Telegraph Co. Ltd
GW	Guyana Water Incorporated
IDB	Inter-American Development Bank
M&CC	Municipality and City Council
MoHW	Ministry of Housing and Water
MoPW	Ministry of Public Works
ToR	Terms of Reference
WWTP	Waste Water Treatment Plant

1. INTRODUCTION

This Environmental and Social Assessment report has been prepared under the contract “Consultancy Services for Update of Master Plan for the Georgetown Sewerage System & Designs for the Rehabilitation of the Production and Distribution of Water Supply Systems in Linden” signed between Guyana Water Incorporated and the Consultant HYDEA S.r.l. in the framework of the Water and Sanitation Upgrade Programme financed by the IDB’s Aqua Fund programme.

The study is part of the **Preliminary Design Report** for Georgetown Sewerage System, composed of:

- Volume 1: Technical Study
- Volume 2: Environmental and Social Assessment
- Volume 3: Cost-benefit Analysis

The overall objectives of the programme are:

- Rehabilitation of the sewage infrastructure in Georgetown
- Reductions of Non Revenue Water levels throughout Guyana

The specific objectives of the Consultancy Services are:

- Modernization of the sewerage infrastructure in Georgetown
- Improvement of the provision of potable water in Linden

This report concerns the Georgetown Component of the Project and in particular the definition of priority works for the Georgetown sewerage infrastructure, aimed at the identification and estimation of urgent rehabilitation works to be presented for IDB funding in October 2010.

The direct beneficiaries of the project are the users of the central Georgetown sewerage system (around 50,000 persons), while the total beneficiaries are all the inhabitants of Greater Georgetown (239,227 persons from 2002 Guyana census).

This ESA has been prepared in compliance with the IDB policies and particularly in conformity with the IDB Environmental and Social Guidance (February 2009) and the GWI Environmental Guidelines for Construction Projects and Environmental Assessment (February 2005). In accordance with those guidelines this ESA comprises a draft structure for Environmental and Social Impact Management Plan to be prepared by selected contractors.

2. PROJECT DESCRIPTION

2.1 Current situation of sewerage system

There exist three piped sewerage systems in Georgetown: Central Georgetown, Tucville and University of Guyana systems. With the exception of Central Georgetown scheme, these are small local networks serving a number of inhabitants comprised between 1,500 and 3,000. Households in Georgetown area not served by the sewerage systems depend mainly on septic tanks, few others rely on pit latrines.

The **Central Georgetown Sewerage System** provides service to approximately 50,000 residents in the service area bounded by the Demerara River in the West, Vlissengen Road in the East, the Atlantic Ocean in the North and Sussex Street in the South.

The Central Georgetown sewerage system was first commissioned in 1929. It was designed by Howard Humphrey and Sons to serve a population of 10,000 residents. It essentially comprises 24 sewerage basins each having a network of gravity sewers draining into a single pumping station. The 24 pumping stations deliver untreated flows into a common ring force main from where they are discharged to the mouth of Demerara River via a short outfall located at Fort Groyne, Kingston. The catchment basins extend over an area of about 460 hectares.

The street sewerage network remains unchanged today since it was first completed in 1929. Some of the yard sewers were changed over the years as buildings were rehabilitated, expanded or whenever foundation work was done for new construction. Additional yard sewers were done with AC pipes in the 1970s and more recently PVC pipes were used for repair works.

As regards the pressurized mains, during the period 1985 – 1988 the old Cast Iron ring was completely replaced with PVC pipes and new pumps and motors were installed. In 2009, thanks to IBD funding, rehabilitation works were done on the pumping stations and 15 pumps were replaced with new ones.

The Tucville Sewerage System was constructed in 1970 and benefits approximately 3,000 residents. It is formed by a small network of gravity sewers, draining into treatment works. The collection system comprises of house connections which are generally 100 mm diameter AC pipes or pitch fibre pipes. The sewerage treatment works were designed to carry out the physical and biological treatment of domestic wastewater by the extended aeration activated sludge process, after which the treated effluent could be discharged into a drainage canal. The treatment works have been out of operation for a number of years, resulting in the direct discharge of untreated effluents into the drainage canals with the consequent negative environmental and sanitary impacts.

Following the completion of IDB funded works in 2009, the Tucville plant has been transformed into a septage receiving station for the disposal of sludge collected at septic tanks in order to reduce the illegal sludge dumping problem in Georgetown city. The

station is presently connected to the existing ring through a delivery main and has been effectively integrated to the Central Georgetown Sewerage System.

However, it has been recently observed that the excessive density of the disposed sludge hampers its pumping into the sewerage system: GWI is planning to install an agitator into the septage receiving tank to reduce sludge density and facilitate pumping to the Central Georgetown sewer system. Meanwhile, the septage collection trucks continue illegal dumping of the sludge directly into the Demerara river estuary next to the Fort Groyne outfall, as it was notified by GWI to the EPA.

2.2 Identification of priority works

The **priority works** proposed in this *Preliminary Design Report* are focused on the rehabilitation of central Georgetown sewerage scheme. Proposed options are based on current conditions of this same system, which have been assessed through detailed investigations carried out by the Consultant by means of advanced technologies, such as CCTV camera inspections, ultra-sonic flow metering and others (see condition assessment section in *Volume 1 – Technical Study*)

The main problems encountered through the condition assessment analysis can be summarized as follows:

- Infiltration of wastewater from street sewers and manholes due to pipe corrosion and inactivity of pumps for at least 18 hours a day
- Formation of corrosive gas through digestion processes linked to the excessive retention of organic matter into gravity sewers and mains
- Leakage from the ring main, trench crossings and delivery mains, due to pipe age and inadequacy of materials used
- Insufficient use of pumps due to malfunctioning or constraints linked to energy consumption
- Functioning of most of the pressurised pipes as open channel collectors
- Inadequate velocity at outfall diffuser.

Based on the preliminary discussions with GWI and IDB representatives on different alternative solutions, the analysis has been focused on the **rehabilitation of existing ring main**. Within the general approach of this first option, two proposals have been identified and developed from the technical and financial point of view.

The following specific objectives have been considered to orient the preliminary design:

- Reduction of risk of contamination of potable water consequent to infiltration of wastewater

- Considerable decrease of dispersion of pollutants into the aquifers
- Elimination of leakage into canals and trenches
- Reduction of retention time of wastewater into sewers, manholes and raising mains
- Improvement of diffusion of effluent at the outfall

From the technical point of view, the proposed works are based on the substitution of old materials with new and more reliable materials, as well as on the reinforcement of the capacity of existing pumping stations.

2.3 Proposed interventions

The proposed urgent works are presented hereafter:

2.3.1 Option 1.a : Rehabilitation of existing ring and pumping stations power increase

This option includes the following works:

1. Complete reconstruction of ring main with HDPE pipes for a total length of 5.5 km
2. Installation of gate valves and fittings on the ring, where appropriate
3. Reconstruction of trench crossings, including washouts and air release valves
4. Replacement of delivery mains from pumping stations to the ring, on a total length of about 5.6 km.
5. Connection of pumping stations PS1 and PS1 to the ring
6. Completion of installation of new pumps with 9 groups remaining in GWI stores
7. Installation of a second pump in the pumping stations, wherever needed in accordance with the results of hydraulic simulations
8. Upgrade of power supply equipment at pumping stations
9. Replacement of some sections of street sewers, where needed.

The proposed interventions and their location are illustrated in **Drawing 1** attached to the first volume of this report (*Technical Study*) and presented in **Annex 1**.

The execution of the above mentioned interventions will require the following construction activities:

- Trench excavation about 1.2 m wide, and 2.1 to 3.0 m deep, with adequate shoring and dewatering. The trenches works shall be carried out in consecutive sections about 30 m long;
- Trench bottom preparation and laying of a sand bed;
- Pipe supply, installation and welding. The main ring pipes shall be of HDPE material with an external diameter varying from 280 mm to 560 mm, while the delivery mains shall be 160 mm and 200 mm HDPE pipes;
- Supply and installation of pipe fittings including gate valves, Tee's, air vent valves, washouts, couplings and dismantling joints;
- Installation of pumps and power supply equipment in the existing pumping stations;
- Demolition and replacement of some sections of gravity sewers
- Relocation of existing utilities (pipes, cables, etc.) as it might be required in some sections;
- Road reinstatement.

The estimated time for completion of works relevant to **Option 1.a** is eighteen months, and the estimated cost is approximately **1.68 billion GY\$** (8.4 million US\$)

For all proposed works, a budget is allocated for works supervision, capacity building and public awareness and information campaigns to be started few weeks before the commencement of the works and to be continued all along the construction period.

2.3.2 Option 1.b : Inclusion of preliminary treatment facilities

A second option has been taken into consideration in the Technical Study (Volume 1) of this report: The alternative referred to as **Option 1.b** is essentially an extension of **Option 1.a** with the inclusion of a primary treatment plant designed for a population of 70,000 inhabitants.

In the framework of the identification of priority works for the rehabilitation of Georgetown sewerage system, this option has not been retained. Therefore, the relevant interventions are not considered in the present analysis.

2.3.3 Rehabilitation of gravity sewer networks

In addition to the problems relevant to the main ring and the delivery mains, the condition assessment showed that the degradation of street and yard sewers is responsible for a considerable amount of infiltration of wastewater and contaminants in the ground.

For this reason, a **lump sum** for emergency rehabilitation of street sewers in selected locations has been included in the project estimate.

3. INSTITUTIONAL AND LEGAL FRAMEWORK

The legislative and regulatory framework, for the project, is a combination of national, international and regional policies, regulations, legislations and guidelines to which Guyana is a signatory. The environmental and social assessment process for development and operation of the project will be undertaken in accordance with the legislative and regulatory framework detailed below.

3.1 National Policies

The importance of the environmental and the social issues in Guyana policies is well expressed and highlighted in the following major documents:

3.1.1 Constitution of Guyana

From the Guyana Act N°2 of 1980 and its consecutive amendments (2003):

Article 25: *"Every citizen has a duty to participate in activities to improve the environment and protect the health of the nation."*

Article 36: *"The wellbeing for the nation depends upon preserving clean air, fertile soils, pure water and the rich diversity of plants, animals"*

Article 149J "The environment":

1. *Everyone has the right to an environment that is not harmful to his or her health or wellbeing.*
2. *The State shall protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures designed to:*
 - a) prevent pollution and ecological degradation;*
 - (b) promote conservation; and*
 - (c) secure sustainable development and use of natural resources while promoting justifiable economic and social development*
3. *It shall not be an infringement of a person's rights under paragraph (1) if, by reason only of an allergic condition or other peculiarity the environment is harmful to that person's health or wellbeing.*

3.1.2 Millennium Development Goals, 2000

In 2000, at the United Nations Millennium Summit, 189 world leaders adopted the Millennium Declaration and agreed to collective commitments to overcome poverty through a set of eight mutually reinforcing interrelated time-bound goals (MDGs) with related targets. Guyana was part of the Nations adopting the MDGs.

The MDGs synthesize the goals of 1990s global UN conferences and provide an accountability framework and global partnership for progressively eradicating poverty in all its dimensions. The MDGs are at the forefront of the global development agenda and

represent the international community's commitment to eradicate poverty by 2015 where ensuring environmental sustainability is one of the main goals.

Goal 7. Ensure environmental sustainability:

4. *integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources;*
5. *By 2015, reduce by half the proportion of people without access to safe water;*
6. *By 2020 achieve significant improvements in the lives of at least 100 million slum dwellers. "*

3.1.3 National Development Strategy 2001-2010

The NDS 2001-2010 enunciates the "environmental philosophies" on which Guyana's social and economic development will be based underlying the importance of the respect of the environment and its sustainability in all forms of physical and social development and defines Guyana's principal environmental policy objectives as follows:

- *to enhance the quality of life of the country's inhabitants by utilising its natural resources while neither degrading nor contaminating them;*
- *to ensure that the natural resource base for economic growth continues to be available in the future; and*
- *to intensify and widen the dimensions of our living standards through the conservation of unique habitats, natural treasures, biodiversity and our cultural heritage."*

3.1.4 Guyana Poverty Reduction Strategy Paper (PRSP), 2001

The Guyana PRSP of 2001 in line with the Millennium Development Goals defined its policy objectives for minimizing the impact of environmental degradation and the strategy for their achievement by enforcing the provisions of the Environmental Protection Act, promoting public awareness and involving local communities in vulnerable ecosystems management and conservation of the resources of protected areas.

In addition, the PRSP included the reinforcement of the EPA capacities and the enhancement of its role of audit, monitoring and ensuring the compliance to environmental standards and the application of the environmental management plans.

"The Government's goal in the sanitation sector is to improve the sanitary conditions of the population of Georgetown, and to reduce the current levels of environmental degradation through improvement in the quality and availability of the water supply and sewerage services".

3.1.5 UNEP Cartagena Convention

Guyana's Cabinet has approved the accession to Cartagena Convention and its three Protocols on June 17th, 2010. The accession becomes official when the Government

submits its instruments of accession for official recording by the Depository for the Convention located in Cartagena, Columbia.

The Cartagena convention is a convention for the protection and Development of the Marine Environment in the Wider Caribbean Region that was adopted in Cartagena, Colombia on 24 March 1983 and entered into force on 11 October 1986, for the legal implementation of the Action Plan for the Caribbean Environment Programme.

The Convention is supplemented by three protocols:

- 1- The Protocol Concerning Pollution from Land-Based Sources and Activities (LBS Protocol)
- 2- Oil Spills Protocol with the objective to strengthen national and regional preparedness and response capacity of the nations and territories of the region.
- 3- The Protocol concerning Specially Protected Areas and Wildlife (the SPAW Protocol).

Cartagena Convention Article 7: POLLUTION FROM LAND-BASED SOURCES

The Contracting Parties shall take all appropriate measures to prevent, reduce and control pollution of the Convention area caused by coastal disposal or by discharges emanating from rivers, estuaries, coastal establishments, outfall structures, or any other sources on their territories.

Cartagena Convention Article 12: ENVIRONMENTAL IMPACT ASSESSMENT

- 1- *As part of their environmental management policies the Contracting Parties undertake to develop technical and other guidelines to assist the planning of their major development projects in such a way as to prevent or minimize harmful impacts on the Convention area.*
- 2- *Each Contracting Party shall assess within its capabilities, or ensure the assessment of, the potential effects of such projects on the marine environment, particularly in coastal areas, so that appropriate measures may be taken to prevent any substantial pollution of, or significant and harmful changes to, the Convention area.*
- 3- *With respect to the assessments referred to in paragraph 2, each Contracting Party shall, with the assistance of the Organization when requested, develop procedures for the dissemination of information and may, where appropriate, invite other Contracting Parties which may be affected to consult with it and to submit comments.*

The Cartagena convention has not yet entered into effect for Guyana, however the GoG's goal is to get aligned with the different protocols. The present project is concerned mainly with the LBS protocol with respect to the discharge of domestic wastewater into the Convention protection area and the definition of the effluent

limitations and the effective date of obligation for achieving these limitations. Actually, for all new domestic wastewater systems (including existing domestic wastewater systems which have been subject to substantial modifications after such entry into force, which is the case of this project), obligation to respect the effluent limitations initiates directly after entering into force of the Protocol.

Effluent limitations are defined as a function of the classification of the receiving water body, divided into Class I Waters and Class II Waters as follows:

Class I waters are waters in the Convention area that, due to inherent or unique environmental characteristics or fragile biological or ecological characteristics or human use, are particularly sensitive to the impacts of domestic wastewater.

