COOPERATIVE REPUBLIC OF GUYANA EDUCATION SECTOR IMPROVEMENT PROJECT

Project ID: P159519

THE WORLD BANK

Environmental Assessment (EA) and Environmental Management Plan (EMP)

Submitted by the

Faculty of Earth and Environmental Sciences (FEES)

of the University of Guyana

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Acronyms

AC	Air conditioner or air conditioning unit
BOD	Biological Oxygen Demand
CAAM-HP	Caribbean Accreditation Authority for Education in Medicine and other Health Professions
CBJ	Cheddi Bharat Jagan
CCTV	Closed circuit television
CDC	Centers for Disease Control and Prevention
cm	Centimetres
CEI	Construction Environmental Inspector
CIT	Centre for Information Technology
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CWP	Construction Work Plan
CCP	Construction Communication Plan
dB	Decibel
DNA	Deoxyribonucleic acid
DO	Dissolved oxygen
ESRA	Electricity Sector Reform Act
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPco	Environmental Management Plan of the contractor
EPA	Environmental Protection Agency
ES	Environmental Specialist
ETS	Environmental Technical Specifications
FAO	United Nations Food and Agricultural Organization
FHS	Faculty of Health Sciences
GD	Georgetown Datum
GDP	Gross Domestic Product
GFS	Guyana Fire Service
GNBS	Guyana National Bureau of Standards
GPL	Guyana Power and Light Incorporated
ft	Feet
GoG	Government of Guyana
GWI	Guyana Water Incorporated
IAST	Institute of Applied Science and Technology
ICT	Information Communication Technology
ICZMP	Integrated Coastal Zone Management Plan
ITCZ	Inter Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
km	Kilometres
L&FS	Life and fire safety
LCD	Liquid Crystal Display

LCDS	Low Carbon Development Strategy
M&CC	Mayor and City Council
MPI	Microbiology, Parasitology and Immunology
m	Metres
m^3/s	Metre cubed per second
$\mu g/m^3$	Microgramme per metre cubed
mg/l	Milligramme per litre
MOE	Ministry of Education
NAAQS	National Ambient Air Quality Standards
NBS	New Building Society
NDS	Guyana National Development Strategy
NEAP	National Environmental Action Plan
NTU	Nephelometric Turbidity Units
OSHE	Occupational safety, health and environment
OP	Operational Policy
ppm	Parts per million
PC	Project Coordinator
PIU	Project Implementing Unit
PM10	Particulate matter of size less than 10 microns
POP	Persistent Organic Pollutants
SDSs	Sustainable Development Goals
RRR	Reduce, Reuse, Recycle
SPL	Sound pressure level
TDS	Total dissolved solids
UNEP	United Nations Environment Programme
USEPA	United States of America Environmental Protection Agency
UG	University of Guyana
UGSS	University of Guyana Students Society
UGSTSP	University of Guyana Science and Technology Support Programme
UGWU	University of Guyana Workers Union
UWI	University of the West Indies

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Executive Summary

Introduction

The proposed project is the "Guyana Education Sector Improvement Project (P159519)" by the World Bank. The objective of component 2 is to improve the learning environment of the Faculty of Health Sciences (FHS) at The University of Guyana (UG). It would support construction of a new Health Sciences facility.

The proposed new facility would include a four storey building with a capacity to accommodate 850 students. The building will be energy efficient, utilise natural lighting, where possible, and use solar panels to offset energy supply to the building. In addition, elevators and ramps will be built in order to accommodate differently-abled students.

There will be ten classrooms capable of seating 50 students each, three of which will have collapsible walls, thereby creating a larger space, and two classrooms with a seating capacity of 75. All classrooms would be required for the accreditation process by the Caribbean Accreditation Authority for Education in Medicine and other Health Professions (CAAM-HP). The classrooms must have adequate ventilation (AC or Fans), proper lighting, comfortable seating, internet access to facilitate teaching, LCD projectors and computersfor lectures, and white boards. Four laboratory facilities will be built, including a state-of-the-art anatomy lab, a 'skills' lab, a biochemistry/haematology lab and a microbiology lab. The labs would include proper ventilation (AC), trained laboratory staff and adequate relevant equipment. The proposed new FHS Building would be organised to respond to current and future teaching, research and services demands. A library and a boardroom are expected to be built and approximately 20% of space will be assigned to offices. Considering the limited resources available for this component and high cost of construction, it is necessary that proposed new FHS building meet the Caribbean regional or international standards within the budget.

