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GUYANA

ENHANCING THE NATIONAL QUALITY INFRASTRUCTURE FOR ECONOMIC DIVERSIFICATION AND TRADE PROMOTION (GY-L1059)

Draft Environmental and Social Analysis (ESA) and Environmental And Social Management Plan (ESMP)

September 9, 2016

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ACRONYMS

ADI	Area of Direct Influence
AII	Area of Indirect Influence
CARICOM	Caribbean Community
CBD	Convention on Biodiversity
CDO	Community Development Officer
CEMP	Construction and Environmental Management Plan
CH&PA	Central Housing and Planning Authority
CITES	Convention on the International Trade of Endangered Species
CLO	Community Liaison Officer
CO	Carbon Monoxide
CoP	Conference of Parties
CROSQ	CARICOM Regional Organization for Standards and Quality
CSO	Community Support Officer
DO	Dissolved Oxygen
ECM	Environmental Compliance Monitoring
EDMI	Enumeration District Marginality Index
EDWC	East Demerara Water Conservancy
EDWCRP	East Demerara Water Conservancy Rehabilitation Programme
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMS	Environmental Management System
ENSO	El Nino Southern Oscillation
EPA	Environmental Protection Agency
EPM	Environmental Performance Monitoring
ESA	Environmental and Social Analysis
ESMP	Environmental and Social Management Plan
ETZ	Equatorial Trough Zone
FAO	Food and Agricultural Organization
GA-FDD	Government Analyst Food and Drug Department
GBTI	Guyana Bank for Trade and Industry
GCMs	Global Climate Models
GFC	Guyana Forestry Commission
GFS	Guyana Fire Service
GGMC	Guyana Geology and Mines Commission
GHG	Greenhouse Gas
GLASP	Guyana Land Administration Support Programme
GLDA	Guyana Livestock Development Authority
GLSC	Guyana Lands and Surveys Commission
GNBS	Guyana National Bureau of Standards
GoG	Government of Guyana
GO-INVEST	Guyana Office for Investment
GPF	Guyana Police Force
GRA	Guyana Revenue Authority
GS&WC	Guyana Sewerage and Water Commission
GUYWA	Guyana Water Authority
GWI	Guyana Water Incorporated
HD	Hydrometeorological Department
HSD	Hinterland Scholarship Dormitory
HSP	Hinterland Scholarship Programme
IADB	Inter-American Development Bank
IAST	Institute of Applied Science and Technology
IICA	Inter-American Institute on Agriculture
IMR	Infant Mortality Rate
IPCC	Inter-Governmental Panel on Climate Change
ISO	International Standards Organization
ITCZ	Inter-Tropical Convergence Zone
ITTO	International Timber Trade Organization
LCDS	Low Carbon Development Strategy
LCI	Living Condition Index

M& CC	Mayor and City Council
MDGs	Millennium Development Goals
MGI	Matching Grant Initiative
MIPA	Ministry of Indigenous Peoples Affairs
MoA	Ministry of Agriculture
MOAA	Ministry of Amerindian Affairs
MoB	Ministry of Business
MoC	Ministry of Communities
MoE	Ministry of Education
MOH	Ministry of Health
MOIPA	Ministry of Indigenous Peoples Affairs
MoP	Ministry of the Presidency
MoSP	Ministry of Social Protection
MOU	Memorandum of Understanding
MPWC	Ministry of Public Works and Communications
NAAQS	National Ambient Air Quality Standards
NCSU	National Competitive Strategy Unit
NDC	Neighbourhood Democratic Council
NDIA	National Drainage and Irrigation Authority
NDS	National Development Strategy
NEAP	National Environmental Action Plan
NO	Nitrogen Oxide
NTFP	Non-Timber Forest Product
OHS	Occupational Health and Safety
OPM	Office of the Prime Minister
OS&HA	Occupational Safety and Health Administration
PMU	Programme Management Unit
PTCCB	Pesticide and Toxic Chemical Control Board
QMS	Quality Management Standard
RDC	Regional Democratic Council
REO	Regional Executive Officer
RM&ERP	Risk Management and Emergency Response Plan
SME	Small and Medium Enterprises
SO2	Sulphur Dioxide
SPAW	Specially Protected Areas and Wildlife
TSS	Total Suspended Solids
UAEP	Unserved Areas Electrification Programme
UG	University of Guyana
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification and Deforestation
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programme
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
WHO	World Health Organization
WTO	World Trade Organization
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

1. Introduction

The Government of Guyana (GoG) is seeking to improve the National Quality Infrastructure in Guyana. In this regard, it is seeking a loan from the Inter-American Development Bank (IDB) to build a new complex to house the Guyana National Bureau of Standards (GNBS) secretariat. The IDB, therefore, in seeking to move forward with this project, contracted the services of Dr. Mark Bynoe to conduct an Environmental and Social Assessment (ESA) and Environmental and Social Management Plan (ESMP). What follows is a description of the project, identification of the investment option, description of the physical, social and economic environments, the impacts that are likely to emerge and recommendations to mitigate the impacts while identifying ways of enhancing the positive virtues of the project.

2. Project Description

The current laboratories infrastructure and equipment is not adequate for supporting exports, protect consumers and the environment. There are 20 existing main national laboratories offering services in metrology, chemical and microbiological and physical testing of products and materials used. These laboratories have limitations and gaps in terms of: (i) unsuitable laboratory facilities, lacking the proper physical conditions to assure reliability; (ii) absence of laboratory facility to perform tests for consumer protection and for dynamic sectors; (iii) limited calibration capacity in terms of capacity in temperature, moisture, pressure, force, volume, electricity; (iv) lack of adequate equipment and consumables; (v) outdated test methods that no longer meets the needs for the industry requirements; (vi) lack of accreditation and participation in proficiency testing programmes; and (vii) insufficient trained staff for performing tests and calibrations as well as competence in use an maintenance of instrumentation. In this regard, the Government of Guyana (GoG) carried out in 2014, with the support of the Inter-American Development Bank (IDB) a needs assessment of a State of the Art Laboratory and is contemplating its implementation through and IDB loan. However, the demand for services needs to be updated to reflect the recent economic changes, as well as the dimensioning of cost of the current facility.

3. Methodology

The ESA was conducted using different recognised standards, methods and approaches, and international best practices, inclusive of the IDB's guidelines for conducting Environmental Impact Assessment of Investment Projects (2002). These methods and approaches are detailed within the relevant section of the report.

Field studies were carried out to determine and evaluate impacts of the project based on direct observations and professional judgment. A comprehensive content review of pertinent literature and some desktop techniques were used to complement or supplement field data where it was not available. In addition, extensive public consultations were carried out to capture public views and concerns about the proposed projects.

4. Environmental, Regulatory and Administrative Framework

The purpose of this ESA was to identify potential impacts, and propose measures to devise mitigation measures for negative impacts, ensure compliance to national and international laws and regulations and that all interested and affected parties are given an opportunity to express their views and concerns about the project while being kept informed of the crucial project decisions regarding their bio-physical and social environments. In this regard, it was found that the Project will need to make applications to the following entities:

Environmental Protection Agency	-	Environmental Authorization/Permit and to determine if an EMP is required
Mayor and City Council	-	Approval of designs and building permit
Central Housing and Planning Authority	-	Land use and fire permit

Furthermore, an ESA and ESMP of the project are necessary prior to the project's commencement. This would ensure that the adverse impacts are identified and addressed. Such an initial assessment will satisfy the requirement of fulfilling the legislative requirement of the Environmental Protection Act of 1996 and that of the IDB.

5. Environmental Setting

Topography: The proposed project lies in a flat land, flood plain area with elevation of between 0.5 – 1 metre

Geology: The geology of the area mainly comprises basement complex rocks.

Soils: Mostly comprise clayey soils, with a soil suitability classification of II.

Hydrology: The project site is bordered on both sides by drains which are in need of rehabilitation.

Climate: The project site has a tropical climate (mean annual temperatures 25 to 28 degrees celcius).

Flora: Vegetation within 10m of the road side is dominated by Congo Pump (*Cecropia sciadophylla* and *C. obusa*), Fire rope (*Pinzona coriacea*) with strong patch dominance by cowtail - *Andropogon bicornis*, razor grass – *Scleria* spp. and savanna grasses (*Panicum pilosum*).

Fauna: The area is largely denuded of faunal species, with few local species of fishes found in the surrounding canals.

Land Use: The main land uses within the identified area is commercial and services

Land Tenure and Rights: The proposed site is found on state land.

6. Main Findings

Potential Positive Impacts and enhancement measures

Positive Impacts

Among other benefits, the improved GNBS complex is expected to provide some short term employment during construction, enhanced property values after completion, improve upon current waste disposal methods applied at the GNBS, improve Guyana's competitive position internationally as well as its exports and reduce the country's trade balance.

Enhancement Measures

In order to secure project benefits, the contractor will maintain open dialogue with stakeholders during the entire project implementation period as a way of ensuring that all concerns and suggestions are specifically dealt with or resolved. This way, stakeholders will be able to perceive benefits and take advantage of this opportunity to request the contractor to fully address their concerns or demands. The other way to sustain the project benefits is for the Government to ensure that a comprehensive plan towards road improvement is pursued.

Potential Negative Impacts and Mitigation Measures

The construction phase is likely to have the largest number of activities that can be potentially damaging to the environment. Major potential negative impacts during this phase include the following:

(i) Atmospheric Impacts: To reduce atmospheric pollution the contract documents should specify that the contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent, and otherwise minimize atmospheric emissions and discharges of air contaminants.

*Potential Mitigation***:** Accordingly, the contractor would be expected to ensure that mechanical equipment, utilized during the construction phase, work at their optimal levels, thereby reducing atmospheric emissions to the manufacturer specified levels. Vehicles and equipment showing excessive emissions of exhaust gases due to poor engine adjustments or other inefficient operations will not be allowed to operate until corrective repairs or adjustments are made.

Airborne particulates from the borrow pits can be mitigated by application of water to the ground surface, if required. However, it is very unlikely that much can be done to reduce this impact significantly. Airborne particulates from the vehicles transporting materials during the rehabilitation phase can be mitigated by ensuring that the vehicles have proper covering and the road is consistently wet to reduce the impact of this pollutant. Application of the mitigation measures will aid with managing the impacts associated with atmospheric emissions.

To reduce water pollution, proper storage and transporting of bituminous material, fuel and waste will be a vital prerequisite at all times. Additionally, work should occur mainly during the hours of 09:30 – 15:30 hrs a period of high ambient noise level. Furthermore, all workers will be expected to work with protective gear and air protectors.

(ii) Geology, Soils, and Topography: A major source of soil contamination is expected to be the disposal of waste, i.e., chemical, liquid and oils (during operations) and liquid and oil mainly during construction from equipment and heavy vehicles working on the project site.

Potential Mitigation: It is recommended that this oil be collected, stored and resold to the service stations. The chemical waste should be collected, stored and exported following established international protocols. Liquid waste should be collected in a separate holding tank, recycled, with the improved quality of water then released into the environment or applied on grey spaces. All other wastes will be disposed in impervious lined pits or at the Eccles Landfill site approximately 6 km away from the proposed project site. Further, to mitigate any possible soil erosion it will be important to avoid construction in areas of relatively steep gradients, balancing fill and cut and by ensuring that slopes are less than the natural angle of repose for the soils. The mitigation measures will result in minor residual impacts which are of medium severity and which will have a low likelihood of occurrence.

(iii) Water Resources: If culverts are constructed to allow water to flow from the tertiary ditches bordering the site into secondary drains they can potentially result in erosion, and increased sediment discharge to drains along the road. Further, surface water quality may potentially be impacted by discharges to surface water of spilled and leaked chemicals and oils from vehicle maintenance. At the same time, the failure to connect the current project site to the secondary canals confounds the site to being constantly flooded and water logged from rainfall.

Potential Mitigation: These impacts will be mitigated by minimizing the number of culverts to allow for connectivity, but still ensuring that there are sufficient for the effective drainage of the site and surrounding areas. Moreover, the canals will need to be rehabilitated to reduce the risk of flooding. Detention basins can also be strategically located to trap sediments in surface water runoff before discharge to drains. This will result in minor residual impacts of low severity with a low likelihood of occurrence. Additionally, to minimise the possibility of ground and surface water contamination the project will utilize simple preventative techniques consisting of segregated and contained areas with sumps and oil traps. Chemicals and oils collected from sumps and segregated areas should be stored in drums and be resold to some service stations.[1]

[1] Small quantities are often bought by those in the agricultural sector and used as lubricants, while larger volumes are often collected by service stations and shipped to designated facilities to be burnt or disposed of in an environmentally sensitive manner.

(iv) Biological Resources: Minor erosion from the built complex and borrow source(s) can potentially increase sediment discharge to streams and drains located downstream of these facilities. Increased sediment discharge may potentially ruin spawning beds for fishes.

Potential Mitigation: The impacts on aquatic ecosystems will be mitigated by minimizing re-channelling of streams and/or implementing silt barriers where possible.

(v) Socio-Economic Issues

Traffic congestion: It is anticipated that during construction there will be some level of congestion particularly if trucks taking material are using the main access Railway Embankment road during peak hours.

Potential Mitigation: This impact can be mitigated through having an effective traffic management plan in place, with police presence as much as is practically possible. This plan will be developed with the Guyana Police Force (GPF) as outlined in the ESMP.

Increase in traffic along secondary roads: Guyanese drivers are on the average indiscipline, impatient and aggressive. This is likely to result in many seeking to use side streets to avoid any congestion during the construction phase of the project. This will result in some of these streets having greater flows of traffic than is normally the case.

*Potential Mitigation**:*** This impact can be mitigated by careful planning before the project is executed and continued public consultation. Further, the design engineers may wish to consider the possibility of designating some streets as one way streets with sleeping policemen installed to reduce potential road accidents.

I. INTRODUCTION AND BACKGROUND

A. Introduction

1.1 The Ministry of Business (MoB) is developing a strategy to support small and medium enterprises (SMEs) productivity, value added and export readiness, considering the modernization of traditional sectors: sugar, rice, forestry, and mining, and supporting new growth and diversification in new sectors: non-traditional agriculture, aquaculture, business process outsourcing/information technology, and tourism, under a social and environmentally sustainable framework[2]. However, there is a need to modernize the current National Quality Infrastructure in order to facilitate the growth of businesses in the local and external markets, protect the people and the environment and provide recognition for the Guyanese brand in the international market[3]. This modernization should be accompanied by a trade strategy to boost the participation of domestic firms in international markets.

1.2 Due to the need to implement best practices in the National Quality Infrastructure, the production and trading of goods and services in the principal sectors face a number of non-compliance risks in both the local and export markets with significant impact on competitiveness inclusive of: (i) rejection of products at border inspection point; (ii) increased costs due to delays while inspections/test are being done in overseas laboratories; (iii) disruptions in trade, loss or inability to expand into new market; (iv) loss of revenue where inaccurate measurements and test results are used and (v) inability to command premium price where quality and safety products are not defined.[4] In this regard to export markets in both traditional and non-traditional exports require compliance with technical requirements that are standards based[5]. In addition, local consumers and environmental protection conditions need to be enhanced.

1.3 The Guyana National Bureau of Standards (GNBS) holds primary responsibility for standardization, through a process of formulation and application of standards, technical regulations, conformity assessment procedures and metrology[6]. However, all standardizing bodies need to modernize the legal and implementation framework of the National Quality Infrastructure[7], as Guyana has still has to implement national quality infrastructure practices.

1.4 The current laboratories infrastructure and equipment is not adequate for supporting exports, protect consumers and the environment. There are 20 existing main national laboratories offering services in metrology, chemical and microbiological and physical testing of products and materials used[8]. These laboratories have limitations and gaps in terms of: (i) unsuitable laboratory facilities, lacking the proper physical conditions to assure reliability; (ii) absence of laboratory facility to perform tests for consumer protection and for dynamic sectors; (iii) limited calibration capacity in terms of capacity in temperature, moisture, pressure, force, volume, electricity[9]; (iv) lack of adequate equipment and consumables; (v) outdated test methods that no longer meets the needs for the industry requirements; (vi) lack of accreditation and participation in proficiency testing programmes; and (vii) insufficient trained staff for performing tests and calibrations as well as competence in use an maintenance of instrumentation[10]. In this regard, the Government of Guyana (GoG) carried out in 2014, with the support of the Inter-American Development Bank (IDB) a needs assessment of a State of the Art Laboratory and is contemplating its implementation through and IDB loan.

[2] The economy is highly dependent on raw materials and unprocessed foods, as the main contributors to the economy are agriculture, forestry and fishing (19% of GDP), mining and quarrying (10%), agroindustry (7%) and services (66%). Source: Bureau of Statistics.
[3] Needs Assessment for the State of the Art Testing and Metrology Facilities. 2014. Between 2006 and 2010, there were a total of 59 rejections of foods exported to the US from Guyana at an annual average of 12 rejections.. The Unit Rate of Rejection for the US market from 2002 to 2010 ranged from 0.9 in 2003 to just about 0.2 in 2010, higher than the average of countries such as Trinidad and Tobago and Jamaica
[4] Needs Assessment for State of the Art Testing and Metrology Facilities. Executive Summary. 2014..
[5] Food Safety, Good Agricultural Practices, Quality Standards, Animal Health, Plant Health, Environmental, Social, Safety, Information Security, Efficiency and Certification, each with its own specific requirements.
[6] GNBS Strategy. 2011
[7] The GNBS Standards Catalogue 20212 lists twenty (20) standards as having mandatory status. The WTO Report by Measures 2009, states that Guyana makes minimal use of technical regulations"
[8] Needs Assessment for the State of the Art Testing and Metrology Facilities. 2014
[9] Unsuitable type of construction materials to ensure a sterile environment, layouts that may conduce to cross contamination, locations subject to flooding, poor ventilation, humidity and direct sunlight. Needs Assessment Report, 2014.
[10] Ibid.

However, the demand for services needs to be updated to reflect the recent economic changes, as well as the dimensioning of cost of the current facility.

1.5 Regarding the scope of the intervention, as a result of legal and technical analysis, in line with the forthcoming guidelines to be issued by the Caribbean Community (CARICOM) Regional Organization for Standards and Quality (CROSQ), the scope of the program will concentrate on four fronts: (i) strengthening the GNBS and its labs in its central role in legal and industrial metrology, standardization, accreditation and certification, including the strengthening of the industrial metrology laboratories in the areas of mass, temperature, force and pressure, length, hardness, volume, electrical quantities, time and frequency and chemical metrology.

1.6 It is within this context that this Environmental and Social Analysis (ESA) and Environmental and Social Management Plan (ESMP) report has been prepared for the IDB under the Enhancing the National Quality Infrastructure for Economic Diversification and Trade Promotion (GY-L1059) Loan signed between the IDB and the Consultant Mark Bynoe. The ESA and ESMP are essential to ensure that the socio-economic sustainability component of the physical infrastructure and its operations to be financed under the program satisfies the national legislation and environmental and social safeguard policy (OP-703) of the Bank.

1.7 This ESA and ESMP have been prepared in compliance with the policies and regulations of the Environmental Protection Agency (EPA) of Guyana and the policies of the IDB, in particular the Bank's Environmental and Social Guidance note of February 2009. In accordance with those guidelines this ESA and ESMP comprises the Social and Environmental Setting for the project, institutional and governance arrangements, projected impacts during various phases of the project and the mitigation measures to be followed.

II. OBJECTIVES, METHODOLOGY AND CONSULTATIONS

A. Objectives

2.1 The overall objective of this consultancy is to develop an Environmental and Social Analysis (ESA), including an Environmental and Social Management Plan (ESMP) for the Project), which is a management tool to ensure the socio-environmental sustainability component of physical infrastructure and its operation to be financed under the project and thus meet both national environmental legislation and the Environmental and Social Safeguards Policy (OP-703) of the IDB (see *Terms of Reference in Annex 1*).

B. Methodology

2.2 The ESA study was conducted using different recognised standards, methods and approaches, and international best practices, inclusive of the IDB's guidelines for conducting Environmental Impact Assessment of Investment Projects (2002). These methods and approaches are detailed within the relevant sections of this report. The methodological approach therefore used for the collection of data for this study was essentially of three (3) types: (i) visual observation, (ii) review of pertinent literature, and (iii) stakeholder consultations.

Visual Observation

2.3 Given the location of the proposed structure, it was felt necessary to visit the site to better appreciate the surrounding environment, potential socio-economic impacts and to begin to identify some persons and/or agencies it would have been important to speak with. Reconnaissance visits were made to the proposed project site on August 6 and 20, 2016 and September 2, 2016. These visits were done on both wet and dry days, and on a weekend to ensure that a range of issues could be identified. As such, this ESA is informed by both theoretical and practical exercises.

Literature Review

2.4 Literature was collected primarily from two sources: (i) The Implementing Agency for the Proposed Project which is the GNBS and (ii) The Inter-American Development Bank (IDB, Project Team/Project Consultants) the funder. Some of these documents include:

- The Greater Georgetown Development Plan, 2001 – 2010,
- The Environmental Protection Act of 1996 and amendments that have occurred since,
- The third revision of the Government of Guyana's Low Carbon Development Strategy (2010)
- The Town and Country Planning Act (1948)
- Land Development Act (1970)
- State Land Act (1953)
- The Municipal District Council Act (1970)
- Needs Assessment for the State of the Art Testing and Metrology Facilities. 2014

These documents provided the consultant with a better understanding of the context within which the proposed project is to be carried out. Their relevance to the project, important issues to be considered and relevance to the project is noted in various parts of this report, but particularly within the legal and institutional framework section. This approach was adopted to reduce repetition and enhance brevity. For a list of the material consulted, kindly see the bibliography.

C. *Stakeholder Consultations*

2.5 The Consultant met with the Client and officials of the IDB on at least 3 occasions virtually during the conduct of the ESA to discuss the assignment, their expectations, outline and define respective responsibilities and logistical support they might be able to provide to the consultant, such as, the provision of letters of introduction and public notices about a possible public consultation.

2.6 The stakeholders consulted during the period August 3 – September 6, 2016 are shown below in *Table 1*.

Table 1: Stakeholders Consulted

Date	Topics Discussed	Agency	Representative
Aug 3, 2016	• EPAs permitting and authorization process • EPA current regulatory framework • What standards are in place to govern the type of operation under this project • Who should submit an application, documents accompanying such application and the time it takes to provide an Environmental Authorization	Environmental Protection Agency	Dr. Indarjit Ramdass, Executive Director Mr. Kemraj Parsram, Head, Environmental Management Division Mr. Collis Primo, Senior Environmental Officer Ms. Teshanna Redmond, Senior Research and Enforcement Officer Ms. Harsranie Rambaran, Director, Permitting Division
Aug 5, 2016	• Potential concerns about the project • Benefits the projects are likely to bring to the community • Any other issues	Hinterland Scholarship Dormitory (HSD), Ministry of Indigenous Peoples Affairs (MIPA)	Ms. Christine Percival, Welfare Officer
Aug 5, 2016	• Functions and operations of the GLDA • How does the GLDA dispose of its waste • Potential concerns about the project • Benefits the projects are likely to bring to the standards infrastructure • Any other issues	Guyana Livestock Development Authority (GLDA)	Mr. Richard Cumberbatch, Chief Executive Officer Dr. Dwight Walrond, Deputy CEO Dr. Dane Hartley, Director of the Veterinary Laboratory
Aug 5, 2016	• Functions and operations of the GA-FDD • Potential concerns about the project • Benefits the projects are likely to bring to the standards infrastructure • Any other issues	Government Analyst Food and Drugs Department (GA-FDDA, Ministry of Health)	Mr. Marlon Cole, Director
Aug 4, 2016	• Functions and operations of the GA-FDD • Potential concerns about the project • Benefits the projects are likely to bring to the standards infrastructure • Any other issues	Guyana National Bureau of Standards (GNBS)	Ms. Candelle Bostwick, Head of Conformity Assessment Mr. Shailendra Rai, Legal, Metrology and Standards Compliance Department Mr. Edward Melville, Coordinator of Laboratory Services Department
Aug 17, 2016	• The Quality Standards Infrastructure in Guyana • Challenges and opportunities for improving the QSI • The collaborative framework • Resource constraints and the need for capacity building	Ministry of Agriculture	Mr. George Jervis, Permanent Secretary Dr. Mark Pierre, Agricultural, Health and Food Safety Specialist Ms. Melisa October, Head, Monitoring and Evaluation Unit
Aug 17 & Sept 6, 2016	• The drainage infrastructure in and around the proposed project site • Measures to mitigate flooding in and around the project site	National Drainage and Irrigation Authority (NDIA)	Mr. Frederick Flatts, Chief Executive Officer (a.g)
Sept 6, 2016	• The permitting process for new applicants seeking to construct buildings	Mayor and City Council (M&CC)	Mr. Ron Eastman, Deputy Chief Engineer
Sept 4, 2016	• The major causes of fires within and around the proposed project site	Guyana Fire Service (GFS)	Mr. Andrew Holder, Fire Prevention Officer

Date	Topics Discussed	Agency	Representative
	• Is fire a main hazard in the project site • How to mitigate fire risks both at the complex and around the project site		
Sept 6, 2016	• Rates charged for commercial operations • Connection fees • Quality of service	Guyana Water Incorporated	Customer Representative
Sept 2, 2016	• What is the permitting process for a new applicant • How does one go about applying for a permit from the CH&PA	Central Housing and Planning Authority (CH&PA)	Mr. Orsen Simon, Development Facilitation Officer III
Aug 4, 2016	• Functions and operations of the PTCCB • Potential concerns about the project • Benefits the projects are likely to bring to the standards infrastructure Any other issues	Pesticides and Toxic Chemicals Control Board (PTCCB)	Ms. Trecia David Garnett, Registrar

2.7 The remainder of the report is therefore structured in the following order:

- The Socio-Physical Environment,
- Legal, Environmental and Institutional Framework,
- Socio-Cultural and Environmental Impact Prediction and Relative Importance,
- Environmental Impacts
- Risk Assessment,
- Mitigation Measures, and
- Environmental and Social Management Plan.

D. Limitations

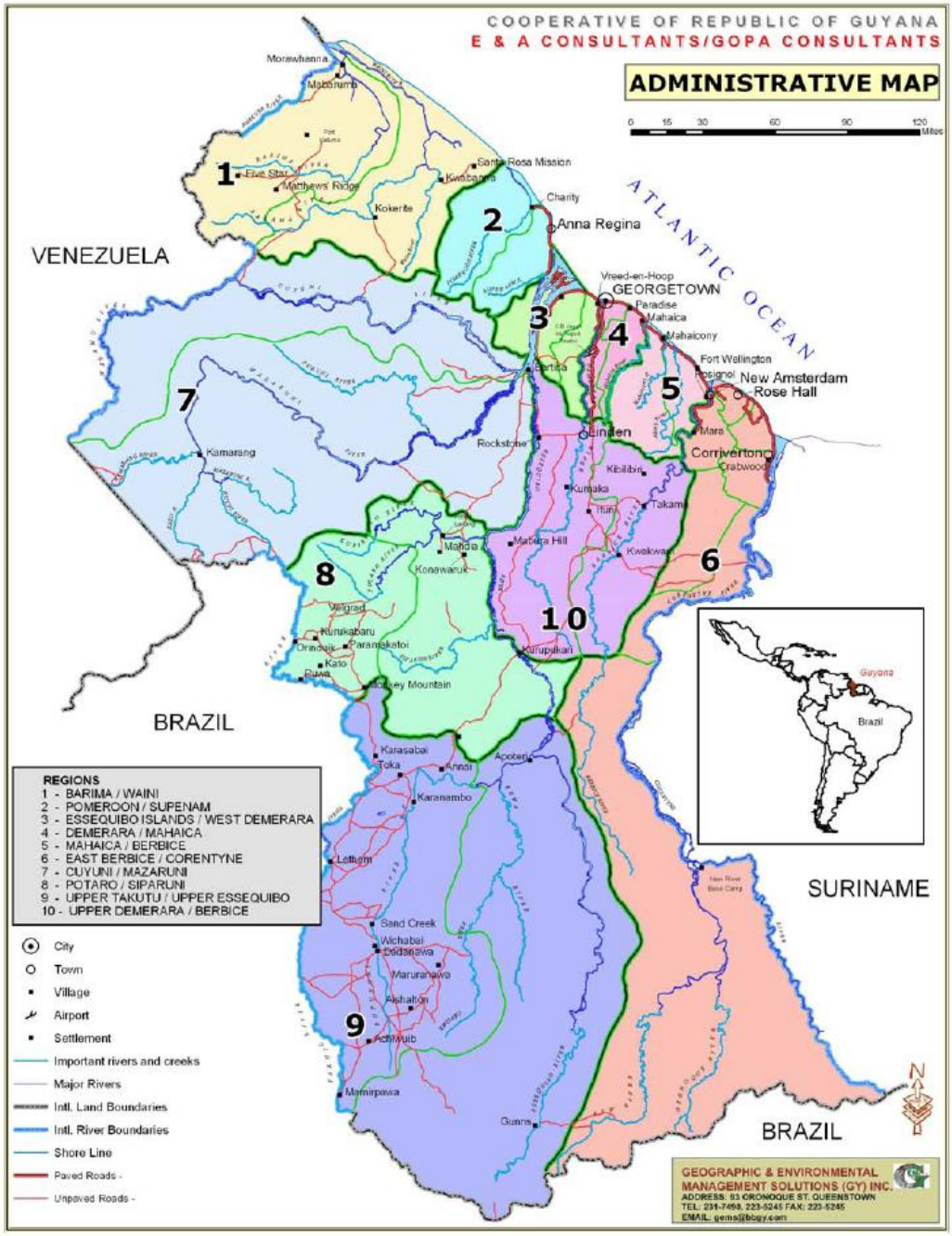
2.8 The main limitation was the time constraint and busy schedules of many of the stakeholders. This meant that multiple trips had to be made before appointments could have been secured and discussions held. It also meant that it was not always possible to meet with stakeholders at prearranged times, but rather, when the stakeholders were able to accommodate the consultant. Despite these issues the consultant was able to hold discussions with in excess of 20 key stakeholders. These persons/organisations raised a number of issues which are reflected in Section 6 that would be important to consider to aid with a more informed project design.

III. PROJECT DESCRIPTION

A. Location

3.1 The IDB is working with the government of Guyana to construct a new laboratory facility for the GNBS. This facility will be situated in Plantation Pattensen, Greater Georgetown in Administrative Region Four, i.e., Demerara-Mahaica (*see Map 1*). The new building is expected to be situated on a one (1) acre plot of state-owned land in a commercial zone that has office buildings or land earmarked for commercial development (*see Map 2).*

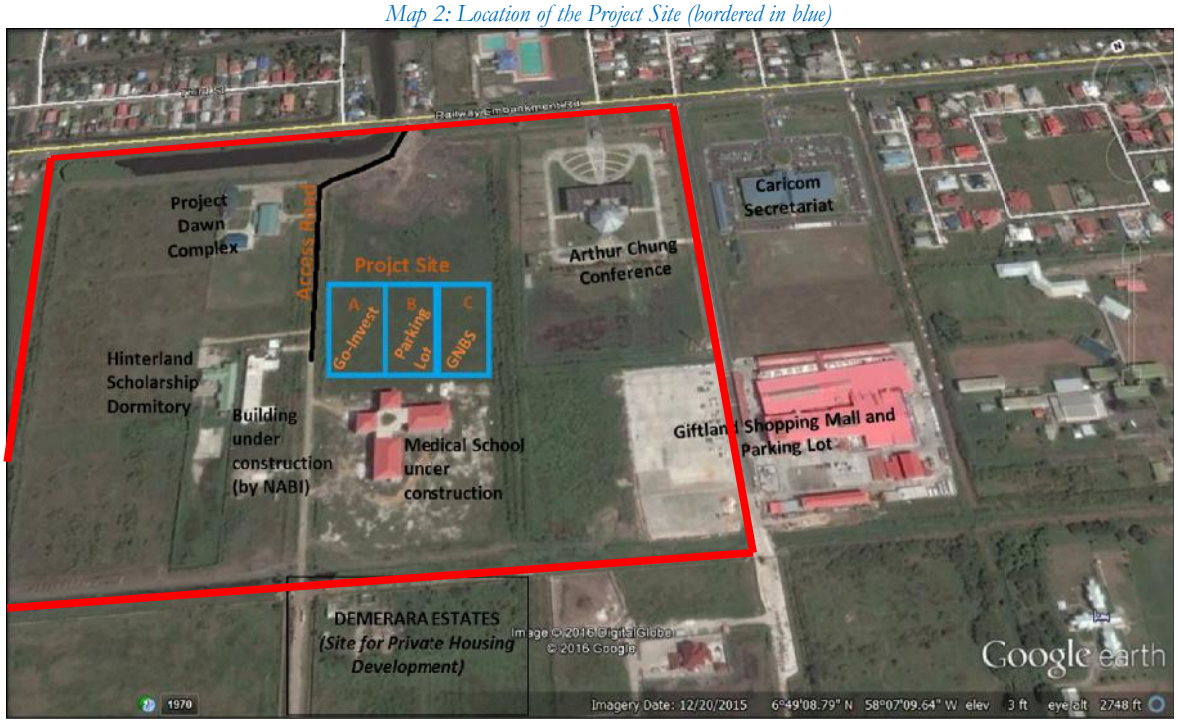
Map 1: Administrative Regions of Guyana



Source: Geographic and Environmental Management Solutions Inc (GEMS), 2006

3.2 The facility to be built is bordered on the north by the Railway Embankment Road, which will be the main transportation artery for accessing the site. Leading in from this main road is a paved access road that allows entry into the site. This road is in very good condition and is a public thoroughfare. Immediately west of the proposed project site is a dysfunctional tertiary ditch (*see Picture 1*), while to the west of the access road is a secondary drain that is expected to flow into the drain along the railway embankment. West of this drain are non-governmental structures and commercial enterprises, i.e., the United States Agency for International Development (USAID) Project Dawn Complex, the Hinterland Scholarship Dormitory and a private commercial building being constructed by local contractor, NABI and Sons Ltd. These structures are situated in Plantation Liliendaal (*see Map 2* below).

Map 2: Location of the Project Site (bordered in blue)



	Area of Direct Influence (ADI)
	Project Site

3.3 To the south of the project site is a private medical school, which building is currently under construction. Behind this medical school, but outside the ADI is a private housing scheme that is yet to be develop. The ADI is completed on the east by a dysfunctional tertiary drain that is in need of dredging, and east of this drain, by empty plots that are yet to be developed. It is said that these empty plots of land will be used to house the Guyana Revenue Authority (GRA) new building.

B. Structure

3.6 The new state of the art laboratory facilities is expected to utilise an area of 1,800 square meters of state-owned land. The compound will comprise four blocks of buildings (*see Annex 2*) with all but Block D being two-floor concrete structures. The compound will consist of the following:

- Block A – The Administration Block (2 floors),
- Block B – The Metrology and Testing Laboratories (2 floors),
- Block C – Microbiology and Chemistry Laboratories (2 floors),
- Block D – Utility Room and Stand-by Generator, Machine Hall and Building Materials (1 floor), and
- Chemical Stores.

The preliminary blueprints of the laboratory facility were derived from the Gaps and Needs Assessment carried out in 2014. One possibility is also for the structures to be green, pursuing renewable energy potentials and energy efficiency ethos as far as practicable. What is evidently missing from these drawings, however, is the storage of possible fuel for the standby-generator. It will be important that this be part of the final design. Furthermore, the designers may wish to consider a collection and holding pond for water coming out of the utility rooms and from washing and decontamination.

Picture 1: Existing ditch that borders the western side of the Proposed Project Site

Source: Consultant's Photographs (2016)

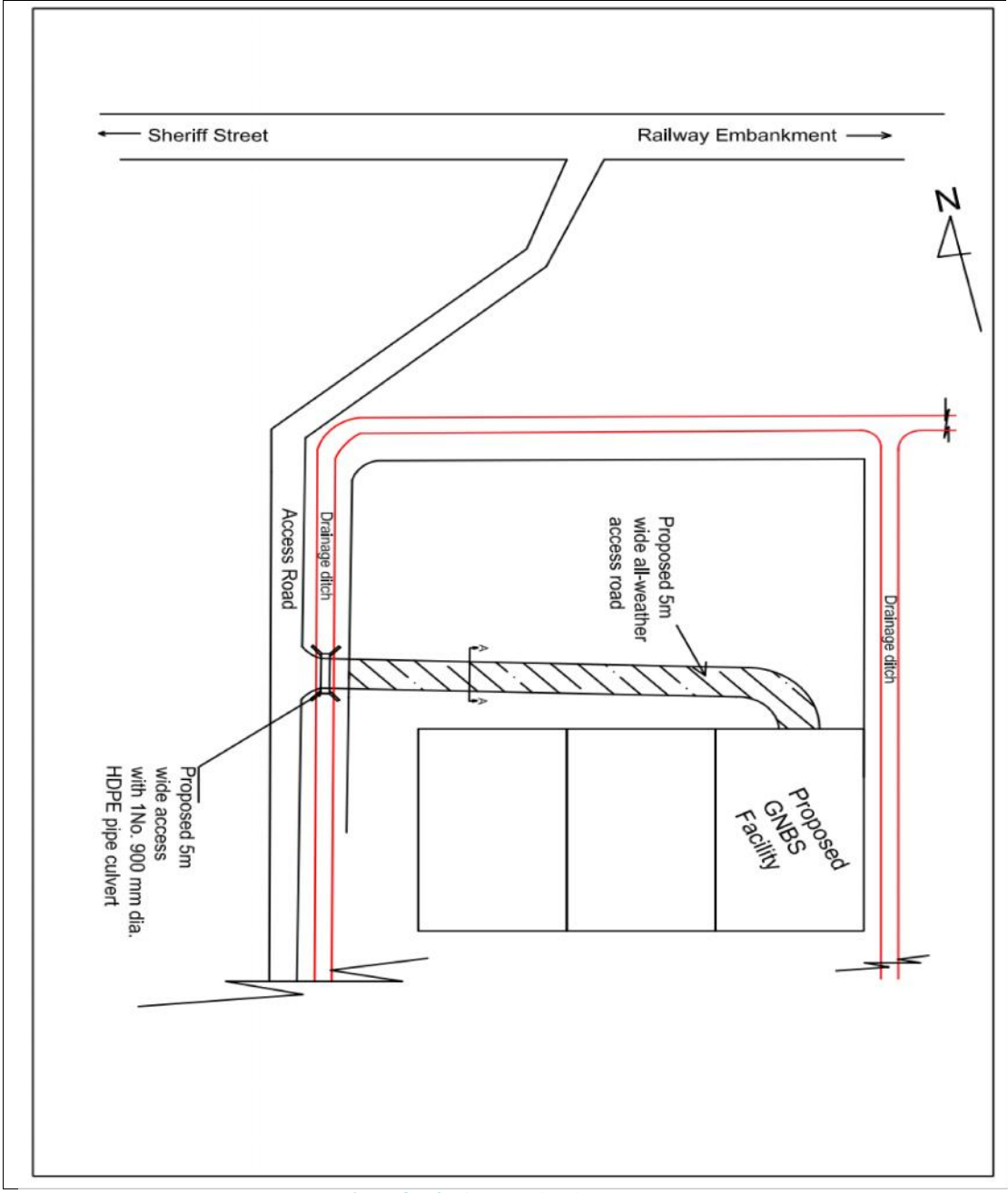
C. Access and Drainage

3.4 Access to the Railway Embankment can be via many sources, inclusive of the University of Guyana and Dennis Street access roads east of the Embankment Road, Sherriff Street access road west of the embankment or the Rupert Craig highway north of the Embankment Road. Entry into the project site is via the main access road as shown in *Map 1* above. However, to enter the plot from the access road it will be necessary to construct a new tertiary road as there is no way to current access the plot of land. Since construction will require the movement of materials, i.e., sand, stones, steel, cement etc., it is necessary that this access road be built. This road will also facilitate access to the compound once construction is completed and operations commences. This should be an all weather road as it will aid with both mitigating dust pollution and make the site more accessible during the rainy season. However, cost estimates are provided in *Annex 3* for the construction of either an all-weather road with a bridge or a fair-weather road with a bridge, based upon the schematic shown below in *Figures 1 & 2*.