Class II waters are waters in the Convention area, other than Class I waters, that due to oceanographic, hydrologic, climatic or other factors are less sensitive to the impacts of domestic wastewater and where humans or living resources that are likely to be adversely affected by the discharges are not exposed to such discharges.

Discharges into Class I Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class I waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Table 1: LBS Protocol effluent limits for discharges into Class I Waters

Parameter	Effluent Limit
Total Suspended Solids	30 mg/l*
Biochemical Oxygen Demand (BOD ₅)	30 mg/l
pH	5-10 pH units
Fats, Oil and Grease	15 mg/l
Faecal Coliform (Parties may meet effluent limitations either for faecal coliform or for <i>E. coli</i> (freshwater) and enterococci (saline water).)	Faecal Coliform: 200 mpn/100 ml; or a. <i>E. coli</i> : 126 organisms/100ml; b. enterococci: 35 organisms/100 ml
Floatables	not visible
* Does not include algae from treatment ponds	

Discharges into Class II Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class II waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Table 2: LBS Protocol effluent limits for discharges into Class II Waters

Parameter	Effluent Limit
Total Suspended Solids	150 mg/l*
Biochemical Oxygen Demand (BOD ₅)	150 mg/l
pH	5-10 pH units
Fats, Oil and Grease	50 mg/l
Floatables	not visible
* Does not include algae from treatment ponds	

The Georgetown sewage effluents are actually discharged without any treatment at Fort Groyne outfall in Kingston, in the Demerara River estuary at the entrance in the Atlantic Ocean.

The following factors should be taken into consideration for the correct classification of receiving waters in the present case:

- the peculiar hydrologic and hydrometric conditions governing the flow of water into the river estuary, particularly in relation to the cycles of high and low tides engendering modifications of velocities and turbulence at the river mouth
- the East bank of Demerara is occupied by docks up to the river mouth, and there are no habitations or significant commercial activities, with the exception of the harbour
- no recreational activities are effected on the river or the ocean coast in the nearby area, due to the daily variation of tide
- due to the presence of the docks, no mangroves are growing at the East bank of the Demerara river where the outfall is located and, according to the information provided by EPA, the discharge area does not contain protected species, in terms of flora and fauna

It can be concluded that the receiving water body is not particularly sensitive to the impacts of domestic wastewater, therefore the waters where the outfall is discharging can be categorized as Class II waters. The effluent limits of **Table 2** shall be considered.

In compliance with the Cartagena Convention, the effluents of Georgetown sewerage system shall be verified to respect the LBS effluent limitations for discharge into Class II Waters.

3.2 National Environmental Action Plan, 1994

The National Environment Action Plan (NEAP) developed in 1994 outlined the Government of Guyana main environmental policy objectives for sound management of the environment and natural resources. Twelve policy objectives were outlined. One of the policy objectives calls the GoG to request the carrying out of environmental assessments for proposed development activities that may significantly affect the environment. In keeping with this environmental policy objective, the **Environmental Protection Act** was made law in June 1996 and the legal framework for undertaking an environmental impact assessment was outlined.

The **Environmental Protection Agency** was established under the Environmental protection Act that outlines the legal process for undertaking sustainable and effective management of the environment and its natural resources. The national plan was updated in 2000 setting out the environmental development strategy for Guyana for the next five years. It states Guyana's Policy position as 'sustainable development that integrates economic, environmental and social values during planning, and recognizes the need to distribute benefits equitably across socio-economic strata and gender upon implementation.' The main goals of protecting the environment as defined in the plan are:

- (i) The prevention or control of pollution in order to maintain the integrity of the land and the natural purity of the air and water resources;
- (ii) The general preservation and conservation of ecological integrity and the protection of natural habitats and fragile ecosystems in particular;
- (iii) Ensuring sustainability through best practice of the management and use of natural resources for economic development.

3.3 Environmental Protection Act and Agency, 1996

The **Environmental Protection Agency** was established through the Environmental Protection Act (1996), its identified functions consist in providing for the management, conservation, protection and improvement of the environment, the prevention or control of pollution, the assessment of the impact of economic development on the environment and the sustainable use of natural resources.

Therefore the Environmental Protection Agency is the agency under which GWI's environmental activities are regulated.

The Environmental Protection Act mandated four functions for the EPA which relate to environmental assessment and are applicable to this project as follows:

1. To take such steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection and sustainable use of natural resources;
2. To promote the participation of members of the public in the process of integrating environmental concerns in planning for development on a sustainable basis;
3. To ensure that any development activity which may cause an adverse effect on the natural environment be assessed before such activity is commenced and that such adverse effect is taken into account in deciding whether or not such activity should be authorized.
4. To give development consent which entitles the developer to proceed with the project.

The Environmental Protection Act has lead to the preparation of the Environmental Protection Regulations enacted in 2000. These are:

- The Environmental Protection Air Quality Regulations
- The Environmental Protection Water Quality Regulations
- The Environmental Protection Noise Management Regulations
- The Environmental Protection Hazardous Wastes Management Regulations
- The Environmental Protection Authorizations Regulations

This Act is applicable to the project due to its potential to impact the environment.

3.4 Environmental Protection (Authorizations) Regulations 2000

Regulations on Hazardous Waste Management, Water Quality, Air Quality and Noise Management were established, in 2000, under the Environmental Protection Act. These pollution management regulations, which would be applicable to this project, were developed to regulate and control the activities of development projects during construction and operation. The EPA has the responsibility to ensure the compliance of all new activities to these regulations by issuing the required authorizations and monitoring their application.

The Environmental protection regulations are described here after.

3.4.1 Environmental Protection Air Quality Regulations 2000

Environmental Protection (Air Quality) Regulations were developed in 2000 under the Environmental Protection Act 1996. In accordance with these regulations anyone who emits any air contaminant in the construction, installation, operation, modification or extension of any facility related to industry, commerce, agriculture or any institution shall

apply to the EPA for an environmental authorization and shall submit an application to the EPA at least ninety days before the date on which the emission is to commence.

During the construction phase, this project is expected to produce dust from excavation activities and air emissions from the construction equipments and trucks. These emissions have **a short-time reversible impact** limited to the construction phase, where the contractor will be required to apply mitigation measures for reducing their impact such as using dust suppression techniques by applying water to minimize dust from vehicle movements, increasing moisture content of fill material and using covers for onsite stocked material and excavated earth as described in **Chapter 6**.

In accordance with the Regulations the EPA shall establish the desirable air pollution limits and may use measuring instruments for the purpose of assessing the air quality. EPA may also prepare Air Pollution Monitoring Index for the project area, defining an Air Advisory Level and First Air Pollution Alert for monitoring the air quality and, when needed, the EPA and the Ministry of health may order the curtailment of air pollution sources' activities.

Currently, no National Air Quality Standards exist, however the WHO Ambient Air Quality guidelines (2007) presented in **Table 3** can be adopted as a reference.

Table 3: WHO Air Quality Guidelines

POLLUTANT	AVERAGING PERIODS	GUIDELINE VALUE ($\mu\text{g}/\text{m}^3$)
Nitrogen Dioxide (NO_2)	1-hour average	$200\mu\text{g}/\text{m}^3$
Particulate Matter (PM_{10})	24-hour average	$50\mu\text{g}/\text{m}^3$
Sulphur Dioxide (SO_2)	24-hour average	$125\mu\text{g}/\text{m}^3$

3.4.2 Hazardous Waste Management Regulations 2000

These regulations outline the rules and procedures for transport, storage, treatment and disposal of hazardous wastes. There are no regulations for the management of hazardous substances. These regulations are intended to ensure, through the environmental authorization process, that all operations that generate, transport, treat, store and dispose of hazardous wastes are managed in a manner that protects human health and the environment. The regulations allow for the provision of information on the types of facilities and quantity of hazardous waste generated, treatment standards and efforts to reduce the waste generated. An emergency preparedness plan is required for anyone who operates a hazardous waste facility.

The project construction is not expected to produce any toxic or hazardous material waste. The use of fuel for the equipments and some lubricants at the construction site is not subject to authorization, however the contractor will be required to apply safety procedures and to use secondary containment in case of fuel or oil storage on site to avoid spill accidents.

3.4.3 Environmental Protection Water Quality Regulations 2000:

These regulations require registration and environmental authorization by any person whose construction, installation, operation, modification or extension of any facility relating to industry, commerce, agriculture, institution or sewage cause the discharge of effluents. These regulations cover parameter limits of effluent discharges, new sources of effluent discharges, fees for registration and environmental authorization, sampling points, records and reports and general provisions for the registration of water effluent, biological integrity, spills or accidental discharges and standard methods of analysis. Guidelines on the discharge of effluents and disposal of sludge are detailed in these regulations.

In accordance with these regulations the EPA was mandated to establish parameter limits for concentration of constituent of effluent which can be discharged into any inland or coastal waters or lands of Guyana. **No standards are available for domestic sewer effluents, and no monitoring arrangements for water effluent are presently in place.**

As a reference for effluent limits **Table 4** presents a comparison of the WB and LBS protocol limits of the main parameters for sewer effluents discharged in water bodies.

Table 4: Limits of effluent parameter for WB and LBS Protocol

Parameter	Unit	WB	LBS Class I Waters	LBS Class II Waters
TSS	mg/l	50	30	150
BOD₅	mg/l	50	30	150
PH	units	6-9	5-10	5-10
Fats, Oil and Grease	mg/l	10	15	50
Faecal Coliforms	mpn/100ml	<400	200	-

The WB limits are less stringent with respect to LBS limits for Class I Waters and more stringent with respect to the limits for Class II Waters. As mentioned before, the receiving water of the Georgetown sewer system can be considered a Class II Water with respect to the Cartagena convention classification. To apply the most stringent standards, **it is then advised to adhere to the WB limits.**

With the purpose of evaluating the actual quality of effluent in present conditions, the Consultant has conducted an extensive research in Georgetown to identify laboratories specializing in water quality testing. Different laboratories of public and private organizations have been consulted, including GWI, University of Guyana and Guyana Sugar Corporation, but it was not possible to perform a complete set of water quality analyses **from the same sample** including measurement of Total and Faecal Coliforms, BOD, COD and fats, oil and grease parameters.

Analysis on Total Suspended Solids, Dissolved Oxygen, COD and other parameters were done in the laboratory of Guyana Sugar Corporation. Samples have been taken from a sewage pumping station (PS8) and from the estuarine water close to the outfall. On water from the same sources, analyses of Total and Faecal Coliforms were done in a private laboratory (see the results in Annex 3).

The results of these spot analyses seem to be suspicious and not representative of average values. The information must be substantiated through the implementation of a long-lasting programme of analysis on the effluents. It is therefore recommended that the GWI or EPA acquire the necessary equipment for the execution of in-house analysis for the continue monitoring of wastewater quality.

3.4.4 Environmental Protection Noise Management Regulations 2000

Under these regulations operations that emit noise in the execution of various activities such as construction, transport, industry, commerce and any institution are required to apply to the Agency for an environmental authorization. The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction and other areas. The EPA may grant authorisation for noise emission unconditionally or subject to conditions and may require environmental audit procedures. Presently the EPA is performing noise monitoring in Georgetown city and dispose of noise measures that can be used as base line for the project monitoring procedure. The Guyana National Bureau of Standards (GNBS) and the EPA together with other relevant agencies developed Guidelines for Noise Emission into the Environment as presented in the following table.

Table 5: Guyana Standard Guidelines for Noise Emissions into the Environment

Categories	Daytime Limits in dB (A)	Night-time Limits in dB (A)	
Residential	75	60	
Institutional	75	60	
Educational	75	60	
Industrial	100	80	
Commercial	80	65	
Construction	90	75	
Transportation	100	80	
Recreational	100	18:00 - 01:00 h	100
		01:00 – 08:00 h	70

With:

Daytime: 06:00h – 18:00h

Night-time 18:00h – 06:00h.

The equipment and work engines are expected to emit noise during working hours. Application to the EPA for Environmental permit will cover noise management during construction phase.

3.5 GWI and Water and Sewerage Act, 2002

The Water and Sewerage Act of 2002 is an Act providing for the ownership, management, control, protection and conservation of water resources, the provision of safe water, sewerage services and advisory services, the regulation thereof and for matters incidental thereto or connected therewith.

Under the Water and Sewerage Act 2002, **Guyana Water Incorporated (GWI)** was established on May 30, 2002, resulting from the merger of the Guyana Sewerage and Water Commission (GS&WC) and the Guyana Water Authority (GUYWA).

The current project is committed by GWI and has to conform to its regulations. For what environment and social issues are concerned, the project shall follow the following GWI Guidelines:

- GWI Corporate Environmental Guidelines January 2005
- Environmental Guidelines for Construction Projects and Environmental Assessment, Written in Conjunction with the World Bank, February 2005.

The mission of GWI is:

“To deliver safe, adequate and affordable water and to ensure safe sewerage systems for improved public health and sustainable economic development”.

3.5.1 GWI Corporate Environmental Guidelines - January 2005

The GWI Corporate Environmental Guidelines are meant to improve the GWI's social and environmental performance. The guidelines are split into three sections:

1. GWI's mandate and environmental and social responsibilities
2. GWI's environmental and social guiding principles
3. GWI employees' roles and responsibilities

The major guiding principles ruling this project are the following:

- GWI will conduct its business in keeping with the Environmental Protection Act and regulations therein;
- GWI will apply to the requisite National Authority for an environmental permit for all projects in excess of G\$ 5M. If deemed necessary, Environmental Impact Assessments (EIAs) will be carried out (new EIAs may not be required if a similar

project already has an EIA). Notwithstanding, environmental screening will be carried out for all activities. Projects in excess of G\$ 5m will be guided by environmental management plans (EMPs), describing in detail the steps and actions required to comply with the EPA and regulations therein;

- GWI will implement and maintain a compliance strategy based on environmental audits to verify compliance with GWI environmental policies and specific EMP;
- GWI will implement and maintain an environmental monitoring program to assess the impact of its interventions and continued operation on the environment, and the impact the environment is causing in its works.
- GWI interventions would be designed to: (i) avoid whenever possible or minimize its impact on biodiversity and natural habitats; (ii) reduce potential negative public health risks; (iii) minimize the need for involuntary resettlement; (iv) provide safeguards for physical cultural property; and, (v) reduce the emission of green house gases and implement climate change mitigation measures.
- GWI welcomes community participation and dialogue at all levels. At project level during planning and before implementation GWI will introduce the project, its components, contractor(s), and GWI's contact personnel to the community, and community concerns will be incorporated as appropriate.
- GWI will approach the community utilizing appropriate communication channels and through cultural sensitive expressions.

3.5.2 *GWI Environmental Guidelines for Construction Projects and Environmental Assessment, February 2005*

This document was written in 2005 in conjunction with the World Bank in response to a request by the World Bank to ensure mechanisms were be in place that would take environmental issues into account should the bank decide to fund future capital investment within GWI. The guidelines are now a mandatory component of any project over GYD 5M carried out either by GWI, or by subcontractors on its behalf. **The application of GWI guidelines is consequently mandatory to the current project.**

The GWI environmental guidelines outline the general environmental and social principles guiding GWI to serve as a basis for design and construction of civil works (pipelines, pump stations, etc), requiring to avoid or minimize the generation of negative social and environmental impacts and public nuisances on population, residents and businesses. When negative impacts cannot be avoided the implementation of mitigation measures and when possible the identification of alternative solutions will be required with emphasis on the importance for public and community consultations and community participation.