The safeguards Policies of the World Bank that were triggered for this component were OP 4.01 Environmental Assessment and OP 4.09 Pest Management. Both will be secured by application of the Environmental Management Plan, which will be disclosed on both UG and World Bank's websites prior to appraisal. An Environmental Specialist will be hired by UG project unit to support the preparation and implementation of the Environmental Management Plan.

Background

The Turkeyen main campus of the UG is located in the floodplain of the Demerara River, at about 2m below sea level and at about 2 km east from the capital city of Georgetown. This Environmental Assessment (EA) has been prepared to evaluate the potential impact of the civil works involved in the construction and operation of the new FHS facility, upon the UG campus activities, its people and its surroundings. In response of this EA, an Environmental Management Plan (EMP) was prepared in order to prevent, mitigate and reduce environmental and social impacts derived from the proposed project development.

With 760 students enrolled in the 2015/2016 academic year, accounting for 12.95% of the total student enrolment, the FHS offered 12 Bachelor of Science and 1 Master of Science (Master of Public Health) programme. It is noteworthy that 207 of the students were freshmen.

Environmental Assessment

Five criteria were selected for the impact evaluation process: duration, likelihood of occurrence, geographic extent, reversibility, and nature of impact –all are standard criteria for project impact analysis. Where applicable, numerical values have been assigned to criteria, as well as, to the degree of significance: values of +- 11 to +-4. The actual analysis was informed by expert opinion, similarity and current environmental regulations in relation to project activities and impacts.

The following impacts have been assessed as high or moderate:

Impacts with High significance

Pre-construction Phase

Negative

- Transport of materials will result in traffic congestion along access road leading to the current building that is being occupied by students and staff, plus other staff and students of the University.

- Traffic congestion can affect students and staff punctuality to lectures, which in turn may lengthen the number of contact hours to complete courses that would have been affected.

- The area identified for the construction of the building will require clearing of mainly grasses at it has already been decided that the large trees will remain. Any species (flora or fauna) whose habitat will be disturbed can easily adapt to suitable sites nearby. Importantly, the species that have been identified in the area are not rare, threatened, endangered or endemic.

Positive

- Creation of employment at unskilled and skilled levels.

Construction Phase (Negative)

- Increased traffic congestion due to on-going delivery of material supply. This will impact the timely delivery of goods and services to the existing canteen.

Positive

- Creation of employment at unskilled and skilled levels.
- Provision of a modern building (Green) for the FHS, which will provide additional facilities for the enhancement of the delivery of the medical programmes.

Operation Phase (Negative impacts)

- Generation of solid waste by the students and staff due to their use and occupation of the facilities. This would include plastic, cardboard and paper.
- Reduction in natural resources used in the manufacturing of the equipment.
- Generation of solid waste and possibly hazardous waste when equipment becomes non-functional.
- Reduction in natural resources used to produce the materials.
- Generation of hazardous (infectious and non-infectious) waste from laboratory sessions. Infectious waste which may be either solid or liquid, and include but are not limited to discarded blood and blood specimens, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human tissues, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids and laboratory waste that exhibit the characteristics described above. Non infectious waste would include chemical waste.
- Generation of solid waste from use of the laboratories. Solid waste may consist of packaging material, (broken) glass.
- Discharge of effluent from the laboratories may result in a deterioration of the quality of water in the surrounding drains.
- Use of water for laboratory and sanitation activities could place an increased pressure on the resource and contribute to water resource depletion

Positive Impacts

- The FHS would be able to meet one of the requirements for accreditation by the CAAM-HP .
- Once accreditation is restored, the Faculty could extend some basic services to the wider University and surrounding communities that can help students to acquire hands-on experience on one hand, and assist the Faculty/University to acquire funds, on the other hand.
- Use of electrical equipment and lights in the facility that would be provided with a renewable source of energy and reduce dependence on the National Grid.
- Increased opportunities for improved health and safety arising from the provision of additional facilities.
- Use of modern facilities will enhance the delivery of the medical and other health programmes and thus lead to improved learning by students of these programmes.
- Use of the enhanced facilities will contribute to improved research output from students and staff and other collaborators.
- Use of the modern facilities could contribute to increased enrolment of and thus learning by “differently-abled” persons.
- Use of the enhanced facilities will reduce dependence on facilities external to the University.