3.5 Much of the surface water in Guyana runs from the highlands in the south to the lowlands in the north and then into the Atlantic Ocean via various rivers, streams and outfalls using gravity. With regards to drainage at the proposed site, the project is bordered on both the east and the west by access ditches (*see Figure 1*). These drains are in need of dredging to mitigate flooding of the proposed site. Additionally, they do not seem to empty into the main drains south of the Railway Embankment Road. As such, the plot of the land is by all intents empoldered. It will be necessary for culverts to be built or tubes installed to allow for the water to flow from these access drains into the secondary and then primary drainage system. Furthermore, the access drains, secondary canals along the Railway Embankment and the primary Downer (Liliendaal) Canal are in need of

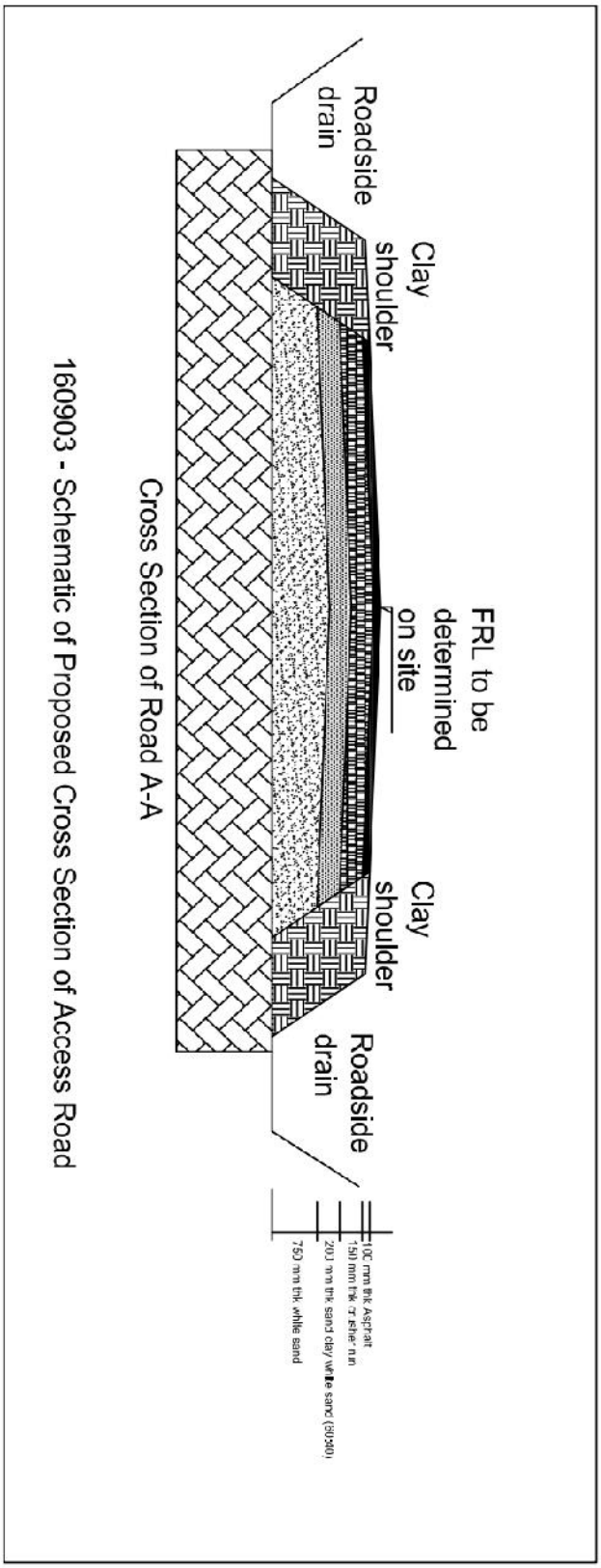
maintenance work, with the first being silted and the latter two being overtaken by water lilies. Given that the project site is in a flood plain it is imperative that this drainage issue be treated with the utmost urgency to mitigate possible flooding and water contamination from any chemicals stored in the building or the store room.

Figure 1: The Guyana National Standards Bureau Schematic of the Site Showing Proposed Tertiary Access Road and Culvert



Source: Consultant's Drawing (2016)

Figure 2: Guyana National Bureau of Standards Schematic of Site Showing Proposed Access Road Cross Section



Source: Consultant's Drawing (2016)

Picture 2: The Downer Canal which collects water from areas surrounding the Project Site	*Picture 3: The Liliendaal Pumps that services the Project Area*
	

Source: Consultant's Photographs (2016)

Picture 4: The Secondary Drain along the Railway Embankment Road	*Picture 5: The Access Drain that is immediately West of the project site*
	

Source: Consultant's Photographs (2016)

D. Waste Disposal

3.7 It is the expectation that with regards to solid domestic waste the facility will have bins where waste separation and collection will occur. The area is serviced by private contractors using compactors (*Picture 6*) under private arrangements. Currently, the private contractor that services the proposed project site collects waste from the GNBS under a private contract at a cost of G$4,000 (US$19.50) per month. This contract is expected to remain in place when the new facility is built. The collection of waste is driven by demand, with the private collector collecting waste twice weekly at the moment. The frequency will also impact the price for collecting waste. The GNBS generates on average approximately three (3) 170 kilogram barrels of waste per week. This waste is disposed of at the Eccles Landfill Site which is approximately seven (7) kilometres away from the proposed project site.

3.8 Since this is a relatively new and undeveloped area, there is no central sewerage system. Each business, household, or office building is expected to install its own sewerage facility during construction. These septic tanks tend to be located in the ground, built out of concrete material and are built with the possibility of flooding in mind. Once filled, private contractors are contracted to

drain and clean these tanks. It would be important that effluent from this system does not get into the nearby drains, resulting in foul odour or pollution of the freshwater system.

3.9 The new facility will focus heavily on testing, metrology and certification. In its testing, it will continue to utilise sulphuric, nitric, and acetic acids. The facility will continue to test textiles, gold and concrete blocks. However, currently, the primary environmental issue that affects the operations of the GNBS is its inability to effectively dispose of chemical/hazardous waste. It was explained that currently they are no existing standards for the storage of hazardous chemicals and disposal after use. This situation has resulted in chemical waste being stockpiled at the facility. Dilution has also been utilized for the disposal of nitric acid. The diluted solution is poured in drains at the facility. However, the Bureau reported that the amount of chemical waste stored is not of a large volume. Proposed mitigating measures to arrest this practice are outlined in the ESMP.

3.10 Additionally, it was reported that liquid waste and the disposal of petroleum is also an issue of concern. In some instances when oil tankers are presented for examination small volumes of oil remain in the tanks which are washed out into the drainage network, as are the other liquid wastes. This does have the potential to pollute and clog the aquatic ecosystems in the location, while simultaneously impacting human health. These matters are taken further in this ESA and the ESMP. Old scales and other tested products are disposed of at the municipal landfill site at Eccles. Clearly, the GNBS will need more environmentally-friendly ways of disposing of these hazardous wastes, the volume of which is expected to increase with the operation of the new facility.

Picture 6: A garbage truck with compactor leaving the ADI

Source: Consultant's Photograph (2016)

E. Utilities

3.11 The area of the proposed project is well served with the basic infrastructure, inclusive of water, telecommunication and electricity. The facility will access metered water from the Guyana Water Incorporated (GWI). The proposed site is serviced by a well which is located in the University Of Guyana Compound. This well was established to serve the Giftland Mall and other large development projects in the Patterson/ Liliendaal area. Water is available to the site on a 24 hour basis. Both the water pressure and quality are said to be good. The cost per water in Guyana is

G$180/m^3 (approximately US$0.88/m^3)[11]. However, with the Global Climate Models (GCMs) downscaled to adequate regional resolution predicting longer and drier summers and less annual rainfall[12], it would be prudent for the facility to also consider putting in place rainwater harvesting facilities, and some greywater recycling to reduce water wastage and increase efficiency. The actual dimensions of the system would be based on projected demand and will have to be worked out with the contractor.

3.12 The area is also well served with telecommunication services, with landlines and cellular services being available from the Guyana Telephone and Telegraph (GTT) Company, and cellular service via the Digicel Group (Caribbean). There are already telecommunication lines in the area and it should not be difficult to connect this facility to said lines to allow for various data packages to be obtained.

3.13 Lastly, the area, like most of Guyana is serviced by the Guyana Power and Light (GPL). This company has a monopoly and is the only authorised distributor of electricity. While the new structure will be connected to the national grid, the project will also have a stand-alone stand-by generator. This will ensure that the facility has uninterrupted power. At the same time, the project may wish to explore the installation of renewable energy, specifically, photovoltaic which equipment can be imported duty free into Guyana. At the same time, the pursuance of energy efficiency measures should be pursued in terms of lighting, implements and equipment purchased for the facility and its ancillary laboratories.

F. Other Issues

3.14 The GNBS currently employs 58 persons on a full-time basis, but the entity is heavily depleted with regards to technical and professional staff. In fact, the Gap and Needs Assessment Report (2014) indicates that the "*the laboratory head position is vacant and the current senior staff does not have the requisite qualifications viz at least a degree in physical science*." There will therefore need to be a training and incentive plan to build the capacity and retain the requisite skills if the entity is to play is role. It is projected, that once completed, the entity will employ 120 persons, all of whom will be permanent staff. At the same time, there is projected to be up to 100 short-term jobs created during the construction and setting up of the facility.

3.15 The GNBS is the only laboratory that provides services for calibration of weighing and measuring devices. This is covered under the Weights and Measures Act and Standards Act. Calibration and traceability are provided to the laboratories by the GNBS in the areas of: calibration of balances, weights, thermometers, micrometers, volume flasks, pressure gauges, ovens and incubators. New areas for which calibration and traceability will be covered with this new facility will be: calibration of micropipettes, low temperature calibration (below – 40°C), height gauges, deadweight testers, compression and tensile testers, infra-red thermometers and torque testers. Further the GNBS will continue to perform temperature, pressure dimensional metrology, and testing of concrete block and PVC pipes. In the area of physical and chemical metrology the laboratories need calibration and traceability support in: pH meters, density meters, polarimetry, refractive index, thermometry, spectrophotometry (UV/Vis) and purchase, storage and distribution of traceable standards from NIST and ASTM.

[11] This is using an exchange rate of US$1 = G$205.

[12] Caribbean Community Climate Change Centre (2012) Achieving Development Resilient to Climate Change – Implementation Plan 2011 – 2021, CCCCC, Belmopan.

IV. INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORK

A. Institutional Context

4.1 The Enhancing the National Quality Infrastructure Project is inserted in the framework established by the Guyana's Environmental Protection Act of 1996 (revised in 2006) and the policies and procedures of the IDB, the funding agency for the project. The regulatory and institutional framework applicable to this project involves the institutions presented on *Table 2* below. However, in the interest of brevity, their roles are responsibilities are incorporated within the discussions on the regulatory framework.

Table 2: Institutions Involved in the Institutional Framework

A. Directly
1) Environmental Protection Agency (EPA)
2) Central Housing and Planning Authority (CH&PA)
3) Ministry of Business (MoB)
4) Mayor and City Council (M&CC)
5) Ministry of Indigenous Peoples Affairs (MIPA)
6) Ministry of Communities – Guyana Water Incorporated (MoC – GWI)
7) Ministry of Agriculture (MoA)
8) Ministry of Health, Government Analyst Food and Drugs Department
9) Ministry of Social Protection (MoSP)
B. Indirectly
1) Guyana Lands and Surveys Commission (GL&SC)
2) Guyana Fire Service (GFS)

4.2 Several government departments and agencies have a role to play in environmental and standards management in Guyana. This large number can itself be a recipe for fragmentation and insufficient coordination. Within this section only the main entities are discussed and their relevance to environmental and standards management highlighted.

4.3 This Environmental and Social Analysis (ESA) identifies the key environmental guidance; regulations and legislation that must be considered during the life of this project and which contractors and other stakeholders will need to comply with to undertake the implementation of the construction and operational aspects of this project. The management of the project will be required to demonstrate compliance with these and the identified activities through the reporting procedures within the ESMP. The ESMP followed the International Finance Corporation's (IFC) guidelines for new constructions.[13]

4.4 The legislative and regulatory framework for the project is a combination of International and national, policies, regulations, legislations and guidelines to which Guyana is a signatory. The environmental and social analysis process for development and operation of the project will be undertaken in accordance with the legislative and regulatory framework outlined below. This section of the report focuses on the essential elements within these legislations and examines the regulatory environment that may impact their performance.

[13] See http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines

B. International Policies

Agenda 21

4.5 In 1992, the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro adopted a Program of Action for the 21st Century. Twenty-seven (27) environmental principles were outlined at the UNCED conference as an attempt to enshrine a charter for the protection of the Earth. The environmental management plan for this project falls directly under Chapters 19 and 20: Environmentally Sound Management of Toxic Chemicals, including Prevention of Illegal International Traffic in Toxic and Dangerous Products and Environmentally Sound Management of Hazardous Wastes, Including Prevention of Illegal International Traffic in Hazardous Wastes respectfully.

4.6 Chapter 19 indicates that substantial use of chemicals is essential to meet the social and economic goals of the world community and recognizes that best practice demonstrates that chemicals can be used widely in a cost effective manner and with a high degree of safety. However, a great deal remains to be done to ensure the environmentally sound management of toxic chemicals, within the principles of sustainable development and improved quality of life for humankind. Two of the major problems, particularly in developing countries, are recognized as a lack of sufficient scientific information for the assessment of risks entailed by the use of a great number of chemicals, and the lack of resources for assessment of chemicals for which data are at hand. This section further recognizes that gross chemical contamination, with grave damage to human health, genetic structures and reproductive outcomes, and the environment, has in recent times been continuing within some of the world's most important industrial areas. Enhancing the National Quality Infrastructure Project is expected to result in some materials being processed and transported by mechanical equipment utilizing some of the aforementioned chemicals.

4.7 Chapter 20 recognizes that effective control of the generation, storage, treatment, recycling and reuse, transport, recovery and disposal of hazardous wastes is of paramount importance for proper health, environmental protection and natural resource management, and sustainable development. This project will entail management, and facilitate the movement, of dangerous/toxic chemicals, and the disposal of hazardous wastes generated mainly during the operational phase of this project. The ESMP will identify measures for the management of hazardous wastes generated.

Convention on Biological Diversity (CBD)

4.8 Guyana ratified the Convention on August 12, 1992, after which it entered into force on November 12, 1997. The National Focal Point is the Ministry of the Presidency (MoP) and the Implementing Agency is the Environmental Protection Agency (EPA). The objectives of the Convention include: the conservation of biological diversity (defined as the variability among living organisms from all sources including *inter alia,* terrestrial, marine and other aquatic ecosystems and the ecological complexities of which they are part, including diversity within species, between species and of ecosystems), the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

4.9 The provisions of the Convention apply to areas within the limits of national jurisdiction of contracting parties and as regards the effects of processes and activities, both within and beyond the limits of national jurisdiction. Contracting parties are required under Article 7 of the Convention, to identify processes and activities which have or are likely to have significant adverse impact on the conservation and sustainable use of biological diversity and to monitor their effects through sampling and other techniques. Parties are also as far as is possible and as appropriate, required to establish protected areas or areas where special measures need to be taken to conserve biological diversity. In areas adjacent to these protected areas environmentally sound and sustainable development should also be promoted. Article 8 requires that degraded ecosystems be rehabilitated and restored and the recovery of threatened species be done through the development and

implementation of plans or management strategies. Contracting parties are also required to regulate or manage relevant processes or activities where a significant adverse effect on biological diversity has been determined.

4.10 Article 10 of the Convention supports the integration of conservation and sustainable use of biological resources in national decision-making, and the support of local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced. In observance of the Convention, Guyana established the EPA in 1996, to coordinate and implement a program for the conservation of biological diversity. A National Biodiversity Action Plan was also developed with stakeholders. These initiatives form part of the foundation within which Guyana seeks to protect its biological resources and what will be essential for this project to consider going forward.

Protocol concerning Specially Protected Areas and Wildlife (SPAW)

4.11 The SPAW Protocol utilises an ecosystem approach to conservation by protecting rare and fragile ecosystems and the endangered species it houses. Through its Caribbean Regional Coordinating Unit, assistance is given for the establishment of protected areas. One of the objectives of the SPAW Programme is to significantly increase the number and improve the management of national protected areas and species.

4.12 The Protocol urges when necessary, the establishment of protected areas in instances where it is necessary to protect:

- habitats and their associated ecosystems critical to the survival and recovery of endangered, threatened or endemic species of flora or fauna,
- the productivity of ecosystems and natural resources that provide economic or social benefits and upon which the welfare of local inhabitants is dependent, and
- areas of special biological, ecological, educational, scientific, historic, cultural, recreational, archaeological, aesthetic, or economic value, including in particular, areas whose ecological and biological processes are essential to the functioning of the Wider Caribbean ecosystems.

4.13 In the application of protection measures, each party is urged to progressively take such measures in accordance with its national laws and international law as are appropriate for:

- the regulation or prohibition of the dumping or discharge of wastes and other substances that may endanger protected areas;
- the regulation or prohibition of fishing, hunting, taking or harvesting of endangered or threatened species of fauna and flora and their parts or products;
- the prohibition of activities that result in the destruction of endangered or threatened species of fauna or flora and their parts and products, and the regulation of any other activity likely to harm or disturb such species, their habitats or associated ecosystems;
- the regulation or prohibition of any activity involving a modification of the profile of the soil that could affect watersheds, denudation and other forms of degradation of watersheds;
- any other measure aimed at conserving, protecting or restoring natural processes, ecosystems or populations for which the protected areas were established.

4.14 Even though the project is not likely to impact endangered flora and fauna, depending on how its waste is disposed of during its operations, it can affect soil profiles. As such, the ESMP will incorporate the measures identified by this protocol.

C. National Policies

4.15 The importance of the environmental and social issues in Guyana is well documented and adumbrated in key documents of the country:

The Constitution of Guyana

4.16 Article 2:25 of Guyana's Constitution indicates that "*Every citizen has a duty to participate in activities to improve the environment and protect the health of the nation*." Furthermore, Article 2:36 indicates that "*In the interest of the present and future generations, the State will protect and make rational use of its land, mineral and water resources, as well as its fauna and flora, and will take all appropriate measures to conserve and improve the environment*."

4.17 It appears that the GoG endorsed the principles of sustained economic growth and the promotion of environmental protection when it published the details of its policy and actions on the environment in its National Environmental Action Plan (NEAP) 2001 - 2005. This document unequivocally commits the country to the principals of sustainable development in its widest context. This document, which followed the Environmental Protection Act of 1996 states that the government of Guyana will endeavour to, *inter alia*:

- Assure all people living in the country the fundamental right to an environment, adequate for their health and well-being;
- Achieve a balance between the use and conservation of the nation's resources to meet the needs of economic development and improve standards of living;
- Conserve and use the environment and natural resources of Guyana for the benefit of both the present and future generations; and
- Ensure prior environmental assessment of proposed activities, which may significantly affect the environment; ensure that conservation is treated as an integral part in the planning and implementation of development activities.

4.18 From the above it is clear that the intention is to integrate economic, environmental and social values during the planning phase of the project cycle, and to distribute benefits equitably across socio-economic cohorts and gender during project implementation. This position is endorsed and reinforced by the National Development Strategy (NDS), which indicates the need for environmental protection to be treated as a cross-sectoral issue in all aspects of the development process.[14]

4.19 The vulnerability of Guyana underscores the importance of proper stewardship of the environmental resource base on which the country is dependent for its survival and the role environmental assessment can play in that process. As such, several different pieces of legislation are important for this Project, inclusive of those with regard to the environment, energy, water and biodiversity.

4.20 The Environmental Protection Agency (EPA) advocates the preparation of Environmental and Social Analysis[15] to mitigate environmental impacts of a program. Further the ESA along with the Environmental and Social Management Plan (ESMP) must ensure that proposed procedures, actions and measures identified are not just a statement of goodwill by the company/developer but that they will be effectively implemented. The ESMP is mandated to identify feasible and cost effective measures to reduce potential significant adverse environmental impacts. It should also include operational procedures to avoid environmental risks during operations, as well as emergency and contingency plans to ensure appropriate response in the event of accidents.

[14] The NDS is for the period 2001 – 2010. It is yet unclear whether the provisions contained in the NDS will be rolled over for a further 5 or ten years.

[15] The Environmental Protect Act of 1996 does not speak explicitly to the social impacts of the impact report or in the management plan (though they are implied), thus the reference to the Environmental Impact Assessment and the Environmental Management Plan. However, the IDB requires that particular attention be paid to social dimension of the project

Environmental Protection Agency

4.21 The Act (No 11 of 1996) was first issued in June 1996, reprinted in 1998 and updated in 2006. It provides 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, the sustainable use of resources and for matters incidental thereto or connected therewith.

4.22 The EPA was established under the Environmental Protection Act in 1996 as the institution with responsibility for environmental protection. The EPA has broad responsibilities and is organized into four divisions: administrative, natural resources, environmental management, and education information and training. The EPA functions are: (i) to coordinate the prevention and control of pollution; (ii) to coordinate conservation and sustainable use of natural resources; (iii) to promote environmental management, and (iv) to give development consent which entitles the developer to proceed with the project.

4.23 Under the Environmental Protection Act, the EPA is mandated to ensure that any project that may have a significant impact on the environment acquires an Environmental Permit. Projects are considered to have an environmental impact when they threaten the health, safety and natural life supporting system of humans and other living things. **This project will be required to apply for an environmental authorization from the EPA**. The environmental permitting process is characterized by the following steps:

1. The developer completed an application form for an environmental authorization and submits a project summary to the EPA or to the relevant sector Agency.
2. EPA reviews the project summary and the developer is notified whether or not an EIA or EMP is required.
3. If an EMP is required the EPA notifies the client and indicates what should be covered in the EMP.
4. If an EIA is needed the developer submits his choice of consultants to the EPA.
5. The EPA approves the consultants and together with the consultant (s) sets the scope of work for the EIA.
6. The EIA or EMP report is submitted to the EPA for review. The EPA reviews the report then forwards it to the Environmental Assessment Board that makes recommendations as to whether or not a permit should be granted.
7. The EPA makes a final decision as to whether a permit is granted. This approval process takes approximately three (3) months after the final report is submitted to the Agency, barring no public challenge to the project.

4.24 The EPA since its formulation has created various mechanisms for actions geared towards environmental protection. These include:

- the establishment of draft environmental quality standards, with teh water quality standards currently being updated,
- mandating that all projects likely to have significant impacts on the environment carry out an environmental impact assessment (EIA),
- regulating and licensing activities with the potential for pollution,
- instituting penalties and fines for environmental degradation,
- monitoring impacts on the environment emanating from industrial and other activities, and
- developing a programme geared towards public awareness and environmental education of the national populace.

4.25 Recognising that environmental protection is a multidisciplinary task the EPA has established links with sectoral natural resource agencies and has sought to involve other stakeholders and interest

groups. Accordingly, the Agency has signed Memoranda of Understanding (MOU) with the Guyana Geology and Mines Commission (GGMC), the Guyana Forestry Commission (GFC), the Ministry of Agriculture (MoA) and the Ministry of Health (MoH). Through these MOUs the Agency has placed the onus for environmental monitoring on the sector agencies. Additionally, it has drafted some environmental regulations that will be important for the project to operate within. However, these regulations, though drafted in 2000 are yet to be made law and in the interim, the US Environmental Protection Agency's regulations, or other internationally recognized standards are applied within the context of Guyana's development.

4.26 This ESA is intended to satisfy the policy objectives of the NEAP and the stipulations of the Environmental Protection Act. It is intended to ensure prior environmental assessment of the proposed activity and to raise the consciousness of the population on the environmental implications of the economic and social activities related to the project implementation.

4.27 There are five (5) pieces of legislations governing environmental protection which were enacted in 2000 as a consequence of the Environmental Protection Act. These regulations are supplemented by interim standards which the EPA has been working with. Some of these standards, i.e., water quality and noise levels, were developed in collaboration with the GNBS. The regulation 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 Authorization Regulations.

4.28 The Act is therefore relevant to this Project due to its potential to impact the environment negatively, if not management appropriately.

The Environmental Protection (Authorization) Regulations 2000

4.29 The project will utilize fuel oils and grease in its operations for cutting of logs. Improper discharge of these substances can impact water quality and wildlife. In addition, equipment used for excavation and construction will have emissions to air that can potentially impact air quality. Noise during construction may also impair communication.

4.30 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 and are referenced in the monitoring plan, were developed to regulate and control activities of development projects during their construction and operational phases.

Environmental Protection Air Quality Regulations, 2000

4.31 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 one hundred and eighty (180) days before the date on which the emission is to commence. In accordance with the regulations, the EPA shall establish parameter limits with respect to emission of smoke, solid particles, sulphuric acid mist or sulphuric trioxide, fluoride compounds, hydrogen chloride, chlorine, hydrogen sulphide, nitric acid or oxides of nitrogen and carbon monoxide. No parameter limits have been mandated to date. Where Guyana has not developed its own regulations, international standards are used instead. All of the applicable standards are described below in *Table 3* as identified within the ESMP for this project, and this shows the levels that would be acceptable during construction and operational activities. However, since the Project is not venturing into a pristine area, the majority of potential impacts are associated more with the operation phase.

Table 3: Air Quality Regulations and Standard Levels

Regulations (*Air Quality Regulations, 2000*) and Parameter	**Background**	**Relevant Body**	**Levels and limits as appropriate**
Smoke	Air quality regulations require the registration and environmental authorisation of persons with facilities that emit air pollution from any process into the atmosphere as outlined in the regulations. Elements related to parameter limits on air contaminants and emission sampling is also stated in the regulations. Schedule I outlines provisions for air pollution-monitoring index	World Bank Air Quality Standards	N.A
Particulate matter less than 2.5 microns in diameter[a]			150 mg/m^3
Sulphur dioxide			0.03 ppm or 125 mg/m^3
Nitric acid and oxides of nitrogen			0.053 ppm
Carbon monoxide			9 ppm (10 mg/m^3)
Lead			1.5 µg/m^3
Ozone[b]			0.075 ppm

Notes:
µg/m3 – micrograms per cubic meter
ppm – parts per million
N. A. – Not applicable (no standard exists)
[a] Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, on July 18, 1997, USEPA promulgated revised AAQS for particulate matter and ozone. For particulate matter, PM2.5 standards were introduced (and modified on December 17, 2006) with a 24-hour average standard of 35 µg/m (based on the three-year averages of the 98th percentile values) and an annual standard of 15 µg/m (three-year average at community monitors).
[b] The O3 standard was modified to be 0.075 ppm (160 µg/m^3) on an eight-hour average basis; achieved when the three-year average of 99th percentile values is 0.075 ppm or less.

Source: EPA, 2016

4.32 With the implementation of this project air quality may be affected temporarily during the construction phase due to the production of dust during excavation to lay the foundation for the buildings. However, during the operational stage and testing operations there is the possibility of more sustained impacts. If these standards are projected to be exceeded mitigation measures will be identified to minimize their impacts.

Hazardous Waste Management Regulations, 2000

4.33 These regulations outline the rules and procedures for transport, storage, treatment and disposal 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. For the purpose of that regulation, hazardous material/waste is regarded as the following:

- Explosives
- Flammable liquids
- Flammable solids or waste solids other than explosives which may be readily combustible
- Oxidising substances
- Organic peroxides
- Poisonous substances
- Infectious substances
- Corrosives
- Toxic gases
- Toxic substances which if inhaled or ingested may cause delayed or chronic effects
- Toxic substances which, if released, may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon systems
- Material capable, after disposal, of yielding another material which possesses any of the characteristics specified above.

4.34 A significant proportion of the hazardous material identified above will not be utilised for the implementation of this project. However, based on discussions with the GNBS it was indicated that

they will be using corrosives, inclusive of hydrochloric acid, and sulfuric acid. Currently, the hazardous wastes from the operations of the Bureau are diluted and released into water streams. Measures for disposing of hazardous waste and mitigating their impacts on the environment are addressed in the ESMP. There will also be fuel used to power a stand-by generator. Fuels and acids may be classified as hazardous and the requisite regulations will therefore apply to at the project site.

Environmental Protection Water Quality Regulation, 2000

4.35 These regulations require registration and environmental authorization by the entity whose construction, installation, operation, modification or extension of any facility 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.

4.36 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 as shown in *Table 4*. Standards were also established for any substance that either by itself or in combination with other waste or refuse may give rise to any gas, fume or odour or substance which causes or is likely to cause pollution.

4.37 The effluent discharge from the site during all operational phases will be required to adhere to the most stringent of water quality standards detailed in *Table 4* below.

Table 4: Water Quality Regulations and Standard Levels

Regulations (*Water Quality Regulations, 2000***)**	**Background**	**Relevant Body**	**Levels and limits as appropriate**
Physical test - pH	Guidelines on the discharge of effluents and disposal of liquid wastes are detailed in the water quality regulations however no standards for water quality for construction operations have been developed as of September 2010	World Health Organisation (WHO) Standards	6.5 – 8.5
Conductivity			N.A.
Total suspended solids (TSS)			Should not exceed the depth of the compensation point for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life.
Total dissolved solids (TDS)			250 mg/l
Dissolved oxygen			More than 4 mg/l
Turbidity			Max day less than 150 NTU
Temperature			N.A.
Anions			N.A.
Iron			1 mg/l
Alkalinity			Nil
Sulphate			250 mg/l
Calcium			145 – 250 mg/l
Copper			Nil
Iron			0.3 mg/l
Lead			Nil
Mercury			Nil
Zinc			Nil
Sodium			70 mg/l
Chlorine			1,600 µg/l
Colour			Should not exceed 75 colour units on the platinum-cobalt scale for domestic use or increase colour (in combination with turbidity). Further, it should not reduce the depth of the compensation point for photosynthetic activity by more than

Regulations (*Water Quality Regulations, 2000*)	Background	Relevant Body	Levels and limits as appropriate
			10% from the seasonally established norm for aquatic life.
Biological oxygen demand			30 mg/l
Chemical oxygen demand			150 mg/l
Oils and grease			• 0.01 mg/l of the lowest continuous flow 96 hour LC50 to several important freshwater species having demonstrated high susceptibility to oils and petrochemicals • Levels of oils or petrochemicals in the sediment which cause deleterious effects to the biota should not be allowed • Surface water shall virtually be free from floating non-petroleum oils of vegetable or animal origin, as well as petroleum-derived oils.
Notes: µg/l – micrograms per litre mg/l – milligram per litre N. A. – Not applicable (no standard exists)			

Source: EPA, 2016

Environmental Protection Noise Management Regulations, 2000

4.38 Under these regulations operations that emit noise in the execution of various activities such as construction, transportation, industry, commerce and any institution are required to apply to the EPA for an environmental authorization. The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction and other areas. The categories for which permissible noise levels are fixed by the EPA were identified as the following: Residential, Institutional, Educational, Industrial, Commercial, Construction, Transportation and Recreational. The Guyana National Bureau of Standards (GNBS) and the EPA together with other relevant agencies developed interim Guidelines for Noise Emission into the Environment. Under these guidelines, noise emissions for industrial and commercial sources for both day (06:00 hrs – 18:00 hrs) and night (18:00 hrs – 06:00 hrs) would be 75 and 70 decibels (Industrial) and 65 and 55 decibels (commercial) respectively at the party's boundary or 15 meters from the source (*see Table 5*).

Table 5: Noise Quality Regulations and Standard Levels (2000)

	Category	Daytime (06:00 – 18:00 hrs) Limits (Decibels)	Night time limits (Decibels)
1	Residential	55	45
2	Institutional	50	40
3	Education	50	40
4	Industrial	75	70
5	Commercial	65	55
6	Construction	86	75
7	Transportation	110	70
8	Recreational	110	95

Source: EPA, 2016

4.39 The main noises are expected to arise during construction of the building, and during operations due mainly to the movement of traffic. Very limited noise are expected from operations taking place in the built structure as the building will be built to specifications to reduce noise and will operate during the day-time mainly.

Mayor and City Council (M&CC)

4.40 The Municipal District and Councils Act, Chapter 28:01, governs the work of the Mayor and City Council. The Act provides for the M&CC to make better provision for local government in Georgetown and New Amsterdam. Furthermore, the Local Democratic Organs Act, 1980, gives power to local government bodies to manage communities. Therefore, among the duties of the M&CC is protecting and improving the physical environment and improving living and working

conditions. Both procedural and substantive functional matters are covered in principle by Municipal District Councils Act.

4.41 The M&CC has some amount of autonomy though they come under the Ministry of Communities. Under the Local Democratic Organs Act, they receive support from the Central Government. **Since the project site falls within the confines of the M&CC, authorization is also needed from this entity to ensure that the activity is in keeping with land-use in that area**. The process is of such that the applicant is expected to provide the following with their application form:

- Certified copies of Ownership (Transport, Title, Lease etc.) and /or Document of Authority
- Three (3) copies of Building Plans.
- Geotechnical and Design Report along with three (3) copies of foundation details.
- Processing and Inspection Fees.
- Rates and taxes receipt verifying payment for current year.
- Copy of Survey Plan of Lot.

Central Housing and Planning Authority (CH&PA)

4.42 The Town and Country Planning Act of 1946 provides for the orderly and progressive development of land, cities, towns and other areas, being urban or rural in order to preserve their amenities. However, this Act is merely mentioned in passing and is rarely applied, leading to the haphazard development noticed throughout the country, with little or no attention paid to land suitability, zoning and land capability issues. **In seeking to construct any property approval should first be sought from the CH&PA**. The process is of such that:

- The applications are sent to the CH&PA from the M&CC for approval.
- When the application is sent to CH&PA**,** depending on the type of building proposed and the corresponding activity:
    - The design drawings are sent to the Guyana **Fire Service (GFS)** for their input (determination of muster points, locations for fire extinguishers, emergency exits, etc.)

4.43 The Act is enforced through the CH&PA, within the Ministry of Communities, who may also, with the approval of the Minister, assign to a Local Authority, duties and functions of enforcement of the requisite laws. With specific reference to the proposed project, this falls under the purview of the Ministry of Business. However, the CH&PA, with the Mayor and City Council (M&CC), is responsible for land use planning in the city. It is therefore necessary for the CH&PA, the M&CC and the MoB to collaborate closely on this project. The manner of their collaboration is detailed in the Greater Georgetown Development Plan (GGDP) 2001 – 2010[16] and can be a main vehicle via which the work is executed to reduce conflicts and enhance coordination.

4.44 Under the Town and Country Planning Act, Ch 20:01, the CH&PA has been identified as the entity responsible for the orderly development in urban and rural areas of Guyana. This entity has the authority to authorise, remove or deny developments in certain areas. According to the Act, the CH&PA will "*allocate sites for use in relation to transport and providing for reservation of land for that purpose.*"[17]

4.45 Furthermore, the CH&PA is responsible, according to Part IV (i), for the zoning of land in towns, and country areas (whether public or private and whether built or unbuilt) reserving it for specific purposes. But while the CH&PA Act provides powers for the removal of encumbrances from a particular area that may not be in conformity with the stipulated land use, this has not always been

[16] This document was for the period 2001 – 2010. Thus far, it is unclear whether it will be revised or whether a new policy document will be developed. The GGDP is the starting point for all planning advice and decisions made by the CH&PA and the M&CC. It sets out what type of development will be allowed and where and the policies that the CH&PA and the M&CC will use to assess development proposals. Among its objectives are: (i) to ensure rational and consistent decisions, and (ii) to secure public involvement in shaping local planning policies.

[17] Town and Country Planning Act, 20:01, pp41

enforced. It is this lack of enforcement that has been partly responsible for many areas around Georgetown seeing a rapid change in land-use. This has often led to congestion and areas prone accidents that operate well above the permitted noise level in residential communities.

Ministry of Business (MoB)

4.46 The MoB provides services to many entities, inclusive of:

- The issuance of Export license for specific products. The Ministry issues export license for the export of Gold, Diamond and Sugar. The regulatory institutions of other sector provide this function for other products.
- Serve as the focal point for the Competition Commission within the MoB (Commission was established with the passing of the 2006 Competition and Fair Trading Act). The Act seeks to:
  a) promote, maintain and encourage competition and enhance economic efficiency in production, trade and commerce;
  b) prohibit anti-competitive business conduct which prevents, restricts or distorts competition or constitutes the abuse of a dominant position in the market; and
  c) promote the welfare and interest of consumers.

4.47 The MoB, through the National Competitive Strategy Unit (NCSU), foster a Matching Grants Initiative (MGI) aimed at raising the competitiveness of private Guyanese firms, in particular small and medium enterprises, by enhancing their export capacity.

The Ministry of Indigenous Peoples Affairs – The Amerindian Act

4.48 The Amerindian Act of 2006 was assented to by the President of the Cooperative Republic of Guyana on March 14th, 2006 and came into operation in April 2006. The Act provides for the recognition and protection of the collective rights of Amerindian Villages and Communities, mechanisms for good governance within Amerindian Villages and Communities and the granting of land to these Villages and Communities.

4.49 Under the 2006 Act, Amerindian lands titles are issued in different forms - Amerindian Villages, Amerindian Areas, and Amerindian Districts. The law also allows Amerindians Village Councils to lease community lands up to 10 percent of the titled area owned. It enshrines the ownership of land grants by Absolute land title and makes provision for matters of land management, allocation, leasing, titling, demarcation and extension. The new Act provides the Village Council with the functional authority "to hold for the benefit and use of the village all rights, titles and interest in or over village lands and to manage and regulate the use of and occupation of village lands". Further at Part V1 of the Act –the section entitled *Grant of Communal Lands to Amerindian Villages and Amerindian Communities* lays out the process for application for extension of village lands and grant of land to untitled Amerindian communities.

4.50 Under the Act, *non-Amerindians* must obtain permission before they can enter or remain in an Amerindian District, Area or Village, settlement or encampment. The Amerindian Act also addresses the protection of property and legal proceedings on behalf of Amerindians, employment of Amerindians, and prohibiting the supply of intoxicating liquor to Amerindians. Provision is also made for entering into written contracts with Amerindians.

4.51 Each Village Council is also required to set its own Village rules and Regulations and to produce a 5 year Village Development Plan. The functions and responsibilities of the elected Toshaos (Captains) and Councils are also outlined in the Act, with the proviso that any decision pertaining to the collectively owned lands and natural resources must be made at a public meeting of the village residents and carried by a two-thirds majority. Village Council Elections are held every 3 years.

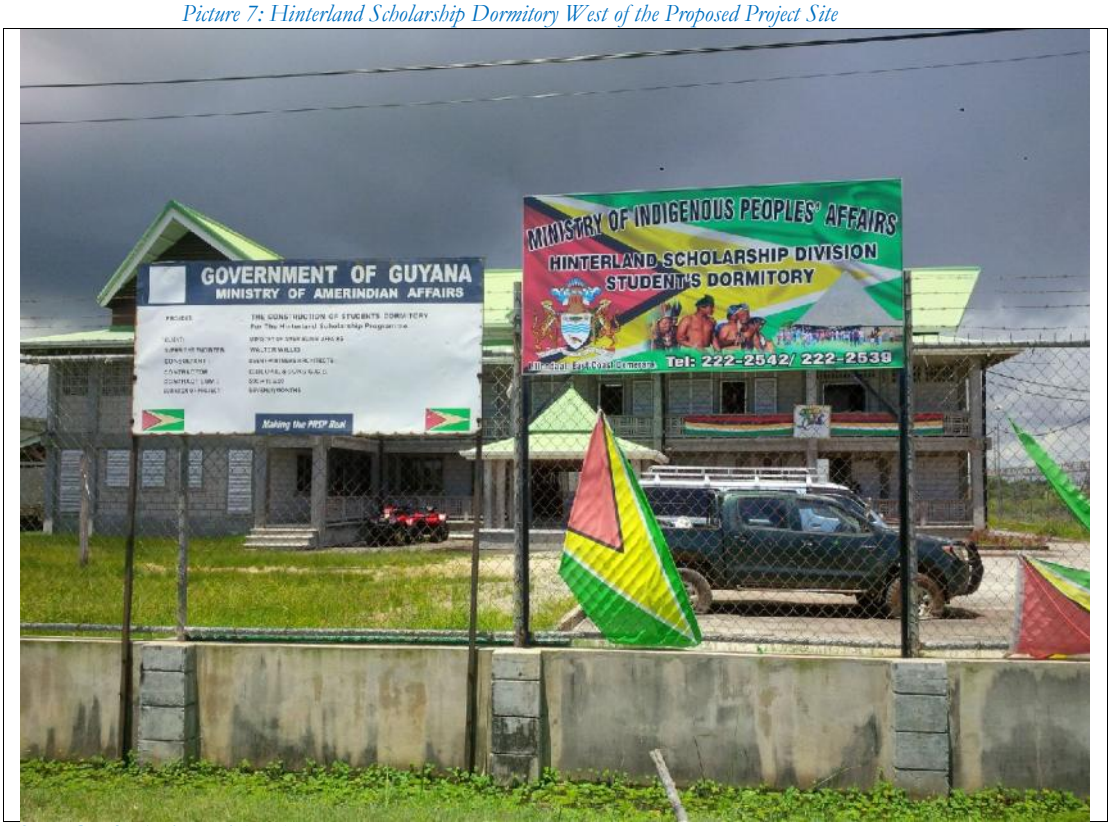
4.52 The Act further assigns to every Toshao the status of *ex officio* Justice of Peace for the district, area and/or village. This also allows the Toshao to serve as a rural constable. However, the

enforcement of the provisions within this Act remains weak and the projected increase in human and vehicular traffic in close proximity to Amerindian areas will test the provisions contained within this Act.

4.53 The Amerindian Act 2006 gives Amerindian communities legal powers to manage and conserve their lands. Communities can use the powers in the Amerindian Act 2006 to create and enforce protected areas over their lands. A community can *inter alia* prohibit or control entry and access to its territory and traditional knowledge, prohibit or control mining, zone its lands, protect sacred sites, regulate hunting, fishing, tourism, research etc. All Amerindian lands are owned collectively by the whole community (technically called a "Village") and administered through a Village Council. The Village Council is elected by the community and is a recognised legal entity. This Village Council also has the power to make law i.e. rules which are legally binding on everyone within the Village lands whether or not they are members of the Amerindian community. Some communities have informal or traditional arrangements by which they regulate or restrict hunting, fishing, burning, poisoning etc.