For all projects (or sub-projects) greater than GYD 5M in contract value, a project specific EIA screen shall be performed according to a checklist template included in the Guidelines for the first assessment of possible negative social and environmental impacts of the project. For screening purposes, impacts are only assessed as positive versus negative and major versus minor. Negative impacts are characterised as either

"minor" or "major". In general, minor impacts are temporarily visible or otherwise notable changes while major impacts generally are permanent and require significant mitigation such as resettlement. The EPA will be consulted to identify best practices for all major issues identified through the screening process. Typically, any potential major impacts will require further studies to assess the sensitivity of the issue, extent of impact and best practice for mitigation and a project specific EMP shall be developed in accordance with guidelines from the EPA.

In conformity with the GWI guidelines, a preliminary screening checklist has been completed by the Consultant to identify significant potential impacts of the project and is presented in **Annex 3**.

In addition, the *GWI Environmental Guidelines* define the basic environmental and social considerations to be addressed during the project planning and design phases as well as during construction activities and for environmental and social supervision during construction. It also defines the procedures for public participation, consultation and information activities to be implemented in coordination between the Contractor and the GWI.

The Consultant shall consider these guidelines to the extent practical during project planning and design and while drafting the bidding documents for construction works.

It is deemed that GWI Guidelines for construction projects and environmental assessment elaborated in 2005 represent an exhaustive document well adapted to the type of construction projects usually implemented by GWI. Since the Guidelines' publication, project screening procedures have not been used by GWI as the projects implemented had a relatively small budget. However, according to GWI, the environmental and health and safety guidelines are well respected on all project sites by the GWI site supervision engineer who usually gets feedback and support from the GWI environmental responsible and the health and safety office. GWI will ensure the good implementation of the construction guidelines for all the project phases, however the scale of the proposed works is larger than all the projects that GWI had to deal with till present.

3.6 Environmental Impact Assessment Guidelines

The Environmental Impact Assessment Guidelines are outlined by the Guyana EPA in the following documents:

- Environmental Impact Assessment Guidelines Volume 1, Rules and Procedures for Conducting and Reviewing EIA's, version 4, dated November 2000
- Environmental Impact Assessment Guidelines Volume 2, Generic, version 4, dated November 2000

As mentioned in the above paragraphs, for water and wastewater projects, EIA are only required in the case of major impacts identified in the preliminary environmental impact screening checklist.

A summary of that EIA process established by the EPA is detailed below.

Commencement of the environmental impact assessment process is preceded by an application for an environmental authorization and a summary of the project including information on the site, design and size of the project, possible effects on the environment and a non-technical explanation of the project. The Environmental Protection Agency would then indicate whether an environmental and social impact assessment is a mandatory requirement for the issuance of an environmental authorization for the operation.

When an EIA is required, a draft Terms of Reference is prepared and submitted to the EPA. After that submission, the EPA publishes a notice of the project in at least one daily newspaper. A summary of the project is made available to members of the public for a period of 28 days. Within this period the EPA accepts written submissions to the Agency related to the project. These submissions detail questions and matters which members of the public consider relevant to the deliberations of the EIA. A public consultation meeting is held after this 28 day period. Additional concerns of the public are noted at this forum and the EPA provides comments to the ESIA Consultants for finalization of the Terms of Reference (TOR) of the EIA. This meeting is chaired by the Environmental Protection Agency and a member of the Environmental Assessment Board (EAB) is present at that meeting. The Environmental Assessment Board is a body which provides an independent contribution to the development and finalisation of the EIA and makes recommendations which uphold the principles of the EP Act in the context of the interests of the developer, the public and the regulatory agencies. In order to carry out its functions, the EAB is involved in the development of the ESIA from the point of ESIA scoping to establishing conditions for the issuance of an Environmental Permit.

During the environmental impact process the Developers and Consultants are required to consult members of the public, interested bodies and organizations and also provide to members of the public on request, and at no more than reasonable cost, copies of information obtained for the purpose of the EIA. The Developer and Consultant must submit to the EPA, the ESIA report along with an Environmental Impact Statement (EIS) for evaluation and recommendations.

Every environmental impact assessment is required to contain a description of the project, an outline of the main alternatives studied and reasons for choices, a description of significant effects of the development on the environment, an indication of any difficulties encountered by the developer in compiling information for the ESIA, a description of the best available technology, a description of any hazards or dangers which may arise and a risk assessment of same, a description of mitigation measures for any adverse effects, a monitoring plan and an emergency response/contingency plan and a program for rehabilitation and restoration.

The decision by the Agency to grant an environmental authorization for a project shall be subject to conditions, which are reasonably necessary to protect human health and the environment. The ESIA must be completed to conform to the TOR and copies submitted to the EPA for review and public comment. The EPA subsequently publishes a notice in at least one daily newspaper notifying the public of the submission of the ESIA. The public has 60 days from the publication date of the notice to make submissions to the EPA and/or the EAB related to the EIA. The EPA, along with relevant sector agencies review the EIA during this sixty day period to ensure that the EIA is in line with any plans, guidelines, regulations or codes of practice developed by the EPA and sector agencies. Copies of the EIA and the findings of the review by EPA and sector agencies are passed to the EAB for review and recommendation. A public meeting, chaired by the EPA may be held, if considered necessary, at the end of the 60 days period. Additional comments are provided by members of the public at this meeting.

A final EIA is then prepared to address the comments of the EPA, the sector agencies, the public and the EAB to address issues in the TOR initially agreed to but excluded from the EIA. The EAB will then recommend to the EPA whether the EIA is acceptable and the conditions to be attached to the Environmental Permit, should it be granted. The EPA takes into account the recommendations of the EAB and sectoral agencies, comments of the public and its own review, and decides whether or not the project should be approved.

For approved projects, the EPA issues an Environmental Permit with the terms and conditions necessary to effectively manage the environment. If an Environmental Permit is not granted, the developer can file an appeal within 28 days with the Environmental Appeals Tribunal (EAT). The EAT is a superior court of record and has in addition to the jurisdiction and powers conferred by the EP Act, all the powers inherent in such a court. The Tribunal has the power to enforce its own orders and judgements and the same power to punish contempt as the High Court of Justice. The EAT has the jurisdiction to hear and determine appeals against:

1. The refusal of an Environmental Permit;
2. The requirement of an Environmental Permit;
3. Cancellation or suspension of an Environmental Permit.

For the specific case of this project this ESA has been prepared to respond to the IDB requirements for the project approval and funding.

In this preliminary phase of the project design, this document will be submitted to the EPA for their review and will be discussed during the planned public consultation meeting. The Consultant shall integrate the comments of the EPA and other stakeholders in the final version of this document.

After the grant agreement, the Consultant shall prepare the draft environmental permit application to be submitted by GWI to the EPA who will decide on the need of a further EIA as for the procedure described above.

3.7 IDB Policies and Regulations

As part of the IDB safeguard Policies and Directives, policy B.3 for Screening and Classification requires that all bank financed operations shall be screened and classified according to their potential environmental impacts. Operations are classified according to the following categories:

Category A: “Any operation that is likely to cause significant negative environmental and associated social impacts, or have profound implications affecting natural resources”

Category B: “Operations that are likely to cause mostly local and short-term negative environmental and associated social impacts and for which effective mitigation measures are readily available”

Category C: “Operations that are likely to cause minimal or no negative environmental and associated social impacts”

The present proposed interventions are classified as Category B requiring an environmental and social analysis and an environmental and social management plan (ESMP).

The IDB policy requires that the borrower shall prepare adequate EA and documentation including a minimum screening and scoping for impacts, analysis of compliance to local and regional legislations, and timely and adequate consultation and information dissemination process. The EIA shall also be supported by economic cost-benefit assessment of the project’s environmental impacts and/or the associated protection measures. According to the Disclosure of Information Policy (OP-102) The EIA report must be prepared with its ASMP and disclosed to the public prior to the analysis mission.

In conformity with the IDB policy a draft ESA with its associated ESMP has been prepared in compliance with the IDB Environmental and Social Guidance document, published in February 2009. The ESA has been disclosed at the IDB and GWI websites prior to the analysis mission. The final version of the ESA enclosing the comments and discussions during public consultations shall be re-disclosed prior to the submission of the project to the IDB board for the loan agreement early October.

The ESA recommendations and the ESMP shall be incorporated in the detailed design and tender documents, where a budget shall be allocated for the implementation and the monitoring of application of the ESMP and the safeguard measures during the project execution.

4. ENVIRONMENTAL AND SOCIAL CONDITIONS

This chapter provides a description of the existing environmental and social conditions at the project site.

4.1 Project location

The interested area for the priority works rehabilitation project covers the zone served by the central Georgetown sewerage system, bounded by the Demerara River in the West, Vlissengen Road in the East, the Atlantic Ocean in the North and Sussex Street in the South.

The proposed works are intended to follow the existing sewer system lay-out where the ring main is laid under the following streets (proceeding clockwise) (See **Annex 1**):

- Sussex Street on the southern side
- Charles St., Smyth St., Sendall St., Wellington St. and Waterloo St. on the western side
- New Market St. and Second St. on the north
- Light St., Winter Place, Louisa Row on the eastern side.

The catchment area extends over about 460 hectares and the main ring to be rehabilitated has a total length of about 5.5 Km.

The sewer effluents are currently discharged via a short outfall at the East Bank of the Demerara river estuary into the Atlantic ocean, at Fort Groyne in Kingston. According to the as-built drawings, the outfall pipe is laid offshore on a length of about 40 m and the diffuser is at a depth of 7.6 m below highest tide elevation (17.42), i.e. about 6 metres below mean sea level 15.56 (see **Figure 1**). The outfall location is at the river mouth, north of the zone occupied by docks and harbour infrastructures, away from residential houses and recreational activities, with the only presence of some utilities structures in the direct vicinity.

No mangroves or protected species are present in the vicinity. The nearest mangroves to the outfall exist on the opposite bank of the Demerara River at an approximate distance of 2.2 Km (see **Figure 2**).

The study area is illustrated in the map in Figure 3.

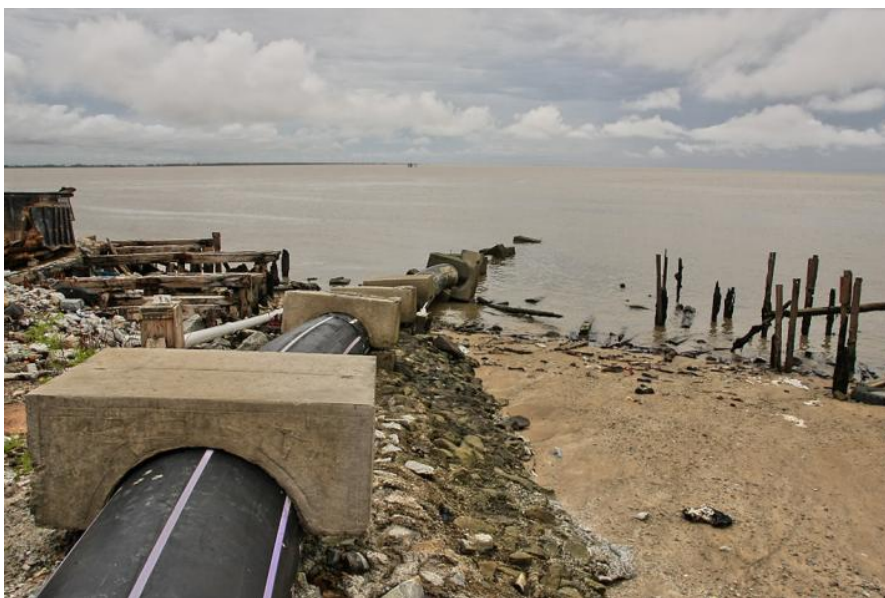


Figure 1 : Fort Groyne Outfall Pipe



Figure 2 : the northern edge of the docks visible from Fort Groyne



Figure 3 : Study Area Localisation

4.2 Morphology

The area covered by Georgetown is basically flat from the southern neighbourhoods limited by Mandela Avenue to the northern coastline. The results of the topographical survey performed in the framework of the project indicate that ground levels range between a minimum of 15.91 m on Princess Street and a maximum of 16.90 m on Cowan Street, 15.56 m being the conventional value assumed for average sea level.

This conventional value originates from a stage located at the estuary of Demerara River for the measurement of sea levels. It has been adopted for the purpose of the topographical study in order to avoid negative figures in the record of manhole bottom levels. If this value is deducted from the ground levels measured, it becomes evident that the whole town is located between approximately 0.35 and 1.35 meters above the **mean sea level** and between 0.31 and 1.31 below **average high tide level** (1.66 m).

This flat morphology characterizes the estuarine zone of lower Demerara River and extends many kilometres south of the town.

4.3 Sea level and tides

According to studies on geodetics and coastal evolution carried out in the past years, the average high tide level is 17.22 m, that is 1.66 m above mean sea level. This figure indicates that before the construction of the river harbour and the town the area presently occupied by Georgetown was subject to inundation at times of high tides and severe hydrologic events in the river.

The normal range between high and low tide is about 3 meters, and two high tides occur daily.

With the development of the port activity during the 18th century, the level of the right bank of the river was raised in order to protect the docks from overflowing, and a seawall about 2.5 m tall was erected along the northern seashore to protect the town from the effects of flooding due to high tide levels. This wall is part of an extensive system of sea defences constructed by the Dutch during the colonial period, consisting of massive concrete seawalls designed to protect the densely inhabited coastal plains. Through the years more concrete, earth and stone embankments, drainage canals, pumping stations and outfall sluice gates were added to the system. Coastal erosive processes over time, however, have severely damaged the sea defences. Lack of maintenance has caused breaches in the dikes, resulting in occasional inundation of the coastal plains.

The drainage of rainwater in the urban Georgetown is ensured by a network of low-gradient canals controlled by penstock gates located on the river bank or at the seawall. In case of concomitance of heavy rains and high tide, the major canals flowing to the ocean can be emptied by means of high-capacity pumps installed close to the seawall.

4.4 Climatic conditions

The climate is tropical with two wet and two dry seasons. Along the coastal lowland region comprising Georgetown area, rain falls an average of 200 days a year, with 50% of average precipitation occurring from mid-April to mid-August. The second wet season is from mid November to January with peak rainfall in December.

Average annual rainfall in the coastal lowlands is about 2,300 mm. In this region, temperatures range from 20 to 33 degrees Celsius, with annual average daytime maximum temperature of 29.6°C and annual average nighttime minimum temperature of 24°C. Relative humidity is generally above 70 percent.