Impacts with moderate significance

Pre-construction (Negative)

- Noise emanating from transporting and off-loading material supply by vehicles (mainly trucks) can be a nuisance to students and staff of the Faculty of Health Sciences and the Faculty of Natural Sciences, as well as the Public Relations Office, and persons using the multi-purpose building that are west of the project site.
- The existing parking space will not be available and will therefore require alternative parking spaces, which in turn, may create security issues.
- Dust emissions are expected as a result of waste removal.
- Localised pollution will occur as a result of traffic of equipment and transporting vehicles.
- Soils will be disturbed as a result of preparation of land.
- With the provision of the new facilities on campus there is the possibility for theft.

Construction (Negative)

- Damage to vegetation due to storage of materials.
- Generation of particulate matter, particularly due to storage of materials and operation of cement mixers.
- Generation of construction materials (for example, moving earth for levelling of the site to make the unit platform and other solid waste materials).
- Overload of current capacity of waste disposal facilities.
- Generation of noise from machinery and construction activities.
- Increased pressure on utilities (particularly water and energy).
- Social conflicts (between University staff and students and construction workers) arising from presence of construction personnel on campus.
- Land 'take' which will prevent alternative uses, for example recreation.

Operation (Negative)

- Generation of sewage from the use of toilets will place increased pressure on the Campus' current non-functional sewage treatment system.
- Discharge of untreated sewage into the internal and surrounding drains on campus could lead to health risk to persons on campus and the surrounding communities.
- Generation of solid waste from the packaging of equipment. This waste could include cardboard and plastic.
- Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO_2, VOCs, particulates (PM10 and PM2.5).
- Generation of solid waste from the packaging of the material.

- Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO2, VOCs, particulates (PM10 and PM2.5).
- Emissions of gases from the use of fume cupboards could result in increased local air pollution and a decrease in local air quality.
- Release of gases toxic gases and infectious substances from experiments conducted within the laboratory into the air may results in a decrease in quality of air within the laboratory.
- Non adherence to laboratory safety practices could result in increased health and safety risk to the students and staff. This could be due to exposure to micro-biological infections, due to the presence of microbes, upper respiratory distress due to constant inhalation of chemicals, injuries from sharps.
- Use of transportation to and from the campus could result in local air pollution and global warming due to vehicle exhaust emissions of CO_2 (cause global warming) CO, NOx and SO_2 (contribute to acidification), VOCs (contribute to the formation of ground level ozone, together with NO_2), PM10 and PM2.5 (cause a reduction in visibility).
- Emissions from vehicle exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health.

Positive

- Improved health and safety opportunities arising from the provision of facilities.

Environmental Management Plan

An EMP has been prepared to provide the framework for translating recommended mitigation measures and monitoring processes into often inter-related actions that shall be carried out by the project proponent. Key among these measures are:

- Having materials being delivered during peak hours. Traffic management shall be coordinated with the University officials.
- Only clear areas that are deemed necessary for the project.
- Workers must use protective equipment such as masks, ear plugs, helmets, safety shoes,etc.
- Materials that are stored will be covered.
- Contractor will stockpile the soils removed to be reused for landscaping after construction
- All construction materials and waste will be classified according to its type (domestic, recyclable, hazardous, etc,) and the final materials disposed in areas designated by the national Authority (such as the EPA/Georgetown M&CC).
- The University Administration will develop and implement a maintenance schedule for improved facilities.
- In the design of the building the use of space will be optimised (to reduce land take).

- The University Administration and staff shall practise separation and shall maximise opportunities for recycling of wastes such as cardboards.
- The University Administration shall select suppliers who provide sustainable products, including recycled and energy efficient products.
- The University will implement the Laboratory Safety and Use Plan which is a component of the Hazardous Waste Management System that is currently being finalised. The University will segregate, handle, store, transport, treat and dispose of waste, particularly hazardous waste in accordance with the Hazardous Waste Management System that is currently being finalised, and the World Bank's *Environmental, Health, and Safety Guidelines for Health Care Facilities*.