4.54 While this project does not fall within an Amerindian area or on Amerindian lands, it is in close proximity to an Amerindian hostel, i.e., *Picture 7*. The Hinterland Scholarship Dormitory (HSD), is located approximately 500 meters west of the proposed project site. The construction of the HSD was completed in 2010 and officially opened in 2011. The Dormitory provides boarding to beneficiaries of the Hinterland Scholarship Programme (HSP) who are awarded places at Schools in the city, i.e., Georgetown. The facility has the capacity to house one hundred and twenty students and staff. Currently it provides boarding to 90 students and provides employment to 18 individuals including "dorm mothers", a dorm father, cooks, laundry workers, cleaner, security and administrative staff. It would be important that the facility does not compromise the quality of life that these individuals currently enjoy with regards to air and water quality, and security. The ESMP outlines possible mitigation measures to alleviate any negative impact.

Picture 7: Hinterland Scholarship Dormitory West of the Proposed Project Site



Source: Consultant's Photograph (2016)

The Ministry of Communities - The Guyana Water Incorporated

4.55 The Water and Sewerage Act of 2002 is an Act to provide 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.

4.56 Under the Water and Sewerage Act 2002 the 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).

4.57 The current project is expected to receive water from the GWI that falls under the Ministry of Communities. To be connected, an application will have to be made to the GWI with the requisite connection fee paid, i.e., G$1,000 (US$4.88). **Additionally, the new structure will therefore be expected to adhere to the following GWI Guidelines:**

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

Ministry of Agriculture

Guyana Livestock Development Authority (GLDA)

4.58 The Guyana Livestock Development Authority (GLDA) is the primary entity involve in surveillance of zoonotic diseases and animal husbandry. Its laboratory facility was commissioned in August 2014. The laboratory is presently working towards certification and has established linkages with the Inter-American Institute for Cooperation on Agriculture **(**IICA**)** and World Animal Health Organisation (WAHO) Laboratories. These linkages has allowed for the IICA and WAHO laboratories to be used to double test results and the use of these facilities as reference laboratories has helped to improve transparency and trust amongst trading partners. It may be useful under this project for the GNBS to improve its support services to laboratories, particularly, in the areas of certification, metrology and training in improved testing techniques.

Pesticides and Toxic Chemicals Control Board (PTCCB)

4.59 The PTCCB has responsibility for regulating importation and use of pesticides and toxic chemicals. The Board plays a pivotal role in ensure that chemical imports are registered and verified. Additionally, through its operations in the agricultural sector the PTCCB utilizes it laboratory facilities to track the use of illegal pesticides and residue concentrations in market products and exports. Some exporters require a certificate of clearance (residue concentrations) from the regulatory body to export. ISO 17000 and 17025 certification for its laboratory is currently being pursued with assistance from the GNBS.

4.60 As the PTCCB seeks to expand its testing capacity (range of analysis testing) and as a consequence expand its laboratory infrastructure the current project is of significant importance. It is hoped that the GNBS will increase its ability to support laboratories moving towards certification and seeking to improve metrology and testing techniques. Additionally, it was noted that coordination of technical capacities among laboratory staff is lacking. Often it has been the experience that expertise and capabilities are not shared even among national laboratory staff and as such efforts towards improving networking capabilities is required and should be given due consideration under this project. Further, it was revealed that at a recent forum the agency was told that for some areas where it was hoping to expand its testing capacity it had no jurisdiction. As such improved networking particularly between the regulatory agencies can result in a more efficient utilization of resources.

Ministry of Social Protection (MoSP)

4.61 The Labour Act sets out the conditions that an employer must observe in the contracting of employees. For example Part V specifies that the entire wages of the employee must be paid as money and not otherwise. However, in occupations where it is customary to make partial payment of allowances in the form of, *inter alia*, food, toiletries, and housing these are acceptable and not considered illegal, if both the employer and employee are agreed on such terms. Wages should be payable either weekly, fortnightly or monthly, except otherwise agreed. Further, the Act covers equal rights, prevention of discrimination, the employment of young persons and children and trade unions.

Occupational Safety and Health Act, 2006

4.62 The *Occupational Safety and Health Act 2006* (Chapter 99:10) is administered by the Ministry of Social Protection (MoSP)[18]. The Act confers a duty of care on both employers and employees, but as yet has no implementing regulations. *Inter alia*, the Act applies to construction sites. Among other laws which will have to be taken into account by construction contractors are: (i) *The Trade Unions Act* 1997 (Chapter (98:03); (ii) *Labour Act* 1942 (Chapter 98:01); (iii) Trade Union Recognition Act 1997 (Chapter 98:07); (iv) Termination of Employment and Severance Pay Act 1997 (amended 1999) (Chapter 99:08); (v) Prevention of Discrimination Act 1997 (Chapter 99:09); and (vi) National Insurance and Social Security Act 1969 (Chapter 36:01).

4.63 The Act outlines the procedures for establishing a factory site, regulating it and mandates that health and safety facilities are provided, maintained and the industrial establishment complies with the regulations under the Act. The Act regulates the registration and regulation of industrial establishments, for occupational safety and health of persons while at work and for related purposes. An industrial establishment is defined as a 'factory, shop, office or workplace and any building or other structure or premises. Regulations may be made under the Act which prescribes specifically for matters related to the health and safety of persons employed or engaged in a particular industrial establishment. The Act imposes a variety of specific duties and obligations relating to the health and safety of workers, pertinent for this program, and other persons on different actors who are or maybe in some way be connected or related to an industrial establishment.

4.64 The owner or employer of an industrial establishment is obligated to apply to the Occupational Safety and Health Authority (The Authority) for the registration of an industrial establishment. All industrial establishments are subject to inspection by the Authority.

4.65 The identification of the health and safety hazards during the construction and operation of the proposed development must be seen as a key element for assessment. The Occupational Safety and Health Act 1997, Section 6 states that "*..any person who intends to erect or cause to be erected a new industrial establishment or any new building appurtenant to any existing industrial establishment shall, before the erection of such industrial establishment or building is commenced, give notice in writing to the Authority of his intention as aforesaid, and shall furnish the Authority with such, drawings, plans or specifications that are required by the Authority*."[19] In addition in Section 52 the owner of an industrial establishment that is not a construction site must ensure the following:

- Health and safety facilities as are prescribed, are provided;
- Any such facilities prescribed to be provided are maintained as prescribed; and
- The industrial establishment complies with the regulations.

4.66 In keeping with the laws and regulations a description of the established management procedures to monitor and manage occupational health and safety hazards is critical for this project.

[18] Formerly known as the Ministry of Labour, Human Services and Social Security.
[19] Guyana Occupational Safety and Health Act (1997), Section 6, page 17.

Ministry of Health – Government Analyst Food and Drug Department (GA-FDD)

4.67 The Ministry of Health has authority over environmental health and pollution control, which it exercises through its Environmental Health Unit and the Regional Health Services. The Environmental Health Unit of the Ministry of Health has statutory responsibility for food inspection as well as aspects of occupational health, drinking water quality and solid waste management. It should therefore be considered a stakeholder in relation to any Enhanced Standards Infrastructure Project.

4.68 The Government Analyst Food and Drugs Department (GA-FDD) is responsible for monitoring the quality of food, cosmetics, and medicinal substances/drugs. Their jurisdiction covers imports, exports and items produced for the domestic market. The regulatory department is responsible for issuance of *a "Free Sale Certificate/Export Certificate"* for exports and for checking and verifying certification (issued in country of origin) from country of origin. Importers of food, cosmetics, and medicinal substances/drugs are also required by law to be registered with the GA-FDD and to be issued with import permit. The GAFDD also routinely checks the authenticity and quality of food products manufactured locally or imported.

4.69 Given its wide range of responsibilities it is very important that there be a closer relationship between the GA-FDD and the GNBS. Further, the Director of the GA-FDD suggested that his department was grossly understaffed with four (4) food inspectors and two (2) drug inspectors. Further, it was believed that given its mandate this department within the Ministry of Health (MoH) should move towards being a semi-autonomous agency. Funding was also mentioned as a major impediment which can be more effetely addressed with a semi-autonomous status.

Guyana Lands and Surveys Commission (GLSC)

4.70 The Guyana Lands and Surveys Commission (GLSC) that came into being in 1994 based on Act 59.05 and an amendment to the Land's Act has responsibility for land management in Guyana that include land regularization, the issuing of land deeds, to compile and maintain an inventory of all land resources, to conduct hydrographic surveys, aerial photography and photo mosaics of the coastline and to prepare land use plans for Guyana or any part of the country with the exception of the municipalities. This entity is also Guyana's focal point for the implementation of the United Nations Convention to Combat Desertification and Deforestation (UNCCD).

4.71 The procedure for someone to acquire State lands is for the applicant or a representative to approach the Commission with a request for land giving indication of the size of land desired and the soil type which is most preferable (given the type of investment proposed). When this is done GLSC provides a mapping of which areas are available which allows the applicant to make a selection of the most suitable location for the proposed land use activity.

4.72 Additionally, a detailed project proposal/business plan (if a business or if concessions are being sought) is required and this is sent to the Guyana Office for Investment (Go-Invest) for review and approval. In its approval process Go-Invest also consults with sector agencies under whose mandate the proposed development will occur.

4.73 Lastly, the approval from Go-Invest the proposal/plan is sent to Ministry of the Presidency for final review and approval. Some reasons for non-approval or delays in granting approvals include; the absence of sufficient documentation and conflicts among stakeholder agencies under whose mandate the project if approved will be executed.

The Guyana Fire Service (GFS)

4.74 **For large buildings such as the laboratory facility under consideration, the CH&PA will request the review and input of the GFS prior to granting their approval or no objection**.

Generally, upon receipt of the design plans the GFS will inspect the proposed drawing to ensure that safety features are existent. These include but are not limited to:

- Adequate entrance and exits for each floor of the building. There must be at least one entrance and exit for each floor of the building.
    a. After the second floor internal steps are not considered as entrance and exit points and an external stairway must be constructed.
- If flammable items will be utilized within the facility a hose-real connected to an independent water line is required. Since in Guyana the GWI water pressure tends to diminish after 10 o'clock it is expected that the hose lines will be connected to a secondary water source such as a well or overhead tank system.
- Muster point(s) must be identified for assembly in the occurrence of an emergency. These are required to be upwind (when consideration is made for a fire) and a fair distance from the building or flammable substances stored on site.

The Low Carbon Development Strategy (LCDS)

4.75 The Low Carbon Development Strategy (LCDS) seeks to position Guyana to make a major contribution to global interests in climate change generally and sustainable forest management in particular. The LCDS also emphasizes the value of forest-based services such as the generation of freshwater resources and biodiversity. In essence, the LCDS promotes a low carbon economy that promotes development without significant loss of forest cover. The LCDS also pronounces on value added enterprises in the forestry sector. To the extent possible, and in keeping with the current Administration's thrust to pursue a Green Economy development paradigm, it may be useful for this project to explore avenues for the pursuance of renewable energy where possible and energy efficiency.

D. Applicable IDB Environmental and Social Safeguard Policies and Directives

4.76 From an environmental standpoint, the Bank has a threefold strategy for addressing environmental concerns: These are:

- To enhance long-term development benefits to its member countries by integrating environmental sustainability outcomes in all Bank operations and activities and strengthening environmental management capacities in its borrowing member countries;
- To ensure that all Bank operations and activities are environmentally sustainable as defined in its Policy, and
- To foster corporate environmental responsibility within the Bank.

4.77 The Bank seeks to act to achieve these specific objectives by adopting measures to mainstream the environment into overall economic and social development, and to safeguard the environment in all Bank activities. Additionally, the Bank's Environmental and Safeguards Compliance Policy (OP-703 GN-2208) on Page 5 states that "*the Bank will proactively support borrowing countries and clients in identifying and financing operations designed specifically to: (i) enhance environmental governance, policy development and institutional capacity building; (ii) reverse environmental deterioration; and (iii) promote the conservation and sustainable use of natural resources and ecological services.*"

4.78 In order to fulfil this mandate, the Bank has identified 3 category of projects. These are: (i) Category A – Operations that are likely to cause significant negative environmental and associated social impacts, or have profound implications affecting natural resources, (ii) 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, and (iii) Category C – Operations that are likely to cause minimal or no negative environmental and associated social impacts.

4.79 According to the IDB's Policy OP-703, this operation is a Category "B" with largely moderate environmental and social impacts. The *Enhancing the National Quality Infrastructure for Economic Diversification and Trade Promotion Project*, i.e., constructing a new building to house the GNBS operations is projected to situated on a piece of State-owned land in an industrial location at Plantation Pattensen, Greater Georgetown. Construction is likely to cause mainly localized and short-term environmental and social impacts for which effective, standard, and easily implementable mitigation measures exist. During the operation phase, the facility will generate mainly hazardous waste from its testing facilities and small amounts of solid wastes and liquid discharges (excreta disposal and grey water), which are the most sensitive environmental issues of concern for this Project.

4.80 The Project triggers several of the IDB's Environment and Social Safeguards policies and directives: Operational Policy on Indigenous People (OP-765), Compliance Policy (OP-703), Access to Information Policy (OP-702), Disaster Risk Management Policy (OP-704), and Gender Equality Policy (OP-270); and Directives: B.2 (Country Laws and Regulations), B.3 (Screening and Classification), B.5 (Environmental Assessment Requirements), B.6 (Consultations), B.7 (Supervision and Compliance), B.11 (Pollution Prevention and Abatement); and B.17 (Procurement).

4.81 Based on the location of this project and its direct beneficiaries, the project does not directly involve Guyana's indigenous peoples, and no involuntary physical or economic displacement of beneficiaries is foreseen, or planned as part of this project. Hence, the IDB's Indigenous People's Operational Policy is not triggered nor the Involuntary Resettlement Policy.

4.82 Thus, based on the methodologies and protocols that are successfully being used to promote social participation in project design and implementation, and in order to comply with Directive B.06, this will develop and implement a mechanism for responding to complaints and claims from beneficiaries and stakeholders directly and/or indirectly impacted by the works and services throughout the project, ensuring compliance with local culture. This mechanism will be incorporated into the ESMP to be prepared.

4.83 In order to comply with the IDB's Directive B.05, the Project will develop an Environmental and Social Analysis (ESA) and an Environmental and Social Management Plan (ESMP), through which risks, impacts and mitigation measures will be identified. The ESA and ESMP to be prepared will be based on, inter alia, IDB policies and local legal requirements.

V. ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

A. Environmental Setting

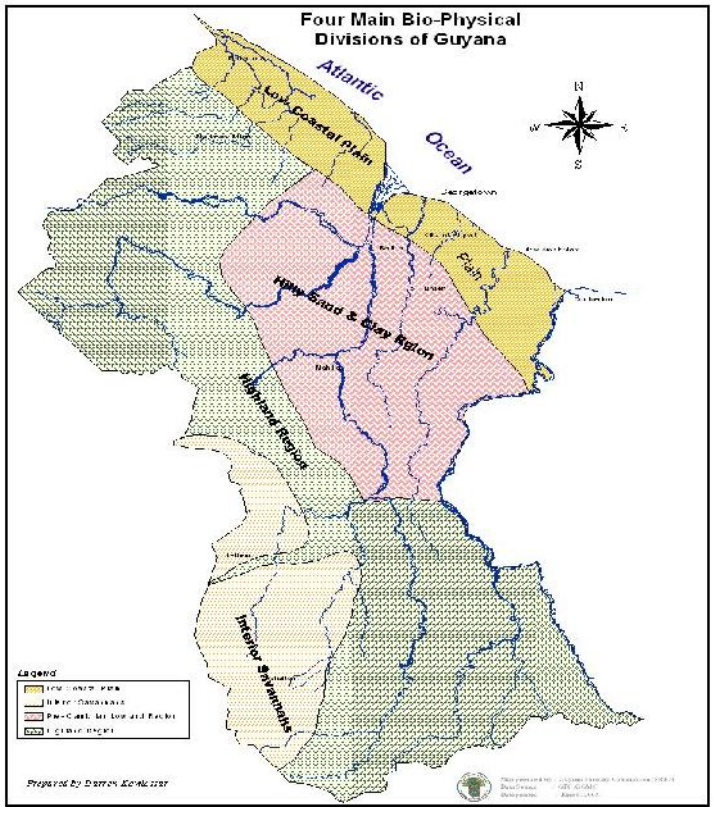
5.1 This section of the ESA discusses the existing physical, natural, and cultural environments of the project area of direct influence (ADI), i.e., bordered by 200 meters on all sides and area of indirect influence (AII), i.e., area outside the 200 radius but impacted by the project nonetheless. The following descriptions of the existing environment are based in part on information and data gathered by the consultant, and provided by government agencies and the Bank. This information was supplemented by site reconnaissance, and stakeholder consultations. However due to the Client's request, no public consultation was undertaken in an effort to advance this study. Nonetheless, the information collected provided some valuable insights that will be critical for the Client in going forward.

Geography and Physical Resources

Location

5.2 The proposed project is situated on the ***low coastal plain*** natural region of Guyana (*Map 3*). The coastal plain is a low-lying narrow piece of land along the Atlantic coast, which is approximately 430 km in length and about 2.4 metres below the high tide sea level mark that occupies about 10 percent of the country. This zone is made habitable due to a series of drainage canals, sluice gates and dykes. The coastal plain is also the most populous area in Guyana, accounting for approximately 90 percent of the population. This zone is also where the bulk of agriculture and food production is undertaken, as well as commercial and service activities. About 10 percent of this area is cultivated, but it is here that the bulk of agriculture and food production is undertaken. A wide variety of cash and permanent crops like cacao and fruit trees, are cultivated. As such, a modern and better equipped laboratory to aid with certification and conformity assessment is likely to aid these producers and the export market in Guyana.

Map 3: The Natural/Bio-Physical Regions of Guyana



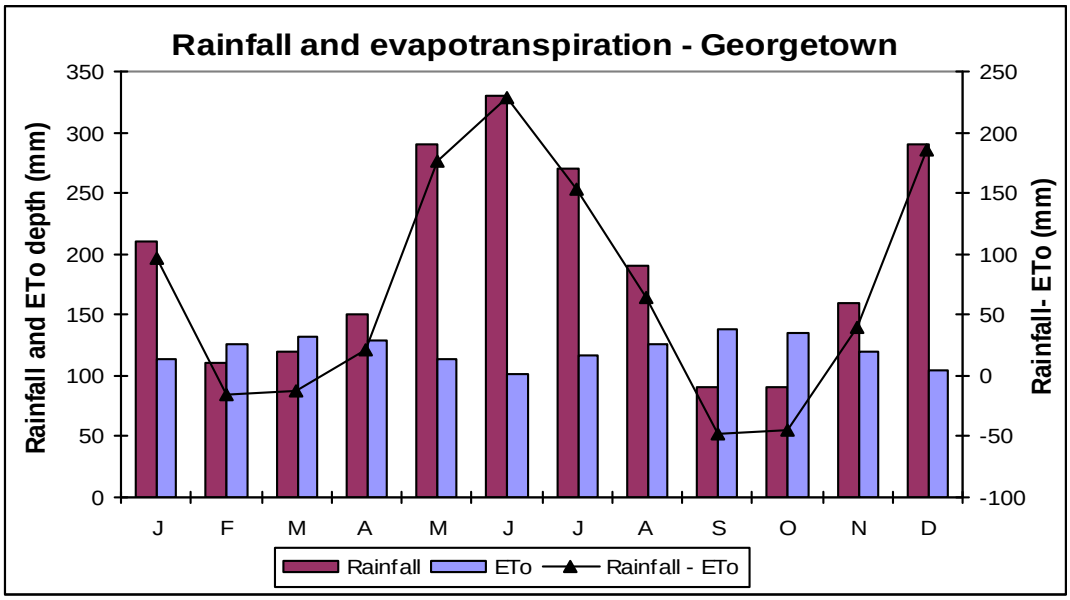
5.3 The project is located in Administrative Region 4 in Plantation Pattensen. As shown above in *Map 1* immediately to the south of the proposed project site is a proposed parking lot and next to that, land allocated for the Guyana Office for Investment (GO-INVEST). To the north of the proposed site is an empty plot of land, while to the south is the current construction of a private medical school. To the east is a drainage canal that separates plots of land that currently accommodates the Arthur Chung Convention Centre (ACCC) and the Giftland Shopping Mall. It is, therefore, evident that the proposed project is in an area that is environmentally denuded, but may have social implications for those areas in close proximity to the site.

Climate

5.4 Guyana is located in the Equatorial Trough Zone (ETZ) and its weather and climate are influenced primarily by the seasonal shifts of the ETZ and its associated rain-bands called the Inter Tropical Convergence Zone (ITCZ). Secondary influences on the climate are of Pacific origin. Formation of El Niño Southern Oscillation (ENSO) and La Niña can disturb the regular location of ITCZ and thus results in higher or lower than normal rainfall at specific locations, such as the proposed project site. These events are predicted to become even more intense in the Caribbean region due to climate variability (IPCC, 2007)[20]. The El Niño/La Niña weather events are primarily responsible for inter-annual variation in rainfall. This has implications for possible flash and coastal flooding in proximity to the project site and would therefore necessitate effective drains, with appropriate capacity, to mitigate this possibility. Drains to the west of the main access road to the proposed site and along the railway embankment are in need of recurrent maintenance as they are secondary drains that empty into the Downer Canal, and then into the Atlantic Ocean via the Liliendaal Pump Station. Drainage within the ADI falls mainly to the Mayor and City Council (M&CC) of Georgetown, with assistance provided by the National Drainage and Irrigation Authority (NDIA).

5.5 But flooding is not the only threat to the proposed site. During the El Nino period the area becomes dry and persons seeking to clear land often use the most cost effective means, which is burning of the scrub-like vegetation. This is an anthropogenic threat, but one which the project will need to be cognizant of.

Figure 3: Rainfall and Evapo-transpiration Patterns in the Coastal Zone



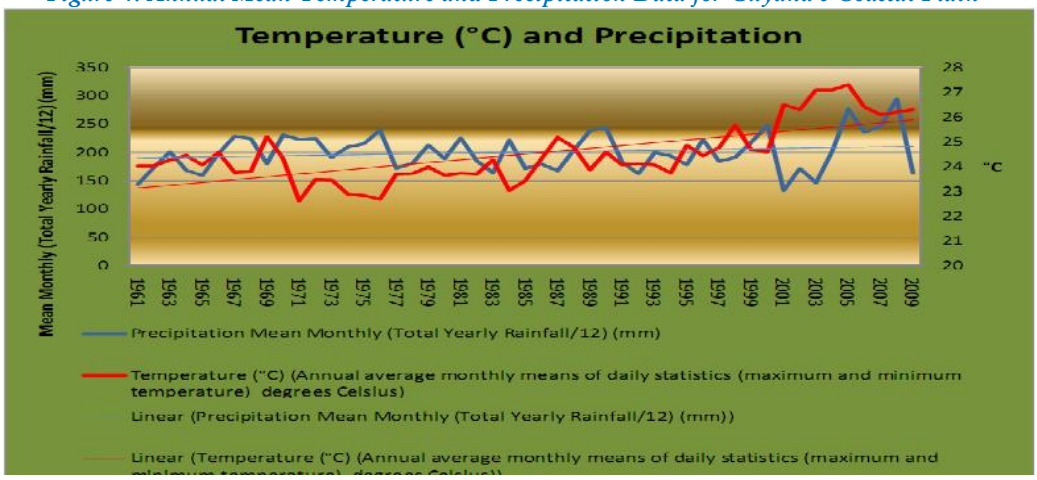
Source: Hydrometeorological Division, Ministry of Agriculture (2015) (Botanical Garden Station)

[20] The last ENSO event was in 2015/2016. This severely impacted the agricultural sector, the quality of freshwater supplies and the livelihoods, mainly of rural and hinterland small scale farmers (Ministry of Agriculture, 2016). In fact, Region 9 was declared a disaster Region.

5.6 Guyana as a whole has a tropical climate. The project falls within a zone that is characterised by two wet (April-July and November-January) and two dry (August-October and February-March) seasons. Information on rainfall was obtained from the Botanical Gardens that falls just outside the ADI. Annual rainfall within the project area is generally in excess of 2,000mm (see *Figure 3*). The weather pattern is largely determined by the Inter-Tropical Conversion Zone (ITCZ). The maximum and minimum instantaneous temperatures are 32°C and 25°C respectively. Along the project zone, the temperatures are moderated by north-east trade winds. Relative humidity ranges from around 95% during mid-morning and drops between 50-75% by mid afternoon (Hydrometeoreological Department, 2015).

5.7 The Hydrometeorological Division (HD) within the Ministry of Agriculture (MoA) has limited climatological data for locations away from the coast, with the data for places like Annai and Kurupukari being incomplete. As such, the climatological data available to the consultant came mainly from secondary sources. This data is also more current than data obtained from the HD. Mean precipitation and temperature data for Guyana's coastal plain are shown in *Figure 4* below. All the available rainfall data confirm the occurrence of the bimodal annual precipitation along the project site.

Figure 4: Annual Mean Temperature and Precipitation Data for Guyana's Coastal Plain



Source: Kirton *et al* (2010)

Air Quality

5.8 Currently, there are no ambient air quality monitoring stations in Guyana which would help establish baseline air quality for air pollutants. The most significant emissions to the atmosphere in this project will likely result from dust during the construction phase, and emissions associated with the movement of motor vehicles to access the project site.

5.9 Emissions from the vehicles are sulfur dioxide (SO2), nitrogen oxides (NO), carbon monoxide (CO), particulates, and volatile organic compounds (VOCs). Small quantities of greenhouse gases (GHG), (particularly carbon dioxide) as well as small quantities of hazardous air pollutants and metals are also released primarily as a by-product of oil combustion. There are no nationally developed regulatory air quality standards in Guyana to which the impacts from the project can be compared.

5.10 The World Bank (WB) and the National Ambient Air Quality Standards (NAAQS) promulgated by the United States Environmental Protection Agency (USEPA) were developed to be protective of human health (primary standards) and the environment (secondary standards). The WB standards

provide levels that are well established in law and should be used for evaluating air quality for the project.[21]

Topography

5.11 Generally there is little variance in the topography throughout the proposed project, with the project site being flat in the main. According to the topographic maps of Guyana both the ADI and the AII (Georgetown) vary between 1 - 2 feet (0.3m – 0.65m) in elevation, making the area particularly susceptible to flooding. However, the areas from which the construction materials, such as sand and stones, are projected to be transported are well above sea level).

Geology and Soils

5.12 According to the geology of the country and the resource map of Guyana (1992) the proposed road traverses an area underlain by the Demerara Clay and the Coropina Formation[22]. The Coropina Formation was developed during the late Pleistocene. During this time, the ocean receded and the soft tidal flats and sandbars were subjected to strong erosion and weathering. As a result, the Coastal Plain was crossed by old shorelines and ridges, oriented parallel with the current shoreline. The erosion and weathering caused clays exposed by the receding ocean to become oxidized and firmer in consistency by loss of water. The result of erosion, weathering, and shifting shoreline was the development of the Coropina Formation. In post-glacial times, the sea rose to its former level inundating the Coropina Formation and resulting in the laying down of the soft clays of the Demerara Formation, which surrounded the Coropina "islands" and filled river valleys.

5.13 The younger parts of the Demerara Clay formation are recent in age; clay indistinguishable from the Demerara Clay is being added at the present time to parts of the coast. The upper clays, upper sands, intermediate clays and lower or "A" sands units compose the Demerara Clay and Coropina Formation. The upper, exposed soil is a layer of soft to firm clays underlain by an oxidized mottled zone and soft to firm silty clays called the upper clays layer. The upper clay layer has an average thickness of 150 feet (50 meters). Underlying the upper clay layer is the upper sands layer, which is composed of unconsolidated sands. The next underlying layer is an intermediate clay layer composed of clays and shales that contain lenses of white kaolin clay and unconsolidated quartz sands. The lower or "A" sands are relatively thin angular to sub-angular quartz sand beds. The average thickness is approximately 150 feet (50 meters).

5.14 The soils along the project site are classified as Category II. The Category II soils are generally suitable for agriculture with some degree of fertilization to cultivate crops. These soils are of variable depth, drainage, colour and texture which have developed mainly in transported materials and areas of natural fertility.

Hydrogeology

5.15 The coastal artesian basin consists of a recharge or catchment area, which coincides roughly with the exposed area of the White Sand Series, and an area of confinement, which is overlain by the Coropina Formation and Demerara clay and accordingly has the same extent as the coastal plain. Confinement in the "A" sand unit is caused by relatively impermeable fine-grained sediments in the overlying intermediate clay unit, the southern extent of which is not known. Similarly, no surface geological data are available concerning the catchment's area or the "A" sand. The base of the groundwater basin is at the base of the White Sand Series, except where the sediments in the deeper part of the basin contain saline water, which forms the lower limit of the usable supply.

[21] While reference is often made to the World Health Organisation's (WHO) standards, these are mere guidelines and as such the US EPA's NAAQS and World Bank's standards are felt a better baseline for the project.

[22] Unfortunately, the Guyana Lands and Surveys Commission (GLSC) does not have soil capability and resource maps for Region 4 in which the project falls. Rather, there are maps for Guyana as a whole.

5.16 Recharge from rain and seepage loss from streams in the catchment area replenishes the groundwater reservoir. Although there are essentially no well data in the catchment area it is logical to assume that groundwater moves generally northward, a part entering the permeable sections of the White Sand Series and a part probably being rejected, at least in the extremely wet seasons of the year as discharge to creeks and streams along the inland edge or the Coropina Formation. The part moving northward in the confined aquifers is discharged through the artesian wells, or seeps through the confining beds, being discharged by flow into streams or by evaporation and transpiration, or by submarine discharge some distance offshore.

5.17 All wells that have been completed at a depth greater than the base of the Demerara Clay are flowing artesian wells. In general, the head in the upper sand unit has ranged from 1.0 to 1.5 m above ground level. Most of the stakeholders within the ADI of the proposed project site are provided with drinking water via a well located within the University of Guyana's compound at Turkeyen, i.e., about 1 kilometre from the proposed project site. It is very unlikely that construction and operational works will compromise the quality from this well or add effluent to this important water body.

5.18 Recharge from rain and seepage loss from streams in the catchment area replenishes the groundwater reservoir. Although there are essentially no well data in the catchment area it is logical to assume that groundwater moves generally northward, a part entering the permeable sections of the White Sand Series and a part probably being rejected, at least in the extremely wet seasons of the year as discharge to creeks and streams along the inland edge or the Coropina Formation. The part moving northward in the confined aquifers is discharged through the artesian wells, or seeps through the confining beds, being discharged by flow into streams or by evaporation and transpiration, or by submarine discharge some distance offshore. All wells that have been completed at a depth greater than the base of the Demerara Clay are flowing artesian wells. In general, the head in the upper sand unit has ranged from 1.0 to 1.5 m above ground level.

Surface Water

5.19 Guyana has an extensive network of rivers and streams that have many rapids and waterfalls with an absence of naturally occurring lakes. About 10 percent of the country's drinking water comes from surface water. Many meandering creeks drain into these rivers across the low relief paleorift valley. Along the eastern and northern sections of the project site there are open drains that connect and empty into the Liliendaal primary drainage canal. These drains are largely in need of routine maintenance which is the responsibility of the M&CC and the NDIA (*Picture 8 & 9*). This has the potential of increasing the possibility of flooding in the area[23].

Picture 8: Southern Canal in front of the Authur Chung Convention Centre in the Background. The tertiary drains will flow into this canal	*Picture 9: The Access Road leading to the Giftland Mall bordered by the drain on the west that separates the Project Site from this Road*
	

Source: Consultant's Photographs (2016)

[23] Once the drainage system map is collected from the M&CC these possible areas will be reflected in the ADEI.

5.20 Water from the project area is expected to be discharged into the drain to the east of the. These waters should then drain into the canal that runs east to west along the southern side of the Railway Embankment Road, connecting to the Downer Canal which then empties into the Atlantic Ocean. However, due to the lack of connectivity to this southern drainage canal, the site is emplodered and subject to flooding. There is a shortage of water quality data for the project site and its immediate surroundings. Nonetheless, surface water samples were collected at strategic locations in January to March, 2011 for a project that is in close proximity to the project site. The sample points were chosen based on areas that are considered to be high risk, such as, the Downer Canal or where there is potential contaminated effluent discharge, such as at the point where the railway embankment intersects with the northern canal. The samples were analysed by the Guyana Analyst Food and Drug Department (GA-FDD) and the Institute of Applied Sciences and Technology (IAST) to determine the presence and concentration of specific constituents.

5.21 The results of the analyses are presented in *Table 6* below. The results at the 2 locations indicate levels of total suspended solids that were above the US EPA limit. The total suspended solid (TSS) is a qualitative characteristic which is impacted by solids obstructing the transmittance of light through a water sample. Turbidity is an important water quality indicator and confirms the presence of disperse, suspended solids, slits, clay, algae and other micro organisms, organic matter and other minute particles. Samples taken from the 2 points revealed that point number 2 was very turbid since the level recorded for this point was above 50 NTU. Oil and grease analysis reveals the total concentration of a family of organic compounds including nonvolatile hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases, and related matter. It has been confirmed that even at low concentrations and with release from nonpoint source inputs, oils and grease is toxic to aquatic life, reduces levels of Dissolve Oxygen (DO), alter the usability and aesthetic of water bodies (USEPA, 1999). In our analysis very high levels of oil and grease were detected at the Northern and Railway Embankment Canal juncture.

Table 6: Water Quality Test at Two Points Related to the Project Site

Parameter	Unit	MRL	Liliendaal Canal (1)	Northern and Railway Embankment Canal (2)
Nitrates	mg/l	10.0	4.20	7.80
Total Suspended Soils	mg/l	25.0	24.00	122.00
Total Dissolved Soils	mg/l	250.0	232	372
Iron	mg/l	10.0	1.97	4.46
Ph	mg/l	9.0	7.10	7.01
Oil and Grease	mg/l	1.0	Not detected (ND)	13.50
Phosphate	mg/l	6.0	1.49	1.38
Biological Oxygen Demand	mg/l	30.0	0.198	0.004
Turbidity	NTU	25 – 50	13.00	127.50
Dissolved Oxygen	mg/l	0.5	7.20	7.05
Escherichia Coli (E. Coli)	MPN/100ml	400	TNTC	TNTC

Source: Sheriff Street – Mandela Avenue Road Rehabilitation Project (2011)

5.22 Dissolve oxygen (DO) is the actual amount of oxygen available in dissolved form in a body of water. When levels of DO drop below the required range, life form in surrounding water is unable to continue at a normal rate. The decrease in oxygen supply then has a negative effect on fishes and other aquatic life. Fish kills and an invasion and growth of certain types of weeds can cause dramatic changes in a stream or other body of water. Levels of DO recorded at the 2 points were all above 0.5 - 6mg/L and this is a clear indication that sufficient amount of DO is available at the sample points tested to support aquatic life.

5.23 Lastly, the coliforms results were noted. Coliforms are bacteria which are naturally present in the environment. They are generally not harmful themselves, but are used as an indicator that other, potentially harmful bacteria may be present. The potentially harmful bacteria, fecal coliform bacteria or E. Coli bacteria, may indicate that the surface water has been contaminated with sewage and/or

animal wastes (including human). Water samples collected revealed that at the 2 sample points there was heavy contamination with total coliform bacteria. Using the MPN count colonies from samples of 100ml of water it was found that they were all too numerous to count (TNTC). This is a clear indication that all point tested are subjected to contamination from animal or sewerage discharge.

Natural Habitats and Wildlife

Vegetation

5.24 To assess the vegetation along the project route two squares were randomly selected along the ADI. Each square was approximately 50m by 50m. The areas selected were the zones north and south of the proposed project site. It was found that the vegetation within the ADI includes patches of vegetation dominated by Muri (*Humiria balsamifera var. balsamifera*) scrub and grasses. Vegetation within 10m of the project site is dominated by Congo Pump (*Cecropia sciadophylla* and *C. obusa*), Fire rope (*Pinzona coriacea*) with strong patch dominance by cowtail - *Andropogon bicornis*, razor grass – *Scleria* spp. and savanna grasses (*Panicum pilosum*). In the drains there is a large segment of water lilies and duck weeds. In some locations along the railway embankment, and outside the ADI, residents and proprietors have sought to beautify their areas through planting flowering plants. These plants include Bouganvilla (*Bougainvillaea glabra*), Ixora (*Ixora coccinea*), Hibiscus (*Hibiscus rosa-sinensis*), King of flowers (*Lagerstroemia indica*) and Eucalyptus.

Wildlife

5.25 A similar methodological approach was applied to the faunal survey as in the case of the vegetation survey. Informal discussion with some residents also helped to inform the fish survey information. Very few animal species were found at the location, which is used as a an informal pasture for cattle for residents living in nearby communities at Cummings Lodge, Liliendaal and Sophia. The drains did show some fish life in the form of some popular species such as the Sunfish (*Crenicichla alta*), Huri (Hoplias malabaricus,), Patwa (*Cichlosamu binaculatum*), Silver bait (*Astyanax sp.*), and Hassar (*Hiplesternum littorale*). Some of these fish species are harvested by residents along the Railway Embankment segment, and the drains to the east and west of the proposed project site in particular on weekends. These help to supplement their protein diet requirement, as well as they are caught as a sport. It will be necessary for the ESMP to address this issue by developing a communication plan that will advise residents on how this issue will be managed for the duration of the project, especially as it relates to health and safety considerations.

B. Land tenure and Rights

5.26 In Guyana, three types of land tenure obtains. These are: (i) lands owned either publicly by the State/government land,[24] (ii) privately owned under freehold tenure[25], or (iii) cooperatively as in the case of Amerindian lands. Given these categories of land, the main identifiable tenure system in the project area is State-owned and freehold lands. In the case of the former, some of these lands have already been leased to private interest, i.e., the Giftland Mall and the Medical School; while others like the land to accommodate the Demerara Estates (a private housing development at the Southern end of the project site) was sold to a private developer. The plot of land for the proposed project is leasehold State land. These are generally lands that have been granted to individuals or organizations/entities by the government on long term leases, often for as much as 99 years. This allows the developer to use these lands as collateral and they pay an annual land rental. **Before such lands are issued, a business and/or development plan is required by the Guyana Office for Investment (Go-Invest) and the GLSC.**

[24] This regime includes State Lands (Crown Lands) for agriculture, mining and forestry purposes, and Government lands. In this regime, the land administration functions are exercised by the Guyana Geology and Mines Commission, the Guyana Forestry Commission, and the Guyana Lands and Survey Commission.

[25] Freehold refers to land owned by persons who hold title deeds to the properties. Freehold lands are also referred to as "proprietor's land" or "bona fide" land. Freehold is generally located along the sea coast and riverbanks in the first depth and benefit from the best conditions regarding transportation, drainage and irrigation, and soils.

5.27 However, there seems to be little threat of resettlement of any of the stakeholders in this area due to the fact that this is a yet largely undeveloped area and the project is to be sited on a vacant piece of land, owned by the State.

Land Use

5.28 The land use pattern in the project area is a function of a number of factors: climate, soil type, topography and culture. For example, the climatic conditions along the coast are ideal for cash crop farming, with these being the major sources of income, nutrient, employment generation, and food supply for some of the lower income residents of Industry, Cummings Lodge, and Sophia. At the same time, the area of the proposed project is largely an area that is beginning to see development, occupied mainly by service type entities, both within and outside its area of direct influence. These include the Caribbean Community (CARICOM) Secretariat Headquarters, the Authur Chung Convention Centre, the Hinterland Scholarship Hostel and the Project Dawn Compound to make a few (*see Map 2 and Pictures 10 – 13 below*). However, there is a vibrant community on the northern section of the Railway Embankment Road, but this falls outside the ADI (*Picture 14*).

Picture 10: The CARICOM Secretariat Headquarters

Picture 11: The Giftland Mall

Picture 12: The Medical School Building Under Construction

Picture 13: The Project Dawn Compound

Source: Consultant's Photographs

5.29 Land use planning within the project zone or ADI comes under the control of the Central Housing and Planning Authority (CH&PA). This entity devised a Greater Georgetown Development Plan (GGDP) 2001 – 2010. Interestingly, this Plan does not propose any zoning within the City, but rather outlines policies for the orderly development of Georgetown. The absence of such zoning may partly be responsible for the changing land use occurring within Georgetown and Greater Georgetown.

Picture 14: The Liliendaal Community located on the Northern Section of the Railway Embankment Road

Source: Consultant's Photograph

C. Demographic Socio-economic Context

Introduction

5.30 The entire population of Georgetown and Greater Georgetown was measured at 191,180 according to the 2012 National Population Census with approximately 15% of these being found in the Industry, Cummings Lodge, Turkeyen, Pattensen, Liliendaal and Sophia areas. These communities are in the main mixed, with various ethnic groups present. The persons are both self-employed in occupations such as retailers, taxi drivers, tailors and seamstresses, barbers and cosmetologists, while others are employed with the government as public servants (teachers, clerks, accountants, etc), or private sector bodies (banks, insurance and beverage companies). What follows is a brief description of demographic and socio-economic features bordering the project site, but outside of its area of direct influence.