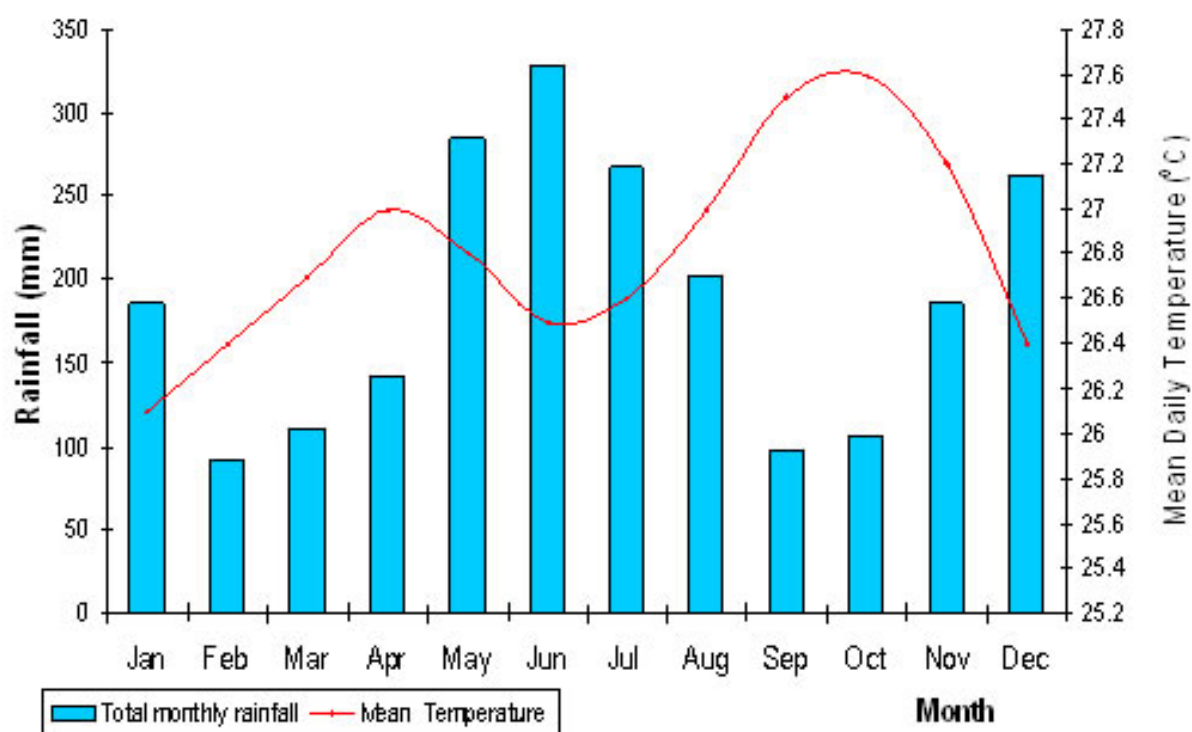


Figure 4: Seasonal changes in monthly rainfall and surface air temperature for Georgetown

(Source: Ministry of Agriculture, Hydrometrological Service- Guyana).

4.4.1 Natural Disaster Risks

Guyana is not susceptible to volcanoes, hurricanes, tornadoes or earthquakes which are classified according to the UNDP risk index as extremely rare. Furthermore, although the rains are sometimes delayed, prolonged or severe, droughts are rare. Floods can be considered as the major natural risk affecting Guyana (the most important inundation of

recent years were experienced in January 2005) since most of its population lives on the coastal low land.

The project area is protected by the sea walls and drained through a series of canals. During low tide, the gates of these canals are opened to allow the water to flow into the Demerara river or the Atlantic Ocean. However, short-term localized flooding is common when heavy rains coincide with high tide, forcing the influx of water out of the canal banks until the gates are opened again. These floods result in local inundation of roads on the low zones, with temporary disturbance to traffic. One of the lowest zones is located in the area of Quamina Street in the very centre of town.

4.4.2 Climate change and vulnerability assessment

The climate change main impact is the increase of the frequency of the extreme weather conditions and the rise of sea level, the combined effect of both phenomena results in the increase of flooding risks due to heavy rains as well as the rise of the high water tide levels.

4.5 Hydrogeology of coastal region

Fresh groundwater is the most important and reliable source of water for public use and is abundant along the coastal lowlands and foothills. The coastal aquifers supply water to the 90% of the population residing in the coastal area region, with surface water supplying the remaining 10 percent.

The coastal aquifer system is composed by a series of three separate but hydrogeologically connected aquifers. This hydrogeologic reservoir has been providing water to the coastal inhabitants for the last century. Due to the excessive dewatering of these aquifers, saline water intrusion became a concern in recent years.

The coastal aquifer system occupies a subsurface area of about 20,000 square kilometres, extending about 250 kilometres along the Atlantic coast and 40 to 150 kilometres inland. Sediments reach a thickness of 1,800 meters onshore and become progressively thicker offshore and towards the East.

The three aquifers are named, from upper to lower, the “Upper Sands”, the “A Sand” and the “B Sand”. Overlying layers of clays confine the lower two aquifers, protecting them from contamination from external sources.

The “Upper Sands “ aquifer is 30 to 60 meters deep and ranges in thickness from 15 to 120 meters, being 15 meters the thickness under the capital town. It is the shallowest of the three aquifers of the coastal system. It was first developed in 1831 and has been for many decades the main source of water supply for Georgetown. However, due to a high iron content and intrusion of brackish water, withdrawals from the aquifer ceased in 1913. In the area corresponding to Georgetown the piezometric head of this aquifer is about 10 meters below ground level.

Within 15 kilometres of the coast, groundwater in this formation is confined by the Demerara Clay, a stratum of marine clay. This impermeable geologic layer has an average thickness of about 30 to 60 meters under the capital town.

The “A Sand” aquifer was first developed in 1913 and is presently considered the main source of water for Georgetown and the coastal region. There is an intermediate clay formation separating it from the upper aquifer. The “A Sand” aquifer is 150 to 220 meters deep and 12 to 27 meters thick. When it was first used, its piezometric head was 4.5 meters above ground level, but progressive dewatering of the aquifer caused the head to fall to 14 meters below ground level.

The “B Sand” aquifer lies below the two above mentioned aquifers at depths of 350 to 800 meters. The piezometric head of this aquifer, which was first used for domestic water in 1962, exceeds those of the “A Sand” aquifer.

The following **Figure 5** illustrates the geologic cross section of the coastal area and the aquifer system.

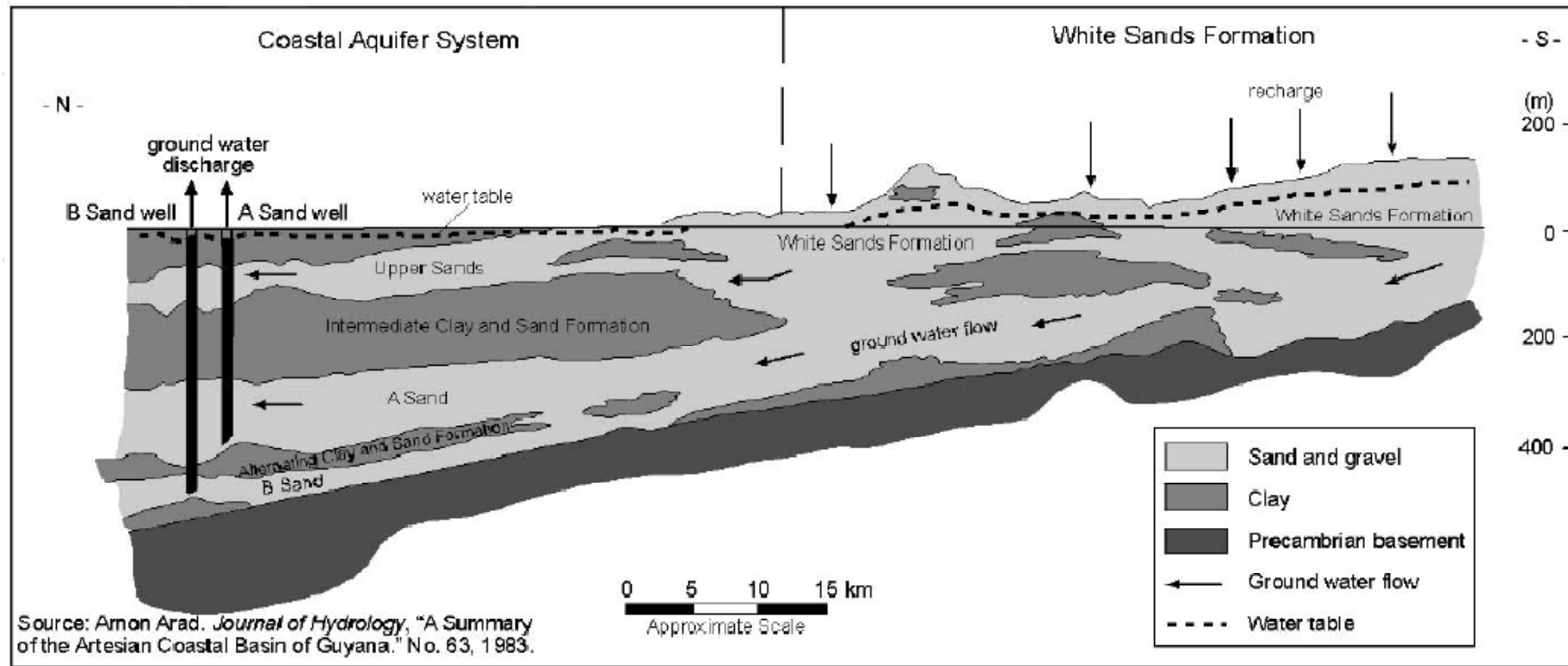


Figure 5: Geologic Cross Section in the Georgetown Area

4.6 Infiltration

The basic geologic data indicate the existence of a 30 to 60 m thick clay stratum under Georgetown area, confining the “Upper Sands” aquifer. Permeability in this formation is supposed to be very low and the number of natural fractures very limited.

Over the clay there exists a superficial soil layer through which infiltration of rainwater (or wastewater) may locally take place, particularly in the areas that are not covered by asphalt. The bed of the several unlined drainage canals existing in Georgetown is a natural source of infiltration. This phenomenon is likely to have a direct effect on the sewerage system and particularly on sewer pipes and manholes corresponding to cavities where seepage can occur.

This local infiltration usually displays a seasonal variation with the sequence of wet and dry seasons.

4.7 Demography

The demographic data received from the Guyana National Bureau of Statistic (GNBS) correspond to the information extracted from the 2002 Census, this being the last census effectuated in Guyana. The total number of households connected to the centralized sewer system in 2002 was 9,358, corresponding to about 35,500 inhabitants. For the design purpose, the Consultant has estimated the population of Georgetown in year 2010 to 48,115 inhabitants and the projection to year 2030 to 49,086 inhabitants (see *Volume 1 – Technical Study*). The average ratio of inhabitants per household was estimated at 3.8.

4.8 Population and social conditions

The central Georgetown urban area is composed globally of two-storey colonial buildings mainly of residential use, while non domestic buildings include institutional, commercial and industrial uses. The only industrial activities existing in central Georgetown are some saw mills cutting and selling lumber for building purposes, while the important industries (such as Banks DIH L.td And Sanata Textiles L.td) are located in the Ruimveldt industrial area in the South of the city. The other activities typically include shops, offices, small restaurants and bars, worship centers and few hotels. Buildings including a considerable number of employees are administrative buildings, ministries and banks.

The central commercial zones are considered to be Bourda, Lacytown, Cummingsburg and Albertyn.

The pipes will be laid in front of residential houses, some commercial activities and shops, also next to the Public Hospital of Georgetown at New Market Street and the different schools at Charles Street, Smyth Street, Waterloo Street and Second Street, and next to the Georgetown Cemetery. The strict compliance to the ESMP and the consultation with stakeholders will be essential for reducing disturbance and traffic disruption in these zones.

4.9 Problems and nuisances related to the sewerage

The socio-economic survey carried out on a sample of more than 500 households living in the 24 catchment areas was intended to reveal, among others, possible problems experienced by the population in relation to the malfunctioning of sewerage system. It appears in general that overflowing of foul water into the toilets is not perceived as a common problem, with the exception of few cases. On the other hand, overflowing onto the yards or in ditches and canals, as well as bad odours, constitute a concrete nuisance for most of the interviewed people living in the poor southern neighbourhoods.

Table 6 here after synthesizes the percentage of households experiencing different types of problems with the Georgetown Sewerage system as concluded from the household survey.

Table 6 : Percentage of households and types of problems encountered

Type of Problem	% Population
Sewage backing up	43,3%
Sewage overflowing into the yard/street	51,4%
Bad odours	62,8%
Insect infestation	63,0%

The residential wards of Albouystown and Wortmanville are considered to be the worst affected areas of the city with regard to broken house connections. This is mostly linked to the age and fragility of yard sewer pipes, as well as the habit of some residents to dispose of kitchen wastes and other litter into the inspection chambers.

According to the technical list prepared by GWI on the base of maintenance reports, the prevailing problems related to the misuse of the sewerage system from residents are:

1. Frequent damage to motor-pump assembly and associated fitting due to solids (rags, pieces of wood etc.. coming into contact with pump impeller).
2. Constant misuse of the sewer system by errant persons dumping unwanted materials such as cans, rags, sanitary napkins, condoms, plastic bags and other solid wastes into the chambers.
3. Vandalism of electrical equipment at sewer stations
4. Excavation and construction of chambers for plugging of illegal house connections.

Occasional sewage overflows into the yards might be related to the clogging or breaking of small bore pipes, mainly at the level of yard sewers and small connection chambers. A programme for repairs of yard sewers was commenced by the M&CC in the early 1970s in the densely populated ward of Albouystown. Many other programmes of such kind were proposed by ESI and other consultants in the 1980s but they were never implemented due to the lack of funds.

Direct sewage infiltration in the storm water drains can be related to the existence of emergency outlet manholes constructed as part of the original 1929 system.

Other problems can be related to external factors independent from the resident's attitude or the inadequacy of maintenance, such as the unstable and unreliable voltage supply and electrical faults along sewer electrical ring main. These factors are responsible for the frequent damage of electrical pump motors and control panels.

The inspections effectuated on some manholes located close to the pumping stations gave evidence of the critical status of the whole street sewers network. The observations resulting from the inspections and computations indicate that a considerable volume of wastewater infiltrates into the ground through openings disseminated all along the sewer networks. The rate of infiltration is increasing with the hydraulic head in the manholes, and is expected to be maximum at the beginning of the day, before starting the operation of pumps. This same rate of infiltration is directed from the sewers to the soil provided the wastewater level is higher than local groundwater level. This was the case of most levels observed into manholes during the inspections: In some cases the wastewater level was found to be higher than the surface water level in roadside drains.

Possible causes of infiltration from the sewer network to the soil are:

- Outflow from pipes cracked due to the corrosion and traffic load stresses. The continuous contact with aggressive water and soils might cause corrosion of C.I. sewers, particularly on the invert of pipes. After 80 years without any intervention or repairs, corrosion might have attained devastating levels.
- Leakage from socket joints where the original lead seal has been cracked or displaced due to the pressure of water.
- Seepage from the walls of non-watertight manholes.

As a consequence of the lack of maintenance and abuse from residents, the inspections of manholes revealed the presence over wastewater of a semi-solid cake of floating objects, including rags, plastics, condoms and other wastes that might represent a risk of clogging and a danger for the integrity of pump impellers.

The continuous surcharging of sewer networks and the consequent infiltration of crude sewage can engender contamination of groundwater and soils, as well as inflow to potable water mains.

5. ENVIRONMENTAL AND SOCIAL IMPACTS

A preliminary screening of the potential environmental and social impact of the proposed works has been carried out using the preliminary environmental screening checklist template proposed by the GWI Environmental Guidelines for Construction Projects and Environmental Assessment. The screening checklist is presented in **Annex 2**.

As previously mentioned the proposed project is classified according to the IDB classification as **Category B**, as it is “likely to cause mostly local and short-term negative environmental and associated social impacts and for which effective mitigation measures are readily available”.