A risk assessment of the project was also conducted and the following risks have been identified:

- Spillage of chemicals and biological materials (including infectious substances) in the laboratories.
- Spillage of hazardous waste. This could occur due to improper storage, such as storage of hazardous liquids and dangerous solids over, storage of flammable wastes in close proximity.
- Fire could occur in facilities, particularly the laboratories.
- Flooding due to the likelihood of heavy rain and overload of surface drainage system.
- Traffic accidents arising from increased traffic on campus during construction.
- Exposure to needle sticks.

Contingency Plans include:

- The **University Environmental Health and Safety Policy Committee** will implement the Laboratory Safety and Use Plan currently being finalised.
- Specifically, users of the laboratories should practise good housekeeping, including keeping their work areas uncluttered, and safe work practices such as covering chemicals immediately after usage and using personnel protective equipment, such as goggles.
- There would be training conducted for all users of the laboratories in the handling of chemicals. Training will include: spill response procedures and materials safety data sheets.

In the event of the occurrence of a chemical spill, the pre-trained persons would:

- Institute spill response procedures which involve stopping the spill, containing it and disposal of the spilled material.
- Follow instructions on Material Safety Data Sheet for specific chemicals.
- The **University Environmental Health and Safety Policy Committee** will implement the Hazardous Waste Management System currently being finalised.
- The user will complete the Reporting form for accident/incident regarding chemical and other hazardous waste in the event of spillage.

- Precautions at the material storage will include limiting the quantity and amount of time such materials are stored, or providing additional containment between hazardous materials and waterways, and using trained personnel to monitor activities at the storage facility.
- Clean-up materials, including absorbent spill pads and spill kits will also be stored in storage areas.
- All works related to the erection of the FHS building structure shall be undertaken in conformity with the provisions of the *Code of Practice for Building – Part 3: Fire safety use and occupancy (first revision)*.
- In the event of fire, adequate fire suppression equipment (as indicated in Table 13 of *the Code of Practice for Building – Part 3: Fire safety use and occupancy (first revision)* shall be made available to restrict the fire growth to the compartment of origin, minmise damage to the building and its contents; and prevent fire spread to adjoining compartments, buildings or allotments; and adequate smoke control systems shall be installed to minimise the spread of smoke to escape paths, compartments and other buildings; and to assist access by fire fighters.
- Fire equipment will be inspected and tested at least each quarter of the year by the Fire Service and a log of tests made should be maintained by the University and shall be available for inspection at any time by the Guyana National Bureau of Standards (GNBS).
- Hand operated and portable extinguishers would be installed at strategic locations in the building. These systems would be regularly tested and approved by the Guyana Fires Service and records of the dates when tests were carried out shall be kept.
- In keeping with the *Code of Practice for Building – Part 3: Fire safety use and occupancy (first revision)*, the roof: (a) shall be of reinforced concrete construction with a fire-rating of 1h; (b) be constructed with a metal or fire-resistant or impregnated timber frame and lined with a non-combustible material; (c) having a ceiling lined with a 1h fire-rated material; (d) roof lights constructed in the roof shall have an area of light spread not greater than 20% of the roof surface, and shall not be closer than 3 metres to another building or to any unprotected part of the building that projects above the roof light.
- All materials and equipment used in the fire protection system for the proposed FHS building shall be consistent with the requirements of the *Code of Practice for Building – Part 3: Fire safety use and occupancy (first revision).*
- **Others are as follows:**
- Evacuation routes will be provided for use in the event of emergencies.
- A separate facility would be provided for the storage of hazardous materials from the main building.
- Incompatible materials will be stored in separate areas.
- Signs will be erected prohibiting smoking in applicable areas, such as near storage facilities for hazardous materials, in laboratories.
- Signs to demarcate evacuation will be installed.
- Smoke alarms and sprinkler systems will be installed.
- All fire safety systems will be maintained in proper working order, including self-closing doors in escape routes.

- Staff and students will be trained in the operation of fire extinguishers and evacuation procedures.

Notably, the University is in the process of finalising guidelines for laboratory safety and the handling of hazardous materials. Implementation of these guidelines would reduce the occurrence of risks mentioned previously, with the exception of flooding. These guidelines must be completed prior to the construction of the new FHS building. The University guidelines are being informed by internationally accepted norms, such as the World Bank's *Environmental, Health, and Safety Guidelines* (International Finance Corporation, World Bank Group, 2007a).