Demographic information

5.31 The project will be carried out in a fairly undeveloped area. However, to access that area would require passage through many built up communities east and west of the proposed project site. These include the Industry, Cummings Lodge, Turkeyen, Pattensen, Liliendaal and Sophia communities. The total population of these communities is shown below in *Table 7*.[26] Based on the last population census in 2012 it was calculated that approximately 27,867 persons were living just outside the project's catchment area with a population density of 340/km² (Guyana Population

[26] Please note that the Statistical Bureau of Guyana is yet to release the breakdown of this census data by village and gender.

Census, 2012). It is quite possible that this number has increased since that time due mainly to rural-urban migration[27]. Moreover, with the growth in the population along the railway embankment and boom in construction activities generally, there has been increased pressure placed on the Railway Embankment and Sophia Access Road corridors.

Table 7: Population Statistics of Communities that may be Indirectly Impacted by the Proposed Project

Villages	Total
Industry	2222
Cummings Lodge	7246
Turkeyen	6599
Pattensen	5013
Liliendaal	3100
Sophia	3687
Total	**27,867**

Source: Guyana National Census (2002), Bureau of Statistics, Georgetown

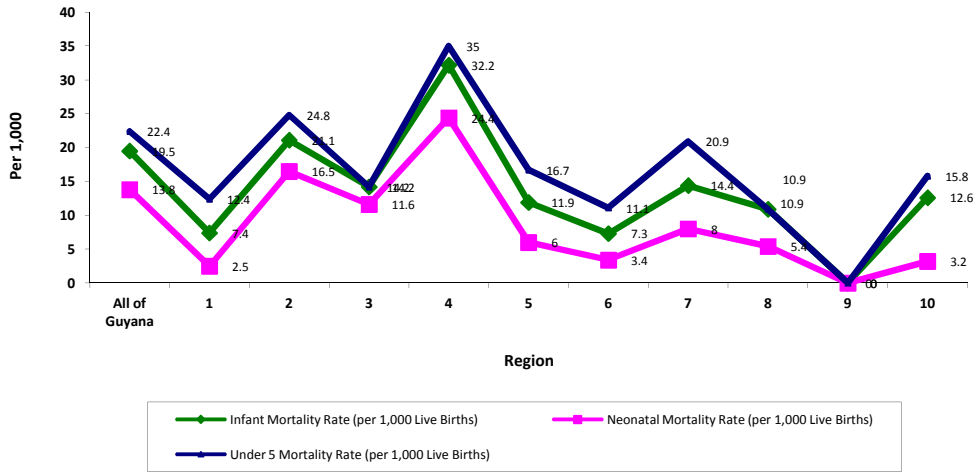
5.32 While we were unable to calculate the sex ratio because of the paucity of disaggregated data by villages[28] in cases where the male population is larger than the female population, it may affect the employment situation in the city, forcing some men to seek employment away from the city in sectors such as mining and forestry.

5.33 The average household size for communities in the ADI was estimate at approximately 5 persons. Nearly one-third of all households are said to be headed by women with the trend being more pronounced in the city. Approximately one-third of the population is younger than 14 years.

Health

5.34 Life expectancy at birth averages 64.8 years for the total population of Guyana. For men, it is 61.5 years and for women, 68.2 years. No data is available on life expectancy for the project area. Furthermore, the MoH does not keep mortality figures on the project area, rather, information is kept on the entire Region 4. Infant mortality rate (IMR), representative for children less than one year old and a vulnerable group, is approximately 32 for every 1000 live births in Region 4 (Ministry of Health, 2012). This is the highest for all the Administrative Regions in the country (*Figure 5*).

Figure 5: Mortality Indicators, 2012



Source: Ministry of Health (2012) Statistical Bulletin, Brickdam

[27] This assumption is based on the fact that most of economic, social and educational facilities are located in Georgetown or close to Georgetown, inclusive of the main University Campus, the Cyril Potter of Education, the Main Banks, all the Ministries and the best public and private schools. This is against the national trend where emigration has resulted in almost no population growth between, but rather a decline since 2002.
[28] The last census data is 14 years ago and that information was considered too dated to be of much use in this report.

5.35 Despite increases in government's outlay on health care in Region 4 and the construction of more diagnostic centres IMR remains high amongst the poor segments of society due to poor prenatal care and more persons having children at a younger age on one end of the spectrum and older women having children on the other end (MoH, 2012). Early childhood mortality is usually utilized as an indicator of poor nutrition and poverty by the World Health Organization (WHO). The Guyana Population and Census Report (2012) indicated that for Region 4 children dying before the age of 5 were 31 per 1000. The reasons for these high child mortality rates were ascribed to children suffering severely from two of the most commonly cited diseases in that region; worm infestations and acute diarrhoea.

5.36 In recent years, there have been improvements and expansion in a number of public health facilities in close proximity to the project site (*see Map 3 attached*) and indicators in Guyana generally. Furthermore, major hospital complexes are all no more than 6 km from the project site. All the facilities offer primary care, thus indicating that the project site would be well served with medical facilities and personnel.

5.37 The total fertility rate dropped from 6.1 in 1960 to 2.3 in 2012. The number of births attended by trained medical personal rose between 2002 and 2010 from 88% to nearly 97% (Ministry of Health, 2012). In urban areas, nearly 100% of the population has access to both drinking water and sanitation facilities.

Education

5.38 The Constitution of Guyana articulates that "*every citizen has the right to a free education from nursery to university*". Consequent to that constitutional decision, education became overwhelmingly a public service provided through the Ministry of Education (MoE). There is a nursery school, 3 primary schools, 2 secondary schools, a teachers training college and the University of Guyana that fall within a 1 mile radius of the project site (*see Map 3 attached*)**.** However, given the location of the proposed site, it is not anticipated that during construction or operations that vehicular traffic or other activities will in any way impact the activities, directly or indirectly of these institutions since most are present to the east of the facility and in built up areas.

Utilities

5.39 A number of utilities are available within the ADI of the project, inclusive of the Guyana Water Incorporated (GWI), the Guyana Power and Light (GPL) and the Guyana Telephone and Telegraph (GT&T). Within the ADI 98% of the buildings access drinking water that is piped into their dwelling, yard or plot (GWI, 2015). The GWI currently provides 100% coverage to the areas within the project zone in terms of drinking water provision. This includes both piped water and well water. However, major concerns surround the quality and reliability of this water supply. For this reason, and given changing climatic conditions, some consumers supplement their water demand via rainwater harvesting.

5.40 Water is viewed as being very affordable at a cost of G$180/m^3 (approximately US$0.88/m^3)[29]. It was further related that the average household consumed 30m^3 of water per quarter at a cost of G$1,827.00 per month[30]. This volume of consumption was equated to the consumption of five (5) filled 400 gallons polyurethane tanks. It is worthwhile noting that bottled water and purchasing water from specific sources have become popular in Guyana, with 32% of residents being engaged in these activities in Region 4, using these as their main source of drinking water (UNICEF, 2010). This adds to the household budget and may be a reflection of the quality of water provided by GWI, since unsafe drinking water can be significant carriers of diseases such as trachoma, typhoid and cholera.

[29] This is the commercial rate.
[30] The domestic rate is approximately G$60.90/m^3.

5.41 The GT&T and the GPL provide telecommunication and electrical supplies to entities within the project zone. All the buildings within the project area are said to have access to both electricity and telephone facilities, if so required. The utilities main pipes (in the case of GWI) and poles (in the case of GT&T and GPL) are currently located within the project site and the services can be easily accessed.

Living Conditions and Income

5.42 According to the Guyana Census Report (2012) most of the persons employed and living within the AII of the project are employed in the areas such as elementary occupations (21%), clerks (20%), sales personnel (18%), technicians (15%), professionals (13%) and legislators and senior managers (10%). These employment avenues are carried out both independently and as paid labour. Furthermore, they are a reflection of the level of education attainment. The project has the potential of providing some short-term employment during construction mainly in the technical and elementary category areas.

5.43 Labour force participation has remained low in Guyana, falling from 60% in 1992/93 to 54% by 2008 (*Table 8*).[31] This may be a reflection of the influence of the growth of the informal economy as less persons are documented as working, even though they may be employed in areas such as mini-bus drivers or conductors, taxi operators, many workers in the construction industry that are undocumented, and those who are self employed (Faal *et al*, 2002). The rate for men in 2008 being roughly what it was in 1992/93, demonstrating the fluctuating production performance of the Guyanese economy, while that for women increased from 39% to 47.3% over the same period reflective of the expansion in the service industry and the growth of single parent households as more women moved into areas of security services, factory operators and store clerks to assist with the maintenance of their families.

Table 8: Guyana Labour Force Indicators

Labour Force Indicators	1992/93	1999	2002	2008
National Labour Force Participation	60	57	56	54
Female Labour Force Participation Rate	39	39	45	47.3
Male Labour Force Participation Rate	81	76	90	84.1
National Unemployment Rate	12	9	12	9.1
Female Unemployment Rate	18	14	15.1	-
Male Unemployment Rate	8	6	10.1	-
Persons Outside the Labour Force	40	43	44	-

Source: *World Bank (1993) Guyana's Household Income and Expenditure Survey, Bureau of Statistics (2000), Guyana's Survey of Living Conditions, and Bureau of Statistics (2004) Guyana's National Census – 2002, United Nations Data (2010).*

5.44 However, this finding should not gloss over the fact that there are still sharp differences in participation in the labour force in Guyana. Guyana has the lowest female participation rate in the region, and the widest gender participation gap (World Bank, 2009). Even considering other factors that affect the decision to join the labour force (marital status, ethnicity, or area of residence), the participation gender gap remains strong. This suggests the existence of distinct gender roles in Guyanese society that create a disincentive for women to participate fully in the labour market (ibid, 2009).

5.45 Based on the information provided in the last Census, a Poverty Map was constructed for Guyana.[32] The document published in September 2005, considers information related to the access of households to basic services in order to measure poverty. Two indices were composed[33]: Living Conditions Index (or LCI) and Enumeration District Marginality Index (EDMI). Since no data on household consumption was provided, the EDMI may be considered as a "better" measure of

[31] CIA Worldfact Book (2010).
[32] Skoufias, E (2005) *Poverty Map for Guyana,* World Bank, Washington, DC.
[33] The way these indices are calculated can be further consulted in the mentioned document.

poverty than the LCI, since it considers a wider variety of variables, which are correlated with the level of household consumption.

5.46 The poverty indicators are not provided for communities in the AII of the project but for Georgetown generally. The EDMI showed that the City of Georgetown and the suburbs had indices of -1.208 and -1.0961 respectively (Enumeration District Marginality Index, 2005) [34]. It is known that generalisations would often cloud over area specific issues, but these figures do provide a guide.

D. Cultural and Archaeological Resources

5.47 In addressing the cultural and archaeological resources of the proposed development three aspects were examined:

- archaeology,
- historic resources, and
- general archaeological potential of the area.

Contact was made with the Walter Roth Museum of Anthropology to gather information on important or contentious archaeological resource of the area. A similar enquiry was made of the National Trust (Guyana). The investigation revealed that there are no known cultural or archeological resources within the project site.

E. Common Property

5.48 The existence of common land in the project area was investigated through examination of maps, review of reports from GLSC's Guyana Land Administration Support Programme (GLASP) concerning land tenure regularization, and local consultation during fieldwork. This work confirmed that all land in the project areas is leased to individuals/companies, is held privately (freehold), or owned by the Government. Consequently the project will not have any effect on land as a common property issue. However, proper demarcation of boundaries and outlines for public thoroughfares, such as ingress and egress, and the boundary lines for the rehabilitation of the drainage canals and the insertions of culverts.

F. Involuntary Resettlement

5.49 The project involves the construction of buildings to house the GNBS operations on a piece of state-owned land not currently occupied or for which is has been determined, there is no other request. As such, no buildings will need to be removed and there will be no need for resettlement based on this project.

[34] Explanations on the calculation of the Enumeration District Marginality Index (EDMI) is provided by Emmanuel Skoufias (2005) on the Guyana Poverty Map.

VI. STAKEHOLDERS' CONSULTATION

A Introduction

6.1 The assessment of the environmental impacts and development of the ESIA was guided by the deliberations of a series of consultations with stakeholders and their representatives. A range of meetings were held between August 4 and September 6, 2016 as detailed in *Section II* above. Present at those meetings was the consultant and his project assistant and representatives from the various stakeholders' organizations. The objective of the meetings was to provide details related to the project to the stakeholders and to receive feedback about issues which can guide the Client in arriving at the most effective and cost efficient solutions in pursuing this project. The consultation notes are appended as *Annex 4*.

6.2 The process often commenced with the consultant or the Bank sending a formal letter, with a brief background on the project and requesting a meeting. Once the meeting was agreed, the consultant and/or his representative attended and commenced by detailing the project scope. The consultant followed with a presentation of information compiled to date for the project area. The objective of the consultant's presentation was to obtain information from stakeholders on the accuracy of the information available in the public's domain for the project area. Stakeholders were then asked to identify possible impacts the project may have on them and/or their operations. Generally, there is acceptance about the need to build a State of the Art Bureau of Standards. However, there were a number of concerns raised and we sought to capture the more salient ones below. These are grouped under specific headings for ease of reference.

B. Drainage

6.3 It was noted by the NDIA Chief Executive Office (acting) that the poor quality of the drainage system in some parts of the project site or within the ADI needs to be addressed to ensure the structural integrity of the buildings is maintained and reduce possibility of flooding. An engineer at the National Drainage and Irrigation Authority (NDIA) highlighted the fact that water is drained from the proposed project area to outlet canals located on both sides of the proposed project site, but these connecting tertiary canals to the secondary canals remain questionable. While the NDIA does not have jurisdiction over the area, they do assist the M&CC in times of need. Both the NDIA and the M&CC agreed that the primary measure being employed to mitigate flooding in the area is the clearing of drains and canals, the maintenance of drainage pumps, kokers/sluices; and the monitoring of the water level in the East Demerara Water Conservancy (EDWC) to ensure that the water level does not surpass 57.75 GD (Georgetown datum)[35]. It was also recommended that the ground floor of the buildings to be constructed be raised to elevations of between 28 to 30 inches above ground level.

6.4 It should also be noted that this area was previously used for agricultural purposes. The changing land use pattern to built structures is likely to increase run-off, thus increasing the volume of water these drains are expected to accommodate. This again, during a changing climate regime that predicts more intense rainfall, even though for shorter periods, can expose the site to flash flooding if proper drainage planning is not executed. Given these possibilities it was suggested by both the NDIA and M&CC that culverts be installed below the access roads and also at the juncture where the eastern canal meets the southern Railway Embankment Canal to drain the area, which is currently empoldered.

C. Fires

6.5 The Guyana Fire Service noted that prior to recent developments in the area (2 to 3 years ago) fires were known to occur in the area. It was posited that while there may have been some accidental

[35] If this level is exceeded, water is released through control measures, into relief canals that flow into the Demerara River and the Atlantic Ocean, i.e., the Hope Canal and the Land of Canaan Canal.

burning, an estimated 80% of such fires were controlled burns, started by individuals who wanted to clear the area for security and development purposes, but wanted to do so at minimal cost. In recent years there have not been any reported fires at the proposed site. Nevertheless, it was noted that the design drawings for the structure will have to receive the approval of the GFS once that entity is satisfied that the buildings contain adequate fire mitigation features. Additionally, there are a number of natural fire breaks around the site with regards to the presence of the drainage canals, and access to water from the GWI that services the area.

D. Waste Disposal

6.6 While it was acknowledged that the project will improve the standards infrastructure in Guyana, leading to improved competitiveness and increased exports, the primary environmental concerns raised by both the GNBS and the PTCCB were the disposal of chemical waste and solvents. It was confirmed that these products were being stockpiled after use without a defined national approach for disposal or removal. It was reported that often other institutions and laboratories will contact the PTCCB for guidance after being referred by the EPA or out of pure frustration of not knowing what to do with said waste. The EPA would often make recommendations to laboratories to dilute or bury their waste but without any specific instructions for the executions of these measures. The entities consulted indicated that there needs to be an effective Waste Management Plan for the Project that will detail procedures for, inter alia, storage, labelling, identification of containers for storage, collection and disposal.

6.7 However, under the Prevention and Disposal of Obsolete Chemicals (PDOC) project of the Food and Agriculture Organisation (FAO) of the United Nations (UN), the PTCCB's chemical stockpiles are being removed for disposal overseas. Through the PDOC project the FAO is hoping to mobilize about US$8 million to support this work over the course of the programme which started in 2009 and will continue until 2017 (http://www.fao.org/agriculture/crops/obsolete-pesticides/news5/en/). Enquiries (by the PTCCB) into the cost of chemical disposal after the conclusion of the PDOC project in 2017 revealed that the removal of toxic chemical was is approximately US$5,000.00 per ton.

6.8 While the project may not have budgeted for a facility at which to dispose hazardous wastes and solvents produced as a result of the Bureau's work, every effort should be taken to explore the further exporting of this waste. Based on feedback from the Bureau, volumes of wastes produced are relatively small and may not make it cost effective to build their own waste disposal facility at this time. This would need further exploration going forward, but will be captured within the Waste Management Plan (WMP). Additionally, the proper transporting and storing of this waste needs to be improved to mitigate any negative externality in the event of an accident. Guiding documents that will aid with the development of the WMP would be the *Laboratory Safety Guidance* manual of the Occupational Safety and Health Administration (OS&HA) and the Environmental Protection Agency of the USA's *Laboratory Environmental Sample Disposal Information Document*.

E. Utilities

6.9 It is important to note that one of the improvements envisaged with the implementation of this project, is the improvement in social amenities such as street lighting and improvement in security. These were particularly important for the HSD.

6.10 Importantly as well, is the fact that water mains are located along the main access road to the project site. This means that any work that involves installing culverts or building a connecting road to the project site, i.e., a T-road, will necessitate some movement of these mains. This is likely to affect the other stakeholders in the ADI. The movement of these utility pipes is deemed necessary since any leakage of water below the road surface can compromise water quality and result in substantial non-revenue loss. Additionally, the need for repair works to be executed would require access to the utility lines.

6.11 The utility companies, i.e., GWI, GTT and GPL have often expressed concerns that knowledge of most projects is brought to them after the service might be disrupted or utility lines or poles proving to be an obstacle to the completion of further works. In cases such as these the developer more often than not expects that these utility companies should be ready to mobilize their resources immediately even when the party who bears the cost is yet to be determined. It was noted that the utility companies usually try to act within the best interest of consumers but compensation for the cost incurred is not always forthcoming. This project should seek to avoid these types of occurrences and involve all parties at a very early state in project design.

6.12 Furthermore, while it is expected that the proposed project will result in some short-term disruptions in the supply of these services during the construction and installation phases, it was posited that with forward planning this can be minimized. This can be done in phases/segments. Additionally, the utilities feel that there should be some financial provision made to the entities for the relocation of the project lines. It will be important to conduct a coordinated site visit with the stakeholders and the contractor prior to project commencement. This would allow the utilities to determine what changes to the existing infrastructure is needed and what cost will be attributed to same. Furthermore, the identification of a liaison from the GNBS can help with any follow up necessary between the utilities and the Client.

F. Permitting Process

6.13 Entities like the EPA and the M&CC stressed the importance of ensuring that the permitting process for the construction of this facility commences early. They indicated that in the past projects were delayed due because applications for permits were sent late. It is therefore important for the Client to adhere to the permitting guidelines and commence the application process as outlined in other parts of this document.

Table 9: Matrix of Stakeholders' Issues, their Significance and Recommended Mitigation Measures

Potential Impact	Stakeholder (s)	Phase	Significance before mitigation/enhancement	Recommendations to mitigate negative impacts and enhance positive impacts	Stakeholder (s) Responsible for this Action
Drainage					
1. Increased potential for flooding during periods of heavy rainfall	NDIA, M&CC, & MoC	DC & PC	-15	• Rehabilitate all primary, secondary and tertiary drainage canals in the area • Develop a routine and recurrent drainage maintenance programme • Observe the building code for building structures on the coast of Guyana • Ensure there is connectivity within the drainage system in the area	M& CC M&CC CH&PA, M&CC and the Client M&CC
2. Increased possibility from flooding due to over-topping of the EDWC dam	NDIA	DC & PC	-13	• Ensure that the early warning system at the EDWC is working effectively and monitoring is continuous	NDIA
3. Increased potential for water-logged soils and flooding	NDIA & M&CC	DC & PC	-17	• Ensure there is connectivity of the drainage network with the main outfall canals in the area	M&CC
Fires					
1. Increased potential for fires due to anthropogenic factors	GFS	PC	-11	• Increased public education about how to control fires • Observe or install fire breaks around the proposed project site • Avoid the use of flammable material where possible • Have the building plans approved by the GFS	GFS
Waste Disposal					
1. Increased contamination of drainage systems in the area	EPA, GNBS, GLDA, PTCCB, GA-FDD	PC	-17	• Develop and implement an effective solid waste management plan • Establish waste separation, storage, collection and removal protocols for chemical waste • Construct specialised sceptic tank with filter bed for the collection of liquid waste from laboratory operations • Ensure septic tanks and built to the M&CC specifications and serviced regularly to prevent over-flowing	Client, contractors, M&CC, & EPA NDIA M&CC
2. Destruction of aquatic life	EPA	DC & PC	-14		
3. Potential to contaminate aquifers	EPA &GWI	DC & PC	-11		
Utilities					
1. Improvement in social infrastructure	HSD	PC	13	• With the construction of the facility there could be improvement in the social infrastructure, inclusive of lighting along the main access road.	GWI, GTT, GPL and Guyana Police Force
2. Disruption of service to some stakeholders	GWI, GPL, GTT	DC	-10	• Inform persons of when the utility companies plan to work in the area	GWI, GTT, GPL
Permitting process					
1. Delay in the project due to sloth in submitting application for approval	EPA & M&CC	BC	-12	• Complete application forms for the EPA, M&CC, and CH&PA expeditiously to minimise any delays in project implementation	Client
Quality Standards infrastructure					

Potential Impact Drainage	Stakeholder (s)	Phase	Significance before mitigation/enhancement	Recommendations to mitigate negative impacts and enhance positive impacts	Stakeholder (s) Responsible for this Action
1. Improvement in the Quality Standards Infrastructure in the country	GNBS, GA-FDD, PTCCB, GLDA	PC	15		Client
2. Improved competitiveness and exports	MoA	PC	15		Client

Note: **BC –** Before Construction, **DC** – during construction**, PC** – post construction

VII. ENVIRONMENTAL AND SOCIAL IMPACTS

A. Impact Assessment Methodology

10.1 An impact rating system was employed to ensure the application of analytical rigour to the assessment of impacts. The impact rating system provides comparable ratings of impacts so that mitigation measures can be prioritized and acts as a guide to identify how and where mitigation measures can truly address impacts. The initial step in the impact assessment methodology consisted of the characterization of the project baseline conducted above. The potential impacts and the sources of those impacts were identified based on the baseline data initially compiled, and the alternatives to be followed. Impacts are classified as being direct impacts, indirect impacts or cumulative.

10.2 Direct impacts are those caused by the project itself, for example the direct consumption of land and the removal of vegetation for the construction of buildings, excavating of gravel pits, and contamination of surface water due to the operations of the GNBS facilities. Indirect (secondary, tertiary, and chain) impacts are those associated with the project which can have consequences on the people, the economy or environment. In some instances these consequences can be more profound than direct impacts due to their nature. Indirect impacts are both spatial and temporal in the extent of their consequences. A typical example may be slow movement of traffic during construction due to congestion caused by trucks transporting materials.

10.3 Cumulative impacts generate additive, multiplicative or synergistic effects. These impacts may result in damage to the function of one or several ecosystems. The project factors which contribute to the additive, multiplicative or synergistic effects on the environmental and which are attributable to the project are detailed in this document. The direct, indirect and cumulative impacts associated with the proposed project are further subdivided into the following:

- positive and negative impacts;
- random and predictable impacts,
- local and widespread impacts;
- temporary and permanent impacts; and
- short- and long-term impacts.

7.4 Positive impacts are considered as those which may lead to a consensus their outcomes will benefit the environment. Predictable impacts are considered as having a high probability of occurrence. Local impacts are those which occur in the immediate vicinity of the project. Widespread impacts are those which have a greater geographic scale and which are identifiable as being caused by project implementation. Temporary impacts lack lasting occurrence and eventually reverse themselves. Permanent impacts are those which cannot be reversed. Permanent for the intent of this ESA is considered as being the duration of a lifetime. Short-term impacts occur during construction. Long-term impacts will extend into the project operational phase and beyond.

7.5 The impacts are further categorized according to their seriousness by examining the likelihood and severity of each impact. Each impact was consequently rated as to their severity/level of enhancement and likelihood prior to the implementation of any impact mitigation measures. The impact mitigation measures were then identified and the residual rating of impacts was then classified as to both severity and likelihood.

7.6 The impact analysis examined the relative importance of the issues raised by stakeholders through the application of an impact matrix, using a formulation used by the Bank. In the first instance impacts were divided into three categories: (i) positive (+), (ii) negative (-), and (iii) neutral (0). Hereafter the characterization of the impacts was done with six (6) categories being identified. These are: (i) the level of disturbance that is likely to take place, (ii) the importance of the impact based on the number of people to be affected, (iii) the probability of the impact occurring, (iv) the extent of the impact, (v) duration of the impact, and (vi) the severity of the impact.

7.7 Each impact is then ranked from 3 to 1 with 3 being the most severe of the impacts and 1 being the least severe. The maximum score, therefore, for any impact was 18 and the minimum score was 0. The relative magnitude of the impacts was then calculated using the following formula:

$$Total\ impact = C(D + I + O + E + Du + R)$$

Where: C = Character of the impact, D = disturbance, I = Importance, O = Occurrence, E = Extension, Du = duration, R = Reversibility. *Table 10* below provides an overview of the methodological framework that was applied to the projected impacts and how these are to be interpreted.

7.8 The potential impacts are projected to occur both during the construction of the facility and the life of the project, occurring in both the ADI and the AII. Taking these issues into consideration, where possible, the impacts were looked at jointly to reduce the incidence of repetition. However, where there are clear distinctions, these are identified. What follows, is a discussion of the proposed physical, biological, aquatic and human impacts associated with the project. Additionally, at the end of the section there is a summary of the impacts under the various scenarios and the sensitive receptors identified.

Table 10: Methodological Matrix Utilised in Conducting Impact Analysis

Impact Classification			
Character (C)	**Positive (1)**	**Negative (-1)**	**Neutral (0)**
Disturbance (D)	Important (3)	Regular (2)	Scarce (1)
Importance (I)	High (3)	Medium (2)	Low (1)
Occurrence (O)	Very probable (3)	Probable (2)	Not probable (1)
Extension (E)	Regional (3)	Local (2)	Punctual (1)
Duration (Du)	Permanent (3)	Medium (2)	Short (1)
Reversibility (R)	Irreversible (3)	Partial (2)	Reversible (1)
Total	**18**	**12**	**6**
Impact Appraisal = $C(D + I + O + E + Du + R)$			
Negative (-)			
Severe	≥ (-) 15		
Moderate	(-) 15 ≥ (-) 9		
Compatible	≤ (-) 9		
Positive (+)			
High	≥ (+) 15		
Medium	(+) 15 ≥ (+) 9		
Low	≤ (+) 9		

***Source*:** Inter-American Development Bank (2006)

B. Construction Phase

IMPACTS

Air Quality

7.9 A major source of atmospheric disturbance will be from airborne particulates from soil disturbance during construction of the buildings and from vehicular traffic transporting materials along the roads (*see Table 11*). The building is expected to be concrete, using sand, stones and cement. The stones and sand are likely to come from the BK Quarries in Region 7 and the Linden-Soesdyke Highway respectively. These are likely to be main sources of dust pollution falling within the AII. These impacts will have a high probability of occurrence and a low level of severity after mitigation.

Noise

7.10 Another potential source of atmospheric disturbance will be noise generated largely during the construction of the facility. This is likely to be associated with sawing of wood, mixing of mortar and nailing of materials. However, since there are currently few buildings in close proximity to the proposed project site, the impact on surrounding stakeholders, especially if work is done during the day time, is projected to be minimal. These impacts will have a high probability of occurrence and a low level of severity after mitigation.

Soils

7.11 There may be areas within the project site where soils will have to be disturbed to lay the foundation for the structures. There could be the potential for noticeable environmental disturbance and the potential for increased soil erosion and/or removing top-soil. Similarly, the extraction of timber and other building materials from the AII, except done in a selective way, can increase soil erosion. These impacts are minor impacts of low severity and with a moderate likelihood of being realized.

7.12 Disturbance during construction of the buildings may potentially impact the balance between vegetation and built structures, the former which tends to reduce soil erosion and running water from the latter which tends to induce erosion. This is an indirect, long term impact and some localized erosion may potentially result in cumulative impacts which can extend beyond the limit of the project area. Run-off may potentially result in water flowing over erosion prone soils and create a greater likelihood of further erosion. These impacts are indirect and long-term. These are localized impacts with a negligible possibility of occurring and a low level of severity. These impacts can be mitigated by avoiding construction in fragile areas, ensuring proper soil compaction and covering open spaces with grasses and trees. The mitigation measures will result in minor residual impacts which are of medium severity and which will have a low likelihood of occurrence.

7.13 Another concern would be the disposal of waste oil from the servicing of mechanical vehicles at the work site during the construction of the complex. It is not uncommon to find waste oil being drained into soils or waterways. These can have profound impacts on the aquatic life unless properly managed. These impacts are projected to be localised, be direct and long-term. Depending on the volume of oils deposited into the waterways and the level of disposal that occurs, this can be of moderate severity. Solid waste is expected to be collected by a private contractor, and all other wastes disposed in impervious lined pits. The residual impacts will consequently be minor with low severity and low likelihood of occurrence.

Biological Resources

7.14 The construction operations, operation of power generation equipment and roadway traffic will generate noise levels higher than currently existing background levels. Increased noise levels can potentially impact animals and modify their behaviour as it relates to search for food and nutrient supplies. It may also potentially impact the location of breeding areas and migration routes, and vulnerability to predators. But given the denuded environment of the potential project site these are direct, short term and reversible impacts. These impacts are of low severity and have a low likelihood of being realized in the project site at a particular point in time. Noise impacts can be mitigated by carrying out activities mainly during the day time hours, which is what the expectation level is with regards to this project.

7.15 The project will consume land and this may result in the loss of natural habitats. This loss will be restricted to the project site and maybe some of the drains that require rehabilitation. These are direct, long-term irreversible impacts. These are minor impacts with a low severity level and a high likelihood of occurrence.

7.16 Erosion from the construction site can potentially increase sediment discharge to streams and drains located downstream of this facility. Evidence indicates that some fish species spawn in some of the

drains close to the project site, i.e., the western drainage ditch. Increased sediment discharge may potentially ruin spawning beds for fish. Further, if culverts or tubes are installed to allow the tertiary drains to be connected to the Railway Embankment secondary drains, the constriction of surface water flows at the culverts/tubes may potentially create currents too fast for some fish species to survive. The construction of the GNBS complex may potentially serve as barriers to movement of some aquatic species, especially where culverts are used. This can potentially restrict the migration of fish, though admittedly, few were found within the ADI and the water samples indicated that these would be presently mostly in the Downer Canal. These are direct, long-term and irreversible impacts.

Ground and Surface Water

7.17 Surface water quality may potentially be impacted by discharges to surface water of spilled and leaked chemicals and oils from vehicle maintenance. These are direct, short term and reversible impacts. These are moderate impacts with a medium severity level and a medium likelihood of occurrence. These impacts can be mitigated by utilization of simple preventative techniques consisting of segregated and contained areas with sumps and oil traps.

Social Impacts

7.18 *Job creation*: It is the expectation that most of the labour for the construction phase will be recruited from the communities within a 5 kilometre radius of the project site, i.e., Turkeyen, Sophia, Cummings Lodge etc. This will provide, at a minimum, some level of short-term employment for individuals, leading to gainful occupation and the retention of some of the labour power in the surrounding communities. This is also positive for family life and can be a positive, short term reversible impact. These have a high level possibility of occurrence. Most of the positive impacts related to local labour and employment creation are likely to occur during the construction phase with only minimal residual impacts being felt during the operational phase mainly with regards to building a cadre of persons who can act as maintenance personnel for the structures. However, of greater benefit is the enhanced skills which persons from the community are now expected to possess due to their exposure to the project during the construction phase. This is likely to make them more marketable, but may also act as a negative to the community as they may now seek employment opportunities outside of the villages, leading to long periods away from their homes and the contingent social implications of such absence. These impacts are therefore projected to be localized, indirect, short-term and have a medium likelihood of occurring.

7.19 *Waste*: Burial of wastes or leachates, generated by both equipment and human presence during the construction phase, can potentially impact groundwater quality. Inert, non-recyclable materials, waste water from the laboratories and cleaning of the vehicles, and waste oils will be collected, but small residues may spill onto the ground. Leaching from these spills can potentially impact groundwater quality. These are local, medium term and reversible impacts. These are moderate impacts with a medium severity level and a moderate likelihood of occurrence. These impacts will be mitigated by constructing holding and collection areas, with specialised sceptic tanks with filter beds. The waste can then be treated and released into the atmosphere once deemed safe by the EPA. The mitigation measure will result in minor residual impacts of low severity and with a low likelihood of being realized.

7.20 *Traffic congestion*: Given the volume of traffic currently using the proposed Railway Embankment Road, even with the best traffic management there is still likely to be localised delays, particularly if access to the Embankment road is via Sheriff Street. This will lead to vehicles having to cut across on-coming traffic to access the project site, leading to some delays during specific hours. As such, the project during construction is likely to lead to increase congestion. This is a direct and reversible impact with a high probability of occurring. This does not preclude the fact that every effort should be made to have an effective traffic management plan in place, with police presence as much as is practically possible.

C. Operational Phase

Atmospheric Impacts

Air Quality

7.21 During the operation of the complex a major source of atmospheric pollution would arise from the combustion of diesel and other fuels from mechanically driven vehicles and the operation of the stand-by generator during periods of power outage. Principal emission compounds will include carbon dioxide (CO_2), carbon monoxide (CO), carbons and nitrogen oxides. Emissions of sulfur dioxides (SO_2) and hydrogen sulfide (H_2S) would be dependent on the sulfur content of the hydrocarbon and diesel fuel used. The impacts of these pollutants are likely to be felt most severely by persons suffering with respiratory ailments and small children. Application of the mitigation measures will aid with managing the impacts associated with atmospheric emissions. These impacts will have a high probability of occurrence and a low level of severity after mitigation.

Soils

7.22 A major concern during the operations of the complex is the disposal of hazardous and chemical wastes (inclusive of waste oil), the former from the servicing of vehicles, testing fuel trucks and servicing the stand-by generator, while the latter will emerge largely from the operations of the microbiological and chemical laboratories. It is not uncommon to find waste oil being drained into soils or waterways and the residual oil from oil tankers ending up in water ways during testing. These can have profound impacts on the aquatic life unless properly managed. Furthermore, as discussed elsewhere in this report, in the past the GNBS has been storing hazardous chemical waste in barrels at its premises, but a more acceptable form of disposal will have to be found, i.e., exporting. Moreover the storage facilities will have to meet best practices given the proposed new location for the facility. Lastly, the entity has been known to dilute its nitric acidic residue and release the diluted solution into the waterways. These impacts are projected to be localised, be direct and long-term. Depending on the volume of oils or hazardous chemical waste that may be deposited into the waterways and the level of disposal that occurs, this can be of moderate severity. A detailed set of management guidelines for the disposal of hazardous waste and waste oil are presented in the ESMP. Solid waste will be collected in bins and collected by the M&CC and sewerage will be stored in septic tanks.

7.23 At the same time, Liquid wastes from laboratory operations are expected to be washed into a specialized septic tank which has a filter bed and stored and treated. This grey water can then be released for watering the lawns and agricultural purposes. The residual impacts will consequently be minor with low severity and low likelihood of occurrence.

7.24 The built structures may lead to the elimination of the productive capacity of soils covered by these buildings. However, the fact that the majority of lands in this area have been converted to buildings this is likely to be minimal. To the extent it occurs, this would be a direct, long-term negative and localised impact. These impacts will be minor with low severity and low likelihood of occurrence. This impact will be mitigated by minimizing the area cleared for the structures, allowing for the maintenance of green spaces. The residual impacts will be minor with low severity and high likelihood of occurrence.

Biodiversity

7.25 A critical concern is the disposal of waste and how this would affect the aquatic life in and around the project area. During use, new oils pick up toxic chemicals, carcinogenic hydrocarbons, and heavy metals which harm the environment and public health when used oil is disposed of improperly. One pint of oil can produce a slick covering approximately one acre of water. Used oil in waterways threatens fish, waterfowl, insects and aquatic life. These impacts would be medium term and reversible and would be localized to the ADI. These are moderate impacts with a moderate severity

level and a moderate likelihood of occurrence. With the indication that some residual oils escape during testing of fuel tankers, it will be important to take measures to reduce this practice by having a holding and testing bay at the new facility with the requisite collectors.

Water Quality

7.26 Increased built structures will modify the amount of run-off and the natural flow of surface water and concentrate flows at certain points and may increase the speed of surface water flow. These changes may potentially result in localized flooding, soil erosion, and increased sediment discharge to drainage canals around the project site. These impacts will be indirect, irreversible and can be localised in areas along the ADI. These are moderate impacts of high severity and a moderate likelihood of being realized. These impacts will be mitigated by putting in place adequate drainage facilities. This will result in minor residual impacts of low severity with a low likelihood of occurrence.

7.27 With the GNBS complex and the use of zinc roof, then we are expanding more impermeable covering which will potentially restrict infiltration and consequently reduce groundwater levels. This can affect aquifer recharge and access to freshwater in some of the surrounding communities that depend on well water. Furthermore, reduction in groundwater levels can potentially alter the vegetation in the site which can potentially result in changes in the habitat of fish in the area. These impacts are indirect, long-term and localized. These potential impacts can be mitigated by encouraging more rainwater collection and channelling into specific low land areas for better aquifer recharge. Further, water will be channelled to areas to ensure continuity of surface water flow. Residual impacts will consequently be minor with low severity and a low likelihood of occurrence.

7.28 With improvement in the GNBS Complex it is the expectation that the water amenities will also improve. For example, one feature of improving the Standards Bureau, while simultaneously addressing the water security issue, is the outfitting of the structures to be constructed with water harvesting facilities. This would be a positive impact of this project. The impacts identified expected to be localized, reversible and direct.

7.29 Chemicals and oils collected from sumps and segregated areas will be stored in drums and would be disposed at off-site locations. The mitigation measures will effectively remove any potential impacts to surface water quality. The residual impacts will consequently be minor with low severity and a low likelihood of occurrence. Removal of vegetative cover over new alignments in the road may potentially increase surface runoff volumes and alter drainage patterns locally in the vicinity of the rehabilitated road. These impacts will be local, long term and irreversible. These are minor impacts of medium severity and with a low likelihood of being realized.

Socio-Economic

7.30 *Economic Activities*: The GNBS complex may potentially induce further land use changes which may lead to economic advancement of surrounding communities. These are positive, direct, long-term, irreversible impacts. These are moderate impacts with a medium level of enhancement and a medium likelihood of occurrence.

7.31 *Improved Quality Standards Infrastructure*: The main purpose for the building of the building of the GNBS complex is to improve the national quality standards infrastructure. This has the potential to improve the competitiveness of products coming from Guyana, boosting exports and improving the country's trade balance. These are medium to long term positive impacts, with a high likelihood of occurring.

7.32 *Job creation*: During the consultations with the GNBS it was revealed that the facility, once completed, will be hiring approximately 120 persons, which represents an addition of 62 persons above what the Bureau currently employs or a more than 100% increase. Most of these persons will be in specialist areas and are expected to enhance the confidence persons and businesses will have conducting transactions with the entity. This will also aid with providing increased disposal income, quite likely

in many cases, to the persons being employed. This can lead to an improvement in their standard of living. These impacts are expected to be short to medium term, localised, significant with a high likelihood of occurring.

7.33 *Increase in traffic along secondary roads*: If the project decides to utilise secondary routes to access the site, such as via Sophia (using Dennis Street), then north into the University of Guyana access road, before turning west on the Railway Embankment, this is likely to compromise the integrity of these roads, many which were not built for weight of the construction material to be transported, reducing the life of such roads as well as exposing the residents to more accidents, damaging body and property. These are short term direct and reversible impacts that have a high probability of occurring. Careful planning before the project is executed and continued public consultation can help alleviate some of the negative impacts.

7.34 *Improvement in social amenities*: As indicated within the Section 6, one of the projected positive impacts from the project is attributed to improved lighting, better access roads, and improved drainage and security in the area. These are all anticipated to occur as the complex will be a Government entity and for which these supporting infrastructure will be critical. The residual impact is that all those within the ADI will also benefit from these positive externalities, which are expected to be long-term, reversible, significant and with a high probability of occurring.

7.35 *Enhanced property value*: The construction of this complex, and other infrastructure being built in the ADI is likely to lead to an enhancement in the value of the property found in surrounding communities at Liliendaal, Cummings Lodge and Sophia. While it is difficult to say what factor of the current property this is likely to be, it is anticipated that the growth in these areas will continue.

7.36 *Gender equality*: The impact on gender due to this project is expected to be minimal. Guyana is an equal opportunities country and persons are not generally hired based on their gender. This is not expected to change under this project, even though admittedly, most construction workers are still men.