This classification is confirmed by the preliminary screening checklist assessment, where all potential negative environmental and social impacts identified are related to the construction phase, are localized and of temporary impact with possibility of mitigation actions. Indeed the project components consist of the rehabilitation of the existing sewer system following the same lay-out of the existing ring main and delivery mains without the inclusion of any new construction sites. Small deviations can be integrated into the detailed design or the execution design after specific consultations to minimize the construction works impact on sensible buildings like the Hospital of Guyana if deemed necessary.

The works will concern only public roads that has been previously disturbed for the construction of the existing public utilities, therefore there exist no risk of disturbing natural habitats of protected species (animals, birds or plants) and there will be no need of removal of existing trees and no expect negative influence on the local fauna and flora. The project is not expected to disturb any cultural or archaeological site.

The proposed works will not require any resettlement or expropriation, as it is located on public roads. Temporary storage areas for materials and equipments will be required in the project area and shall be agreed upon between the Contractor, GWI and the Municipality.

5.1 Potential impacts during preconstruction phase

As mentioned before, the proposed project consists simply in the rehabilitation of the existing infrastructure. The project alignment will follow the existing street’s alignment with possible small deviations if deemed necessary for reducing negative impact during the construction phase on sensitive structures (emergency entrance of the Georgetown hospital for example).

In all cases the construction works will concern only existing streets. For this reason no resettlement or expropriation is expected, and no cutting of trees or de-bushing is needed on the project site. Consequently, **no negative impacts are expected during the preconstruction phase**.

The Contractor might need for the construction period a space for material and equipment storage. The allocation of this space, that will be in any case outside the town borders, shall be coordinated between the Contractor, GWI and Georgetown Municipality. Possible de-bushing would be in this case needed, but this will be part of **construction phase**.

After contract signature and before starting construction works, the Contractor shall produce detailed execution drawings taking into consideration the baseline maps with exact utilities locations (GT&T cables, GPL and GWI pipes). The execution drawings shall be presented to GWI and all interested utilities companies for comments and approvals. When relocation of utilities is needed, the relocation project shall be coordinated with the concerned institution before the beginning of the works.

In addition, before the beginning of construction works, the Contractor shall develop the project phasing programme and drawings, the site management plan, the environmental and social management and the hazard management plan for consultation with the different interested stakeholders and the approval of GWI.

Finally, an **information and communication campaign** for the mitigation of construction works impacts shall start prior to Works' commencement date and continue all through the project period.

5.2 Potential impacts during construction phase

The expected negative environmental impacts and risks are generally the same risks encountered in all linear construction sites crossing a city centre for several kilometres and lasting several months (in this case 18 months). The impacts and risks nature are expected to be: safety of pedestrians and workers, access difficulties, disturbance of traffic and public utilities, air quality and noise problems, environmental risks due to water pumping and discharge, and materials management.

The identified negative impacts and risks during the construction phase are detailed hereafter while the proposed mitigation measures for every potential impact or risk are detailed in **Section 7** relevant to the ESMP.

- Disruption and damage to public service: the proposed interventions will necessitate road cuttings, excavation of trenches, and in some cases the relocation of existing public utilities like water lines and electrical and telephone cables resulting in the interruption of the services for a period of time. Also some accidental damages to existing services might occur during excavation;
- Traffic congestion and temporary road closures: the construction activities will necessitate partial or total traffic interruption, and temporary road cuts and vehicle and pedestrian traffic deviations resulting in traffic congestion and risk of accidents. Also the materials supply and disposal will generate circulation of camions increasing the traffic load on central Georgetown area;
- Difficulties of access to houses, businesses and schools: the trench excavations will create temporary difficulties of access to the adjacent buildings also on account of the traffic deviation and road cuts leading to some disturbance of the neighbouring residents and users;

- Air quality problems due to smoke emissions from the use of machines and dust production while excavating, resulting in annoyance to the site workers, nearby residents and activities and the pedestrians.
- Noise generation from the use of excavation machines and construction equipment with its impact on workers and neighbourhood;
- Construction materials and waste management: the construction activities will necessitate temporary on site storage of construction materials and excavated materials, bad management of the stored materials and wastes can result in dispersion of materials in the nearby canals, streets and adjacent properties;
- Storing of lubricants on site: the Contractor will need to store some oils and lubricants on site for the machines and pipe laying activities, this can create a risk of water and soil contamination in case of spill;
- Safety risks due to excavations and construction site: the excavation of 2.1 to 3.0 m deep trenches, the open trenches and manholes and the vehicles and machines operations on site can create health and safety risks for both workers and pedestrians in case of instable excavation sections, inadequate shoring, fencing and signage;
- Pumping and discharging of storm water and ground water off-site during trenching: for the excavation and construction works, the Contractor will need to extract ground and storm waters from the trenches to insure working conditions, the pumped water will be discharged into the nearby drainage canals;
- Temporary disposal of wastewater in the drainage channels during the phase of connection between the old and new ring: in order to reduce the interruption of the wastewater system during all the construction period, a new ring main will be constructed in parallel to the existing one, allowing for its normal functioning during the work phases, the only disruption will be at the end of the works during the connection between the old and new ring. At this limited period, wastewater will have to be discharged into the adjacent drainage canals;
- Risk of flooding: the Georgetown city is subject to flooding in case of heavy rains in concomitance with high water tide impeding the drainage channels of discharging into the ocean or Demerara river. When such case is expected, the Contractor shall temporary stop dewatering and construction activities and insure that the workers, the excavations and all on site materials are well protected until the end of the emergency.

The impacts can be mitigated and the risks can be avoided by a correct implementation of the ESMP that shall be closely monitored by site supervision team through well defined monitoring and reporting procedures.

Special attention shall be paid for the planning and notification of the works phases in order to reduce the traffic disruption and road closures for residents and businesses, and in particular

for the sections crossing public services like the Public Hospital of Georgetown at New Market Street and the different schools at Charles Street, Smyth Street, Waterloo Street and Second Street. Also particular consideration shall be taken for the works of the section crossing Le Repentir Cemetery.

Crucial issues to be respected for reducing the negative impacts will be :

- continuous consultation and coordination with interested stakeholders;
- adequate phasing of the works and strict respect of the project planning;
- timely and adequate information dissemination all through the project execution period;
- setting up of complaints mechanism and duly response for conflict solving;
- definition of an Emergency Response Plan

Finally, the project cost estimate includes a budget for the reinstatement of public utilities and roads, it would be very important at an early stage of project planning to consult with the Municipality, the Ministry of Public Works and other institutions to coordinate any possible planned infrastructure works in order to avoid overlapping of works or conflicts of activities on project site and also to optimize resources and reduce disruption time.

5.3 Potential impacts during operation phase

The key **positive** environmental impacts expected from this project are:

- Reduction of leakage into the ground and superficial groundwater;
- Reduction of risk of contamination of potable water consequent to infiltration of wastewater;
- Elimination of leakage into canals;
- Consequent improvement of the public health and sanitary conditions of central Georgetown residents.

During the operation phase the collected sewerage will be discharged into the Demerara River estuary without any preliminary treatment as it is the current situation. Even though after the rehabilitation of the sewer system the quantity of effluent to be discharged will be increased, the environmental impact is not expected to worsen, as it is explained in the following paragraphs.

5.4 Impacts of effluents and dilution factor

An estimation of the dilution factor has been done based on the hydrologic characteristics of Demerara River and the morphology of its estuary, as well as the effluent envisaged flow after project completion. The discharge flow has been calculated through the hydraulic modelling of the Georgetown sewer system carried out by the Consultant using the WaterGEMS™ software.

5.3.1 General features of Demerara River estuary

The section of the river adjacent to the town area has a width ranging from 0.95 and 1.8 km, while downstream of the Starbroek Market docks the estuary opens to a triangular shape reaching a width of 2.2 km in correspondence to Fort Groyne. The narrowest river section in the estuarine zone is the one corresponding to the hydrometric stage at the Harbor Master building (Boat House). The cross section is closed on the left bank at Best Groyne. This dredged section has a width of 0.95 km and minimum depths at low sea level ranging from 5.2 to 6.6 meters (source : Harbor Master's map of river depths – 2009 edition and 2010 Tide Book).

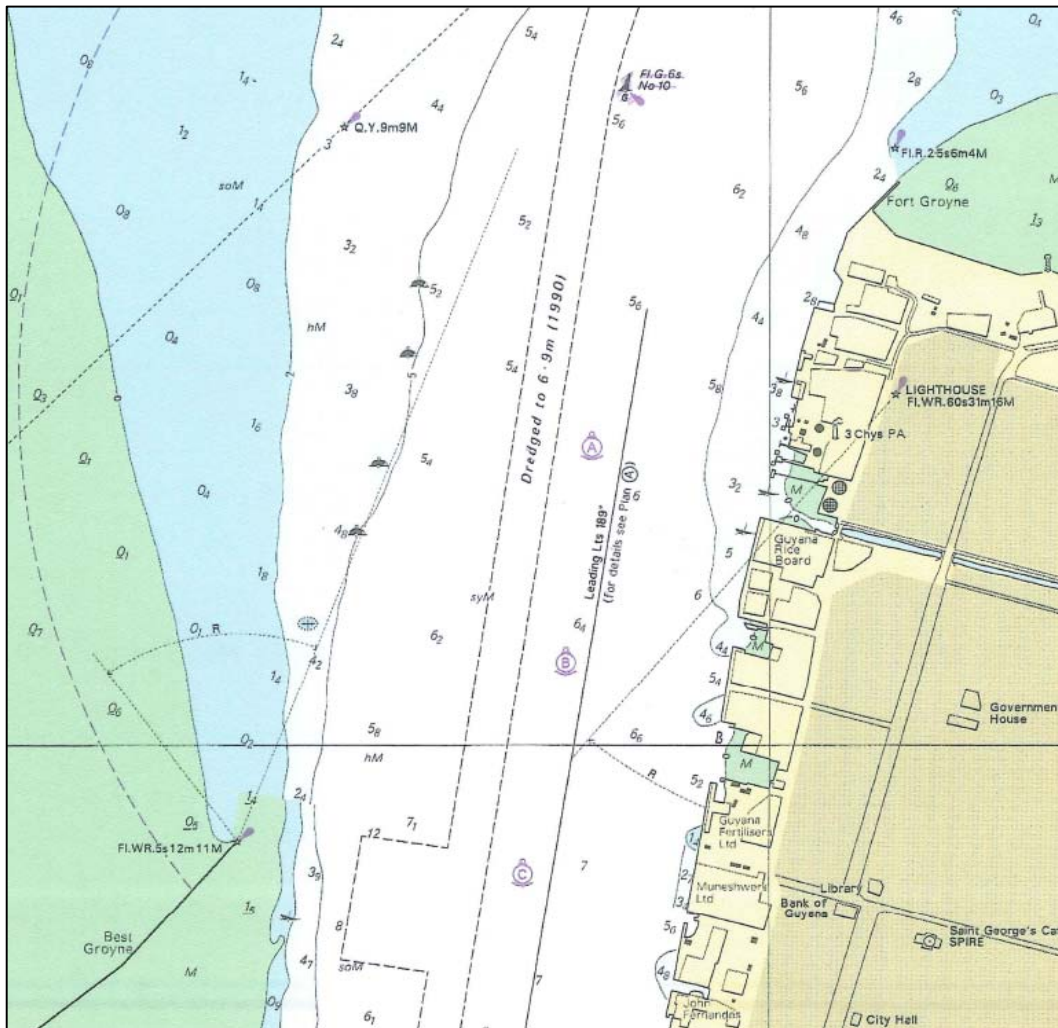


Figure 6: minimum river depths in the estuarine zone

The minimum channel section area in this point is estimated at 5,600 m² at low tide.

5.4.2 Estimate of river flow

No hydrologic study on maximum and minimum discharges is available on the Demerara River section at the estuary, neither at the Harbor Master Office, nor at the Hydro-meteorological Unit.

Water velocities are variable with positive and negative values corresponding to low tide and high tide periods respectively. For the purpose of estimating a minimum value of discharge in the river, a prudential velocity value of 0.1 m/s has been considered. This very conservative assumption yields to an estimated value of the minimum dry-season discharge equal to 560 m³/s.

5.4.3 Effluent flow

The effluent flow in current conditions is generally not exceeding 0.15 m³/s, due to the fact that pumps are used on shifts and some pumps are working far below their nominal duty point. Different tests effectuated with the ultra-sonic flow meter on the 1000 mm outfall pipe demonstrated that the pipe is flowing 10% full or is, in some hours of the day, completely empty.

The maximum effluent flow in **project conditions** has been estimated through the implementation of the WaterGEMSTM hydraulic model. The configuration used includes the contemporary operation of 24 pumping stations and the resulting flow is about 0.80 m³/s. This has to be regarded as the peak flow that could be sent into the river during short pumping periods (approximately four hours a day).

5.4.4 Conclusions

Even if the effluent peak flow will be increased five times due to the higher efficiency of the system, the ratio between the maximum wastewater flow in project conditions and the total flow in the river remains absolutely negligible (0.001). Mixing of the effluent with the estuarine water is enhanced by the following factors:

- The diffuser is placed some 40 m offshore at an (average) depth of 6 m, at a location where water velocity is sensibly higher than on the river bank.
- The flow in the estuarine zone is not linear but strongly turbulent due to the diffusion of water into the ocean. Even if wastewater will float due to its lesser weight vis-à-vis the salty water, the effluent will be rapidly mixed and dispersed in the estuary
- Velocity and direction of flow are subject to change many times a day due to the tidal effects. Maximum velocity has been observed at low tide periods, when the difference in hydraulic head between the river and the sea is maximum

- The new system would allow for concentrating pump operation procedures in short times (approximately four hours per day): This will enhance velocity and diffusion of the effluent at the outlet.

As a simple mitigation measure, it is recommended to operate the system in correspondence to the two low tide periods occurring daily. It has been observed that during these periods water velocity in the river is much higher than the conservative value used for the computations above. The implementation of this procedure would further enhance the diffusion of the effluent in the estuary.

Being the dilution factor value absolutely negligible, it is evident that future programmes for the monitoring of water quality should concentrate on the values of BOD₅, faecal coliforms and other contaminants. Due to the domestic nature of effluents at Fort Groyne, it is not likely to find poisonous substances, like heavy metals, in the water: Nevertheless, the presence of these substances might be related to the illegal discharge of industrial wastes in upstream sections of the river.

5.5 Water quality analyses

As part of basic preliminary studies on the current environmental conditions of study area, two water quality tests have been carried out to assess the presence of possible abnormal values of wastewater parameters.

The first sample was taken at **pumping station n°8** (Basin J): The pump of this station was removed some months ago, therefore the sewage contained in the wet well is supposed to be representative of worst concentration of pollutants. Obtaining sewage samples from the bottom of the wet well was impossible, due to the presence of wastewater up to the ground level. A sample was taken at a depth of about 60 cm from the road level. Moreover, at the moment of sampling this wastewater was probably mixed with rainwater, due to a period of continuous storms.

The second sample was taken from the estuarine water close to the existing outfall, in the direction of dominant stream. Obtaining an effluent sample directly from the outfall mouth would be problematic, as the pipe outlet is located 6 meters under mean water level.

The sample taken from PS8 shall give an indication about the effluent quality before its discharge into the river estuary, while the sample taken from the estuarine water shall give indication of the river water quality after dilution of the discharged effluent.