Finally, an Environmental Policy Statement has been developed for the UG. This Policy Statement clearly indicates the University's adherence to a set of core values, as a general Code of Practice for the institution. These include:

- apply safety and health working procedures and practices, and act in conformity with appropriate safety and health legislation;
- create and maintain a working environment with adequate facilities and arrangements for the safety, health and welfare of employees, patients, and visitors;
- comply with all relevant national legislation (including the Environmental Protection Act (1996), Environmental Protection (Air Quality) Regulations 2000, Environmental Protection (Water Quality) Regulations, and Hazardous Waste Regulations, 2000), Occupational Health and Safety legislation, and other requirements (when deemed necessary) as minimum performance standards;
- Implement measures to promote efficient use of energy, water, and other resources, where feasible.
- Reduce, reuse, and recycle wastes, and improve hazardous waste management;
- instill environmental consciousness and responsibility in staff through quarterly environmental awareness, education and training seminars;
- consider environmental factors during all planning, purchasing, and operating decisions;
- communicate our environmental policy to all contractors and suppliers and encourage them to comply with national environmental laws and regulations; and
- adopt a proactive approach on environmental health and safety matters with all stakeholders to minimise injuries and threat to health.

Guyana Education Sector Improvement Project

Project ID: P159519

1. Project Background

The Project "Guyana Education Sector Improvement Project (P159519)" financed by the World Bank aims to support the Government in improving: (i) the curricula and teaching quality at the pre-primary, primary, and lower secondary levels, and (ii) the learning environment in the Faculty of Health Sciences (FHS) at the University of Guyana (UG).

The project will be supported by three components:

Component 1: Integrated Curriculum Reform (US$5.98 million). The objective of this component is to improve the quality of the curriculum at the nursery, primary and lower secondary levels of the education system in Guyana to meet regional and international standards. This will be achieved through four sub-components which seek to (i) reform and pilot a revised curriculum (ii) align textbooks with the revised curriculum (iii) align teacher training program with the new curriculum and (iv) develop and align student assessment system with the new curriculum.

Component 2: Improving learning environment for the Faculty of Health Sciences at UG (US$ 6.9 million). The objective of this component is to improve the learning environment of the FHS at the UG. It would support construction of a new Health Sciences facility. The proposed new facility would include a capacity to accommodating 850 students. All classrooms would be required for the accreditation process by the CAAM-HP. The classrooms must have adequate ventilation (AC or Fans), proper lighting, comfortable seating, internet access to facilitate teaching, LCD projectors and computers for lectures, and white boards. The Labs would include proper ventilation, trained laboratory staff and adequate relevant equipment. The proposed new FHS Building would be organised to respond to current and future teaching, research and services demands. Considering the limited resources available for this component and high cost of construction, it is necessary that proposed new FHS Building meet the Caribbean Regional or international standards within the budget.

Component 3: Project Implementation Support, Administration and M&E (US$ 1.12 million). This component would support project coordination, implementation and administration. It would ensure appropriate monitoring and evaluation of project implementation and impact, as well as of procurement and financial management matters. The project would also finance annual audits and the standard bi-annual project supervision missions to monitor and support the project's implementation.

Given that component 2 will involve civil works connected with the construction of the FHS, the following Environmental Assessment (EA) has been prepared to evaluate the potential impact of the civil works involved in the rehabilitation and operation of proposed FHSbuilding, upon the UG campus activities, its people and its surroundings. In response of this EA, an Environmental Management Plan (EMP) was prepared (See Section 9) in order to prevent, mitigate and reduce environmental and social impacts derived from the proposed project development.

2. Description of the Project

Project Description of Component 2:

Component 2. Improving learning environment for the Faculty of Health Sciences at UG (US$ 6.9 million). The objective of this component is to improve the learning environment of FHSat the UG. It would support construction of a new Health Sciences facility (Figure 2). The proposed new facility would include a four storey building with a capacity to accommodate 850 students. The building will be energy efficient, utilise natural lighting, where possible, and use solar panels to offset energy supply to the building. In addition, elevators and ramps will be built in order to accommodate differently-abled students.