7.37 *Community Relations and Participation:* An improved neighbourhood and environment generally tends to enhance community relations. Many of the communities in close proximity to the proposed project site are cohesive units, with the adage "together we stand divided we fall" never being truer than in these communities. It is the expectation therefore that the project will build upon this social capital that is present within these communities through first seeking to employ the skills present therein, rather than "importing" workers. To the extent that this is pursued, the community will then tend to have a sense of belonging and ownership, which will filter over to the operational phase of the project. The impact here is projected to be mostly positive, of a long-term, regional basis, with a medium possibility of occurring.

Table 11: Magnitude of the Various Positive and Negative Impacts Projected during the Construction and Operational Phases of the Proposed Project

Medium	Phase	Sensitive Receptors	Type of Impact (Direct/ Indirect)	Significance before mitigation/enhancement						
				D	I	O	E	Du	R	Total
Construction										
	Negative Impacts									
Atmospheric	1. Increased air pollution (dust)	Persons with respiratory ailments and small children	D	2	2	3	2	1	2	-12
	2. Increased air pollution (toxic fumes from vehicular traffic and construction and vehicular waste)		D	2	2	3	2	1	2	-12
	3. Major noise nuisance along project route	Schools and residents within the AII	D	2	2	3	2	1	1	-11
	- during the mining of raw materials and transport	Other stakeholders in the ADI	I	2	2	2	2	1	2	-11
Geology, Soils and Topography	1. Indiscriminate disposal of waste	Other Stakeholders in the ADI	D	2	2	2	2	1	1	-10
	2. Soil erosion due to removal of vegetation associated with foundation laying	Other Stakeholders in the ADI	D	2	1	2	2	2	2	-11
	3. Contamination of soil profile from	Other stakeholders in the ADI and Residents in the AII	D	3	3	2	2	1	1	-12
	- chemical and biological waste		D	3	3	2	2	1	1	-12
	- toxic waste from construction material		D	2	2	2	2	1	1	-10
	- fuel and other vehicular waste		D	2	2	2	2	2	1	-11
	- lubricants and detergents etc.									
	- chemical storage bond	ADI Stakeholders	D	1	1	2	1	1	1	-7
	- construction of camps	ADI Stakeholders	D	1	2	2	2	1	1	-9
Water Resources	1. Increased flooding due to water diversion and increased run off	Physically challenged, the elderly and children	D	2	3	2	2	1	1	-11
	2. Water Pollution	Children and residents in the ADI								
	- suspended solids and spillage of waste		I	2	3	3	2	2	1	-13
Biodiversity	1. Ecological damage resulting from construction works and clearance	-	D	1	1	2	2	3	3	-12
	2. Effect on fish life	-	I	1	2	1	2	2	1	-9
Socio - Economic	1. Congestion of the roadway, particularly at peak hours	School children and the elderly	D	1	1	2	1	1	1	-7
	2. Increased traffic through secondary streets	Children	I	3	3	3	2	1	1	-13

Medium	Phase	Sensitive Receptors	Type of Impact	Significance before mitigation/enhancement						
	3. Damage/disturbance to streets and possible increased accidents	-	I	2	2	2	2	1	1	-10
	Positive Impacts									
Socio-Economic	1. Short term job creation for residents in neighbouring communities		D	2	3	3	2	1	1	12
	2. Increased demand for supply for raw materials from local quarries and mining sector		D	2	1	3	2	1	2	11
	3. Increase in skills of workers from community		I	3	3	3	2	2	2	15
	4. Improved family life and cohesion		D	3	3	3	3	2	2	16
Operational Phase										
	Negative Impacts									
Atmospheric	1. Decline in air quality	Children, the elderly and the physically challenged	D	3	2	3	3	2	1	-14
	2. Increased congestion on Railway Embankment	-	I	3	2	2	2	3	1	-13
	3. Ground water pollution	Residents in the AII and Stakeholders in the ADI	D	3	3	2	2	2	1	-13
Geology and Soil	1. Increased pollution due to improper waste disposal	Residents in the AII and Stakeholders in the ADI	D	1	3	3	2	2	2	-13
	2. Reduced productive capacity of soils	Stakeholders in the ADI	I	1	1	2	1	1	1	-7
Biodiversity	1. Impact on aquatic life	Residents in the AII and Stakeholders in the ADI	I	1	2	2	2	1	1	-9
Water quality	1. Increased run-off	Residents in the AII and Stakeholders in the ADI	D	2	2	2	2	1	1	-10
	2. Reduction in aquifer recharge rates		D	1	2	1	1	1	1	-7
	3. Change in vegetation		I	1	1	1	1	1	1	-6
	Negative Impact									
Socio-Economic	1. Increased traffic congestion	Residents in the AII and Stakeholders in the ADI	D	2	2	2	2	1	1	-10
	Positive Impacts									
	1. Improved standards	Populace of Guyana	D	3	3	3	3	2	2	16
	2. Improvement in income for exporters from Guyana	Populace of Guyana	I	3	2	2	3	2	2	14

Medium	Phase	Sensitive Receptors	Type of Impact	Significance before mitigation/enhancement						
	3. Increased job creation and better training for staff at the GNBS	Communities near the project site	I	3	3	3	3	2	2	16
	4. Better working conditions at the GNBS	GNBS Staff	D	3	3	3	2	2	2	15
	5. Increased competitiveness of Guyanese exports	Populace of Guyana	I	3	3	2	3	2	2	15
	6. Improvement in property value	Communities near project site	I	3	2	3	3	1	2	14
	7. Better coordination amongst standards agencies	Populace of Guyana	I	3	3	3	3	2	1	15
	8. Improvement in social amenities	Stakeholders in and around project site	I	3	3	3	2	2	2	15
	9. Improved waste management system	GNBS	D	2	3	3	2	2	2	14
	10. Better output from workers	GNBS	D	2	3	2	2	2	2	13

VIII. MITIGATION MEASURES

A. Air Quality Management

8.1 The noise emissions would be limited by appropriate soundproofing of individual pieces of equipment. Equipment will be fitted with special exhaust systems (mufflers). Additionally, the employees will be required to wear personal noise-protection gear, e.g., ear protectors.

8.2 The implementation of these measures will commence during the construction phase of the Project and the Project Management Unit (PMU) will be responsible for implementation. The costs associated with these measures are part of the project costs.

8.3 All vehicles transporting materials will be expected to be covered to reduce air pollution. Furthermore, as part of the contract with the Contractor for the buildings, it should be made a condition that only trucks with covered trays should be hired.

B Protection of Soils

8.4 To reduce the impact of excavation and earth movements in the construction phase, mitigation measures are required. The exposed surface should be covered with grass and re-vegetated as soon as possible. Erosion measures are to be implemented during construction. Further, the project will be undertaken with long-term erosion and sediment control as primary considerations. Operations conducted during the rainy season will be carried out to the satisfaction of the EPA by ensuring that at no stage of the operations will there be any substantial risk of increased sediment discharge from the project site.

8.5 Natural features, including vegetation, terrain, watercourses and similar resources shall be preserved wherever possible. Limits of excavation/extraction shall be clearly defined and marked to prevent damage by excavation/extraction equipment. Permanent vegetation and structures for erosion and sediment control shall be installed as soon as possible. Adequate provision shall be made for long-term maintenance of permanent erosion and sediment control structures and vegetation. No topsoil shall be removed from the area outside the excavation/extraction limits unless approved by the EPA.

C. Biodiversity

8.6 Vegetated will be replanted once extracted. Further, construction will occur in a manner slow enough to ensure that animals can move to other locations.

8.7 Particular attention will be paid to vulnerable or conservation-worthy plants and animal species that may be affected and conservation measures will be enforced in consultation with the EPA Biodiversity Unit and the Wildlife Division in the MoP. Wildlife will be restricted access to fuel depot areas by erecting fences around the perimeter of these locations. In addition, all discharges from these facilities will be monitored to ascertain that discharges are safe for fish, as well as people.

8.8 Lastly, every effort should be made to take advantage of various stakeholders' strengths, while minimising institutional weaknesses. This would entail coordinating to the optimum level possible and across a wide array of stakeholders in carrying out: (a) environmental and social impact monitoring, (c) impact amelioration and mitigation, and (d) information access and public awareness building. These activities can be promoted through various mechanisms including co-management or partnership agreements.

D. Protection of Water Quality

8.9 Mitigation measures are required to reduce the impact on water quality. The parameters to be monitored are organic matters, pH, carbon, nitrates and nitrites mostly. Criteria for both surface and ground water to be tested are:

- Color and turbidity;
- The pH;
- Ammonium concentration; and
- The organic matter concentration.

8.9 Additionally, site clearing operations will progress in a gradual and phased manner to ensure there are no large increases in sediment discharge. Sediment control structures should be used to prevent the inflow of sediment to surface water. These control practices will include sediment traps and screens to control runoff and sedimentation. Surface runoff from vehicle service areas will be channeled to oil/water separators. All water from the oil/water separators will be skimmed prior to discharge. Drains will be provided for seepage collection and all seepage collected in these drains will be monitored before being discharged into the surrounding water bodies.

8.10 The project will undertake all aspects of the design related to the water management facilities. That work will be done before construction activities commence. The costs for the design, construction and maintenance of these facilities are an element of the project cost.

8.11 Contamination of water quality is projected to come mainly from improper solid waste disposal and the use of chemicals in the laboratories. To combat these it will be imperative for the GNBS to educate all employees about the proper and safe use, disposal and clean-up of chemicals. Lastly, it will be contingent upon the EPA, along with the GWI, to conduct regular water quality checks to ensure that the quality of the resource is not being compromised. The parameters to be measured will be those as set out in the water quality standards as followed by the EPA. The responsibility for these measures will fall to the PMU, EPA, and GWI.

E. Waste Management

8.12 The complex will be outfitted with solid waste disposal facilities and sceptic tanks. These must be kept clean at all times and measures must be taken for storage, disposal, collection, transportation and ultimate management of any solid and liquid waste material.

8.13 During construction, the contractor will be responsible for providing adequate sanitary facilities, including sanitary toilets, garbage collection, disposal and management for their operations. The Project shall take all reasonable measure to prevent spillage and leakage of materials likely to pollute surface and ground waters.

F. Workers Health and Occupational Safety

8.14 Pesticides that are non-toxic to humans, fish and livestock will be used for habitat and vector control. The Community Health Workers framework will be utilised to provide health advisory and support health services and to monitor disease vector and disease incidences. During the construction phase of the project, emphasis will be placed on providing a safe and healthy environment for the workers. A health and safety plan will be developed and implemented to ensure compliance with the regulations of the Occupational Health and Safety (OHS) Act 1997. Occupational Safety and Health plans will be implemented in the following areas:

- Occupational Hygiene,
- Illness and Infectious disease prevention and management, and

- Sewage and all types of waste disposal.

8.14 The main environmental occupational hazards to which workers will be exposed during the construction phase are:

- Dust,
- Noise,
- Heat, and
- Fumes.

Dust Exposure

8.15 The following measures will be implemented in order to decrease or eliminate respirable dust inhalation and prevent any adverse effects on workers:

- Provision of dust respirator with filters to employees exposed during the construction material,
- Minimal denudation of vegetation around the site,

8.16 These measures will assist in elimination or reduce further the very low risk of the development of lung impregnated disease by employees exposed to dust.

Noise

8.17 The following measures will be implemented to address worker health and safety related to noise associated with the construction phase:

- Control of noise levels at source via installation of silencers on exhaust system of motor vehicles,
- Provision of hearing protection to workers exposed to high noise levels,
- Warning signs in areas of high noise levels instructing employees to wear earmuffs or earplugs as required
- Measurement of sound levels in instances where it is suspected that deviations from the previous levels are occurring.

Heat

8.18 Measures to decrease the effect of increased exposure to heat will include working with adequate protective clothing to reduce the effect of heat stroke and skin cancers.

8.19 Implementation of the management program for health and safety of employees will coincide with the commencement of construction activities and will last through work on project closure. The contractors and the PMU will be responsible for its implementation and the costs for implementation are part of the project costs.

G. Workers Education and Awareness

8.20 Essential for minimizing risks and occupational issues would be for the Project to undertake an intense workers education and awareness program at the very commencement of the project. This should detail responsibilities, with clearly demarcated areas of potential hazard, waste disposal sites, etc. This will be the responsibility of the PMU, the Contractors and the Clients.

H. Community Health and Safety

8.21 The community health and safety will follow pathways that will restrict the exposure of the communities to the negative impacts associated with the program in its construction phase. These will involve improved signage, development of a public awareness program, working only during the daylight hours to ensure that the noise levels related to construction activities are in consonance with the ambient noise level, and use sprinklers to keep the dust level down. Furthermore, the main challenges to the communities' health and safety during the operational phase is likely to come from impure water quality, poor waste disposal, insufficient understanding of how to monitor a solar system, potential for fire outbreaks (particularly during the dry season when the stand-by generator is operating) and general lack of adherence to occupational safety when conducting routine maintenance to the structures. To address these challenges, an occupational health and safety manual should be prepared for the stakeholders under this project. This manual should then be rolled out at the commencement of project operations, with regular training sessions and refresher workshops. This would be the responsibility of the Contractor and the PMU.

I. Community Education and Awareness

8.22 As mentioned above, there will be need for the development of a public awareness program. This should ensure that the messages are targeted at the different interest groups and various media are used to communicate these. This will be the responsibility of the PMU.

L. Promotion of Gender Equality

8.23 This program is not expected to have any significant impact on gender equality. Nevertheless, it should continue to be monitor to ascertain that the program does not deviate from the a priori expectations. This will be the responsibility for the MIPA and the PMU.

M. Disaster Risk Management

8.24 The main disasters that the project will face are localized flooding, droughts and fires set by landowners. The project is not anticipated to exacerbate these, but may be impacted by these nonetheless. As such, it is imperative that to treat with these adequate and pragmatic mitigation measures be sought. As regards localized flooding, the project should ensure that the project site is well equipped with functioning and effective drainage systems. Further, the construction of all structures should adhere to the building standards of Guyana, where elevated structures are always recommended along the coastal plain. This would ensure that the project does not have to face the constant scourge of flooding that can weaken the foundation of structures, lead to water contamination if the chemical bonds and gas storage facilities do not adhere to these standards, damage valuables and result in the spread of water-borne diseases.

8.25 Concurrently, the project has little control over droughts but given that all the climate models are indicating more extreme El Nino type weather events unless there is a drastic cut in greenhouse gas (GHG) emissions, then it is contingent upon the project to plan accordingly. In this sense, the complex should be outfitted with a redundant freshwater storage facility. This facility should remain full at all times and will be utilized during the dry season. Monitoring this facility will be the job of the GWI and the Client.

8.26 Lastly, the GFS indicated that approximately 2 to 3 years ago fire was known to occur in the area. The Fire Prevention Officer posited that approximately 80% of these fires were caused by humans. These fires were started largely to clear the area for security and land development purposes. This approach was often viewed as most cost effective. It will be imperative that the natural fire breaks be observed, public education about fire prevention ramped up, and that the facility have fire mitigation facilities.

IX. RISK ASSESSMENT AND MANAGEMENT

9.1 According to the *National Integrated Disaster Risk Management Plan and Implementation Strategy for Guyana (2013)*, the two major hazards threatening the coast of Guyana are floods and droughts. The proposed project site falls within a flood plain. This makes it particularly vulnerable in the wet season or during periods of unseasonal rainfall, to excessive flooding. This was evident in the December 2005 floods that rose to almost 4 feet in the project site and took more than 3 weeks to be drained (ECLAC Damage Assessment Report, 2005; Civil Defence Commission, 2013). Flood in this context is defined as the temporary covering by water of land not normally covered by water. This term is a generic term to include floods from rivers, mountain torrents, water courses, and floods from the sea in coastal areas, and may exclude floods from sewerage systems. Floods occur when the natural or man-made channels are unable to carry all the water, leading to rising water flows that flow over the banks and flood the surrounding dry land.

9.2 Guyana, meaning land of many waters, is home to many river, streams and creeks. Furthermore, it utilises a complex drainage and irrigation system, inclusive of conservancies, to make the Coast habitable. As explained in other parts of this report, the country is also well endowed with ground water and excess water flows from the highlands in the south to the low lands in the north using gravity.

9.3 Over the years, changing global weather patterns (IPCC, 2015) and land use within the proposed project site have exacerbated the potential for flooding, unless the requisite mitigation measures are adopted. Floods have been recognised as potentially undermining Guyana's drive towards sustainable development with the adverse effects they have on the economy. At the same time, more frequent drought events said to be associated with the El Nino weather phenomenon (Development Policy and Management Consultant, 2009) also threaten the project site. This project aims to manage the risks that floods and droughts pose to human health, the environment, and economic activity.

9.4 The identification of areas with potential significant flood and drought risks has to be based on available or readily derivable information. No definition for the term 'significant' was provided so the consultant has the flexibility to determine which areas are considered to have a significant flood and drought risk potential within a national context. In accordance with the requirements of the terms of reference, the assessment presented in this report has considered 3 main types of flooding, including natural sources, such as that which can occur from rivers, the sea and estuaries and heavy rain and groundwater, and the failure of built infrastructures. Similarly, it considers the main source of drought as being derived from natural sources.

A. Rainfall Flooding

9.5 As discussed earlier, Guyana has a bimodal weather pattern, with two wet and two dry seasons. Rainstorms occurring in the areas of the various catchments of Guyana generate surface water runoff that converges and flows through the various drains, rivers and streams. This is a result of the specific climate and watershed characteristics found in Guyana, and more specifically, within the project site. Rainfall events can range from a couple of minutes to days and given that all watersheds are large, and the project area is close to the sea in a low elevation area, surface runoff is rapid and is often synchronized with the rising and the falling of the tide in the Atlantic Ocean.

9.6 During the rainy season, the tertiary and secondary drains are reactivated with runoff water flowing for a couple of hours in some areas following the end of a rainfall event, as drainage is heavily dependent on the falling of the tide in the Atlantic Ocean. It is further noted that the lower parts of some of the larger catchments have become urbanized around the low-lying coastal areas. The original watercourses have become incorporated into the development footprint and some of the catchment areas have been converted into housing schemes and other social infrastructure. Intense rainfall does lead to localise and flash flooding around the proposed project site in communities such as Sophia and Liliendaal. Some urban areas have been made susceptible to accumulation of surface

water runoff due to lack of foresight and failure to provide rainwater infrastructure alongside the advance of urban sprawl and other areas that formerly provided areas of percolation.

9.7 Although there is incomplete information on past flood events in the proposed project site, the following observations can be made (*some of these were observed on September 2, 2016 during a rainy episode when the site was visited*):

- Flooding occurred as a result of uncontrolled surface runoff following intense rainfall events,
- Flooding occurs due to rainfall and thus tends to be most severe during the November to December and May-June months,
- Some of the adverse consequences associated with past flood events were the result of a very limited public perception of the flood risk,
- The lack, and insufficient maintenance of an adequate storm water infrastructure is one of the main problems leading to flooding,
- The most widespread consequence of past flood events is the disruption of traffic and economic activities as a result of the temporary covering of some surrounding roads and streets, and
- In most cases a combination of rapid urbanisation and planning which did not integrate storm water control led to the modification of the flood plains which are then flooded by street surface runoff with the onset of intense rainfall events.

B. Flooding from the Sea

9.8 The project is approximately 1,500 meters from the seawall that helps to protect the coast of Guyana from rising sea levels. This coastline is often exposed to saltwater over topping during above normal high-tide events. Additionally, there is the possibility of saltwater intrusion into the freshwater system during periods of extreme drought. While the site is not immediately in danger of being flooded from the sea, the Rupert Craig Highway that runs parallel to the seawall, has been known to experience localise flooding.

C. Flooding from Infrastructural Failure

9.9 Most of the agricultural lands on the coast and the water system that serves this site receive their water from the East Demerara Water Conservancy (EDWC). This is a body of water with catchment area of approximately 200 square miles that is empoldered by a system of earthen dams. The dams serve both the purpose of flood prevention and the retention of irrigated water. The system operates in a manner that often results in water being released into the main drainage canals at (i) Sara Johanna, (ii) Nancy Intake, (iii) Annandale Intake, (iv) Hope canal, (v) Shanks Intake, and Maduni Outlet and into the Atlantic when the expected onset of the rainy season is near. This is to prevent possible over-topping of its banks when the rains come. However, there have also been cases, due to insufficient early warning systems, where waters were released but the rainy season failed to materialise resulting in significant hardship. Should the banks of the EDWC fail, the risk of flooding is significant because of the high volumes of water involved. However, planning for this possibility is on-going with a new drainage canal recently being opened at Estate Hope on the East Coast, approximately 15 miles from the proposed project site.

D. Future flood risk

9.10 A large volume of work has already been carried out to develop hydrological models of the Guyana coastal river basin and catchment areas and to model future flood events. This support is being provided largely by the World Bank and the Government of the Kingdom of the Netherlands[36] (Flatts, *per comm.*, 2016). The first important study in this regard was the EDWC Rehabilitation Project which developed a hydrological model of the present and foreseeable flood events in an effort to identify the key problem areas. The EDWCRP also included a technical feasibility study to

[36] The draft report from this flood modeling effort is expected to be presented to the Government during the week of September 9, 2016.

abate the flooding by suggesting a number of technical options. Due consideration was given to the effectiveness of existing structures in alleviating problems as well as explore potential benefits of future project options. The EDWCRP adopted a comparison procedure for filtering and ranking the major flood relief projects in order to be able to prioritize the projects and to enable the Guyanese decision maker to choose the order of the projects construction. Preference was given to projects within the following criteria: (i) urban areas rather than those draining agricultural areas, (ii) densely populated areas, (iii) commercial areas, and (iv) flood relief in areas located in the vicinity of public services such as hospitals, first aid stations, police, fire stations and other public serving and essential institutions and premises.

9.11 The risk of flooding in the areas was calculated according to a widely accepted definition of flood risk. The flood risk, measured in $/yr of damages caused by a certain rainfall storm, is defined as the probability of failure of the hydraulic system, i.e. the storm water system, corresponding to the occurrence of the storm – overcoming probability (pf), by the associated expected damages (E(D)): R= pf .E(D) The probability of failure is a function of the occurrence of a certain rainfall storm (hazard) and of the performance of the storm water system (vulnerability). The calculation of the probability of failure included (i) rainfall analysis, (ii) determination of flow discharges, (iii) flood routing models, and (iv) hydraulic design of only storm water system.

9.12 For the practical application of the flood risk assessment, the expected damages were evaluated for flood events of different probabilities. Based on these damage evaluations, a damage-probability curve was constructed. In the risk calculation, all hydraulic processes are not deterministic. Moreover the expected damages were also associated with uncertainties since little information is available about the relation between damage causing factors and the resulting flood damage. Therefore, for the design rainfall event, there is a residual flood risk that assumes an acceptable value ($R \rightarrow 0$), defined according to International and/or National standards. The purpose of calculating this flood risk is to create an accepted vulnerability level of the system, namely to provide flood relief to the project area vulnerable to impact from the rainfall storm with a return period of 1 in 5 years, as established statistically by the rainfall data captured by the EDWCRP study, that is on-going.

9.13 The level of accepted vulnerability was derived after considering the specific assets at risk, the type of floods that occur in Guyana, the type of storm water infrastructure required to provide flood relief in along the Guyanese cost and cost-effectiveness considerations. Common return period of similar projects is between 10 to 20 years, but there are a number of arguments that support the value of 5 years as the optimal solution for the EDWCRP. A return period of 10 years would have increased the cost of the project implementation by approximately 40%, making the project economically unviable. Moreover, in terms of risk of occurrence of a storm of a certain return period (5,10, 20 years) within the expected life of the system (50 years) the benefit of adopting 10 instead of 5 years return period is limited.

E. Future Flooding and Climate Change

9.14 In projecting for possible future flood events, the consultant sought, apart from reducing the risks to life and property, to also reduce the vulnerability to climate change. This is addressed through proposing the development of infrastructure that is capable of withstanding the uncertainties associated with future flood events and also through the adoption of a holistic catchment based approach to surface runoff management. Moreover the National Climate Change Adaptation Strategy has put forward a number of recommendations to limit the effect of climate change on the occurrence of flood events such as the enforcement of the fines for not adhering to the building codes of Guyana and Georgetown more specifically.

F. Drought Risks

9.15 The current clear and overwhelming consensus is that drought impacts and their causes will worsen over the coming 10 to 20 years (IPCC, 2015). This projection is based on a changing climate regime

as a major driver of future risk. Guyana as a country has witnessed at least 3 El Nino weather events in the past 10 years, i.e., 2007/2008, 2012 and 2015. Yet, the country seems ill-prepared for droughts. While many homes and businesses have implemented water saving and rainwater harvesting facilities, these seem more in response to the quality of water being provided by GWI rather than as a drought reduction strategy. It will be important for the project to pursue at least 3 main measures to combat drought: (i) invest in rainwater harvesting facilities, (ii) invest in greywater recycling facilities, and (iii) install water efficient implements at the complex.

X. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

A. Environmental Management System to be implemented

10.1 This Environmental and Social Management Plan (ESMP) for the Enhancing the National Quality Infrastructure has been prepared in compliance with requirements of the Terms of Reference of the Inter-American Development Bank (IDB), IFC Environmental, Health, and Safety (EHS) Guidelines, and the Guyana Environmental Protection Act. For projects of this type, an authorization/"permit" is required from the Guyana Environmental Protection Agency (EPA). A meeting was held with the EPA on August 3, 2016 at which the Project was discussed. Representatives from the EPA stated that the project would require a permit. The application form for this permit has to be completed by the Bank, along with a sketch of the Project and submitted to the EPA.

10.2 The Client is committed to enforcement of the stipulations contained within the ESMP dictated by Guyana's EPA regulations and those of other bodies for environmental and social management of built development projects. Further, the Client is prepared to adhere to regulations which may be more stringent than those identified, if adequate technical justification is provided for those standards and provided that those standards do not compromise the economic viability of the proposed action. The Client will hire an Environmental, Health and Safety (EHS) officer. That officer will have specific responsibility for enforcement and for adherence to and compliance with EHS issues and for implementation of the ESMP.

10.3 The ESMP incorporates protection, mitigation and enhancement measures. The avoidance and mitigation measures include:

- Engineering designs and disposal techniques,
- Pollution control, recycling, and monitoring of scientifically sensitive areas and resources, and
- Enhancement of the physical environment, where possible, and stakeholders involvement.

10.4 Additionally, the ESMP outlines a separate monitoring framework to assess the effectiveness of the Plan over time. The monitoring framework will determine whether the ESMP requires reorienting, based on changed conditions or factors not necessarily accounted for in the Plan. The ESMP's purposes therefore are:

- to reduce the risks of adverse impacts that may be associated with the project on environmental resources, and
- to minimize disturbance to local stakeholders and/residents.

10.5 The national environmental regulation, the Inter-American Development Bank's (IDB) requirements and socio-physical environment are described above. As such, no further discussion on the project's justification and importance are deemed necessary. However, it is important to elaborate that the application of the EHS Guidelines is to outline the performance levels and measures that are normally acceptable to IFC, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology.

10.6 The EPA Guidelines for Environmental Assessment identify that developers should demonstrate within their environmental management plans that they have an objective to meet the ISO14000 standards. It is expected that the contractor would have an Environmental Policy in place that should accompany their site specific environmental management plan.

10.7 The ISO14000 series of international standards have been developed for incorporating environmental aspects into operations and product standards. In September 1996, the International Organisation for Standardisation finalised the ISO 14001 standards for environmental management systems. Similar to the Quality Management System (QMS) implemented for ISO 9001, the ISO

14001 requires implementation of an environment management system (EMS) in accordance with defined internationally recognised standards (as set forth in the ISO 14001 specification).

10.8 As with ISO9001, the key to a successful ISO14001 EMS is having documented procedures that are implemented and maintained in such a way that successful achievement of environmental goals, commensurate with the nature and scale of activities, is promoted. In addition the EMS must include appropriate monitoring and review to ensure effective functioning of the EMS and to identify and implement corrective measures in a timely manner. It is only within the context of this certification that compliance with the environmental social management plan for this project can be assured. Many of the procedures outlined in the following sections are inherently part of an environmental management quality control system.

10.9 From baseline information collected during the preparation of the ESA potential impacts were identified that will require mitigation, through best practice during construction and operation of the GNBS complex, or through special measures employed as part of the contracted work. Impacts on the environmental components have been categorized into positive and negative impacts and further into direct (noise and dust pollution) and indirect impacts (improvement in amenities due to the construction of the complex). Additionally it is important to distinguish between short- and long-term impacts occurring during the construction and operational phases of the project.

10.10 Activities to be carried out during each stage of development are further divided into:

- Detailed design mitigation;
- Implementation/installation of mitigation measures;
- Response to incidents or unforeseen issues arising e.g. spills, emergency situations, chance finds (construction stage only);
- Routine daily and weekly inspections;
- Review of ESMP and Construction Environmental Management Plan (CEMP);
- Performance and compliance monitoring and response to any corrective actions;
- Reporting – Daily Inspection Logs, weekly reports, monthly reports and quarterly reports in conjunction with Contractor's project management administration procedures.

10.11 The ESMP should be applied as a document that provides direction on the management of the environment and social relationships to construction, inspection and management personnel throughout the construction and operational phases of the project. The ESMP sets out the condition that the project is expected to follow to meet legislation, regulations and best practice for sustainable management of the project. The goal of the ESMP, therefore, is to reduce adverse impacts on both the physical environment and affected stakeholders as identified in the ESA. This ESMP is a legally binding document and the actions contained therein are expected to be followed by the Contractor(s), who will need to demonstrate their commitment through the adoption of this ESMP and the development of a CEMP for the stages of the project, for which they have responsibility.

10.12 The Contractor(s) will need to include the compilation, implementation and the administration of the ESMP on the site, including training of the site team on their environmental duties and responsibilities. For ease of reference, a summary of environmental positive impacts and negative impacts which will require mitigation are highlighted below and reflected in *Table 12*. Furthermore, for ease of reference, the issue is first identified, followed by a discussion of the mitigation measure and who will be responsible for executing the specific mitigation measure(s).

Table 12: Summary of the Potential Impacts During the Construction and Operation of the GNBS Complex

Medium	Impact	Type of Impact (Direct[D]/ Indirect[I])	Mitigation/ Enhancement/ Avoidance	Phase	Design Requirement	Procedures for execution	Responsible Entity/ Individual for Mitigation	Budget
	Negative Impacts							
Atmospheric	1. Increased air pollution (dust)	D	Dampening and covering of vehicle trays to be used	Construction	None	Identify best practice methods and ensure machinery and equipment are designed for dust suppression	Contractor & EMS	Contractor staff time
	2. Increased air pollution (toxic fumes from vehicular traffic and construction and vehicular waste)	D	Filters to be used on vehicles or alternative methods	Construction and Operational	None	Identify best practice and ensure vehicles and machinery are operating optimally, thus emitting limited exhaust fumes and potential noxious emissions	Contractor & EMS	Contractor staff time
	3. Major noise nuisance along project route	D	Mufflers or alternative methods to be used	Construction	None	Contract Specification for contractor to have protocol in place for managing any complaints – Use Communication Plan. Agree noise levels and working hours with EPA.	Contractor & Vehicle owners	Included in contract with vehicle owners
	- during the mining of raw materials and transport	I	Mufflers or alternative methods to be used	Construction	None	Contract Specification for contractor to have protocol in place for managing any complaints – Use Communication Plan. Agree noise levels and working hours with EPA.	Mine Operators & Vehicle owners	
	4. Increase in congestion along the Railway Embankment Road	I	Transport materials during off-peak hours and adhere to traffic laws	Construction and operational	None	Work with the Guyana Police Force to identify best routes to access the site	Contractor and Client	
	5. Ground water pollution	D	Construct sump for collecting of wastewater and treat before releasing into the environment	Operational	Include tank for the collection of wastewater, with filter bed in the design	Work with the EPA to design best model for treating wastewater from the facility	Client	Cost for constructing wastewater recycling facility
Geology, Soils and Topography	1. Indiscriminate disposal of waste	D	Adequate waste disposal facilities	Construction and operational	None	Waste facilities are clearly designated and disposed using private contractors. Hazardous chemical waste will be collected and stored to be exported.	Contractor and Client	

Medium	Impact	Type of Impact	Mitigation/ Enhancement/	Phase	Design Requirement	Procedures for execution	Responsible Entity/	Budget
	2. Contamination of soil profile from toxic waste from construction material/fuel/lubricants/detergents etc.	D	Manage the containment of materials, fuel storage, and equipment with efficient prevention measures in place	Construction and operational	None	Identify best practice within site methods and supply adequate covering materials, bonding facilities for long term storage of any fuels, oils, or chemical shelters to avoid any potential combustion of heat/light sensitive materials. Further, work with the M&CC to determine the elevation off the ground for the chemical bond	Contractor, EMS & Client	
	3. Soil erosion from land clearance for storage of raw materials, construction camps and laying foundation	D	Utilise an area already denuded as construction site and clear only spaces needed for construction activities	Construction	None	The site most suitable for the placement of storage and workers camp will be identified	Contractor & SC	
	4. Reduced productive capacity of soils	D	Ensure that as much green spaces are retained as possible	Operational	None	Follow best practices during the operations of facility to maintain its environmental integrity	Client	
Water Resources	1. Possible increased flooding due to water diversion and increased run off	D	Conduct thorough site survey to determine the number of culverts that will possibly need to be installed and maintain watercourses flow potential through inspection and regular clearance	Construction and Operational	Design specifications to identify the most reasonably practical place to locate any new culverts	Retention basis will be placed strategically along the project site to trap sediments in surface water before discharge	Contractor, SC and EMS	Included in contract bill of quantities
	2. Increased flooding due to intense rainfall and/or overtopping at the EDWC	D	Adhere to the M&CC and CH&PA building codes	Operational	Design structures to reduce the risk of flooding by adhering to national building codes and standards	Applications and design specifications to be approved by the M&CC and CH&PA. Additionally, the NDIA will install early-warning systems at the EDWC and continue to rehabilitate outfall canals, i.e., Hope, Cunha and Maduni	Contractor, Client, NDIA, M&CC and CH&PA	Included in contract bill of quantities
	3. Water Pollution from suspended solids and spillage	D	Application of best practices, such as lining pits with flexible impervious membrane	Construction	None		Contractor, SC & EMS	

Medium	Impact	Type of Impact	Mitigation/ Enhancement/	Phase	Design Requirement	Procedures for execution	Responsible Entity/	Budget
	4. Reduction in aquifer recharge rates	D	Application of best practices through leaving as much green spaces as possible to allow for percolation of water	Construction	None	Design application is cognizant of this requirement	Contractor	Part of contract
	5. Increase in drought conditions that can lead to water scarcity at the facility	D	Construct redundant water facility	Construction	Modify design to include rainwater harvesting and water storage tanks	Design specifications modified based on climate models and information from the Hydrometeorological Department (HD) to assess future demand for water	Contractor and Client	Cost for the construction of the water harvesting and storage facilities
Biodiversity	1. Damage to ecology from construction works	D	Use best practices to reduce the impact on the environment	Construction	None		Contractor	
	2. Effect on aquatic life	I	Mitigate foreign material getting into the waterways	Construction and Operational	None	Have clearly marked waste disposal bins for waste separation and collection	Contractor and Client	
Socio-Economic	1. Congestion of the roadway, particularly at peak hours	D	Road users should be provided advance notice in a clear, timely and culturally appropriate manner via various media (TV, newspaper, radio, roadway signage, etc).	Construction and operational	None	Advanced notice periods to be agreed	Contractor and GPF	Cost for notices in the local press
	2. Increased traffic through side streets	D	The contractor, in collaboration with the Guyana Police Force will establish an effective Traffic Management Plan (TMP)	Construction and operational	None	Proper signage and notices to be instituted	Contractor, & GPF	Cost for notices in the local press
	3. Road safety concerns	D	The TMP will consider safety along main carriage way as well as through areas of ADI and AII. Measures will include proper signage, pedestrian walkways and notices	Construction and operational	None	Advance notice period to be agreed with the Contractor	Contractor, GPF, SC	
	4. Deterioration of side streets	I	Restrict access through some side streets and enforce the TMP	Construction and operational	None	Prior notice to the members of the public in the print, electronic and voice media	Contractor & M&CC	

Source: ESA, 2016

B. General Roles and Responsibilities

10.13 *Tables 13 and 14* outline the administration roles and responsibilities of the client and its representatives, regulatory agencies, and Contractor in the preparation and detailing of protocols to be followed during the construction and operational phases of the project. Many of these protocols will be done in consultation with other stakeholders, such as the private sector, residents, and the taxi and mini-bus associations. These roles and plans should be agreed by all parties prior to the commencement of any contract activities. This ESMP is a transitional document and aspects may be adjusted based on review and changed conditions in the field.

Table 13: Key Role and Responsibilities for Environmental Management of the Project

Role	Lead Responsibility
PMU Project Manager	• Overall Management of the Project and main liaison with GoG and IADB. • Oversee project and meet regularly with key members of the Supervising Consultant and his team and the Contractor's Project Management team and provide feedback to the Client and the GoG. • Attend public consultation meetings as required.
PMU Environmental Engineer	• Overseeing that the overall implementation of the ESMP. • Undertake regular inspections on a discretionary basis of all areas of the works, site offices, compound, storage of materials areas and general provisions for environmental management during pre-construction and construction activities. • Conduct reviews to ensure reporting and monitoring systems are in place and being maintained and recorded appropriately. • Recording any incidents that require corrective actions which could be recorded as non-compliance. If the action is not corrected within the dedicated timeframe, the EE will write the Contractor on this formally. • Be consulted on any departure from the stipulations of the ESMP. • Follow up visits to be undertaken to check actions have been carried out appropriately. • Attend regular meetings with other environmental representatives from Contractor and Consulting organisations. • Attend regular project management meetings.
Supervising Consultant	• Maintain administrative overview and design, review and monitor inspection reports and identify actions to Contractor. • Audit the Principal Contractor's Construction Environmental Management Plan and activities associated with strategic plans and method statements and compliance with the Contract Specification, local regulations and the ESMP. • Maintain inspection reports. • Provide weekly reports to the Client • Hold regular meetings with the Contractor's Environmental Inspector and the GNBS Environmental representative and others as required. • Ensure compliance and performance monitoring of the ESMP are conducted as stipulated in the ESMP. • Monitor compliance with the engagement of the public in accordance with the Communication Plan.
Construction Contractor Project Manager	• Contractor responsible for compliance with Quality Environment and Safety, and the full implementation of the ESMP.
Contractor's Environmental Manager	• Reports to Contractor's Project Manager and the Supervising Consultant Environmental. • Regular daily site inspections of all work areas and reporting as required for corrective actions. • Training new team members on any environmental aspects and specific tool box talks for site specific activities e.g. occupational health and safety, etc. • Coordinate all environmental quality testing as required by the ESMP. • Provide monthly reports to the Project Manager which will include training and induction records; incident reports and reports /complaints by the public inclusive confirmation of actions taken. • Maintain waste management records – materials and domestic waste management.

Role	Lead Responsibility
	• Implement with the Contractor's site team adherence to the strategic plans - Traffic Management Plan, Communication Plan, Emergency Response Protocols and general environmental best practice. • Prepare site specific or standard generic methods for the site team to adhere to for working near watercourses. • Implement the ESMP in full. • Agree hours of working to meet accepted noise and vibration limits in consultation with GNBS and EPA. If there is to be a variation in the agreed times, must write the GNBS and the EPA for written consent well in advance so the public can receive at least two (2) week notice in advance of the deviation.

Table 14: Responsibility for the Development and Approval of Specific Plans

Mitigation Strategy as per ESIA	Comments		
	Construction	Operational	
Emergency Response Plan (ERP)	Updating and Reviewing the ERP will be the responsibility of the Contractor with approval being sought from the GNBS and/or the EPA	Same as in the case in the construction phase	Consultation with stakeholders is required to ensure this would be a working document with commitments of all relevant parties who will be required to participate in the successful implementation.
Waste Mitigation strategy	Updating and Reviewing the ERP will be the responsibility of the Contractor with approval being sought from the GNBS and/or the EPA	Same as in the case in the construction phase	Consultation with stakeholders is required to ensure this would be a working document with commitments of all relevant parties who will be required to participate in the successful implementation.
Communication Strategy (CS)	Updating and Reviewing the CS will be the responsibility of the Contractor with approval being sought from the GNBS	Same as in the case in the construction phase	Consultation with stakeholders is required to ensure this would be a working document with commitments of all relevant parties who will be required to participate in the successful execution of the actions. Furthermore, it must be linked with the TMP to reduce the negative impact of the project, particularly during construction on businesses and residents.
Training and Induction Plan	Update and review will be the responsibility of the Contractor and the Supervising Consultant's Environmental Management Specialist with approval being sought from the GNBS and/or the EPA	Same as in the case in the construction phase	Training will cover all aspects of the project's activities and must be done prior to a person commencing work. Hence, this document must be prepared prior to construction activities.
Traffic Management Plan (TMP)	Updating and Reviewing the TMP will be the responsibility of the Contractor with approval being sought from the GNBS		Cross reference to CS and maintaining traffic over two carriageways during works and restricting flow through cross-streets and built up areas.
Environmental Permit	ditto	ditto	

C. Risk Management and Emergency Response Plan

10.14 The Contractor(s) shall prepare and submit to the Engineer within the PMU at the GNBS prior to initiation of construction, a Risk Management and Emergency Response Plan (RM&ERP) which outlines procedures for responding to environmental and social emergencies that may occur as a result of unforeseeable circumstances, such as a spill of hazardous materials, significant flooding as occurred in 2005, or El Nino type events. Since it is the expectation that the Program will be managed based on the work taking place the PMU Environmental Specialist or a Supervising Engineer's Environmental Manager should lead on the coordination of any stakeholders meetings to collaborate on the RM&ERP implementation. The PMU's Environmental Specialist or the Supervising Engineer's Environmental Manager should also manage the liaison required between the individual phases of the works and management.