The results of analyses on the most common parameters from the laboratory of *Guyana Sugar Corporation* are included in **Annex 3**.

The laboratory analysis results in the Laboratory sheet are compared to permissible limits for Drinking water GYS 262-.2004 for the simple reason that the Guyana Sugar Corporation, like the other Georgetown laboratories, does not usually perform analysis on sewer water but on

drinking water. Measurement of *faecal coliforms*, BOD₅ and fats, oil and greases are not included within the laboratory routines.

The only parameters that can be compared to the WB and LBS effluent limits requirements mentioned in **Table 4** of section 3 are TSS and PH units value. The parameter values of the sample taken from PS8 are within the permissible limits, actually the registered TSS value is very low (8 mg/l) with respect to usual values of wastewater effluents while the low content of DO (2.23 mg/l) is a sign of physical, chemical and biochemical activity in water. In sewage water, it mostly indicates the presence of biochemical contaminants.

The very low values of pollutants and suspended solids registered are probably related to the particular conditions of dilution present in the water at the time of sampling, as well as to the practical difficulty for the collection of deep sludge samples. In general, few samples cannot ensure a realistic evaluation of the distribution of pollution in time and space in the different parts of a sewerage system, particularly at the outfall into estuarine or sea waters.

Two other samples have been taken from the pumping station PS8 and from the river estuary for the detection of Total and Faecal Coliforms.

Surprisingly, the results are the same for both samples, from the pumping station and from the estuary water (see **Annex 3**):

Total Coliforms : 11 MPN / 100 ml

Faecal Coliforms: 0 MPN / 100 ml

Due to the particular procedure used for the test, it is possible to find zero faecal coliforms and many total coliforms, which could be an indicator of the presence of decaying organic matter. However, the fact that the same results were obtained from both samples is suspicious, as faecal coliforms are very likely to be found in the pumping station sample.

The results of these analyses show that either the method for identification of coliforms is not 100% sure, or the laboratory is not reliable.

As a conclusion it can be outlined that the laboratories existing in Georgetown region do not have the specific experience for the execution of tests on waste water quality, as there are no wastewater treatment plants in the region. Therefore the analysis results carried out on few samples are not deemed to be reliable. Moreover, it has to be highlighted that spot samples analysis cannot be representative or sufficient for deciding on the need of a pre-treatment process and the relevant method of treatment.

It is recommended to enhance the capacities of GWI laboratories or the Guyana University laboratories for executing this kind of analysis, allowing for the commencement of a comprehensive water analysis programme to be implemented by GWI , EPA or other governmental bodies.

6. ANALYSIS OF ALTERNATIVES

For the purpose of identifying the priority works for the improvement of the Georgetown Sewage System, the Consultant has performed a complete condition assessment of the existing situation, including the following methods:

- Topographic survey for completing and updating the existing system drawings,
- Visual inspection for the assessment of the external conditions of the infrastructure and equipment
- CCTV camera inspection for the inspection of the conditions of the pipes from their internal section
- Ultra-sonic flow metering of the main ring for measuring water velocity, flow direction and pipe wall thickness and internal diameter allowing to verify the effective hydraulic parameters in different operating conditions.

The collected information allowed for the creation and the calibration of a hydraulic model of the system with the simulation of the different possible functioning scenarios including the no-action option.

The condition assessment gave information about the current situation and related environmental and functioning problems of the existing ring and confirmed the needs for urgent works.

The urgency of these works is linked to the actual risk of dispersion of contaminants and pollution of drinkable water in the most densely populated area of Georgetown. Based on the findings of condition assessment, it is estimated that about 40% to 50% of the crude sewage pumped in the ring main is dispersed into the ground through leakage.

The proposed project accordingly incorporates the basic works that have to be given first priority:

- Replacement of ring mains for the elimination of leakage
- Amelioration of the capacity and operational flexibility for pumping stations
- Replacement of all delivery mains from pumps

An alternative option for inclusion of a Waste Water Treatment Plant was considered in the technical study detailing the feasibility and costs for interventions. This extension of the project, which would involve a substantial increase of investment and operation costs, has not been retained as part of the **priority works** forming the object of the present analysis.

Nevertheless, the advantages and disadvantages linked to the possible construction of a treatment facility in a **second phase** have been considered:

Table 7 : Issues related to the construction of a WWTP

Why
<ul style="list-style-type: none"> • Quality of effluent could be raised to international standards (particularly with the reduction of the rate of BOD₅ in the effluent) • Georgetown sewerage system could adhere to international recommendations • The low-head pumping station foreseen at the outlet of treatment plant might provide constant flow and high velocity to the sewage contained in the outfall pipe, thus further ameliorating the diffusion of treated (or partially treated) water into the estuary
Why not
<ul style="list-style-type: none"> • According to the Cartagena Convention, the receiving waters are categorized as Class II waters. Corresponding limits for effluents are less stringent than limits for Class I waters, and do not require extended treatment • The studies effectuated on the dilution factor indicate that the impact of domestic effluents on the estuarine waters is probably negligible even in the case of non-treated water (the same considerations do not apply to industrial effluents). Obviously, this should be confirmed through an extensive programme of water quality testing. • The WWTP for central Georgetown sewerage must be located close to the city centre: This would create serious nuisances in terms of bad odours, noise and visual impacts. • Even for a small size primary treatment plant, the required space is not available close to the outfall site. Locations far from the outfall would considerably increase the energy costs for operation of the system • In addition to energy costs, the operation of the WWTP would require a considerable augmentation of costs for staff and reagents (Operation and Maintenance costs would be almost doubled with the treatment, compared to the selected option).

The option of constructing a treatment facility in a **second phase** of the project depends essentially on the available funding and the structure of the investment plan.

As concerns the effective characteristics of the effluent, these should be assessed through a comprehensive monitoring programme to be implemented by the agency responsible for environment in order to assess the treatment needs.

In the technical study it is then suggested that the option without treatment be initially implemented, incorporating in the design a gated outlet for the **successive connection to the treatment plant**.

With regard to the rehabilitation of **streets and yard sewers** in the 24 catchment areas, it is suggested that these works be included in a long term investment plan involving the gradual reconstruction of the whole network, working on two or three of these catchments per year. A **lump sum** for rehabilitation of selected sections of gravity sewers was included in the cost estimate for priority works.

7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

According to the GWI Environmental Guidelines for Construction Projects and Environmental Assessment the project ESMP shall be developed by the Contractor after contract award and before breaking ground. Contractor shall also train workers on ESMP practices and audit the ESMP implementation. The project ESMP shall deal with the potential impacts and risks identified in **section 5** and all additional impacts notified during public consultation or identified by the Contractor in relation to its construction methods. The ESMP shall incorporate the GWI environmental and Social Guidelines for Construction Planning and execution dealing with:

- Occupational Health and Safety
- Excavations
- Traffic Management
- Social Impact Management
- Construction Materials and Waste Management
- Emergencies/Accidents
- Involuntary Resettlement
- Community Complaints

For this stage of the project, a draft ESMP has been elaborated by the Consultant in a matrix format including mitigation measures, institutional responsibilities, monitoring and reporting requirements to all potential impacts previously identified. Proposed mitigation measures are in compliance with the GWI social and environmental guidelines.

The Contractor shall submit the ESMP and the Hazard management Plan to GWI and EPA for approval before the commencement of the works.

It is anticipated that the implementation of the mitigation measures will be supported by **accompanying measures** included in the budget of the project consisting of education campaigns targeted especially towards schools and restaurant-owners in addition to a programmed information and education campaign on tropical disease.

7.1 Environmental and Social Impacts and Mitigation Measures

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation measures	Institutional responsibilities to implement mitigation measure	Cost Estimates
Construction Phase				
Excavations	<p>Disruption and damage to public service:</p> <p><i>the proposed interventions will necessitate road cuttings, excavation of trenches, and in some cases the relocation of existing public utilities like water lines and electrical and telephone cables resulting in the interruption of the services for a period of time. Also some accidental damages to existing services might occur during excavation;</i></p>	<ul style="list-style-type: none"> - The Contractor shall restore the project environment to the state to which it was or better, prior to construction. In the case of road cuttings, the contractor shall restore all roadways to their original state prior to project implementation - The Contractor shall prepare a detailed works' planning and construction phasing, and shall coordinate service interruption with public utilities and public administrations - The Contractor shall advise citizens in advance concerning programmed interruptions in water, sewerage and other services. - The Contractor should notify citizens and collect their concerns to minimise negative reactions according to public notification procedures - Works phasing shall be established in a way to reduce the disruption time. 	<p><u>Main responsibility:</u> Contractor</p> <p><u>Supervision:</u> GWI or its representing site supervisor</p> <p><u>Coordination:</u> public utilities,</p> <p><u>Information and consultation:</u> citizens, hospitals, schools, institutions and local authorities</p>	<p>Relocation of existing utilities and road reinstatement are included in the project design, planning and budget.</p> <p>In the preliminary cost estimate the cost for road reinstatement is included in pipe laying unit rate (per meter)</p> <p>The cost for relocation of underground services is given as a lump sum depending on the location of works</p>
Excavation and construction phases	<p>Traffic congestion and temporary road closures:</p> <p><i>The construction activities will necessitate partial or total traffic interruption, and temporary road cuts and vehicle and pedestrian traffic deviations resulting in traffic congestion and risk of accidents. Also the materials supply and disposal will generate circulation of camions increasing the traffic load on central Georgetown area;</i></p>	<ul style="list-style-type: none"> - All traffic management will be coordinated with authorities - Delivery and discharge camions might be assigned restricted circulation hours - The Contractor shall advise citizens in advance concerning road closures and rerouting of vehicle and pedestrian traffic - Works will be carried out on lots of limited length, in a way to minimize closure of main streets stretches - Flagmen shall be used to warn and direct vehicle traffic around construction sites and hazards during working hours - Outside of working hours, especially at night, all barriers and signs will remain at sites, with lighting and / or lighted signs placed as required to warn both vehicular and pedestrian traffic 	<p><u>Main responsibility:</u> Contractor</p> <p><u>Supervision:</u> GWI or its representing site supervisor</p> <p><u>Coordination:</u> local authorities</p> <p><u>Information and consultation:</u> citizens, hospitals, schools, institutions and local authorities</p>	Included in Contractor's costs as above
Excavation and construction phases	<p>Difficulties of access to houses, businesses and schools:</p> <p><i>the trench excavations will create temporary difficulties of access to the adjacent buildings also on account of the traffic deviation and road cuts leading to some disturbance of the neighbouring residents and users;</i></p>	<ul style="list-style-type: none"> - works will be effectuated on lots of limited length, in a way to minimize disturbance; - Excavated areas and trench crossings shall be clearly marked and temporary fencing, bridges, access routes, signage, etc. shall be constructed to facilitate access and avoid accidental falls into these areas - Prior consultation and notification to the interested entities 	<p><u>Main responsibility:</u> Contractor</p> <p><u>Supervision:</u> GWI or its representing site supervisor</p> <p><u>Information and consultation:</u> citizens, hospitals, schools, institutions and local authorities</p>	Included in Contractor's costs as above

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation measures	Institutional responsibilities to implement mitigation measure	Cost Estimates
Excavation and construction phases	Air quality problems <i>due to smoke emissions from the use of machines and dust production while excavating, resulting in annoyance to the site workers, nearby residents and activities and the pedestrians.</i>	<ul style="list-style-type: none"> - Dust masks and eye protection against dust, splinters, debris etc. - Dust suppression methods such as wetting materials or slowing work should be employed as needed to avoid visible dust - Gas masks / respirators when working in closed areas such as access manholes, sewage pump chambers, etc. 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor	Included in Contractor's costs as above
Excavation and construction phases	Noise generation <i>from the use of excavation machines and construction equipment with its impact on workers and neighbourhood</i>	<ul style="list-style-type: none"> - Hearing protection for working around machinery where the noise exceeds 60 dB - Limiting working hours according to the EPA requirements 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor/ EPA	Included in Contractor's costs
Excavation and construction phases	Construction material and waste management <i>the construction activities will necessitate temporary on site storage of construction materials and excavated materials, bad management of the stored materials and wastes can result in dispersion of materials in the nearby canals, streets and adjacent properties;</i>	<ul style="list-style-type: none"> - The contractor shall handle construction materials and waste in accordance with procedure in the approved EMP. - Sites for temporary piles should be agreed with GWI and local authorities - The community should be aware of constraints imposed on the contractor for waste collection, storage and disposal - The contractor shall contain excavated materials in the vicinity of the worksite within berms to prevent dispersion and sedimentation of canals, streets and adjacent properties - In case of accidental waste dispersion, EPA shall be informed and restoration measures shall be applied 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor <u>Information and consultation:</u> EPA	In the preliminary cost estimate the cost for disposal of excavation material is included in pipe laying unit rate (per meter) or excavation costs (per cubic meter)
Excavation and construction phases	Storing of lubricants on site, <i>the Contractor will need to store some oils and lubricants on site for the machines and pipe laying activities, this can create a risk of water and soil contamination in case of spill</i>	<ul style="list-style-type: none"> - Secondary containment for fuels to avoid spill contamination and inspection during operation 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor	Included in Contractor's mobilization cost (10% of works price)
Excavation and construction phases	Safety risks due to excavations and construction site <i>the excavation of 2.1 to 3.0 m deep trenches, the open trenches and manholes and the vehicles and machines operations on site can create health and safety risks for both workers and pedestrians in case of instable excavation sections, inadequate shoring, fencing and signage</i>	<ul style="list-style-type: none"> - Safety conditions in the trenches during construction phase shall be ensured through the use of appropriate shoring systems and dewatering - Workers should not enter a trench more than waist deep without appropriate safety precautions such as shoring - Safe access and thoroughfare must be provided on site at all times. Dangerous areas shall be clearly identified with appropriate signs - Excavated areas and trench crossings shall be clearly marked and temporary fencing, bridges, access routes, signage, etc. shall be constructed to facilitate access and avoid accidental falls into these areas 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor <u>Coordination and consultation:</u> Health and safety office of GWI	Shoring and dewatering costs are included in the unit price for the trench excavation / pipe laying

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation measures	Institutional responsibilities to implement mitigation measure	Cost Estimates
		<ul style="list-style-type: none"> - Legible warning signs, barriers and signals shall be placed at strategic locations in sufficient number and spacing for all prominent access ways to the sites. Warning signs and other protective barriers shall be erected to prevent accidents to citizens due to open ditches, heavy machinery and construction vehicles etc. 		
Excavation and construction phases	Pumping and discharging of storm water and ground water off-site:	<ul style="list-style-type: none"> - storm water will be pumped from pipe trenches to the ditches and canals existing beside the roads. These are the natural recipients currently used for rainwater drainage 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor	Included in Contractor's dewatering costs as above
Connection to main ring phase	Temporary disposal of wastewater in the drainage channels during the phase of connection between the old and new ring	<ul style="list-style-type: none"> - The existing ring will be kept in operation during the construction of the new mains. During the phase of connection between the pumps and the new ring, wastewater will be temporarily discharged into canals. Measures shall be taken to minimize the reconnection time and negative impacts 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor <u>Consultation:</u> EPA	Included in Contractor's dewatering costs as above
	Risk of flooding	<ul style="list-style-type: none"> - the Contractor shall temporary stop dewatering and discharging water into the drainage canals; - the Contractor shall temporary stop all construction activities - insure that the workers, the excavations and all on site materials are well protected 	<u>Main responsibility:</u> Contractor <u>Supervision:</u> GWI or its representing site supervisor <u>Consultation:</u> EPA	Included in Contractor's dewatering costs as above
Operation Phase				
	Risk of surface water contamination due to the crossing of the project of canals and ditches	Projected mains will follow the existing ring layout overcrossing some canals and minor ditches. The new crossing pipes will be constructed in a way to avoid leakage of foul water into the canals. Leakage detection and repairs will be part of ordinary GWI maintenance procedures	<u>Main responsibility:</u> GWI	Costs for leakage detection and repairs will be part of ordinary GWI maintenance procedures
	Pollution of receiving water bodies	The sewerage will be discharged at the existing outfall at the estuary of Demerara river as it is the current situation in this case analysis on the dilution factor and water quality monitoring will be required during the operation phase	<u>Main responsibility:</u> GWI <u>Supervision:</u> EPA	Cost for water quality monitoring programmes approximately 1 Million GY\$ / year. A 5-year monitoring programme is included in the operation budget (see section 7.3)
	Infiltration into the groundwater due to leaks	Infiltration will be reduced / eliminated with the use of butt welded pipes. Periodic inspections shall be carried out by GWI staff to verify the presence of leakage. Leakage detection and repairs will be part of ordinary GWI maintenance procedures	<u>Main responsibility:</u> GWI	Costs for leakage detection and repairs will be part of ordinary GWI maintenance procedures
	Visual impact	There will be no visual impact caused by the pipes, except for the trench crossing pipes which will be apparent: these might be painted in blue or some other colour to ameliorate the visual impact	<u>Main responsibility:</u> GWI	Cost included in trench crossing construction price
	Noise and vibration generation (pumping stations)	No significant noise can be perceived from existing pumping stations (the pump is submersible).	<u>Main responsibility:</u> GWI	

7.2 Capacity of the GWI for implementing the mitigation measures

As mentioned before the main responsibilities for the implementation of the mitigation measures during the construction phases rely on the Contractor, while the GWI has the responsibility of assuring the correct implementation of the ESMP by the Contractor.

Since the date of publication of the GWI Environmental Guidelines for Construction Projects and Environmental Assessment in 2005, the GWI team has never had the opportunity of supervising a project of considerable importance.

For small and medium-size projects, GWI assigns a site supervisor for the follow up of the Contractor's work. This supervisor is usually supported by GWI's environmental responsible and health and safety officer.

Considering the importance of this project, its extent in the city center, the type of material used and potential negative impacts during the construction phases, it is recommended that the project supervision will be provided by an independent consultancy firm. The supervision firm shall have the appropriate experience and qualifications allowing for the correct supervision of the works and the monitoring of the implementation of the mitigation measures defined in the ESMP.

The supervision consultant will represent GWI and liaise with the Contractor and GWI continuously and effectively.

7.3 Monitoring and reporting

During construction phase, the Work Supervision Engineer shall issue monthly progress reports on the advancement of works incorporating a chapter on environmental impacts and health and safety issues and on the application of the EMSP for the reporting period.

The Contractor shall keep daily site logbooks reporting the salient information concerning staff, equipment, materials and possible accidents occurred during working hours.

GWI will monitor water quality parameters in the sewerage network (pumping stations) and in the proximity of the outfall to estimate potential water contamination from the sewage discharge.

Monitoring activities will include:

- (i) baseline data collection and analysis before the beginning of the project;
- (ii) by-monthly data collection and analysis for the first two years of implementation;
- (iii) data collection and analysis three times during the driest period of the year, at both low and high tide, for the last three years of project implementation.

Parameters to be monitored should include (where possible): Biochemical Oxygen Demand (BOD); Chemical Oxygen Demand (COD); Total Suspended Solids (TSS); Faecal Coliforms (FC); Total Coliforms (TC); PH; Salinity; Oil and Grease.

Based on the outcome of the monitoring program the level and technology of effluent treatment will be better defined.

8. PUBLIC PARTICIPATION

In accordance with the IDB requirements and the GWI guidelines the population must be informed about the project, in order to obtain the required level of support. The concerned population may get knowledge about the necessity of the investment, as well as its expected environmental, economic and social impacts in various forums, and through the media.

As part of this preliminary stage of the project, the Consultant has conducted a socio-economic survey aimed at the information of the residents about the advantages linked to the rehabilitation of the existing sewerage system and the assessment of their willingness to pay for improved service. The survey has been carried out over more than 500 households in the area served by the piped sewerage.

In addition the Consultant has organized information and consultation meetings with GWI environmental section and the environmental management division of the Guyana EPA.

8.1 Disclosure of information

The ESA report shall be disclosed by GWI in accordance with IDB regulations. This document prepared by the Consultant has been reviewed and commented by the GWI and the IDB. A draft version was published on GWI and IDB websites in August 2010.

Following the identification from GWI and IDB of a viable option having the adequate prerequisites of technical and financial feasibility, public disclosure meetings shall be organized by GWI and local authorities.

The purpose of these meetings will be to inform the stakeholders and residents on the improvements expected as a consequence of the rehabilitation of the sewerage system, and the potential positive and negative impacts associated to the works. Copy of the ESA report, even in draft form, shall be sent before the meetings to the representatives of stakeholder or residents, in order to enhance the knowledge about the project characteristics and facilitate discussion on the different aspects.

It is anticipated that the selected priority works consist simply in the rehabilitation of the existing infrastructure and that the negative impacts for local population will regard only the construction phase, therefore these impacts will be only temporary.

A final version of the ESA shall be completed incorporating the comments received during the public consultation process to be published on the IDB and GWI websites by October 2010.

8.2 Consultation process

According to the above mentioned procedure, a **stakeholders' consultation** meeting was scheduled for the 16th of September 2010 for the presentation and discussion of the Environmental and Social Impact Analysis report.

Invitation letters and a copy of the ESA were sent to the Ministry of Housing & Water, Ministry of Public Works, Municipality, University of Guyana, EPA, GT&T, GPL, and civil society representatives.

The stakeholder's consultation meeting was held as scheduled in the presence of representatives of GWI, IDB and the Consultant, where main project components and the expected environmental impacts were presented by the Consultant followed by discussion session. A record of the Consultation meeting is presented in **Annex 4**.

This final version of the ESA has been prepared in consideration of the discussions and comments received during the above mentioned meeting.

Further consultation meetings shall be organised before the commencement of works for coordination of activities between the Contractor and the different public utilities operators and involved stakeholders, in addition an information and education campaign will accompany all the construction phases.

The selected Contractor shall nominate a person from his staff who will liaise with the representatives of GWI, Work Supervision, Municipality, residents and public authorities.

In case an Environmental Impact Assessment should be required by EPA, the consultation process shall be conducted as described in **Section 2**.

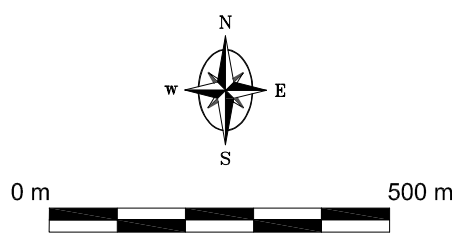
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ANNEX 1 : Proposed Interventions



- TC8 TRENCH CROSSING
- PS4 PUMPING STATION
- MAIN RING
- FORCE MAIN
- OLD C.I. OUTFALL
- NEW OUTFALL (Fiberglass)
- NEW OUTFALL (H.D.P.E.)
- DE355 PROJECT PIPE IN H.D.P.E.



GEORGETOWN SEWERAGE NETWORK
PROPOSED INTERVENTIONS

ANNEX 2 : Environmental Screening Checklist

Environmental Screening Checklist

1. Summary of Project:

Rehabilitation of existing ring and pumping stations power increase

2. Project Environmental Summary

The main potential negative impacts of the project that require careful management concern principally the work construction phases and can be summarized as follows:

- Traffic congestion and temporary road closing,
- Air quality problems and noise pollution during construction
- Construction material storage and transportation;
- Temporary disposal of wastewater in the drainage channels during phase of connection to the new ring.

The negative impact during the operation phase derives from the fact that the collected sewerage will be discharged into the Demerara river estuary without any preliminary treatment. This situation corresponds to the current situation, however we expect that after the rehabilitation of the sewer system, the quantity of effluent to be discharged will increase considerably. Analysis on the dilution factor and water quality monitoring will be required during the operation phase.

The key positive environmental impacts are:

- Reduction of leakage into the ground and superficial groundwater
- Reduction of risk of contamination of potable water consequent to infiltration of wastewater
- Elimination of leakage into canals
- Consequent improvement of the public health and sanitary conditions of central Georgetown residents

3. Description of Site and Checklist

Address: Central Georgetown

Site Configuration: the project site consists of the area served by the existing Georgetown central sewer system. The catchment area extends over about 460 hectares. The main ring to be rehabilitated has a total length of 5.515 Km

Improvement: N/A

Current Use: resident population along public road

Adjoining properties: the service area is bounded by the Demerara River in the West, Vlissengen Road in the East, the Atlantic Ocean in the North and Sussex Street in the South

Area Description:

The project concerns the Georgetown central sewerage system area. The area covered by Georgetown has basically a flat morphology and is located between 0.60 and 1.40 m above the mean sea level. The top soils concerned by the project can be classified as Demerara clay. The economy of the area is mainly based on small trades or linked to the sugarcane, lumber and mining sectors. The population is mostly comprised of low and middle income families.

Property History:

Property owned by Government of Guyana

Proposed Project Description:

- It is proposed the complete reconstruction of the existing main pressure sewer ring collecting the wastewater from the project area and transmitting it to the existing outfalls at the Demerara river estuary
- Installation of second pump and upgrade of power supply in the existing Pumping Stations
- Replacement of some sections of delivery mains from pumping stations
- The existing new outfall at Fort Groyne is integrated in the project (this is deemed to be one of the best locations for discharge)

Potential Benefits of Project:

- Reduction of leakage into the ground and superficial groundwater
- Reduction of risk of contamination of potable water consequent to infiltration of wastewater
- Elimination of leakage into canals
- Increase of pumping capacity and system flexibility

Checklist Assessment

Potential Impacts of Proposed Project	Y/N/NA/ Unknown ¹	Negative Impacts ²			Positive Impacts, Comments
		Construction	Operation	Decommissioning	
Future Use					
Will hazardous chemicals or petroleum fuels be stored on site (i.e., for generators)? <i>If so, potential impact may be addressed by secondary containment and regular inspection</i>	Y	Minor	Minor	Minor	<i>Construction phase: Lubricants may be stored on site, secondary containment shall be used</i>
Geology/physical setting					
Are soils highly erodible due to steep grade or soil content (organic material, muck peat, etc.) within 1 foot (0.3m) of surface?	N	Minor	Minor	Minor	<i>Clay formation allows for cohesion during trenching, heavy rains may compromise stability. Safety conditions in the trenches during construction phase shall be ensured through the use of appropriate shoring systems and dewatering</i>
Is bedrock located within 6ft. (1.8m) of the soil surface (i.e. to limit potential migration of a potential on-site spill)? Alternatively, is fractured bedrock located within 10ft. (3m) of the soil surface (i.e., that might provide a preferential conduit for a potential on-site spill)?	N	Minor	Minor	Minor	<i>Potential for contaminant migration is minimal by virtue of limited quantity in use and cohesiveness of clay formations at project site</i>
Hydrology					
Will storm water be discharged off-site or managed via on-site infiltration? <i>If discharged off-site, minor impact may be addressed via on-site collection and inspection for sheen prior to discharge during both construction and operation.</i>	Y	Minor	Minor	Minor	<i>During the construction phase, storm water will be pumped to the ditches and canals existing beside the roads</i>

Potential Impacts of Proposed Project	Y/N/NA/Unknown ¹	Negative Impacts ²			Positive Impacts, Comments
		Construction	Operation	Decommissioning	
Does project include fill within the 100-year floodplain? If data is not available, has site flooded in memorable history?	N	Minor	Minor	Minor	<i>No impact. The project area is subject to flooding of canals in case of heavy rains and high water tide, however the project does not include any fill or topography modifications.</i>
Will surface topography be significantly altered?	N	Minor	Minor	Minor	<i>No foreseeable impacts: Asphalted roads and adjacent grounds will be reinstated with the same levels as before</i>
Will site be more than 50% covered with impermeable surfaces or result in a significant increase in capacity requirements of a waterway or facility within 1 mile (i.e, such as associated with a grade increase)?	N	Minor	Minor	Minor	<i>No foreseeable impacts: There will be no increase of asphalted / impermeable surfaces</i>
Is the groundwater table located within 10 ft. (3m) of the soil surface? <i>If so, minor impacts during construction may be addressed by dewatering and providing secondary containment for fuels to avoid spill contamination and inspection during operation</i>	Y	Minor	Minor	Minor	<i>The works will be carried out trough dewatering of the trenches. Secondary containment for fuels to avoid spill contamination and inspection during operation</i>
Are suspected wetlands, marsh or mangroves located on site?	N	Minor	Minor	Minor	<i>No impact</i>
Will any stream, ditch, navigable stream or dry run (storm water conveyance) be traversed or transected by the project?	Y	Minor	Minor	Minor	<i>Project will follow the existing ring layout overcrossing some canals and minor ditches . The new crossing pipes will be constructed in a way to avoid leakage of foul water into the canals</i>
Will project be located with ¼ mile (0.4km) of a major water body?	Y	Minor	Minor	Minor	<i>The sewerage will be discharged at the existing outfall at the estuary of Demerara river as it is the current situation</i>

Potential Impacts of Proposed Project	Y/N/NA/Unknown ¹	Negative Impacts ²			Positive Impacts, Comments
		Construction	Operation	Decommissioning	
Water/wastewater					
Will project require water?	Y	Minor	Minor	Minor	<i>Clear water will be required for washouts and construction works, such as concrete mixing and curing, pipe cleaning, etc.. Potable water is available at a short distance from construction site</i>
If groundwater will be used, will pumping or drainage potentially lower the water table?	N	Minor	Minor	Minor	<i>The water table shall be lowered locally through pumping during construction. For the laying of each short stretch of pipe the trench shall be isolated with sheet piles . No permanent effect is expected on shallow or deep aquifers</i>
Will project have a wastewater discharge?	Y	Major	Major	Minor	<i>The existing ring will be kept in operation during the construction of the new mains. During the phase of connection between the old and new ring, wastewater will be temporarily discharged into canals. Measures shall be taken to minimize the connection time and negative impacts</i>
Will septic tank-soil absorption fields for on-site waste disposal be used on-site?	N	Minor	Minor	Minor	<i>No impact</i>
Could any waste materials enter ground or surface waters associated with the site?	Y	Major	Minor	Minor	<i>The project will reduce the risk of wastewater infiltration and consequent soil and water contamination. During the phase of connection between the old and new ring, wastewater will be temporarily discharged into canals. Measures shall be taken to minimize the connection time and negative impacts</i>
Air					
Will project result in air emissions?	Y	Minor	Minor	Minor	<i>Minor emissions from the use of machines during construction phase- they will be re-distributed by coastal air</i>
Will project generate dust?	Y	Minor	Minor	Minor	<i>Small amount during construction phase- the contractor shall use mitigation measures for reducing the impact</i>
Solid waste					
Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill or hazardous waste	N	Minor	Minor	Minor	<i>No impact</i>