10.15 At a minimum, the RM&ERP should provide procedures demonstrating how, during emergencies, the Contractors will respond in a timely manner with all reasonable measures to prevent, counteract

or minimise detrimental effects to other stakeholders and/or communities and the environment, including:

N. the health and safety of local residents, and employees;
O. the quality of soils, surface and groundwater;
P. the protection of environmentally sensitive areas; and
Q. in conjunction with the Stakeholders' Communication Plan develop a system for managing movement of construction personnel, public and traffic in an emergency situation.

10.16 Any emergency conditions or impacts identified by any person at any time during construction and/or operational phases of this project will be handled according to the reporting procedures outlined in this ESMP and the RM&ERP to be prepared by the Contractors.

Spill Contingency Plan

10.17 The ERP to be prepared and submitted to the Consulting Engineer by the Contractor will include a Spill Contingency Plan. A "spill" is considered to be any unscheduled discharge of a contaminant to the natural environment (e.g., soils and/or water) that causes or is likely to cause an adverse impact. A spill may originate from a structure, vehicle or container.

10.18 Construction-related spills include:

- fluid spills (oil, fuel, etc.) into water or onto land from construction equipment;
- the release of other construction-related materials into water or onto land from vehicles or other sources;
- silt and/or sediment released into water from the failure of erosion and sediment control measures or unprotected soils.

10.19 The Contractors' ERP shall specify that the Contractor is responsible for ensuring that the procedures set out in the Spills Manual (to be prepared by the PMU) are followed and implemented. This should minimise the possibility of a spill and, if a spill should occur, to minimise the associated environmental damage by taking whatever course of action is necessary and/or available in compliance with said specifications. These responsibilities will fall to the Client, i.e., GNBS, after construction is completed, but the possibility of this occurring, given the target group is infinitesimal.

10.20 The ERP will also identify the fact that the Contractor is responsible for notifying the Consulting Engineer of any spill of contaminated substances, who in turn shall mobilise the Emergency Response Team as described.

10.21 In any emergency situation, the health and the safety of the workers, nearby residents and the travelling public will be given the highest priority and actions to ensure their health and safety will be implemented immediately.

'Stop Work' Orders

10.22 The Consulting Engineer and the GNBS may at any time issue an order for the Contractor to stop work in the event of an outstanding non-compliance. Except in unusual instances when the environmental consequences of non-compliance are considered by the Environmental Inspector and the GNBS' Environmental Specialist/Engineer to be significant, requiring immediate work stoppage, two warnings from the Consulting Engineer and/or the GNBS Environmental Specialist/Engineer could constitute sufficient grounds for stopping construction. All incidences of work stoppage will be noted in the Environmental Inspector's inspection report. In the instance of a work stoppage, copies of the inspection report will be submitted by the GNBS to the EPA.

10.23 At the discretion of the PMU's Environmental Specialist/Engineer and PMU's Project Manager, the GNBS may withhold payment to the Contractor in the event of repeated non-compliance with environmental procedures.

Environmental Emergency Response Capacity

10.24 It is reported that there is very limited capacity in Guyana to respond to environmental emergencies (Ramdass per comm., 2016). There is no legislation that controls such events and no specific agency responsible for responding to, and reporting on environmental emergencies. The GFS Service and EPA staff have no formal notification and reporting procedure for spills or other large scale environmental emergency events. There is a risk that the emergency response personnel are not adequately trained to control/manage environmental emergencies and have not been provided with adequate equipment. There will be a requirement for early liaison between the above organisations and the Project Team to discuss the local limitations and to ensure that adequate provisions are made to enable effective implementation of the Contractors' emergency preparedness plans. At this time, agreed systems should be put in place for communications, making requests for assistance and addressing any incidents in an effective and timely manner.

10.25 Below is an overview of the capacity within the Project area and the protocols that have been followed with other projects in Guyana. The Contractors will need to be aware of these constraints and produce an Emergency Response Plan that includes regular training and practice drills as well as methods developed to deal with any incidents appropriately within the capacity of the Contractors and local support network.

Guyana National Bureau of Standards (GNBS)

10.26 At the time of drafting this ESMP, the GNBS currently has no trained staff, no equipment, and no clear mandate to provide response to environmental emergencies.

Environmental Protection Agency (EPA)

10.27 According to EPA staff, the Environmental Protection Agency is not specifically charged with the administrative responsibility to respond to, or report on environmental emergencies, nor does the EPA have the resources required to assume such responsibilities. Although the EPA would prefer to remain in a regulatory and advisory role in the event of emergencies, they have been involved in an oversight capacity on at least one environmental emergency event in the past several years involving an uncontrolled spill of contaminants at a mine facility.

Guyana Police and Fire Services

10.28 From a procedural and response perspective, an environmental emergency that may occur during the construction of the Program would be treated as any other emergency. First responders would include the Guyana Police Force (GPF) and the Guyana Fire Service (GFS). However, Police officers are not trained to manage spills and in general, the Guyana Fire Service officers have limited capability to manage spills. Other fire officers receive basic fire-fighting training on a regular basis (minimum 80 hours per year).

The Private Sector

10.29 Fire-fighting training sessions are offered by the Fire Prevention Section of the Guyana Fire Service to petroleum product companies approximately 3 to 4 times per year. Most drivers of petroleum product transport trucks receive this basic training at least once (commonly with very few repeats). Most petroleum product companies have nominated a Fire Safety Officer who receives training on an annual basis. Occasionally petroleum product companies will offer special training by outside consultants that may include techniques in spills management. A representative of the Guyana Fire Service attends such training sessions.

D. Environmental and Social Management Plan

10.30 This ESMP, therefore, presents relevant, appropriate and applicable measures to avoid, mitigate and/or minimize the potential negative impacts associated with various phases of the Project. The ESMP provides a management framework for the implementation and operation of the program in accordance with environmental and social commitments and legal requirements adumbrated within the Environmental and Social Analysis (ESA).

10.31 The EPA advocates the preparation of an ESA to mitigate environmental impacts related to programs of this type. Further the ESA, along with the ESMP, must ensure that proposed procedures, actions and measures identified are not just statements of intent by the developer but that they will be effectively implemented. The ESMP is mandated to identify feasible and cost effective measures to reduce potential significant adverse environmental impacts. It should also include operational procedures to avoid environmental risks during operations, as well as emergency and contingency plans to ensure appropriate response in the event of accidents.

Water Supply and Potabilization

10.32 These specifications cover the protection of water supply facilities during the construction and operation of the Project.

10.33 These specifications apply to all Personnel and Contractors involved in the project, particularly in proximity to potable water supply, watercourses or drains. These specifications include erosion and sediment control and should be applied together with the following specifications to provide protection of the water bodies that could be impacted by the program:

10.34 Protection of Watercourses and Waterbodies

- The work shall be controlled to provide effective protection of watercourses and water bodies and associated fish habitats.
- The Contractors shall at their own expense take all necessary precautions to prevent damage due to erosion and siltation during construction. Precautions will include temporary drainage berms. Waste material shall be disposed in a manner so as not to interfere with aquifers, streams, watercourses or any of the drainage works detailed by the Engineer, and shall not be planned within 10 m of a watercourse or drain.
- Whenever such protection is found to be ineffective, the Contractor shall implement changes immediately to the procedures and work practices to provide such protection.
- No work shall be carried out in watercourses or water bodies either during construction or operation of the Project.
- Construction vehicles and equipment are prohibited from entering into or crossing a watercourse or water body.
- Debris shall not be stored or disposed of within 10m of a watercourse or drain.
- Construction equipment shall be maintained in good operating order to minimise leakage.
- Vehicle maintenance during construction and operational phases shall be conducted a minimum of 10 m from any watercourse.
- The following procedures should be implemented prior to construction and maintained during construction and operationalization of the Project, where appropriate, based on site conditions:
  - Limit the size of the disturbed area;
  - Limit duration of soil exposure;
  - Retain existing vegetation, where feasible;
  - Limit slope length and gradient of disturbed areas;
  - Break and redirect flows to lower gradients;
  - Install erosion control measures where site-specific characteristics (e.g., erodible slopes) or sensitivities (e.g., proximity to watercourses) indicate a need for such measures;

  - Maintain erosion control measures until erodible areas have been stabilised;
  - Bench slopes, as necessary, to reduce sheet erosion where benching is deemed beneficial.
- Construct barriers or temporary rock flows checks or install equivalent erosion control measures (e.g., sand bags, berms, silt fencing), where required, to prevent the entry of sediment laden runoff into watercourses or drains
- All waste storage piles shall have a toe berm consisting of clean fill.
- Silt fences, if deemed necessary, shall be installed to provide a high level of protection in environmentally sensitive areas and in instances where soils are exposed within 10m of a watercourse.
- Sediment, which has accumulated by erosion control measures, shall be removed in a manner that avoids escape to the downstream side of the control measure and avoids damage to the control measure. Sediment shall be removed to the level of the grade prior to installation of the measure.
- Sediment, which has been removed, shall be managed as excess earth material.
- Seeding, mulching, and/or hydro-seeding where conditions warrant.
- Any damage to adjacent properties resulting from the Contractor's (during construction) or GNBS (during operations) failure to take necessary precautions shall be at the Contractor's or GNBS' expense.

Sanitation

10.35 In this section of the report, we outline the standards to be followed for improved sanitation at the GNBS complex. These include the fact that:

- The complex will be outfitted with sanitary toilets, which will confirm to the Ministry of Health standards;
- The complex must be accompanied by the respective septic tank, with a maintenance schedule worked out with the GNBS for the maintenance of said tank,
- All toilets must be accompanied with the necessary sinks for hand-washing purposes,
- If the area is susceptible to flooding, a relatively elevated area will be identified for the sighting of the septic tank and these will adhere to CH&PA and M&CC building codes,
- The septic tank will be at least 15 feet on the leeward side from the building on the south-western corner of the plot of land,
- All excess materials shall be managed so as to prevent their entry into water bodies and watercourses,
- All stockpiles will be placed so as not to interfere with watercourses or surface drainage and shall not be placed within 10 m of a watercourse or drain,
- The Contractor shall develop a strategy for the reuse, recycling and/or disposal of all waste materials at the outset of construction. The strategy shall identify the types of materials that can be reused or recycled and shall specify the manner in which these materials will be removed from the site. The strategy shall also specify those materials, which are to be disposed and shall identify specific approved facilities where these materials shall be sent, and the manner in which materials will be removed from the site.

Solid and Liquid Waste

10.36 The effective management and disposal of solid and liquid waste, hazardous chemical waste, non-hazardous domestic wastes, including waste food, packaging, office wastes, paper, etc., is essential to reduce the volumes of materials to be put into landfill/incinerated or exported. This section identifies strategies for the management and disposal of solid and liquid wastes at the project site. The waste management strategies apply to all personnel and visitors who are involved in the generation, storage, handling, transportation or disposal of waste materials.

- Solid waste reuse, recycling, sorting and disposal procedures shall apply to all personnel and shall be undertaken consistent with the waste management strategy to be developed by the contractor.
- The Contractor shall provide sufficient numbers of waste collection receptacles to prevent littering of the construction site.
- All combustible, non-hazardous wastes including food wastes, packaging and paper products will be collected by the M&CC and private contractors.
- Measures shall be taken to ensure that hazardous wastes are segregated from, and not collected with, the more routine domestic wastes, and handled according to applicable procedures.
- Non-combustible domestic waste shall be properly stored in designated containers and should be periodically removed for disposal at the Eccles landfill site.
- Chemical solid waste shall be collected, stored, and exported by a certified hauler and handler of such waste. Storage will be done in a compatible container, and stored at a location approved by the EPA.
- Methods for collecting, handling and storing chemical waste will be detailed in the waste management strategy to be developed by the Contractor.
- The Consulting Engineer Environmental Inspector shall monitor domestic waste handling practices on a regular basis. Operating procedures should be adjusted to further improve waste minimisation and waste handling practices as appropriate.
- Liquid waste will be collected in a separate waste disposal tank. The specifications of this tank will be determined by the EPA.
- Liquid waste will be treated for the removal of dangerous chemicals and go through a recycle process before being released into the environment.

Flood Mitigation

10.37 As stated in other parts of this document, the project site exists in an area susceptible to flooding, particularly during the rainy season. It will therefore be imperative that all efforts are made during the construction and operational phases of the Project to ensure that the integrity of the buildings are not compromised. In this regard the following will be essential:

- Conduct a thorough assessment of the drainage facilities in and around the site.
- Ensure there is an effective and efficient drainage system in place in and around the site, that flows into the main canals and the Atlantic Ocean, i.e., sufficient culverts, tubes, etc.
- Work with the relevant authorities and communities to ensure that all tertiary, secondary primary drains/canals are routinely maintained.
- Develop a flood management plan for the project and the site in particular. This would involve how to store and dispose of chemicals, structures for equipment, where and how to store fuels, etc.
- Ensure the building designs are flood-proof and the various infrastructure to be erected are cognizant of the area in which the project is being situated.
- Observe and adhere to the building code in Georgetown, i.e., consult with the M&CC on the final building designs and obtain their approval before any building is erected.
- Set up early warning system in the ADI where persons can be provided with climate services from the Hydrometeorological Department of the Ministry of Agriculture. These messages can be easily transmitted via various media to the stakeholders.
- Ensure that the complex is insured against flood risks as a means of implementing a risk transfer mechanism.
- Conduct training for all staff in terms of what should be done in the event of flood.
- Work with the NDIA to ensure the best flood mitigation measures are put in place at the site.
- Allow for proper management of garbage so that they do not become a main hindrance to drainage.

Drought Mitigation

10.38 The other major natural hazard that threatens the success of the project is the advent of droughts. To mitigate this risk the project should pursue the following initiatives:

- Collaborate closely with the HD to ensure an effective early-warning system is in place to warn not only the project, but the country, about impending droughts.
- Construct rainwater harvesting facilities and water storage capacity to meet its projected demands.
- Install grey water (recycled water) facilities. This is the usage of wastewater that has been treated and purified for use.
- Install water saving devices within the complex, such as water taps with sensors, and low flush lavatories.

E. Stakeholder Engagement and Participation

10.39 The ESMP strongly recommends the development of a communication plan. The objective of the development of the communication plan will be to develop the internal project team communication and reporting system. In addition, and as part of the grievance mechanism, there will be need to have a direct helpline number and a key individual identified as the first point of contact prior to delegation of responsibility for handling complaints, press notices and liaison with the GNBS and the Supervising Engineer. The communication plan may also involve the production of positive publicity of the raising of standards.

F. Complaint Procedure and Grievance Resolution Mechanism

10.40 A Community Liaison Officer (CLO) will be appointed by the PMU. Among this person's responsibilities, will be to accept complaints and seek resolution of these amicably through the involvement of the project team as necessary. The CLO will formally log grievances. A comments sheet will be produced by GNBS for those wanting to make a complaint or comment. In the first instance, grievances will be directed to the CLO who will classify grievances according to *Table 15* below.

Table 15: Grievance Classification Criteria

Grievance Classification	Risk Level	Validity	Response
Low	No or low	Unsubstantiated	CLO will conduct investigation, document findings and provide a response
Medium	Possible risk and likely a one off event	Possible substantiation	CLO and an appropriate investigation team will conduct investigation. The Project Manager may decide to stop work during the investigation to allow the corrective preventive actions to be determined. The CLO will provide a response.
High	Probable risk and could reoccur	Probable substantiation	CLO will organise a Major Investigation Team including GNBS for prompt investigation and resolution. Work will be stopped in the affected area. The CLO will provide a response.

10.41 The CLO will log the receipt of a comment, formally acknowledge it, track progress on its investigation and resolution, and respond in writing with feedback to the aggrieved party. The CLO will also initiate the investigation and ensure its speedy conclusion aiming to provide a response within 10 working days, unless there are exceptional circumstances. If the Project receives a large number of unsubstantiated grievances, the process will be reviewed to define instances when no response is needed.

10.42 The Environmental Specialist or the Consulting Engineer's Environmental Inspector will monitor environmental and social indicators during the operational phase and will play an important role in investigating the validity and responsibility for the grievance effect. Project staff, and outside authorities as appropriate, will also contribute to the investigation. The CLO will collaborate to

identify an appropriate investigation team with the correct skills to review the issue raised and to decide whether it is Project related or whether it is more appropriately addressed by a relevant authority outside the Project. The investigation will also aim to identify whether the incident leading to the grievance is a singular occurrence or likely to reoccur. Identifying and implementing activities, procedures, equipment and training to address and prevent reoccurrence will be part of the investigation activities. In some cases it will be appropriate for the CLO to follow up at a later date to see if the person or organisation is satisfied with the resolution or remedial actions.

10.43 The CLO will summarise grievances to report on project performance bi-annually during operation removing identification information to protect the confidentiality of the complainant and guaranteeing anonymity.

10.44 The point of contact for grievances and comments is as yet unspecified. When the contact details of who will fill the role are available, these should be disclosed to the general public, as well as the contents of this grievance mechanism and the location of comments sheets for grievances.

G. Environmental and Social Monitoring and Evaluation Program

10.45 An environmental monitoring program will be devised during the pre-construction stage and will be carried out through to the operation stage. Baseline monitoring shall be undertaken by the Contractor to measure any changes in the event of complaints or issues arising in the operational period that could be attributed to the construction or Project generally. The extent of the monitoring shall be discussed with the GNBS and the EPA at the pre-construction meeting, where any baseline data collection can be identified and programmed into the scheduled works. Water quality and localised soils testing is required, but the need for any air quality, noise assessment will require confirmation from the GNBS and EPA.

Monitoring Activities

10.46 Suggested monitoring activities are listed in *Table 16* and include:

- Soil quality monitoring (at least one soil sample) at the project site, additional samples could be required by the GNBS Environmental Specialist/Engineer;
- Groundwater quality monitoring (at least twice yearly at strategic locations to be worked out with the GNBS Environmental Specialist),
- Vegetation monitoring,
- Water quality (suspended solids) monitoring for signs of erosion/sedimentation;
- Site monitoring for localised flooding.

Responsibilities

10.47 Initial monitoring activities and restoration will be the responsibility of the Contractor. The GNBS Environmental Specialist/Engineer will be responsible for follow-up monitoring, typically on an annual basis.

Table 16: Post Construction Monitoring (recommended)

Post-Construction Monitoring Element	Monitoring Activity	Analyst	Location	Frequency	Follow-up Actions Required
Soil quality	Soil samples (at least one sample per location) at areas with visible signs of contamination (e.g., staining); including laboratory analysis of samples for hydrocarbons by a recognised and accredited laboratory; additional samples could be required by the GNBS Environmental Engineer and/or third party supervisor	Construction contractor	All fuel storage facilities, waste oil storage facilities and oil changing areas that show visible signs of contamination (i.e., staining)	Within 3 months of construction/demolition completion	Soils testing above 100 ppm gas/diesel or 1000 ppm for heavy oils (lubricants and bitumen) must be removed and replaced with clean soils. A plan for remediation of contaminated soils must be developed for approval by the EPA prior to commencement of works. A third party supervisor/inspector shall supervise sampling and may request additional samples
Vegetation	Visual monitoring of re-vegetation success at construction sites	Construction contractor	All stakeholders; All waste storage locations	Within 3 months of construction/demolition completion	Seeding/sodding as required to re-establish vegetation
	Visual monitoring of vegetation	GNBS's Environmental Engineer	All sites	Annual	Vegetation restored to allow for enhanced integrity of the natural habitats
Water quality	Groundwater samples (minimum 2 sample holes per location), completed within shallowest aquifer; including laboratory analysis of samples for hydrocarbons by a recognised and accredited laboratory	Construction contractor	Each equipment and materials staging area that shows visible signs of contamination (e.g., staining)	Within 3 months of construction/demolition completion	Groundwater exceeding 1000 ppb for gas/diesel or heavy oils (lubricants, bitumen) must be remediated. A third party supervisor/inspector shall supervise sampling A plan for remediation of contaminated groundwater must be developed for approval by the GNBS and EPA prior to initiation.
Resident and business interference	Visual monitoring surround areas	Construction contractor	Every community	Throughout construction	Restore area access as necessary, and clear clogged drainage system
	Visual monitoring of road drainage for signs of localised flooding	Construction contractor	Every community	Throughout construction	Repair incidents of localised flooding Restore proper drainage function

H. Schedule and Mitigation and Monitoring Costs

10.48 The ESMP outlines the way in which the environmental and social impacts of the Project should be managed and monitored. The ESMP describes environmental and social management and monitoring measures both for the responsible agencies in the GNBS and for other sectoral agencies with responsibility of environmental management in Guyana. The plan also takes into account likely changes to current institutional arrangements and outlines institutional linkages within and outside the relevant agencies.

10.49 The ESMP outlines appropriate mitigation measures for both the construction phase and the operational phase of the project. For each activity, the ESMP identifies appropriate institutions for implementation and provides an approximate cost. The cost estimates are derived from an understanding by the consultant of what will be required and the costs estimates for such services nationally.

10.50 While it is understood that the Project will have both positive and negative impacts, the focus of the ESMP is on the preventive and mitigation measures to protect the receiving environment from negative impacts. Positive impacts which are mostly socio-economic, are described in the ESA draft report for the project. The main objective of the plan is to prepare an appropriate institutional, social and legal framework for the implementation of actions to enhance the positive benefits of the proposed project under the Client's preferred option.

10.51 Attention must be paid to the implementation of the monitoring package in terms of timing and the correct application of the measures. Each measure will help mitigate a potential problem. However, the full benefits of the package will not be realized if some measures are not implemented. The results could be disappointing and the welfare of Guyanese and other sensitive ecological issues that will arise from this project may be less than expected. It is, therefore, very significant that the recommended mitigation measures be applied and/or pursued in their entirety before and during the construction and operational phases.

Environmental Monitoring

10.52 The ESMP outlines two basic monitoring regimes that will be followed. These are: (i) environmental compliance monitoring (ECM), and (ii) environmental effects/performance monitoring. Environmental Compliance Monitoring (ECM) focuses on physical investment that has to be carried out in accordance with relevant clauses in contract documents, and the IDB regulations. Environmental Compliance Monitoring is the process of checking that agreed actions have been carried out effectively, in the right place and at the right time. They are described in project sequences. It should be noted that rather than carrying out site inspections with agency staff, the EPA encourages self-monitoring by project proponents; monitoring reports should be submitted to the EPA for review (*see Table 17*).

10.53 The second component, Environmental Performance Monitoring (EPM) is the process of checking the impacts of the project on specific social or environmental parameters or features (e.g. "valued ecosystem components" such as wetlands). This is normally done through the measurement of one or more indicators. If the value of the indicator exceeds a certain legal level, or if it is changing too fast in comparison with a pre-project baseline value, then further investigation is carried out to determine an appropriate management response. The following areas of effects monitoring are considered most relevant to this project: socio-economic, health, soil, surface and sub-surface water quality, and plant and aquatic life along the road corridor and surrounding areas. The primary water and soil quality monitoring program will be implemented under an arrangement between the GNBS, EPA, and the PMU. The objectives of this monitoring program are to provide the project

management team with the information required to evaluate the success or failure of the project from an environmental and social standpoint and determine if subsequent interventions would be required. The EMS will be carry out and/or coordinate the monitoring program to be executed.

10.54 The ESA for the project has demonstrated the importance of sound planning, high standard of project implementation and on-going management in promoting the successful implementation of this Project.

10.55 The following sections set out a menu of measures to mitigate the direct and indirect negative impacts of the project and to help establish a sounder base for future development. These measures have been selected based upon their technical feasibility, economic viability, socio-cultural palatability and environmental sustainability. Furthermore, the institutional capacity necessary to implement these measures is also briefly examined.

10.56 The ESMP model is built on the structure that management depends on measurement. Without measurement, management has nothing on which to base its decisions. The ESMP will have two components:

- Activities within the PMU which will support the monitoring program; and
- Activities within the PMU, EMS, EPA and other sector bodies that will monitor water quality, soil contamination, and air quality.

10.57 The PMU will be responsible for monitoring the performance of all project activities. This will be done through a coordinated program that starts with a baseline survey and then continues through the life of the project.

Institutional Requirement for Environmental Monitoring Programme

10.58 In order to establish a proper framework for environmental and social management and monitoring, a well structured institutional arrangement needs to be identified. The principal stakeholder for environmental management will include the GNBS, EPA, PMU, the EMS, and the Contractor. The IDB will conduct review and supervision missions. Furthermore, some members of the communities and Village Councils will be trained to observe certain parameters, consistent with the EPA's and other regulatory standards with regards to water quality, air pollution, sanitation, waste management, and soil degradation. The division of work and suggested responsibility are presented in *Table 17* below.

Table 17: Compliance Monitoring Framework

Organisation	Tasks
1. GNBS	• As the project proponent, obtains environmental clearance from the EPA. • Ensures that the supervision mechanism for the physical works includes resources to ensure enforcement of compliance with the environmental and health and safety provisions of the contracts. • Prepares regular monitoring reports and forward these to the EPA and IDB.
2. PMU	• Working under the direction of the GNBS the PMU will perform the following tasks: 1. Support EMS to develop an environmental monitoring operational plan. 2. Coordinate with relevant private and public sector entities and non-governmental organizations (NGOs) to mitigate the key environmental problems that may arise during project implementation. 3. Maintain and manage project reports. 4. Report Environmental Monitoring results into project progress report and submit to the GNBS

3. EMS	• The National Environmental Monitoring Specialist (EMS) will be contracted by the PMU for the duration of the construction period and will assist with on site supervision of environmental assessment and biological control measures especially in worker areas, training of GNBS staff members to continue the monitoring work during the operational phase of the project, and taking samplings
4. GNBS/EPA	• The GNBS, in collaboration with the Environmental Protection Agency (EPA), will set up a programme to periodically monitor key environmental parameters with the PMU. The reports from this collaboration will include: 1. An assessment on the changes in water and air quality, changes in water use and changes in soil contamination. This may include baseline survey and subsequent periodic monitoring. 2. Reporting on the extent and severity of the environmental impacts against the predicted impacts in the ESA and ESMP. 3. An assessment on the overall effectiveness of the project in environmental mitigation and monitoring measures.
5. EPA	• As the regulatory authority, administers the environmental assessment process and issues the project's Environmental Permit. • Reviews monitoring reports from the project proponent and ensures compliance with Permit conditions.
6. IDB	• Ensures compliance of the project design with IDB environmental and social procedures and guidelines. • Reviews monitoring reports and carries out supervisory missions to ensure compliance with loan conditionality.
7. Supervising Consultant	• Supervises the work of the contractor(s) and ensures compliance of the works with the environmental and health, safety and welfare specifications and conditions in the contract documents.
8. Contractor	• Carry out his/her work in conformity with the Contractor's Guidelines and specifications in his/her contract for design, construction and operation of the project and environmental mitigation.
9. Communities and Village Councils	• Conducting compliance monitoring alongside regulatory bodies in the first instance and then on their own over the long-term.

Source: Compiled by Consultant

10.59 The monitoring system should be workable and manageable; there is a need for an efficient and Workable Reporting System for the Monitoring to be effective. This has to be initiated by the PMU.

10.60 The EMS will monitor the implementation of mitigation measures and the impacts of the project during the rehabilitation and operation phases. In the plan, there will be an estimate of capital and operating costs and description of other inputs (such as training and institutional strengthening) that are needed to carry out the Project.

Table 18: Compliance Monitoring

Phase	Activity	Responsible Entity	Task	Budget (US$)	Source of Funding
Pre-Construction					
	Environmental Management and Monitoring Program. Detailed Monitoring describing Contractors Social & Technical Responsibility	*GNBS*	*Collect "baseline data" on a selected number of biological, social and economic indicators reflecting environmental sensitivity and that will be moderately or significantly affected due to the project*	*$20,000*	*IDB and GoG*
Construction					
	Construction of work camp(s)	*Contractor with supervision from EMS*	*Monitor and track siting process*	-	*Contractors budget*
	Operation of camp(s)	*Contractor working in compliance with contractual conditions relating to health, food, sanitation, and waste management*	*Monitor health and labour force, camp site environs*	-	*Contractors budget*
	Impact on the labour force	*Contractor with supervision from the PMU.*	*Monitor employment and cash flow in local communities; reactions of surrounding areas to the project and work force.*	*5,000*	*Project funds*

Impact	Activity	Responsible Entity	Task	Budget (US$)	Source of Funding
Construction cont'd					
	Monitor atmospheric, water and biological parameters during site preparation	Contractor, EMS and the Environmental Inspector	Compliance with contractual conditions on atmospheric, water and biological parameters. Audit against the Contractor's contractual obligations	10,000	IDB and GoG
	Monitoring water quality in streams and the level of erosion and sedimentation during construction	EPA , GNBS, EMS	Compliance with technical specifications for earthworks and spoil disposal, especially erosion control and drainage, and for protection of watercourses	5,000	IDB and GoG
Post-Construction					
	Maintain the buildings	GNBS	Compliance with environmental/social conditions governing the maintenance of the structures	Not Known	Households
	Sanitation and solid waste monitoring	GNBS	Monitoring water quality.	Not Known	GoG

Source: Compiled by the Consultant

Reporting

Monthly Report from the Contractor

10.61 The proposed EMS will produce a monthly performance report of environmental monitoring, summarizing the environmental monitoring and management of the project and other related environmental management problems.

Table 19: Effects/Performance Monitoring Plan

Parameters to be Monitored	Periodicity	Number of Samples				Cost for one Year in US$	Total Cost in US$ for 2 Years
		Total Number of Samples	Number of Indicators	Sum of Determination	Total/ yr		
1. Potential Soil Toxicity	Once per year for 2 years	5	3	15	15	15	$450.00
2. Surface Water measurement	Twice yearly for 2 years	5	5	25	25	25	$1,250.00
3. Ground Water Quality	Twice annually for 2 years	5	5	25	25	25	$1,250.00
4. Surface Water Quality	Twice annually for 2 years	5	10	50	50	25	$2,500.00
5. Reforestation	Onetime Expense		$200 per Km		$1,000	-	$1,000.00
6. Solid Waste Collection & Management, provision of garbage bins	Onetime expense 10 bins						$1,000.0
7. Environmental Management Specialist	$1,250.00 Per Month				$15,000.00 Yearly for 2 years	$15,000.00	$30,000.00 for 2 years
1. Environmental Inspector.	$750.0 per mth for two years				$9,0000.00 for two years	$9,000.00	$18,000.00 For 2 years
2. Miscellaneous 10%							$5,945.00
Grand Total							**$61,395.00**

Source: Compiled by Consultant

Semi-Annual PMU Report

10.62 Every half year the PMU will compile an environmental assessment working report, summarizing the progress with regards to the ESMP implementation, and monitoring status. This report will be prepared by the EMS and audited by the Project Manager and may be attached to the Project Manager's Semi-Annual report or be integrated into "The Progress Report" and sent to the Client and the IDB for review. The water parameters to be monitored are shown in *Table 20* below.

Table 20: Indicators and Parameters for Monitoring Surface and Ground Waters[37]

Indicators	Parameters	EPA Standards
Physical Properties:	Temperature	N. A.
	Odour	N. A.
	Turbidity	Less than 150 NTU
	TSS	25 mg/l
	TDS	Less than 500
Chemical Properties:	pH	6.5 – 8.5
	Iron	0.3 mg/l
	Nitrate	70 mg/l
	Nitrite	70 mg/l
	Sulphate	250 mg/l
	Organic Matter	N.A.
	Salinity	Less than 3%
	DO	More than 4 mg/l
	BOD	N.A.
	Other Pollutants	N.A.

Source: Compiled by Consultant (2016)

Environmental Monitoring Details

10.63 Monitoring is necessary with respect to (i) soil and water quality and quantity; (ii) monitoring environmental indicators related to design, construction and operation; (iii) socio-economic impacts, wildlife and natural resources management; (iv) maintenance and management, including inspection of work camps, erosion control, liquid and solid waste collection and management, and (v)monitoring of key environmental indicators indicated in *Table 20*.

10.64 No air pollution monitoring/data is required for the program at this stage. The dust that will be generated during construction phase will be mitigated by the "Contractor" as indicated in their contracts. The contractor will regularly spray the dust with water hose and soak dust particles properly. The Project Engineer will mention this dust management clause in contractor's agreement before construction.

10.65 However, EPA will be requested to take air samples from the project area once every six months and report to PMU.

[37] Please note that there are currently no ground water standards for Guyana

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Annex 1: Terms of Reference

ENHANCING THE NATIONAL QUALITY INFRASTRUCTURE FOR ECONOMIC DIVERSIFICATION AND TRADE PROMOTION
(GY-L1059)

I. Background

1.1 Guyana experienced a 4.5% average economic growth during 2009-2014 period, mainly due to due to the expansion of mining and agricultural exports and the high prices of commodities, in particular gold[38]. However, in 2015, as a response to the decline in international prices of commodities, economic growth declined to 1.6%, highlighting the vulnerability of the economy due to the high concentration of exports, mainly related to mineral and agricultural exports (45% correspond to gold, 18% to rice, raw sugar 6.6% and crustaceans 3.5%[39]). Regarding Guyana's economic structure is based on strong links between the main engines of growth (mining and agriculture) and other domestic sectors, as most goods (tradable and non-tradable) and services are bought on the domestic market[40]. In this regard, there is consensus among public and private stakeholders on the need to diversify the economy and the export base, as well as to improve efficiencies and remove bottlenecks in the sectors that are currently the engine for growth, i.e. mining and agriculture.

1.2 The Ministry of Business is developing a strategy to support SMEs productivity, value added and export readiness, considering the modernization of traditional sectors: sugar, rice, forestry, and mining, and supporting new growth and diversification in new sectors: non-traditional agriculture, aquaculture, business process outsourcing/information technology, and tourism, under a social and environmentally sustainable framework[41]. However, there is a need to modernize the current National Quality Infrastructure in order to facilitate the growth of businesses in the local and external markets, protect the people and the environment and provide recognition for the Guyanese brand in the international market[42]. This modernization should be accompanied by a trade strategy to boost the participation of domestic firms in international markets.

1.3 Due to the need to implement best practices in the National Quality Infrastructure, the production and trading of goods and services in the principal sectors face a number of non-compliance risks in both the local and export markets with significant impact on competitiveness such as: i) rejection of products at border inspection point; ii) increased costs due to delays while inspections/test are being done in overseas laboratories; iii) disruptions in trade, loss or inability to expand into new market; iv) loss of revenue where inaccurate measurements and test results are used and v) inability to command premium price where quality and safety products are not defined.[43] In this regard to export markets in both traditional and non-traditional exports require compliance with technical requirements that are standards based[44]. In addition, local consumers and environmental protection conditions need to be enhanced.

1.4 The Guyana National Bureau of Standards holds primary responsibility for standardization, through a process of formulation and application of standards, technical regulations, conformity assessment procedures and metrology[45]. However, all standardizing bodies need to modernize the

[38] Guyana Private Sector Assesment Report. 2014. Bureau of Statistics Data.
[39] Observatory of Economic Complexity 2016.
[40] PSAR. 2015
[41] The economy is highly dependent on raw materials and unprocessed foods, as the main contributors to the economy are agriculture, forestry and fishing (19% of GDP), mining and quarrying (10%), agroindustry (7%) and services (66%). Source: Bureau of Statistics.
[42] Needs Assesment for the State of the Art Testing and Metrology Facilities. 2014. Between 2006 and 2010, there were a total of 59 rejections of foods exported to the US from Guyana at an annual average of 12 rejections.. The Unit Rate of Rejection for the US market from 2002 to 2010 ranged from 0.9 in 2003 to just about 0.2 in 2010, higher than the average of countries such as Trinidad and Tobago and Jamaica
[43] Needs Assessment for State of the Art Testing and Metrology Facilities. Executive Summary. 2014..
[44] Food Safety, Good Agricultural Practices, Quality Standards, Animal Health, Plant Health, Environmental, Social, Safery, Information Security, Efficiency and Certification, each with its own specific requirements.
[45] GNBS Strategy. 2011

legal and implementation framework of the National Quality Infrastructure[46], as Guyana has still has to implement national quality infrastructure practices.

1.5 The current laboratories infrastructure and equipment is not adequate for supporting exports, protect consumers and the environment**.** There are 20 existing main national laboratories offering services in metrology, chemical and microbiological and physical testing of products and materials used. These laboratories have limitations and gaps in terms of: i) unsuitable laboratory facilities, lacking the proper physical conditions to assure reliability; ii) absence of laboratory facility to perform tests for consumer protection and for dynamic sectors; iii) limited calibration capacity in terms of capacity in temperature, moisture, pressure, force, volume, electricity[47]; iv) lack of adequate equipment and consumables; v) outdated test methods that no longer meets the needs for the industry requirements; vi) lack of accreditation and participation in proficiency testing programmes; and vii) insufficient trained staff for performing tests and calibrations as well as competence in use an maintenance of instrumentation [48]. In this regard, the Government of Guyana carried out in 2014, with the support of the IDB a needs assessment of a State of the Art Laboratory and is contemplating its implementation through and IDB loan. However, the demand for services needs to be updated to reflect the recent economic changes, as well as the dimensioning of cost of the current facility.

1.6 Regarding the scope of the intervention, as a result of legal and technical analysis, in line with the forthcoming guidelines to be issued by the CARICOM Regional Organization for Standards and Quality, the scope of the program will concentrate on four fronts: (i) strengthening the GNBS and its labs in its central role in legal and industrial metrology, standardization, accreditation and certification, including the strengthening of the industrial metrology laboratories in the areas of mass, temperature, force and pressure, length, hardness, volume, electrical quantities, time and frequency and chemical metrology. In this regard, a new laboratory facility for the GNBS will be constructed. The new facility will consist on a new building on government owned land, with an expected area of 1,800 square meters and two stories. Preliminary blueprints of the laboratory facility have been carried out as part of the Gaps and Needs Assesment carried out in 2014.

II. Objective(s) of the Consultancy

The purpose of this consultancy is to develop an Environmental and Social Analysis (EAS), including an Environmental and Social Management Plan for the Program, which is a management tool to ensure the socio-environmental sustainability component of physical infrastructure and its operation to be financed under the program and thus meet both national environmental legislation and the Environmental and Social Safeguards Policy (OP-703) of the IDB.

Main Activities

The Consultant will:

Perform an Environmental and Social Analysis (EAS) of the activities of the Program and prepare an Environmental and Social Management Plan (ESMP) in accordance with the ToR as set out below: The consultant will be guided by the inputs of the Program team, and will consult relevant available information, stakeholders and conduct site visits as necessary. The ESA and ESMP will include the following:

Introduction

- Objectives, background and scope of the Program, including a description of the need for the Program in the context of national strategies,
- Expected social and economic impact of the Program.

Program Description

[46] The GNBS Standards Catalogue 20212 lists twenty (20) standards as having mandatory status. The WTO Report by Measures 2009, states that Guyana makes minimal use of technical regulations"

[47] Unsuitable type of construction materials to ensure a sterile environment, layouts that may conduce to cross contamination, locations subject to flooding, poor ventilation, humidity and direct sunlight. Needs Assessment Report, 2014.

[48] Ibid.

- **Location.** Describe and present schematically, the administrative, political and geographical location of all infrastructure works of the Program, as well as the areas of both direct impact (DIA) and indirect (IIA).[49]
- **Program Description.** Detailed description of all of the infrastructure to be financed by the Bank loan and to be built as part of the Program, including, among other relevant aspects:
  - Proposed Program activities/renovations
  - Total land area of the facilities where construction, expansion and upgrading will be carried out.
  - Building design features, including detailed description of all components, number of floors, total construction areas, green spaces, etc.,
  - Description of the infrastructure associated with the Program such as access roads to have direct access to the edifications, sewer, connection to the electric grid/lighting, connection to drinking water, solid waste recollection systems, among other basic infrastructure.
    - Identify and describe, if applicable, power generators, fuel tanks operation, sanitary landfills in the area of the Program and wastewater treatment plants,
    - Storage and drinking water treatment.
  - Description of the required personnel to be hired temporary and permanently during the stages of construction and operation of the Program and to include, if available, the detailed schedule of the construction and operation activities,
  - Describe how and if "Sustainable Infrastructure" principles have been included in the Program with focus on: energy efficiency and use of renewable resources, conservation of resources such as water and energy, internal air quality, and community aspects, such as public transport access.
  - Description of all the activities and process that will be carried out in the laboratories, as well as, explaining and describing chemicals and procedures to be used and implemented.