Potential Impacts of Proposed Project	Y/N/NA/Unknown ¹	Negative Impacts ²			Positive Impacts, Comments
		Construction	Operation	Decommissioning	
that could occur as a result of this project?					
Will project generate, transport or store solid or hazardous waste?	Y	Minor	Minor	Minor	<i>Trenches excavation will lead to store and transport of non reusable excavation materials- excavation materials are not harmful</i>
Will dredging be required?	N	Minor	Minor	Minor	<i>No impact</i>
Does (will) this site have storage tanks, underground or above ground? If so, what will be stored in the tanks?	N	Minor	Minor	Minor	<i>No impact</i>
Is the site located near a landfill?	N	Minor	Minor	Minor	<i>No impact</i>
Natural resources					
Does the site contain critical habitat for endangered, threatened or rare plants and animals? <i>If none listed by EPA, no impact</i>	N	Minor	Minor	Minor	<i>No impact</i>
Are endangered, threatened, unusual or rare species (animal, bird or plant) present in the area? <i>If none listed by EPA, no impact</i>	N	Minor	Minor	Minor	<i>No impact</i>
Will project result in removal of a significant percentage of trees?	N	Minor	Minor	Minor	<i>No impact</i>
Does the project involve conversion of existing agricultural land?	N	Minor	Minor	Minor	<i>No impact</i>
Cultural/archeological					
Has the site been previously disturbed?	Y	Minor	Minor	Minor	<i>The site has been previously disturbed during construction of the existing sewer ring</i>
Are there any places or objects listed on, or proposed for national or local preservation registers known to be on or next to the site?	N	Minor	Minor	Minor	<i>No impact</i>

Potential Impacts of Proposed Project	Y/N/NA/Unknown ¹	Negative Impacts ²			Positive Impacts, Comments
		Construction	Operation	Decommissioning	
Disruption					
Will project disturb more than 1 acre of land? <i>If so, construction impact may be addressed by erosion control methods</i>	Y	Minor	Minor	Minor	<i>Construction will follow existing sewer route. Total length 5.515 Km</i>
Will project disrupt traffic (road closures, etc.)?	Y	Major	Minor	Minor	<i>Temporary disruption of traffic during construction due to excavation across and along roads. The works will be effectuated on lots of limited length, in a way to minimize closure of main streets stretches</i>
Will project disrupt businesses?	Y	Minor	Minor	Minor	<i>Short term potential impact during works</i>
Will project require resettlement?	N	Minor	Minor	Minor	<i>No impact</i>
Aesthetics					
Will project emit noise?	Y	Minor	Minor	Minor	<i>Noise pollution during construction phase due to the use of excavation equipment</i>
Will ambient light be altered via spotlights, etc.	N	Minor	Minor	Minor	<i>A temporary impact can be foreseen in the case of overnight works</i>
Regulatory review					
Have regulations applicable to project been identified and strategy for compliance developed? Provide detail in separate attachment	N	Minor	Minor	Minor	<i>No impact</i>

Key:

¹ “Y”= yes, “N” = No, “NA”= not applicable

² Negative impacts are characterized either “minor” or “major”. In general, minor impacts are temporary visible or otherwise notable changes while major impacts generally are permanent and require significant mitigation such as resettlement. All minor impacts may be addressed sufficiently in the contractor’s EMP. All major impacts will review by EPA to determine is a full-scale EIS is needed.

Italic = Guidance for determination of impact or impact mitigation procedure that may be included in contractor’s ESMP

ANNEX 3 : Water Analysis



GUYANA SUGAR CORPORATION INC

CENTRAL LABORATORY

Research Centre, Agriculture Department, LBI Compound, E.C.D, Guyana, S.A.

Telephone #: 592- 220-2601 Email: ganpatj@guysuco.com

Fax #: 592-220-3018

CAEMS SOP/RF No.: 013.1

Version:
2

Revision Status: 1

Date of Issue: September 6,
1996

Expiry Date:

Analysis Report

Report Number: W124/2010—C

Date: 2010-07-20

To:

Mr. Franco Luisi, Team Leader
HYDEA (Guyana water and Sanitation Upgrade
Programme)

Email: f.luisi@hydea.it

Tele: 681 - 5426

Fax:

From:

Mr. Ganpat Jafer
Analyst

Central Laboratory

Agronomy and Analytical Services Department

Date Sample Received: 2010-07-13

Date Analysis Completed: 2010-07-20

SAMPLE TYPE: Water

SAMPLE DESCRIPTION	PARAMETER (with permissible limits)					
	DO (mg/L) ≥ 5.0	pH 6.5-8.5	TSS (mg/L)	Ammonia Nitrogen (NH ₃ -N) (mg/L)	COD (mg/L) < 250	Chlorine (mg/L) 0.2
PS 8	2.23	7.10	8	3.00	168	Nd
New Outfall	6.89	7.23	127	0.25	144	Nd

Nd = Not detected

Permissible limits: GYS 262: 2004 = Guyana Standard for Drinking water

Checked by:

.....
Mr. G. Jafer

Copied To: Mr. G. Ramnarine – Head, Agriculture Research, Guysuco Inc

MEDICAL LABORATORY "EUREKA"

263 Thomas Street, North Cummingsburg, Georgetown, Guyana

URL; www.eurekalabgy.com

Telephone #592-225-7574, 227-5131; Fax #592-226-8979

NAME OF INSTITUTION: GUYANA WATER AUTHORITY INC.
(HYDEA)

NUMBER OF SAMPLES: 2

DATE RECEIVED: September 14, 2010

MEHTOD USED: Multiple tubes (MPN-Most Probable Numbers)
For the determination of **total coliforms** and **faecal Coliforms**. (For polluted water)

MACROSCOPICAL ANALYSIS

The samples received were light brown in color. The samples were received in a sterile container, and were free of odor.

MICROSCOPICAL ANALYSIS

SAMPLE	TOTAL COLIFORMS MPN/100ml	FAECAL COLIFORMS MPN/100ml	SPECIFICATIONS TOTAL COLIROMS MPN/100mls	SPECIFICATIONS FAECAL COLIFORMS MPN/100mls	QUALITY
Sample 1- Water from Outfall	11	0	<10	0	POOR
Sample 2- Water from PS8	11	0	<10	0	POOR

DONE BY

ngana Kach

DATE:

2010/09/22

MICROBIOLOGIST

A Boyl

ANNEX 4 : Stakeholder's Consultation_ Questions and Answers

GUYANA WATER INC.
Questions and Answers with GWI, IDB & Stakeholders

Employer:	Guyana Water Incorporated
Project:	ATN/OC-11805-GY-Water & Sanitation Upgrade Programme – Consultancy Services of Update of Master Plan for the Georgetown Sewerage System – Stakeholder’s Consultation
Consultant:	HYDEA

Purpose:	Discuss Stakeholders involvement in the above mentioned project.
Date:	September 16, 2010
Time Start:	10:10 hrs.
Time Ended:	12:20 hrs.
Location:	GWJ Boardroom

Participants:	
Mr. Marcello Basani – IDB	Ms. Leticia Ramjag – IDB
Mr. Dudistir Gookul – Project Engineer, GWI	Mr. Christopher Cathro – GWI
Mr. Joseph Rensford– Sanitation Manager, GWI	Ms. Savatri Jetoo – GWI
Mr. Ron Eastman – Engineer, M & CC	Mr. Campton Sparman – GFS
Dr. Paulette Bynoe – Director, SEES - UG	Ms. Shenelle Agard – SEES/UG – Student
Ms. Bibi N. Khan - SEES/UG Student	Mr. Royston King – ECHO
Mr. Roderick Dyer – Engineer 1, GT&T	Mr .Sheik Nazamodeen – GT&T
Ms .Veronica Rose – MoPWC	Mr. Jeffrey Walcott – WSG
Mr. Ashok Sookdeo – MoH	Mr. Adrianus Vlugman – PAHO
Ms. Marle Reyes Dantoja – EPA	Ms. Teijvarti Persaud – EPA
Mr. Franco Luisi – HYDEA	Ms. Sawsan Mohsen – HYDEA
Ms. A. Ramsaywack - Administrative Assistant, GWI	
Absentees:	
Ms. Shaun Hamlet – System Planning Manager, GPL	Mr. Don Gomes – Civil Society

Item	Matters Discussed	Actions/ Parties Responsible	Due Date
1.0	GENERAL		
1.1	Mr. Gookul welcomed all stakeholders to the meeting and asked them to introduce themselves and the company they are representing.	Info.	
1.2	Mr. Gookul then introduced the project and stated that the consultation would be done in two phases, power point presentation followed by open discussion.	Info.	
2.0	PRESENTATION OF ESA		
2.1	Presentation was done via overhead projector by Mr. Luisi and Ms. Mohsen of HYDEA.	Consultant	
3.0	QUESTIONS/COMMENTS & ANSWERS		
3.1	Mr. Luisi asked where cables (GTT, GPL) and pipe lines (GWI) are located.	Hydea	
3.2	Mr. Dyer indicated that GT&T has baseline maps for location of cables in Georgetown.	Hydea	
3.3	Baseline Maps of pipeline and cables locations are to be requested from GPL, GTT and GWI.	Contractors	During construction period
3.4	Mr. Luisi indicated that the Contractors would be responsible for requesting the baseline drawings and for any damages to underground and aerial utilities during the execution of the project. This clause is usually included in the Tender Documents	Contractors	During construction period
3.5	Dr. Bynoe stated that the ESA included outdated legislation and it should be replaced with GoG updated legislation.	Hydea	To be included in final version
3.6	Dr. Bynoe stated that climate pattern documented as general, this needs to be looked at. Needs to liaise with Ministry of Agriculture and analyze 5 years weather pattern then update accordingly.	Hydea	
3.7	Mr.Luisi recalled the nature of the project, that	Hydea	

	is a simple reconstruction of existing sewerage pipes without any modification of drainage networks, and concluded that long-period climate changes have no direct impact on the project. He added that a 5-year series is too short to have any significance in precipitation forecast and climate change assessment		
3.8	Dr. Bynoe asked what methodology was used to measure what is significant.	Hydea	
3.9	Ms. Mohsen stated that scientific methodology based on GWI and IDB regulations was used.	Hydea	
3.10	Dr. Bynoe asked what monitoring tool will be used.	Hydea	
3.11	Ms. Mohsen stated that a checklist was prepared to evaluate project impacts, .in keeping with GWI guidelines	Hydea	
3.12	Mr. Cathro enquired about the risk assessment. He further asked what methodology was used to assess risk.	Hydea	
3.13	Mr. Luisi stated that screening checklist was used.	Hydea	
3.14	Mr. Cathro stated that GWI has a Management Hazard Plan that each contractor must complete before commencement of project and he advised that this should be utilized in this project.	Contractors	
3.15	Ms. Persaud stated that EPA has a hazard plan also and the contractor will be required to submit to EPA their hazard plan for approval.	Contractors	
3.16	Mr. Sookdeo enquired which canal will be used to deposit/drain the system.		
3.17	Mr. Luisi stated that canals will be identified in the Contractors' Work Plan – consultation to be done with EPA first - then EPA effluent standards would be used.	Hydea	
3.18	Mr. Sparman indicated that the canals in Georgetown are being used for fire fighting.	Info.	

3.19	Mr. Luisi stated that the canals will still be adequate for firefighting since there will be no sewerage deposited into them during works and operation (with the exception of a few days when the system will be switched from the old ring to the new one)	GW	
3.20	Mr. Sparman stated that notification of commencement of projects not timely done. GWI to inform GFS in a timely manner.	GW	
3.21	Mr. Basani stated that IDB and GoG are working on a Caribbean standard for quality of waste water deposited into ocean.	Info.	
3.22	Mr. Sokdeo enquired about the risk of waste water raising and getting to households.	Info.	
3.23	Mr. Luisi stated that waste water would not get to the level of houses if pumping is properly done. The new system with new pumps will allow for reducing the pressure into gravity sewers. No works will be carried out on yard sewers in this phase.	Hydea	
3.24	Dr. Bynoe asked why there is need for a budget for measuring and testing.		
3.25	Mr. Luisi that a long-period monitoring on domestic and industrial effluents should be done either by MoH or EPA.	EPA/MoH	
3.26	Mr. Basani stated that IDB and GoG are presently in discussion to establish a grant from the Crew funds. This budget allocation will allow for implementation of environmental monitoring campaigns	IDB	
3.27	Dr. Bynoe enquired if risk management of Georgetown fragile drainage system was considered.		
3.28	Mr. Luisi recalled that this is a separate sewerage rehabilitation project, that the pipes will have no connection with the rainfall drainage network and the risk of pollution of the drainage system will only concern the	Hydea	

	construction phase.		
3.29	Mr. King asked how this project would be communicated and if information campaigns were envisaged to educate the public.		
3.30	Mr. Basani stated that there is a budget of \$50,000 for Education campaign in the Program, targeted especially towards schools and restaurant-owners. Also, extra budget will be available for an information/education campaign on tropical diseases.	IDB/GWI	To be included in final version of ESA
3.31	Mr. Vlugman stated that the outfall is 6 m below sea level and giving the high level and low level it will not give sufficient diffusion. He further recalled that sewerage water is lighter than saline water thus it would get to the surface.		
3.32	Mr. Luisi stated that they have run hydraulic model of the system and presently the system is giving a maximum flow at 0.15m ³ /s and new system will give a peak of 0.8m ³ /s. He recognized that there will be an effect of flotation of wastewater but he said the characteristics of river flow will allow for sufficient mixing of the waters.	Hydea	To be included in final Technical Report
3.33	Mr. Basani stated it would be good to incorporate the data collection in the final study.	Hydea	
3.34	Mr. Luisi stated that the construction of the new sewerage ring will be done parallel to existing ring without demolishing the old pipes, in order to allow for pumping during the work period.	Hydea	
3.35	Mr. Dyer asked about road reinstatement.		
3.36	Mr. Luisi stated that the specifications used for Guyana road design will be incorporated in tender documents, thus Contractor will be responsible for restoring roads as per specifications. Mr. Luisi also stated that the Contractor must contact GT&T, GPL and other service providers to get existing networks drawings.	Contractors	

3.37	Mr. Dyer asked who is responsible for roadways in Georgetown.		
3.38	Mr. Gookul stated that for past sewer projects, MoPW indicated that M&CC is responsible for roadways in Georgetown.	Info.	
3.39	Mr. Walcott stated that before construction the information on who is responsible for roadways and design to use can be obtained from either M&CC or MoPW.	Contractors M&CC & MoPW/GWI/	
3.40	Mr. Gookul indicated that specifications for road design will be forwarded to M&CC & MoPW.	GW	
3.41	Dr. Bynoe asked if impact of pre-construction phase was considered in the report, e.g. trees and bushes to be cleared.		
3.42	Mr. Luisi stated that the clearing of site is not a pre-construction phase but is part of Contractors' activities. He said that there will be no need for tree cutting during construction, as excavation will be carried out on asphalted roads. Clearing and de-bushing might be needed for the Contractors' site stores out of town.	GW/ Contractor	
3.43	Mr. King asked what methods are there to engage stakeholders to interact.		
3.44	Mr. Basani stated that presently IDB is setting up a stakeholder database that will allow for communication to all relevant stakeholders.	IDB/GW	
3.45	Mr. Basani stated that induction will be announced during the project.		

4.0	OTHER There being no other questions/comments, Mr. Gookul thanked everyone for attending and for participating. Discussion was adjourned. Prepared By: <i>A. Ramsaywack</i> <i>Administrative Assistant</i>		
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