Legal and Institutional Framework

- Description of legislative and institutional framework regulations, norms, systems and environmental licensing requirements, and other necessary requirement for the implementation of the program's infrastructure works;
- Description of any specific local regulations and requirements regarding laboratories and Program facilities management in relation to solid waste' wastewater, air pollution, labor, and health and safety. In addition, to include a description of the requirements, which are applied for the activities of the Program, of other institutions such as the World Bank / IFC, World Health Organization, and other entities;
- Identify compliance required in accordance with the Environmental and Social Safeguards Policy of the Bank, and where applicable, compliance with policies of Access to Information, Disaster Risk Management, Indigenous Peoples, Gender in Development and Involuntary Resettlement;
- Describe, if applicable, mechanisms of Public/Civic Participation Consultation to include information related to public consultation processes and citizen participation as requirements for the construction and operation of the Program.

Diagnosis and Characterization of the Area of Influence and Program Beneficiaries

- **Environmental Characterization.** Characterization of the area of influence where the infrastructure will be carried out, describing its current environmental conditions, and detailing the area where it is intended to intervene or implement the program. This characterization must include the appropriate definition of both the Area of Direct Influence (ADI) and the Area of Indirect Influence (AII) of the Program. This information, whenever possible, should be based primarily on quantitative data. The factors to be discussed may include:

[49] El área de influencia directa (AID) del proyecto, es aquella donde se manifiestan los impactos generados por las actividades de construcción y operación; está relacionada con el sitio del proyecto y su infraestructura asociada. El área de influencia indirecta (AII) es el área donde los impactos trascienden el espacio físico del proyecto y su infraestructura asociada, es decir, la zona externa al área de influencia directa y se extiende hasta donde se manifiestan tales impactos.

- Land characteristics and use (i.e., topography, soil characteristics, terrain stability and susceptibility to erosion or landslip, existing land uses occurring at the proposed site, and existing surface characteristics of the surrounding area). Further, existing land uses occupying the surrounding area should be delineated; particularly for those land uses which would be sensitive to industrial development or other types of uses, and which could contribute to cumulative effects on local and regional resources.
- Landscape character and existing views (i.e., existing character of the landscape both on the development site and in the surrounding area; and views of the site from adjoining properties and public areas, particularly where these are sensitive, e.g., residential, recreational or tourist areas, etc.).
- Air quality including: (1) meteorological data, particularly prevailing wind direction and speed, rainfall, and temperature; (2) occurrence of extreme weather such as storms and droughts, and their location and duration; (3) existing ambient air quality, particularly dust loading and existing sources of gaseous air emissions in the local and extended area of the project; and (4) risk related to inversion conditions. Existing air quality cannot be determined with precision without sampling over an extended period. This may not be practicable, and a descriptive approach based on prevailing weather conditions and identification of the main local emission sources affecting air quality (e.g., traffic and heavy industries with multiple stacks) is often a better approach. Most likely these data may be obtained from a nearby airport, a local meteorological institute or governmental department, or a local university.
- Noise levels are relatively easy to measure, and this may be undertaken at the nearest sensitive receptor locations; e.g., residential areas or schools which are nearby the proposed project, activity, or action. Existing sources of elevated noise levels, which might result in nuisance conditions even if they are located a considerable distance from the source, should be considered..
- Geology and soils-related information, with particular attention given to the presence of erodible soils and/or contaminated soils.
- Natural hazards (seismic, faults, sink holes, flooding, hurricanes, tornadoes, etc.)
- Water, including hydrology, surface runoff, groundwater and water quality. Topics which should be addressed include: (1) existing drainage, including the location and capacity of sensitive receptors such as canals, drains and rivers; identification of areas prone to flash floods; and depth to groundwater; (2) surface water and groundwater movement patterns, including groundwater hydrology, the range of water levels and daily flushing regime in canals, drains and rivers, tidal ranges and wave climate in coastal areas and sediment transport processes; (3) the quality of waters, both surface water and groundwater; and (4) abstraction of waters including abstraction of groundwater, reservoirs and intakes of surface waters, the usage of the waters for irrigation, public water supply or watering of animals, industrial plant water supply, and the quantities abstracted, etc..
- Habitats – terrestrial and aquatic. As appropriate, two types of habitats may be relevant; namely, natural habitats and critical natural habitats. Information on these types is in Section B.9 of IDB's Environment and Safeguards Compliance Policy (2006), and in the International Finance Corporation's (IFC's) Performance Standards on Social and Environmental Responsibility (2006). Detailed information on categories of habitats or species is in IFC's 2006 standards.
- Flora (especially tropical rain forests, wetlands, or unique or sensitive habitats).
- Fauna
- Endangered and threatened species (including sensitive species, economically important species, and critical habitats).
- National parks or protected areas.
  Traffic flows and transport infrastructure aspects.
- **Social Characterization.** An overview of the existing social and cultural conditions should be provided in order to place the Program in context. The baseline information considered important to an ESMPshould be presented. This may include:

- Towns/communities surrounding the area, and their population and socioeconomic characterization by age, gender, ethnicity, language, literacy/education, income and occupation;
- Sources of livelihood (level/availability of employment by gender/occupation and income patterns);

- Land tenure/titling;
- Migration and settlement patterns;
- Health and education levels (including disease patterns and endemic diseases);
- Archeological/cultural sites and monuments, including sacred sites such as caves, lakes, quarries, etc.;
- Services and infrastructure (i.e., existing utility infrastructure including water supply, sewage, wastewater treatment works, power lines and transformer sub-stations; and existing capacity of and load on utilities infrastructure);
- Access to basic healthcare, education (i.e., existing clinics/hospitals, capacity of healthcare system; existing schools/training centers, and daycare facilities);
- Social organizations and dynamics;
- Indigenous populations/territories;
- Access to infrastructure/roads or network of existing transportation modes to/from the proposed development project, activity, or action; and,
- Vulnerable populations (elderly, poor, disabled, and young).

Assessment of the Environmental and Social Impacts of the Program

Identification and assessment of environmental and social impacts of the Program, including those impacts related to occupational safety and health in the stages of construction, operation and maintenance should be done. Consideration should be given of all potential direct and indirect negative impacts.

The identification and evaluation of socio-environmental impacts must be based on the characterization of the area of influence. This characterization expresses the general conditions of the area without the effects of the program and constitutes the basis for analyzing how the program will impact the area.

The assessment of the impacts should be done by identifying and describing impacts and overall impact by the program on the environment as a result of the interplay between the different stages and activities. Describe the evaluation method used, indicating the criteria for assessment and pointing out its limitations, according to the environmental characteristics of the area of influence of the program and its activities. Such assessment should have their respective categories so as to facilitate the qualitative and quantitative weighting of impacts.

Disaster Risk Assessment and Disaster Risk Management

This section should be focused in the identification and evaluation of potential natural and manmade project risks that can occur in the context of the project. This Disaster Risk Assessment (DRA) should include a Disaster Risk Management Plan (DRMP) that will cover the management of the disaster risks identified in the project design, construction and operation. This DRMP will be integrated into the Environmental and Social Management Plan. A detailed guideline for this section is contained in Annex 1.

Environmental and Social Management Plan (ESMP)

This section of the ESA should describe an environmental and social management plan for the project, activity, or action. This plan should include, as a minimum, the following components:

- Detailed description of the proposed environmental and social control and mitigation measures for project, activity, or action construction (e.g., air quality management plan, and landscape management plans) and operation (e.g., hazardous materials and fuel management, transport and packing management, maintenance and site security plans, and emergency evacuation and contingency plans).
- Detailed description of the planned environmental and social monitoring program for both construction and operation and a discussion of how the information will support management practices.
- Description of the planned worker health and safety plan, procedures and controls.
- Regarding hazardous materials, include a management plan covering their transport, handling, storage and disposal, with associate management and reporting practices including preventive and contingency measures, in consultations with potentially workers and communities (if applies). Include an annex of the restricted toxic substances for the activities in this Program, and make reference to international treats such as Basel Convention, Rotterdam Convention, and others.

- Description of planned environmental contingency plan and procedures.
- Description of a proposed environmental, health and safety management system (including personnel, training, documentation, auditing, etc.).
- Description of a plan to manage population influx into the project site or controlled land use area (e.g., contracting requirements to manage potential worker expectations).
- Description of a plan/mechanism to receive and facilitate resolution of affected community concerns and grievances about the project, activity, or action and its negative impacts.
- Descriptions of a plan to protect, reduce, and manage the negative impacts on sacred/archaeological and historic sites/monuments.
- Description of project, activity, or action-specific supervision and evaluation actions to be implemented.
- Public awareness, communication and training programs for operational staff.
- Indicators of compliance with licensing and approval requirements.

For each component listed above, the proposed time schedule (i.e., when initiated, when completed, and frequency), responsibility (i.e., who will implement), and the estimated cost should be provided; as appropriate, this information should also be provided for the individual actions within a component.

More specifically, monitoring/evaluation parameters which may be relevant include:

- Performance indicators in relation to critical operational issues (i.e., water quality -- marine and freshwater, shoreline morphology and sediment budget, soils and sediments, noise and air quality, public health indicators, land surface and hydrology, flora and fauna, etc.).
- Waste management performance indicators in relation to recycling and reuse.
- Documentation of complaints received.
- Also, monitoring procedures should cover:
    a. The key conditions that will be monitored and their criteria and reason for monitoring such as noise (low frequency, high frequency, and vibrations), dust (particulate matter), air emissions (NO_2, SO_2, CO, CO_2, H_2O %, metals, etc.), wastewater (volume, suspended solids, pH, toxic substances, etc.), waste (solid waste and hazardous waste) and odor;
    b. The monitoring locations (air emission outlet: particulate matter, CO_2, NO_2, and SO_2; the property boundary: noise, odor, particulate matter, CO_2, NO_2, SO_2 and other relevant substances; outdoor storage areas for raw materials (dust fall from the areas), intervals and duration;
    c. Actions to be undertaken if the monitoring indicates a noncompliance condition or abnormality; and
    d. Internal reporting and links to management practices and action plans.
- Reporting to relevant authorities and, if appropriate, to the consent authority or the community on matters such as reports on interruptions of operations, operational journals, list of used raw materials, protocol on stored raw materials, dustfall reports from the storage areas for raw materials, and noise documentation.
- Reports on odor and air pollutant emissions and ambient concentrations, CO_2 equivalent documentation reports for greenhouse gases, energy consumption reports, wastewater reports, etc.

Products

- Work plan and timeline.
- Environmental and Social Analysis Draft, including the Environmental and Social Management Plan. The week before the analysis mission –August 15**, 2016.**
- Environmental and Social Analysis Final Version, including the ESMP – **September 4, 2016**.

Payments Schedule

1.1 Three (3) payments: (i) 30% after constract signature and delivery of the work plan and timeline; (ii) 30% after delivering the Environmental and Social Analysis Draft, including the Environmental and Social Management Plan, and (iii) 40% after delivering of the Environmental and Social Analysis Final Version, including the ESMP.

Qualifications

- Academic Level & Years of Professional Experience: Master in Environmental Engineering with experience in civil infrastructure, with a minimum of a 10- year experience or an equivalent combination of education and experience.
- Languages: English
- Areas of Specialization: Civil Engineering, Environment, Water Resources, Risk Management, and Risk Management Environmental Impact and Social Infrastructure Health.
- Skills: Previous experience with the IDB on infrastructure operations related to urban development sector, and robust knowledge in handling the implementation of the Environmental and Social Safeguards Compliance Policy (OP-703) of the IDB, and best practices and standards that apply to this type of operation.

Consultancy Characteristics

- Type of Consultancy: PEC
- Contract Period: 35 non continuous days, starting after contract signature and ending on October 31, 2016.
- Place of work: Guyana and the city of the consultant
- Division Leader or Coordinator: Coordination and monitoring of the consultancy will be in charge of Claudia Stevenson (IFD/CTI) Team Leader of Project claudiast@iadb.org.

Payment and Conditions of Employment: Remuneration will be determined in accordance with Bank regulations and criteria.

Consanguinity: Individuals with relatives working for the IDB within, and including the fourth degree of consanguinity and the second degree of affinity are not eligible for employment as staff or consultants. Candidates must be citizens of a member country of the Inter-American Development Bank.

Diversity: The IDB is committed to diversity and inclusion and to providing equal opportunities in employment. We embrace diversity on the basis of gender, age, education, national origin, ethnic origin, race, disability, sexual orientation, religion, and HIV/AIDs status. We encourage women, Afro-descendants and persons of indigenous origins to apply.

G. Managing the Flood Risks

9.15 Given the strong possibility of flooding in and around the project site, moreover with a changing climate regime based on the GCMs downscaled to acceptable resolutions for small island developing and low-lying coastal states (SIDS), it will be imperative that the following be following during project design, construction and operation:

- Conduct a thorough assessment of the drainage facilities in and around the site.
- Ensure there is an effective and efficient drainage system in place in and around the site, that flows into the main canals and the Atlantic Ocean, i.e., sufficient culverts, tubes, etc.
- Work with the relevant authorities and communities to ensure that all tertiary, secondary primary drains/canals are routinely maintained.
- Develop a flood management plan for the project and the site in particular. This would involve how to store and dispose of chemicals, structures for equipment, where and how to store fuels, etc.
- Ensure the building designs are flood-proof and the various infrastructure to be erected are cognizant of the area in which the project is being situated.
- Observe and adhere to the building code in Georgetown, i.e., consult with the M7CC on the final building designs and obtain their approval before any building is erected.
- Ensure that the complex is insured against flood risks as a means of implementing a risk transfer mechanism.
- Conduct training for all staff in terms of what should be done in the event of flood.
- Work with the NDIA to ensure the best flood mitigation measures are put in place at the site.

Annex 1

Guidelines for Disaster Risk Assessment and Disaster Risk Management Plan

1. Disaster Risk Assessment

Disaster Risk Assessment (DRA) includes the risk identification and analysis required to identify and evaluate appropriate Disaster Risk Management (DRM) measures into project planning.

1.1 Hazard selection

Summarize available information for the project area in order to select the priority hazards, including historical disaster data, risk information (hazard, exposure, and vulnerability), and regional climate change model outputs and studies.

Especially (but not only, and if apply) the following hazards shall be considered:

Rapid-onset hazards:

1. Coastal flooding, storm surge, and sea level rise of 0.5m, 1.0m, and 1.5m;
2. Inland flooding;
3. Hurricanes and tropical storm-strength winds;
4. Seismic activity and its effects (ground shaking, liquefaction, tsunamis, etc.);
5. Volcanic activity;
6. Landslides;
7. Wildfires;

Slow-onset hazards:

8. Heat waves and Cold waves;
9. Coastal erosion (also taking into account sea-level rise)
10. Groundwater salinization
11. Drought.
12. (Further) Effects of changes in minimum or maximum temperatures, precipitation, insolation, and in seasonal climatic patterns (e.g. food and water shortages).

Hazards shall be selected using a multi-criteria analysis for comparing and prioritizing them. Criteria should include, at a minimum, hazard frequency and recurrence and potential impact in the project. The final selection must be approved by the IDB.

1.2 Disaster risk assessment

A risk assessment is an estimate of the expected loss to a system exposed to a given hazardous event. It is a function of the probability of the hazard and the vulnerability of the components that can be affected by the hazard. Carrying out a risk assessment requires an estimate of the probability of experiencing the selected event and an understanding of the effects of such an event on the resources at risk—people, structures, employment and the economy—in the assessment area.

Methodology for the probabilistic disaster risk analysis. The methodology and tools from CAPRA (http://ecapra.org) or a similar platform (e.g. Hazus), with the following general steps, is recommended:

- **Hazard analysis:** Analyze past, current, and future hazard trends (under consideration of climate change if applicable to the hazard) in a probabilistic manner. The consultant should model an appropriate number of stochastic hazard scenarios, each one with a probability associated and with values of intensity for each unit of analysis. The scale of analysis should be at least 1:5,000. The analytical data and modeling could be complemented with field work (e.i. identification in the field of historical inundation levels). Multi-hazard analysis should be considered (e.g. tropical storms and hurricanes in coastal areas where storm surge, winds and inland flooding should interact).
- **Exposure value calculation:** Develop an inventory of infrastructure and assets which are part of the project. The inventory will define the construction area, value of assets, and exact location of constructions and assets.
- **Description and identification of vulnerability functions:** Define, with the appropriate technical justification, the physical vulnerability function of each type of construction, asset and infrastructure located in the project for the considered hazards. Existing vulnerability functions developed and/or deemed adequate by the IDB (e.g. CAPRA) may be applied. As part of the vulnerability analysis it should be verified if the existing or designed assets comply with the standards of acceptable risk defined by the Bank (see glossary).
- **Risk estimation:** Based on the information of hazards, exposure values and vulnerability functions, develop a quantitative probabilistic risk analysis in terms of economical and human losses. This calculation includes the probable maximum loss (PML) and average annual loss (AAL) from the

prioritized hazards (see glossary). The consultant should include the estimation of direct and indirect loses.

- **Develop maps** that illustrate the results of the probabilistic disaster risk analysis in terms of PML and AAL.

Calibration of risk and estimations: The consultant shall carry out and include in the report a calibration of the risk maps and risk estimations using information on historical losses in order to estimate the accuracy of the results.

2. Disaster Risk Management Plan

DRM is the result of the integration of different processes (risk reduction, disaster management and financial protection) and sub-process (prevention, mitigation, disaster preparedness, respond, recovery, risk retention and risk transfer)[50].

The DRM[51] plan should include:

(i) Identification and prioritization of DRM measures. In order to identify and prioritize DRM measures three different type of analysis should be considered:

a. Compliance with Bank and national risk acceptable standard. "Bank-financed public and private sector projects will include the necessary measures to reduce disaster risk to acceptable levels as determined by the Bank on the basis of generally accepted standards and practices". If the vulnerability analysis identifies that the project or the design of the project doesn't comply with national and international acceptable risk standards the DRM will include and analysis of measures to reduce the risk to acceptable levels. If different measures are identify a Cost Benefit Analysis or Cost/efficiency analysis following Bank standards[52] and international best practices[53] should be carried out.
b. Human loses. The DRM should analyze a combination of disaster reduction, prevention and disaster preparedness measures which minimize the risk of human losses.
c. Impact of disaster loses in the achievement of project development goals. It should be analyzed if the disasters losses may compromise the achievement of the benefits of the project. If this is the case DRM measures should be considered in order to guarantee the viability of the project under Bank parameters[54].

Ideally the prioritization of DRM activities should be based on an optimal combination of the different process of DRM to manage the risk represented by the loss exceedance curve.

(ii) Design of disaster prevention and mitigation measures. The DRM should include the design at pre-feasibility level of the prioritized disaster prevention and mitigation measures.

(iii) Business continuity and contingency plans to protect human health and economic assets. The DRM should include the business continuity and contingency plan, with protocols, scenarios analysis, etc.

(iv) Estimated costs. The DRM plan should include estimated cost at pre-feasibility level for the different activities.

[50] See glossary for definitions.
[51] Bank Disaster Risk Management Policy. OP-407.
[52] Guidelines for the Economic Analysis of IDB-Funded Projects. IDB, 2012.
[53] A reference could be Mechler, 2005. Cost-Benefit Analysis of Natural Disaster Risk Management in Development Countries
[54] Ibid.

(v) An implementation plan. The implementation plan includes protocols to undertake periodic safety evaluations from project implementation up to project completion and maintenance of project equipment and works.

(vi) A monitoring program and indicators for progress; and an evaluation plan.

ANNEX T

CONFIGURATION AND LAYOUT OF THE STATE OF THE ART LABORATORIES

FIGURE T 1: CONFIGURATION 1a: 4 BLOCKS OF 4 SEPARATE BUILDINGS WITH BLOCK D PERPENDICULAR TO B

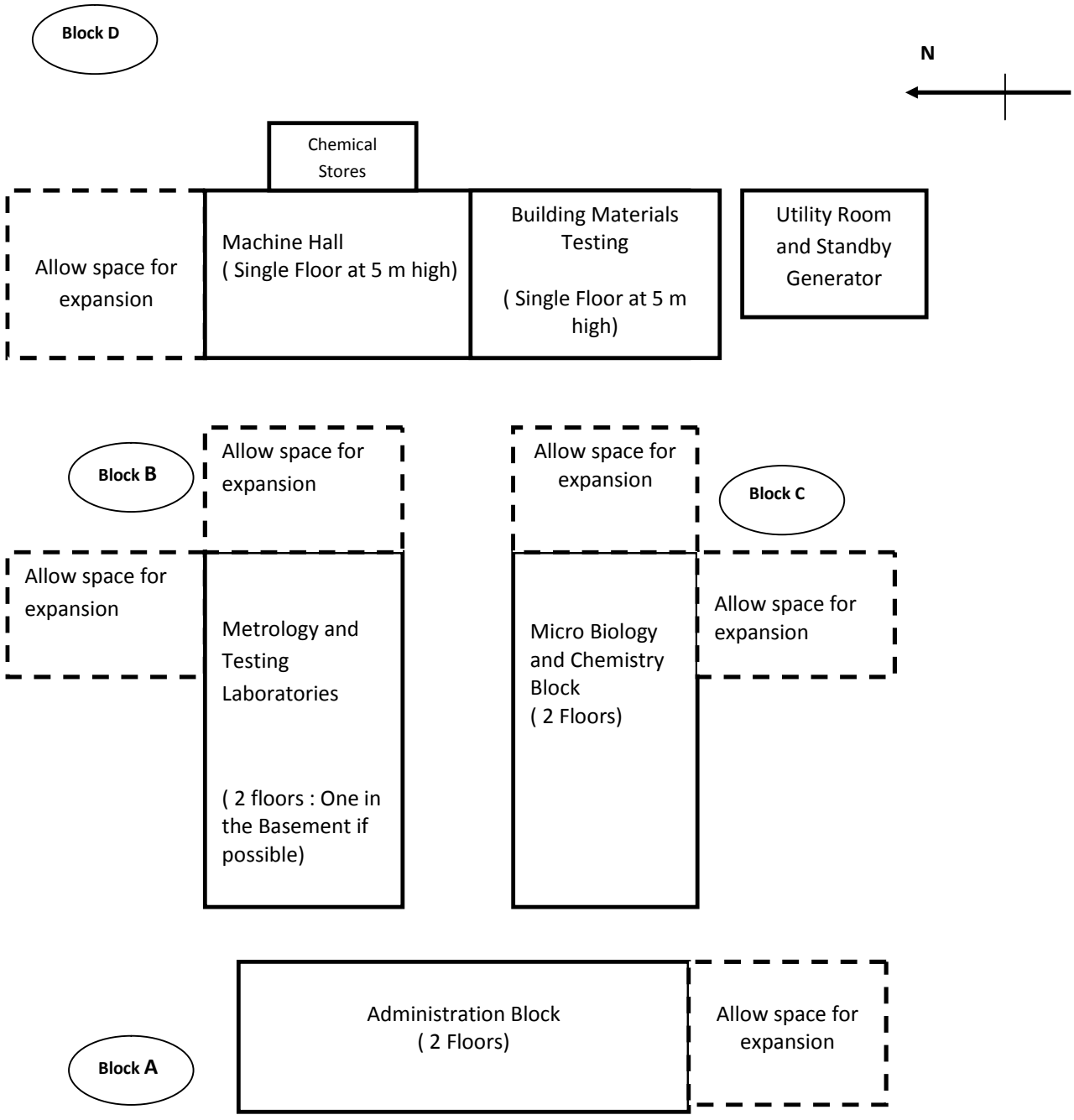


FIGURE T2 : CONFIGURATION 1B:
4 BLOCKS OF 4 SEPARATE BUILDINGS WITH BLOCK D PARALLEL TO B

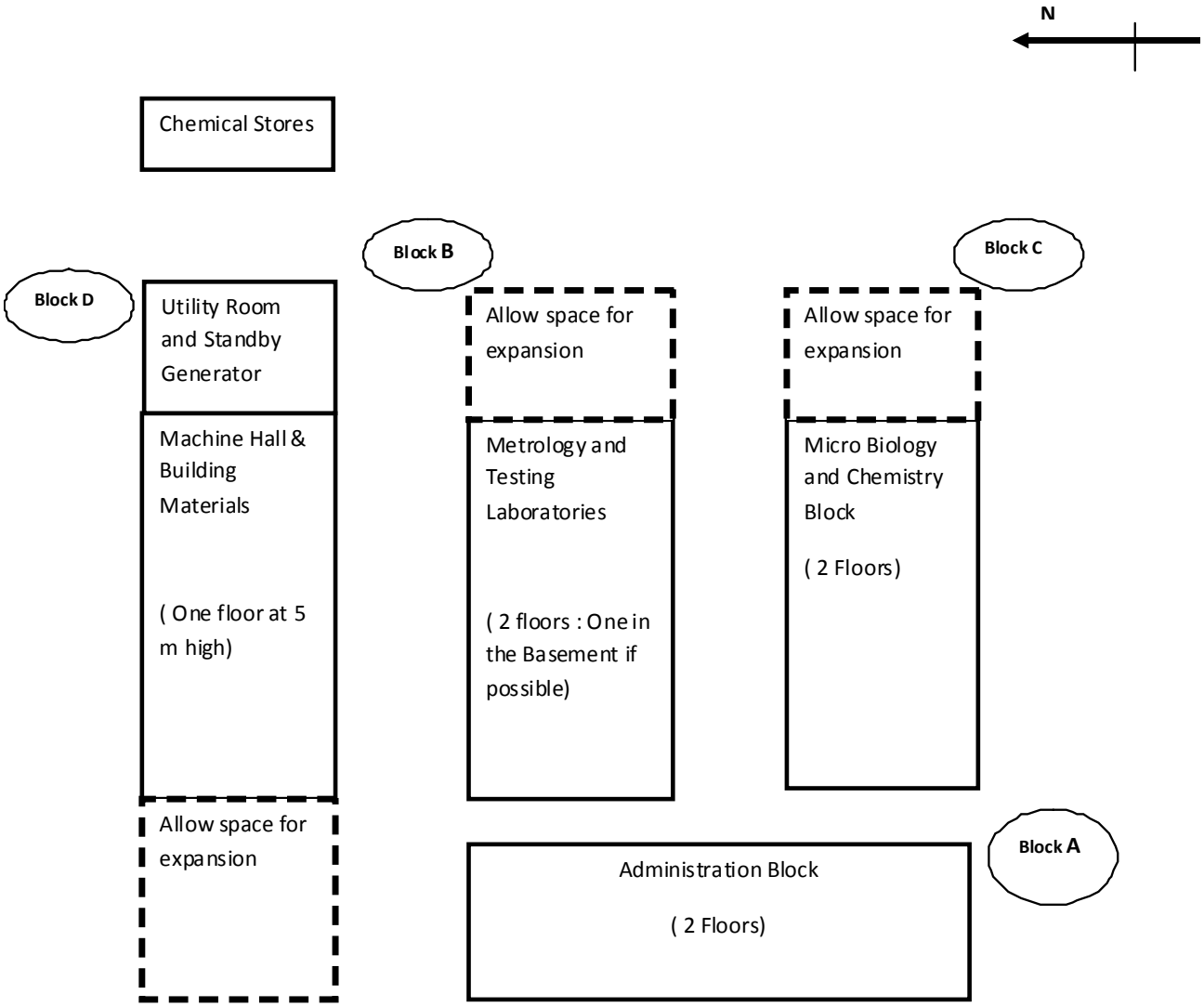


FIGURE T3: CONFIGURATION 1C:
3 BLOCKS OF 3 SEPARATE BUILDINGS WITH BLOCK D PERPENDICULAR TO B

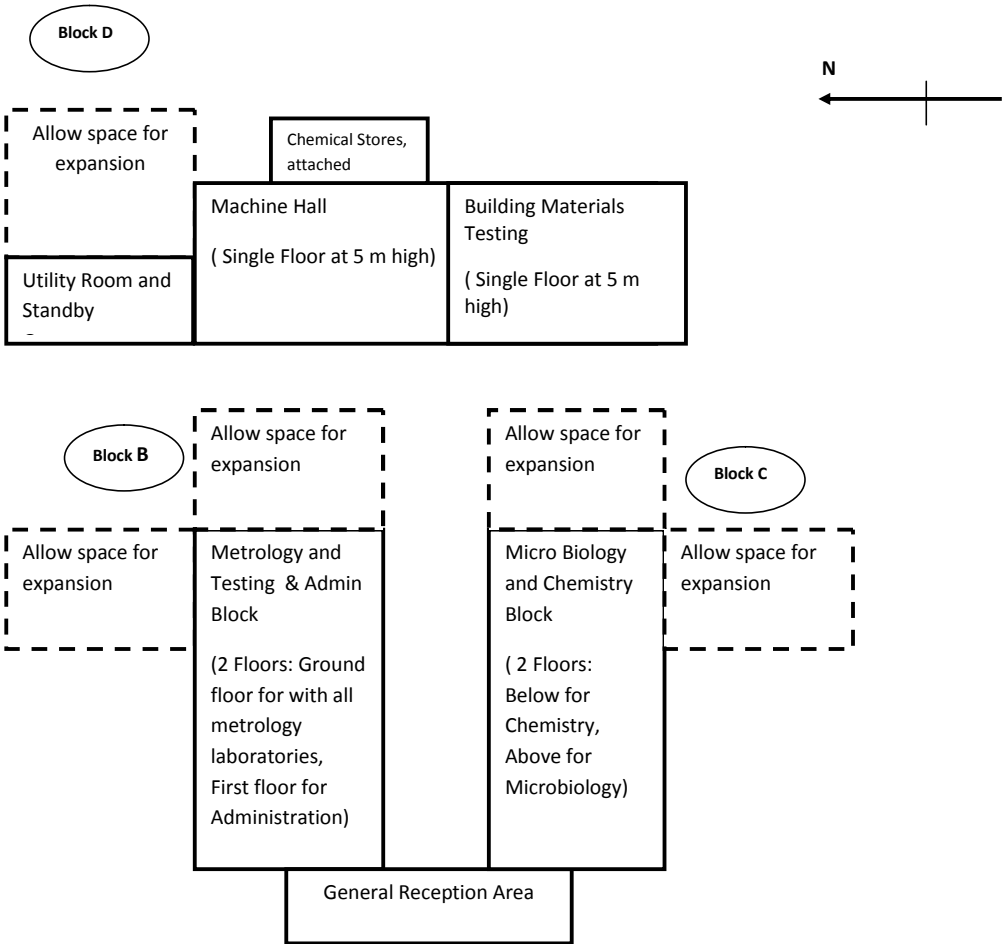


FIGURE T4: CONFIGURATION 1d:
3 BLOCKS OF 3 SEPARATE BUILDINGS WITH BLOCK D PERPENDICULAR TO B, ALTERNATIVE POSITION OF UTILITY ROOM

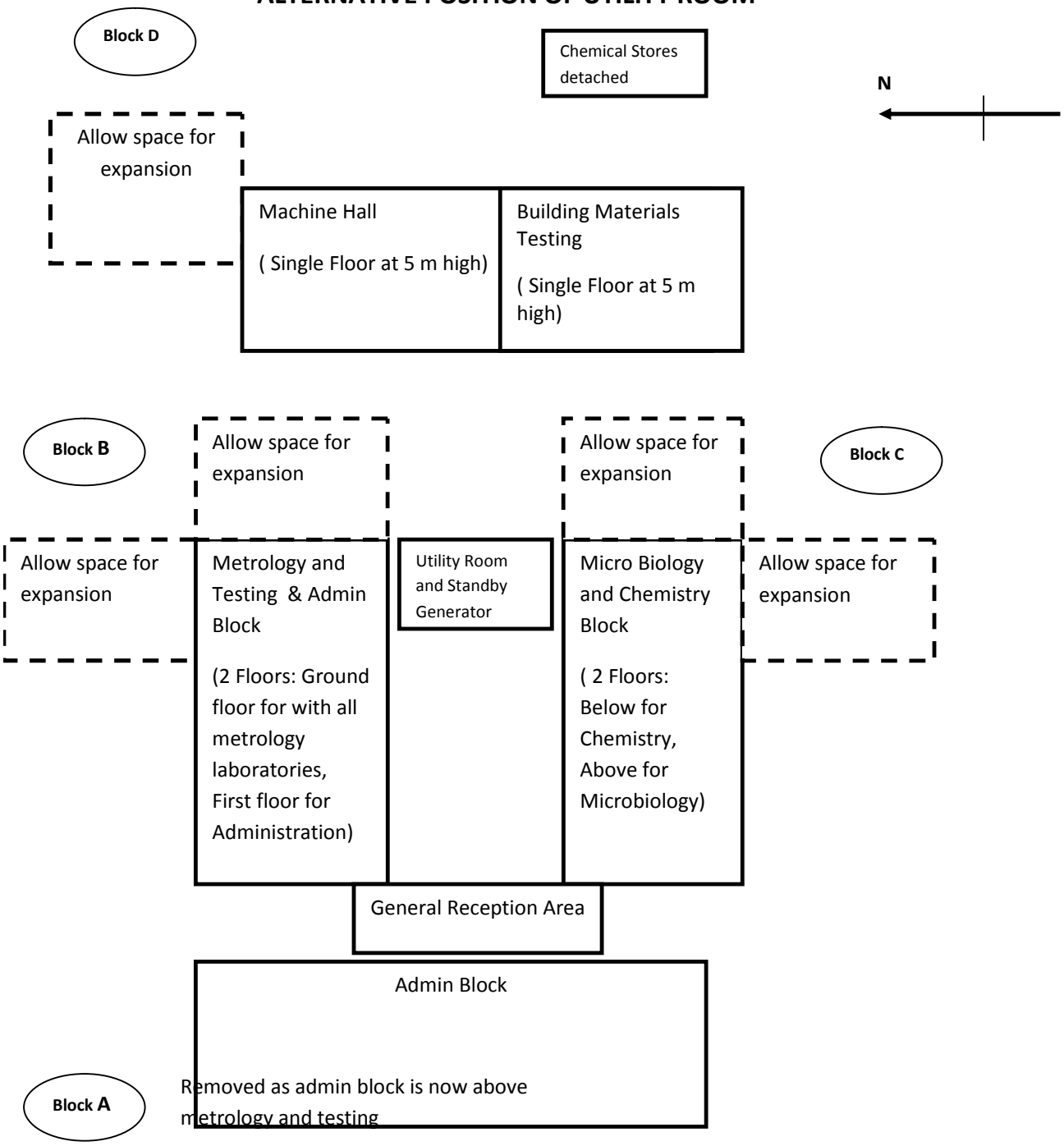


FIGURE T5: CONFIGURATION 1d (Details): LOCATION OF LABORATORIES ON GROUND/ LOWER FLOOR

For dimensioned layouts for metrology and chemistry labs see drawings GNBS -SAL 02 and GNBS -SAL 03 in Annex V

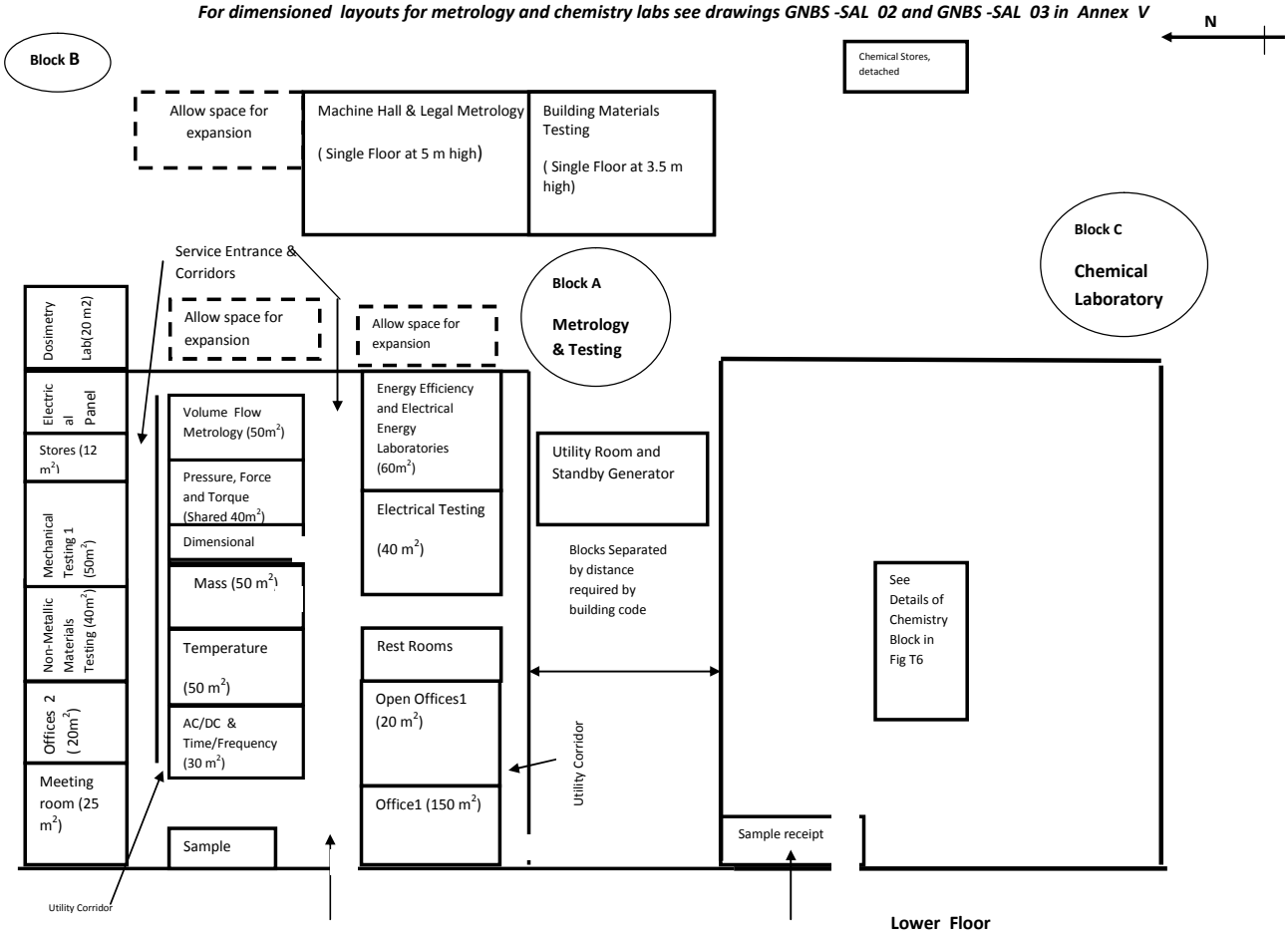
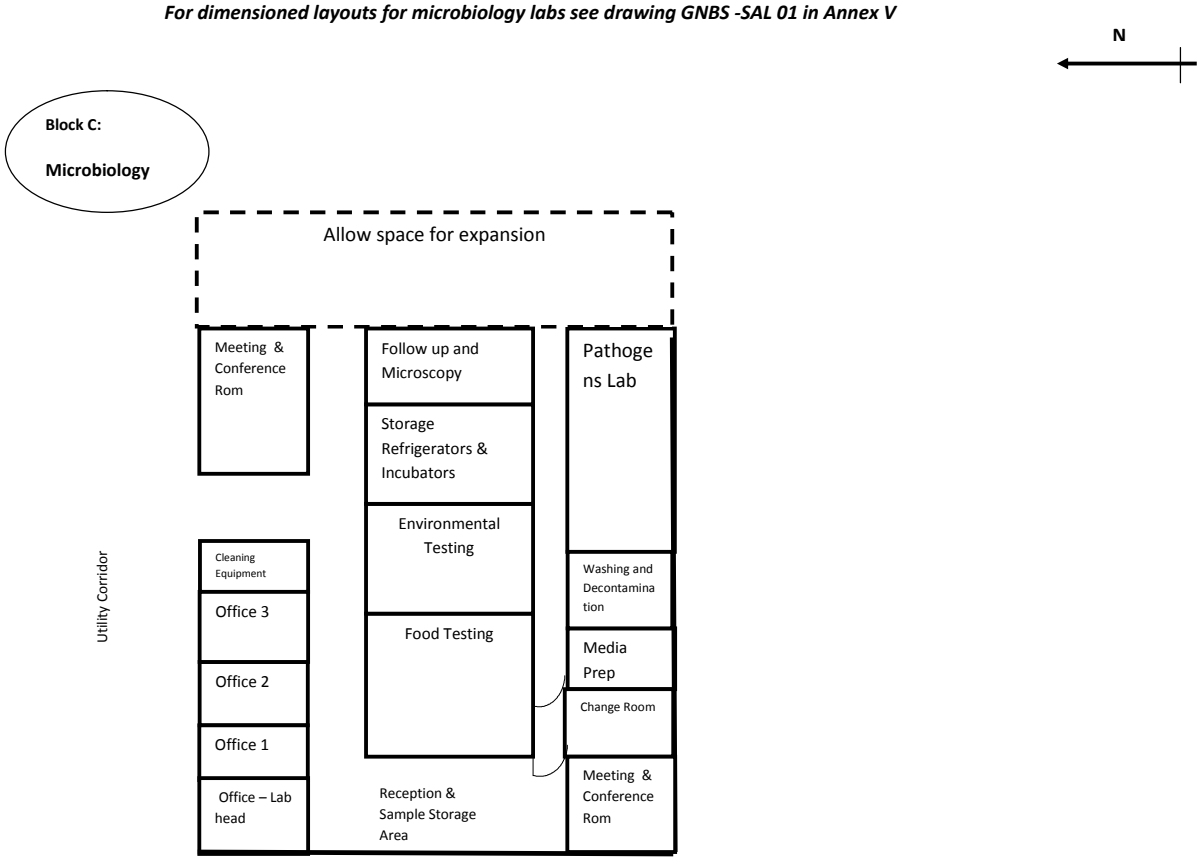


FIGURE T6: CONFIGURATION 1d (details): LAYOUT OF MICROBIOLOGY LABORATORIES AND ADMIN OFFICES - FIRST/UPPER FLOORS

For dimensioned layouts for microbiology labs see drawing GNBS -SAL 01 in Annex V



Upper Floor of Blocks C

Fig, T6A: Typical Layout Details of the Pathogen Lab

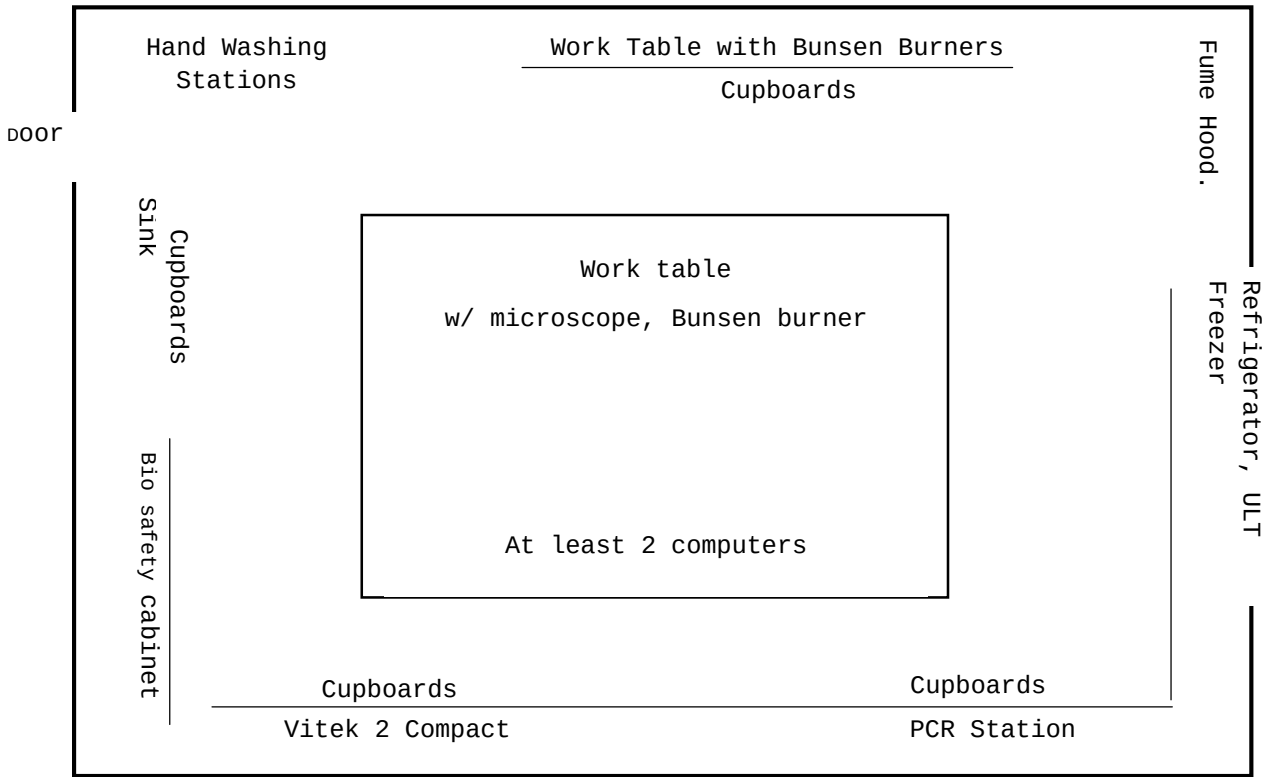


Fig T6B: Typical Layout Details of the Follow-up Microscopy Lab

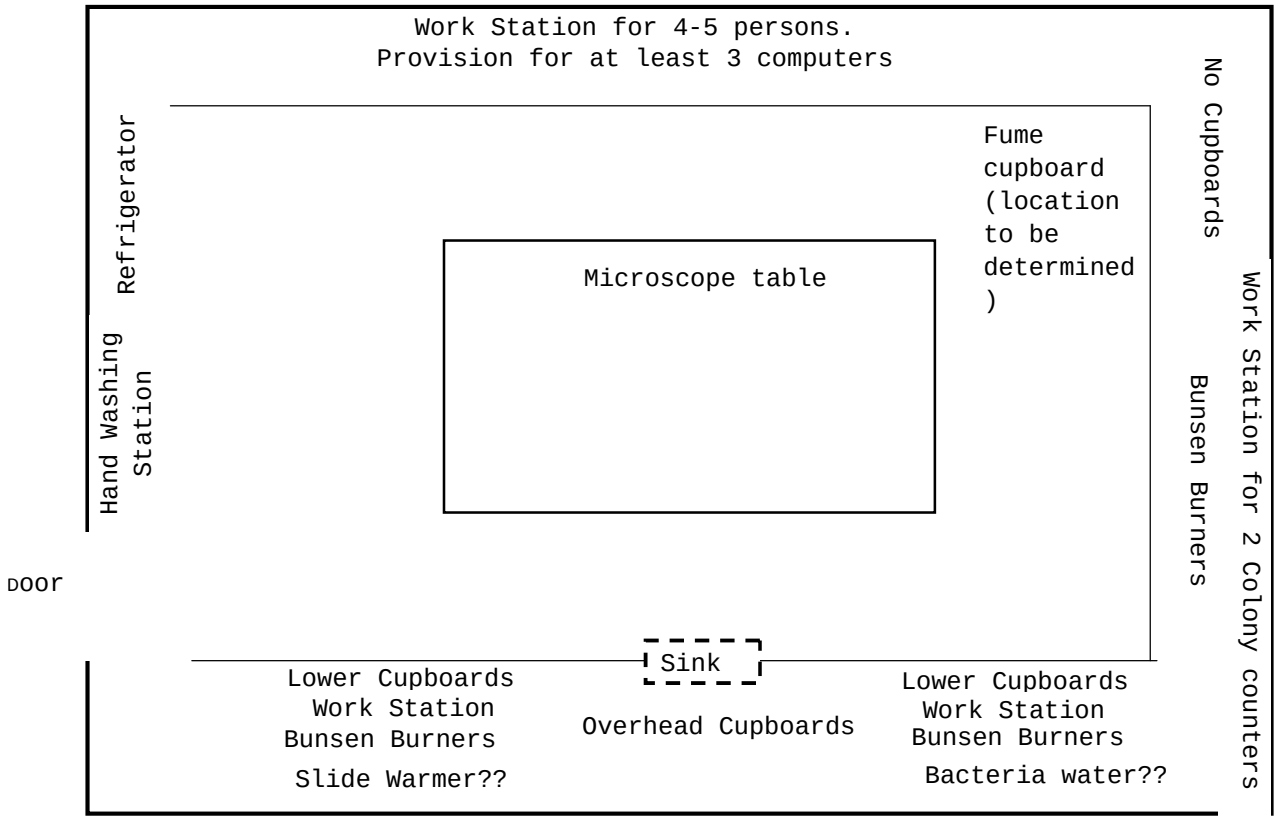
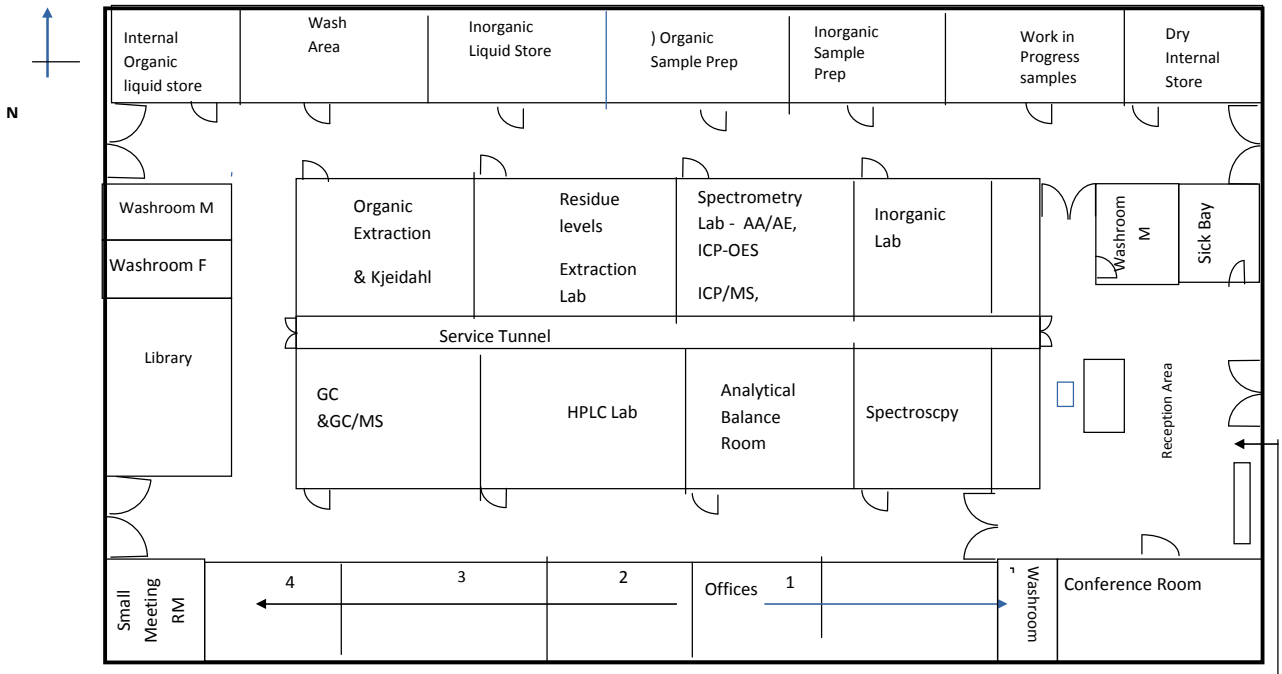


FIGURE T6: CONFIGURATION 1d (details): LAYOUT OF THE CHEMISTRY LABORATORIES - GROUND FLOOR

For dimensioned layouts for microbiology labs see drawing GNBS - SAL 03 in Annex V

***



*** Compressed gas storage, air and vacuum compressors, HVAC systems adjacent but not contiguous with main lab

Reception Area
with temporary storage for incoming and outgoing samples and reports

FIGURE T7: BLOCK D- CONFIGURATION 1C: LAYOUT OF BUILDING MATERIALS TESTING LABORATORIES

For dimensioned layout for the building materials laboratory see drawing SAL 003 in Annex FFFI

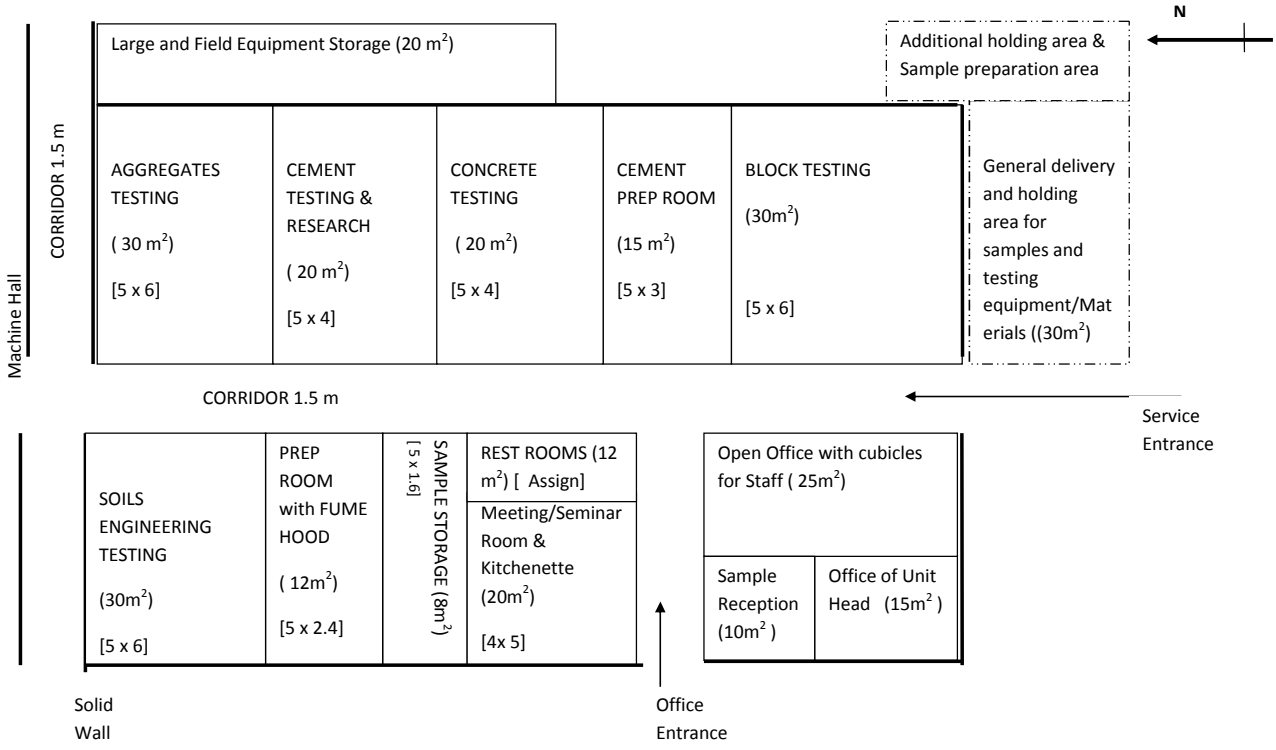
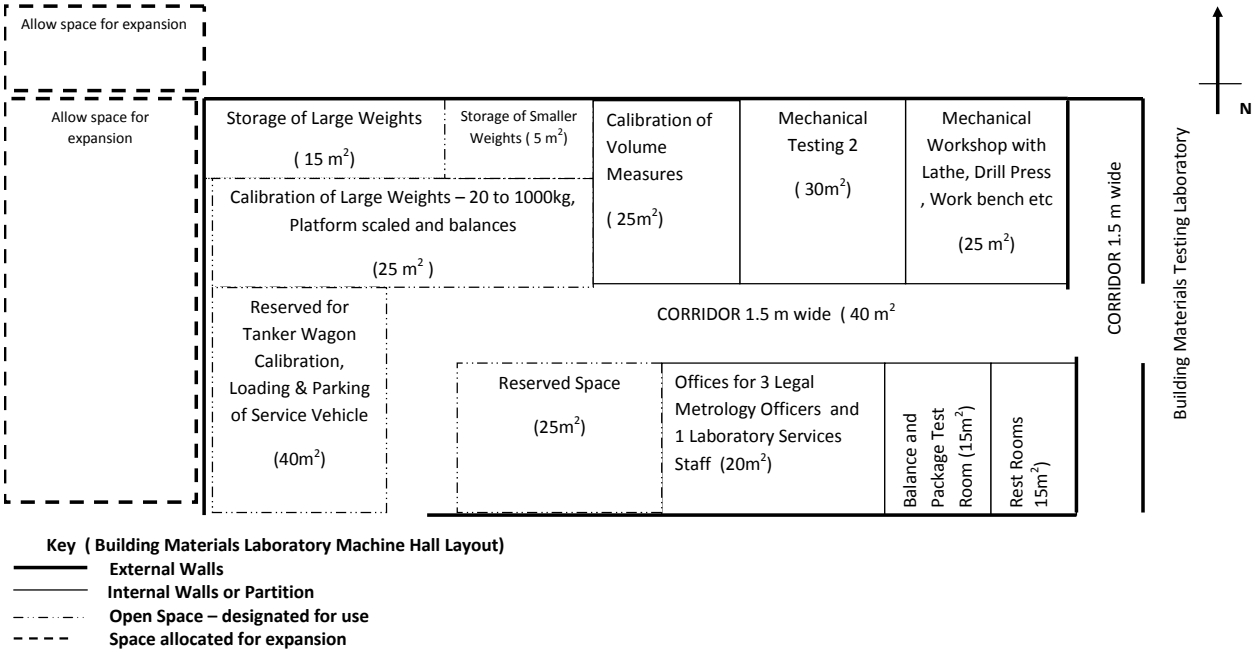


FIGURE T8: BLOCK D: LAYOUT OF MACHINE HALL BASED ON LABORATORY CONFIGURATION 2A ABOVE

For dimensioned layouts of the Machine Hall see drawing SAL XX Appendix I



Key (Building Materials Laboratory Machine Hall Layout)

External Walls

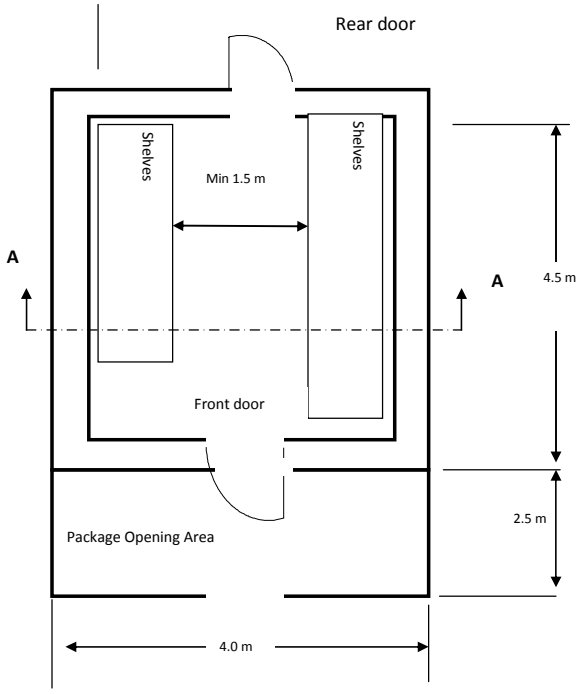
Internal Walls or Partition

Open Space – designated for use

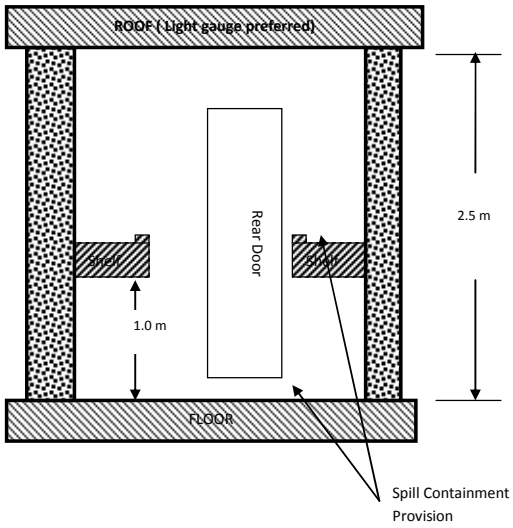
Space allocated for expansion

FIGURE T9: LAYOUT OF HAZARDOUS CHEMEICAL S TORES

For further specifications on the chemical stores, see table H4 in Appendix H



Plan View



Section A-A Through Building

Annex 3: Cost Estimates for the Construction of the Access Road into the Proposed GNBS Compound

Guyana National Bureau of Standards (GNBS)
Estimate for Proposed All-weather Access Road (Approximately 165m long x 5m wide)

Item	Description	Unit	Quantity	Unit Rate (G$)	Amount (G$)
1.0	**CULVERT WORKS**				
1.1	**Temporary Works**				
	Construct and remove temporary facilities used in the execution of the work. These temporary works may include falsework, forms and form travellers & shoring.				
1.1.1	Falsework (formwork), forms and form travellers and shoring for all concrete and associated works.	m^2	156.1	8,395.00	1,310,459.50
1.2	**Concrete Structures**				
	Furnish, place, finish and cure concrete members.				
1.2.1	In Situ Concrete				
	In Situ concrete, Grade fc' = 32 N/mm2. Concrete finish Class 2 - Rubbed.	m^3	11.4	82,000.00	934,800.00
1.3	**900mm dia. HDPE Pipe Culvert**				
1.3.1	Structural excavation in soft clay not exceeding 3m deep including disposal.Allowance to be made for shoring.	m^3	94.4	6,052.00	571,587.19
1.3.2	Cofferdams and water control within vicinity of structure.	Item			390,476.00
1.3.3	Provide, place and compact white sand fill to base of culvert. Fill to be compacted to 95% proctor.	m^3	41.5	6,150.00	255,218.85
1.3.4	Provide, place and compact clay blanket to back of wing walls.	m^3	42.9	1,025.00	43,956.20
	900mm Diameter HDPE pipe.	m	5.0	73,800.00	369,000.00
1.4	**Reinforcing Steel**				
	Furnish and install reinforcing steel				
	Reinforcing steel. Deformed Bars, Grade 60 (Grade 420)				
1.4.1	12mm dia.	kg	626.7	1,035.00	648,634.50
1.4.2	16mm dia.	kg	1526.2	1,035.00	1,579,617.00
1.5	**Timber Sheet Piles**				
	Greenheart timber driven sheet piling; 75mm thick by 8000mm long by 3000mm deep	No	2	349,476.00	698,952.00
	Sub-total (Culvert Works)				***6,802,701.24***

Guyana National Bureau of Standards (GNBS)
Estimate for Proposed Fair-weather Access Road (Approximately 165m long x 5m wide)

Item	Description	Unit	Quantity	Unit Rate (G$)	Amount (G$)
1.0	**CULVERT WORKS**				
1.1	**Temporary Works**				
	Construct and remove temporary facilities used in the execution of the work. These temporary works may include falsework, forms and form travellers & shoring.				
1.1.1	Falsework (formwork), forms and form travellers and shoring for all concrete and associated works.	m^2	156.1	8,395.00	1,310,459.50
1.2	**Concrete Structures**				
	Furnish, place, finish and cure concrete members.				
1.2.1	In Situ Concrete				
	In Situ concrete, Grade fc' = 32 N/mm2. Concrete finish Class 2 - Rubbed.	m^3	11.4	82,000.00	934,800.00
1.3	**900mm dia. HDPE Pipe Culvert**				
1.3.1	Structural excavation in soft clay not exceeding 3m deep including disposal.Allowance to be made for shoring.	m^3	94.4	6,052.00	571,587.19
1.3.2	Cofferdams and water control within vicinity of structure.	Item			390,476.00
1.3.3	Provide, place and compact white sand fill to base of culvert. Fill to be compacted to 95% proctor.	m^3	41.5	6,150.00	255,218.85
1.3.4	Provide, place and compact clay blanket to back of wing walls.	m^3	42.9	1,025.00	43,956.20
	900mm Diameter HDPE pipe.	m	5.0	73,800.00	369,000.00
1.4	**Reinforcing Steel**				
	Furnish and install reinforcing steel				
	Reinforcing steel. Deformed Bars, Grade 60 (Grade 420)				
1.4.1	12mm dia.	kg	626.7	1,035.00	648,634.50
1.4.2	16mm dia.	kg	1526.2	1,035.00	1,579,617.00
1.5	**Timber Sheet Piles**				
	Greenheart timber driven sheet piling; 75mm thick by 8000mm long by 3000mm deep	No	2	349,476.00	698,952.00
	Sub-total (Culvert Works)				***6,802,701.24***

2.0	**ROAD WORKS**				
2.1	**Site Clearance and Earthworks**				
	Clearing and Grubbing				
2.1.1	Clear, grub, remove and dispose of vegetation and debris within designated limits	m^2	2475	635.00	1,571,625.00
2.2	**Roadside Drains**				
2.2.1	Construct roadside drains (600mm bottom width and 1.5m top width).	Lm	330	5,662.00	1,868,460.00
2.3	**Excavation and Embankment**				
	Common Excavation				
2.3.1	Excavate and place or dispose of unclassified material. 0 to 1.5m deep in roadway construction.	m^3	1584	635.00	1,005,840.00
	Subgrade Preparation				
2.3.2	Shape and compact subgrade before placing a base or surface course	m^2	1320	244.00	322,080.00
	Shoulders/Verge Embankment				
2.3.3	Preparing areas, placing and compacting approved fill material in edge of roadway/verge embankment.	m^3	495	615.00	304,425.00
2.4	**Pavement**				
	Subbase - White Sand Fill (CBR 15-25%) - 750mm thk				
2.4.1	Provide, place and compact to 95% proctor, acceptable white sand fill.	m^3	990	3,690.00	3,653,100.00
	Road Base - Sand Clay / White Sand - 60:40 ratio (CBR 45-55%) - 200mm thk				
2.4.2	Provide, place and compact to 95% proctor, acceptable sand clay/white sand fill, blend in the ratio 60 loam:40 white sand.	m^3	198	5,125.00	1,014,750.00
	Prime Coat				
2.4.3	Provide and apply an asphalt binder prime coat (CRS 2 :- 0.30 to 0.35gal/yd^2) to a clean road base.	m^2	825	1,025.00	845,625.00
	SBST Layer				
2.4.4	Supply, place and compact S.B.S.T layer.	m^2	825	4,300.00	3,547,500.00
	Sand Seal				
2.4.5	Supply and apply sand seal on S.B.S.T layer	m^2	280	1,025.00	287,000.00
	Sub-total (Roadworks)				***14,420,405.00***
	GRAND TOTAL (G$)				**21,223,106.24**
	Using an average exchange rate of 1US$ to 205G$				
	TOTAL (US$)				**103,527**

Annex 4: Consultation Notes

CONSULTATION NOTES

Institution:	Guyana National Bureau of Standards (GNBS)
Time/Date:	15:15hrs on Thursday August 4, 2016
Representatives:	Ms. Candelle Bostwick**, Head of Conformity Assessment**
	Mr. **Shailendra Rai**, **Legal Metrology and Standards Compliance Department**
	Mr. Edward Melville, **Coordinator of Laboratory Services Department**

General Overview

As it relates to supporting the national development trust, the Guyana National Bureau of Standards is involved in product inspections/quality assurance testing, metrology testing and building the capacity of manufactures, factories and laboratories towards improved standards and certification.

Comments on Project

The current project undertaking will improve the Bureau's capacity in metrology testing and the monitoring of products. It is also expected that the range of products monitored can potentially be widened and level of technical assistance which will be offered to laboratories will be significantly enhanced.

Environmental Issues

The primary environmental which affects the operations of this institution is its inability to effectively dispose of chemical waste. It was explained that currently they are no existing standards for the storage or hazardous chemicals and disposal after use. This situation has resulted in chemical waste being stockpiled at the facility. Dilution has also been utilized for the disposal of nitric acid. The diluted solution is poured in drains at the facility. However, the Bureau reported that the amount of chemical waste stored is not of a large volume.

Additionally, it was also reported that the disposal of petroleum was is also an issue of concern. In some instances when oil tankers are presented for examination small volumes of oil remain in the tanks which is washed out into the drainage network. Old scales and other tested products are disposed of

Outstanding/Additional Information Requested at Consultation

1. List of tests conducted by the laboratory
2. Inventory of chemicals used at the laboratory facility in 2015.

Institution:	**Pesticides and Toxic Chemicals Control Board (PTCCB)**
Time/Date:	9:30hrs on Friday August 5, 2016
Representatives:	**Ms**. Trecia David Garnett**, Registrar**

General Overview

The PTCCB has responsibility for regulating importation and use of pesticides and toxic chemicals. The Board plays a pivotal role in ensure that chemical imports are registered and verified. Additionally, through its operations in the agriculture sector the PTCCB utilizes it laboratory facility to track the use of illegal pesticides and residue concentrations in market products and exports. Some exporters require a certificate of clearance (residue concentrations) from the regulatory body to export. ISO 17000 and 17025 certification for its laboratory is currently being pursued with assistance from the GNBS.

Comments on Project

As the PTCCB seeks to expand its testing capacity (range of analysis testing) and as a consequence expand its laboratory infrastructure the current project is of significant importance. It is hoped that the GNBS will increase its ability to support laboratories moving towards certification and seeking to improve metrology and testing techniques. Additionally, it was noted that coordination of technical capacities among laboratory staff is lacking. Often it has been the experience that expertise and capabilities are not shared even among national laboratory staff and as such efforts towards improving networking capabilities is required and should be given due consideration under this project. Further, it was revealed that at a recent forum the agency was told that for some areas where it was hoping to expand its testing capacity it had no jurisdiction. As such improved networking particularly between the regulatory agencies can result in a more efficient utilization of resources.

Environmental Issues

The most critical environmental issue encountered at the PTCCB laboratory is their inability to effectively dispose of chemical waste and solvents. It was confirmed that these products were being stockpiled after use without a defined national approach for disposal or removal. The registrar complained that other laboratories will usually contact the institution for guidance after being refereed by the EPA or out of pure frustration of not knowing what to do. The registrar noted that often the EPA would make recommendations to laboratories to dilute or bury their waste but without any specific instructions for the executions of these measures.

However, under the Prevention and Disposal of Obsolete Chemicals (PDOC) project of the Food and Agriculture Organisation (FAO) of the United Nations (UN), the PTCCB's chemical stockpiles are being removed for disposal overseas. Through the PDOC project the FAO is hoping to mobilize about US$ 8 million to support this work over the course of the programme which started in 2009 and will continue until 2017 (http://www.fao.org/agriculture/crops/obsolete-pesticides/news5/en/). Enquiries (by the PTCCB) into the cost of chemical disposal after the conclusion of the PDOC project in 2017 revealed that the removal of toxic chemical was is approximately US$5,000.00 per ton.

Outstanding/Additional Information Requested at Consultation

1. List of tests conducted by the laboratory
2. Frequency of each test (of each type)
3. Inventory of chemicals purchased for use laboratory facility in 2015 (type/volume).

Institution:	**Hinterland Scholarship Dormitory (HSD), Ministry of Indigenous Peoples Affairs (MIPA)**
Time/Date:	11:00hrs on Friday August 5, 2016
Representatives:	**Ms**. Christine Percival**, Welfare Officer**

General Overview

Hinterland Scholarship Dormitory (HSD), is located approximately 500 meters west the proposed construction site for the GNBS site. The construction of the HSD was completed in 2010 and officially opened in 2011. The **Dormitory provides boarding to b**eneficiaries of the Hinterland Scholarship Programme (HSP) who are awarded places at Schools in Georgetown.

The facility has the capacity to house one hundred and twenty students and staff. Currently it provides boarding to 90 students and provides employment to 18 individuals including "dorm mothers", a dorm father, cooks, laundry workers, cleaner, security and administrative staff.

Comments on Project

- ***Social Concerns***

While there have been no reported security breaches, Ms. Percival the Welfare officer at the facility posited that street lighting should be provided with the new project since the access road has no lighting. With increased activity it was believed that there is the potential for an increased risk to criminal activity.

- ***Environmental Concerns***

The storage and utilization of chemicals at the new laboratory facility was noted as the most significant concern for the proposed project.

Institution:	Guyana Livestock Development Authority (GLDA)
Time/Date:	13:30hrs on Friday August 5, 2016
Representatives:	Mr. **Richard Cumberbatch,** Chief Executive Officer **Dr. Dwight Walrond,** Deputy CEO **Dr. Dane Hartley,** Director of the Veterinary **Laboratory**

General Overview

The Guyana Livestock Development Authority (GLDA) is the primary involved in surveillance of zoonotic diseases and animal husbandry. Its laboratory facility was commissioned in August 2014. The laboratory is presently working towards certification and has established linkages with the Inter-American Institute for Cooperation on **Agriculture** (**IICA**) and World Animal Health Organisation (WAHO) Laboratories. These linkages has allowed for the IICA and WAHO laboratories to be used to double test results the use of these facilities as reference laboratories has helped to improve transparence and trust amongst trading partners.

Comments on Project

The Director of the Laboratory suggested under this project the GNBS can improve its support services to laboratories particularly in the areas of certification, metrology and training in improved testing techniques.

Environmental Issues

The disposal of waste is of critical importance to the laboratory. Presently several approaches are being utilized for waste disposal.

1. Biological waste/material is presently disposed at the Georgetown Public Hospital Facility
2. Chemical Waste (very small volume) is sent to the PTCCB Storage Bond at National Agriculture Research Institute (NARI). Reagents (in prepared kits) are mainly used for testing at the facility.
3. Liquid waste for laboratory operations are washed into a specialized septic tank which has a filter bed.
4. The laboratory also has an Incinerator for the burning of solid non-toxic waste.

Institution:	**Government Analyst Food and Drugs Department (GA-FDD, Ministry of Health)**
Time/Date:	15:30hrs on Friday August 5, 2016
Representatives:	Mr. Marlon Cole**, Director**

General Overview

The Government Analyst Food and Drugs Department (GA-FDD) is responsible for monitoring the quality of food, cosmetics, and medicinal substances/drugs. Their jurisdiction covers imports, exports and items produced for the domestic market. The regulatory department is responsible for issuance *a "Free Sale Certificate"/Export Certificate* for exports and for checking and verifying certification (issued in country of origin) from country of origin. Importers of food, cosmetics, and medicinal substances/drugs are also required by law to be registered with the GA-FDD and to be issued with import permit. The GA-FDD also routinely checks the authenticity and quality of food products manufactured locally or imported.

Given its wide range of responsibilities the Director of the GA-FDD suggested that his department was grossly understaffed with four (4) food inspectors and two (2) drug inspectors. Further, it was believed that given its mandate this department within the Ministry of Health (MoH) should move towards being a semi-autonomous agency. Funding was also mentioned as a major impediment which can be more effetely addressed with a semi-autonomous status.

The GA-FDD is currently perusing ISO Certification (17025), through funding received from the European Development Fund (EDF). It is projected that the certification process should be concluded by December 2016.

Comments on Project

The Director of the **GA-FDD** indicated that the GNBS should have conceived a project which simultaneously improved the laboratory facilities of the regulatory agencies. Mr. Cole, posited that while the current project focuses primarily on improving the facilities of GNBS with the possibility of assistance being given subsequently to other laboratories this approach would not have the desired effect of improving exports within an efficient timeframe. It was stressed that GNBS was responsible for the establishment and maintenance of standards for importers/retailers, manufactures and producers. This is in contrast to the regulatory agencies such as the PTCCB, GLDA and the GA-FDD that are primarily responsible for enforcement. As such for there to be a marked improvement in exports sufficient financial support should be allocated towards improving the facilities of the PTCCB, GLDA and the GA-FDD.

Environmental Issues

The primary environmental which affects the operations of this institution is its inability to effectively dispose of chemical waste. Currently reagents and chemical waste are being stockpiled at the laboratory.

Additional Information Requested at Consultation

1. List of tests conducted by the laboratory
2. Frequency of each test (of each type)
3. Inventory of chemicals purchased for use laboratory facility in 2015 (type/volume).

Institution:	**Central Housing and Planning Authority (CH&PA)**
Time/Date:	14:30hrs on Friday September 2, 2016
Representatives:	Mr. Orsen Simon, **Development Facilitation Officer 3**

Comments on Project

- Property owners are required to make *'Building Applications'* to the **M&CC**.
- The application forms can be uplifted from the **M&CC**.
- The application must also include;
    - **Floor, site** and **elevation** drawings.
    - Proof of ownership documentation (ownership of property)
- The **floor** and **elevation** drawings must be done to a scale of 1/8 (inch) per 1 foot, while the
- The applications are sent to **CH&PA** for approval by the **M&CC.**
- When the application is sent to **CH&PA,** depending on the type of building proposed and the corresponding activity:
    - The drawing are sent to the **Fire Service** for their input (determination of muster points, locations for fire extinguishers, emergency exits, etc.)
    - Applicants are asked to check with the **EPA** to determine if an Environmental Impact Assessment is required.
    - Sinergy/Compatibility with the **existing land uses** in the proposed construction area is also considered.
    - Apart from the mentioned areas CH&PA seeks to ensure that the building will be **well ventilated** and that **sufficient washroom facilities** are available based on occupancy levels.
    - Generally, the approval of applications are guided by the principles and specifications as outlined in national Building Codes (https://chpa.gov.gy/news/219-test) and **CH&PA's Developers Manual (source: https://chpa.gov.gy/images/stories/Developers_Manual.pdf)**

Institution:	**Guyana Water Incorporated (GWI)**
Consultation Mode:	Telephone
Representatives:	Customer Service Desk

Question: Which GWI well facility serves the area identified for the GNBS Laboratory Facility?

Answer: The proposed site area is serviced by a well located in the University Of Guyana Compound. This well was established to serve Giftland and other large development projects in the Patterson/ Liliendaal area. Previously, the area was served by a well in Sophia which can still be used to supplement water flow to the area.

Question: What rate payment system is ascribed to facilities/buildings owed by Government/Semi-Autonomous Agencies?

Answer: All Government/Semi-Autonomous Agencies are required to pay commercial rates. The commercial rate is G$180.00 per m^3.

Institution:	**National Drainage and Irrigation Authority (NDIA)**
Time/Date:	13:30hrs on Tuesday September 6, 2016
Representatives:	Mr. **Frederick** Flatts, **Chief Executive Officer (a.g)**

Comments on Project

Flood Mitigation

The NDIA does not have jurisdiction within Georgetown in addressing issues of drainage. This responsibility resides with the Engineering Department of the Georgetown Mayor and City Council (M&CC). However, upon request and during periods when the Municipality is unable the meets its responsibilities the NDIA provides support particularly as it relates to providing machinery for the clearance of the main drainage canals. In this regard the NDIA had already provided assistance for the clearance of the Cummings, Downer, Sussex Street and Canals.

The management of the water level within the East Demerara Conservancy Water (EDWC) is also of critical importance to mitigate against flooding within Georgetown, East Coast Demerara (ECD) and East Bank Demerara (EBD). The conservancy id monitored on a 24hr basis to ensure that the integrity of conservancy walls are maintained and that water does not surpass the 57.75 Flood GD (Georgetown Data). In this regard the conservancy is staffed by 30 individuals who are equip with pontoons, boats, tools and mechanical equipment to fulfill their mandate. It was also noted that he Hope Canal which was dug to be relief channel for the release of excess water has twice been utilized for this purpose, i.e. in July/ August 2015 and in July/August 2016.

Institution:	**Guyana Fire Service (GFS)**
Time/Date:	14:45hrs on Thursday August 4, 2016
Representatives:	Mr. Andrew Holder, **Fire Prevention Officer**

Comments on Project

Building Requirements

The Senior Fire Service Official confirmed that for large buildings such as the laboratory facility under consideration, the Central Housing and Planning Authority will request the review and input of the GFS prior to granting their approval or no objection.

Generally, upon receipt of the Drawing Plans the GFS will inspect the proposed drawing to ensure that safety features are existent. These include but are not limited to:

- Adequate entrance and exits for each floor of the building. There must be at least one entrance and exit for each floor of the building.
    a. After the second floor internal steps are not considered as entrance and exit points and an external stairway must be constructed.
- If flammable items will be utilized within the facility a hose-real connected to an independent water line is required. Since in Guyana the GWI does not provide a 24 hour water supply it is expected that the hose lines will be connected to a secondary water source such a well or overhead tank system
- Muster point must be identified for assembly in the occurrence of an emergency. These are required to be upwind (when consideration is made for a fire) and a fair distance from the building or flammable substances stored on site.

Occurrence of Fires

It was noted that prior to recent developments in the area (2 to 3 years ago) fires were known to occur in the area. It was posited that while there may have been some accidental burning, 80% of such fires were causes by individuals who wanted to clear the area for security and development purposes (but wanted so at minimal cost). It was noted that no data exists to support these claims. In recent years there have not been any reported fires at the proposed site.

Emergency Response

Should a fire occur in the area, it was posited that a unit the Campbellville Fire Station will provide the first response. This unit will consist of six (6) fire fighters and a single water tender. If this unit is unable to bring the fire under control a second response unit (same capacity) from Alberttown Fire Station. Units from the aforementioned station can reach the proposed site in three (3) and five (5) minutes respectively.

Should a larger response be required the GFS and provide a total of eight (8) water tenders, three (3) ladder trucks which can extend to 400 feet, portable pumps (which can be placed directly into a nearby water source and preform the services of a water tender), an ambulance and other safety and firefighting equipment.

Institution:	Georgetown Mayor and City Council (M&CC)
Time/Date:	15:30hrs on Tuesday September 6, 2016
Representatives:	**Mr. Ron Eastman, Deputy City Engineer**

Comments on Project

Building Application

The M&CC official confirmed that an application has to be made to the municipality for approval/no objection to be granted prior to construction of the building. *(A copy of the application form was provided for reference).*

The application form must be completed and accompanied by other documentation upon submission. These documents include the following:

1. **Certified** copies of Ownership (Transport, Title, Lease etc.) and /or Document of Authority
2. **Three (3) copies** of Building Plans.
3. **Geotechnical and Design Report along with three (3) copies of foundation details, sections for structures three (3) floors and above.**
4. Processing and Inspection Fees.
5. Rates and taxes receipt verifying payment for current year.
6. Copy of Survey Plan of Lot.

Generally, the approval of applications are guided by the principles and specifications as outlined in the Laws of Guyana Chapter 28 01 - Municipal and District Councils Ac (Source: http://www.guyaneselawyer.com/lawsofguyana/Laws/cap2801.pdf)

Flood Mitigation

Presently, the primary flood mitigation measures being employed within the city is the clearing of trenches and canals and the maintenance of drainage pumps, Kokers (sluice box systems). It was recommended that the ground floor of the facility to elevated to approximately 28 to 30 inches above ground level (equivalent of three 8 inch concrete blocks with plaster).

Outstanding/Additional Information Requested at Consultation

1. *Georgetown Drainage Plan*

Annex 5: Land Use Map of the ADI and AII