There will be ten classrooms capable of seating 50 students each, three of which will have collapsible walls, thereby creating a larger space, and two classrooms with a seating capacity of 75. All classrooms would be required for the accreditation process by the CAAM-HP. The classrooms must have adequate ventilation (AC or Fans), proper lighting, comfortable seating, internet access to facilitate teaching, LCD projectors and computers for lectures, and white boards. Four laboratory facilities will be built, including a state-of-the-art anatomy lab, a 'skills' lab, a biochemistry/haematology lab and a microbiology lab. The Labs would include proper ventilation (AC), trained laboratory staff and adequate relevant equipment. The proposed new FHS Building would be organised to respond to current and future teaching, research and services demands. A library and a boardroom are expected to be built and approximately 20% of space will be assigned to offices. Considering the limited resources available for this component and high cost of construction, it is necessary that proposed new FHS Building meet the Caribbean Regional or international standards within the budget.

The safeguards Policies of the World Bank that were triggered for this component were OP 4.01 Environmental Assessment and OP 4.09 Pest Management. Both will be secured by application of the Environmental Management Plan (EMP), which will be disclosed on both UG and World Bank's websites prior to appraisal. An Environmental Specialist (ES) will be hired by UG project unit to support the preparation and implementation of the EMP.

Figure 1 Proposed Site of Building, Road and Car Park (Source: Ian Marfleet)

3. Country Context[1]

Figure 2 Location of Guyana in South America

The Cooperative Republic of Guyana, whose capital city is Georgetown, is a low-lying country situated in Northern South America, with the Atlantic Ocean, Suriname, Venezuela and Brazil bordering it to the North, East, West, and South and Southwest, respectively. This middle-income country is the third smallest in the South America (in terms of population) after Suriname (543, 000) and Uruguay (3.432 million) with a populace of approximately 767, 100 (2015 estimate) -- the life expectancy of which is 64 years (2014 estimate). Moreover, it has one of the lowest population densities in the world. The 214,970 km^2 country is inhabited by approximately 43.5% East Indian; 30.2% African; 16.7% Mixed; 9.1% Amerindian; and 0.5% Portuguese, Chinese and Caucasian. Most of the Amerindians reside in the interior upon which they depend for their economic, social and cultural subsistence, while 90% of the total populace resides

[1] **Guyana Country Brief Report. 2011. The World Bank.; Guyana Overview. 2016. The World Bank Group; The Word Factbook. Central Intelligence Agency.**

along the low coastal plain resulting in a population density of about 115 persons per km^2. Guyana's religious community comprises mainly of Christians (57.4%); Hindus (28.4%); and Muslims (7.2%).

Though Guyana is the third poorest country in Latin America and the Caribbean, after Haiti and Nicaragua, it has vast wealth in natural resources, minerals and fertile agricultural lands which span across about 80% of the country. The resources drive the economy of Guyana; in 2015 agriculture, forestry, fishing and the mining industry contributed 28% to the total Gross Domestic Product (GDP). Furthermore, in 2015, bauxite, rice, sugar, timber and gold accounted for 83% of exports. Guyana's per capita income was estimated at US$4,090 in 2015.

Moreover, Guyana has initiated efforts to provide environmental services on a global scale. This includes using the forest (which covers approximately 152, 050 km^2 thereby having one of the world's highest forest cover per capita ratios) as a carbon sink to generate a new revenue stream for the country. Notably, the Amerindian communities hold formal land titles for over 2.4 million hectares of the forest.

The annual deforestation rate is estimated at 0.1-0.3 percent, which is relatively low, compared to most tropical countries. Currently, the main pressures on forests are considered to be forest clearing for mining, the conversion of forest to agriculture, and the opening of infrastructure, especially roads. The main factors that have protected Guyana's forests thus far are considered to be the very low population density away from the coastal plains, and the forest hinterland being inaccessible.

Though challenges can constrain Guyana's growth, a projected growth of four percent is expected in 2016-2017 due to the continued growth in gold production, a recovery in performance of wholesale and retail industries as well as in construction, in addition to an expected suppresses inflation rate.

4. The University of Guyana –Turkeyen Campus

4.1 Location

The Turkeyen Campus is located along the coastal plain of Guyana which is about 2 meters below sea level and about 2 km East of Central Georgetown, the capital city (Figure 3). The campus as well as the rest of Georgetown has gone through significant manipulation of the natural water flow regime which dates back to the colonisation period when the Dutch developed an extensive drainage system in the city to control water flow in the floodplains to increase arable land. The UG campus is apparently based upon a retention water site, and during heavy rainfall the UG campus can become flooded. Soils in the UG campus area are hydromorphic and belong to recent and sub-recent deltaic deposits; these are front land or marine clays that are low ¨humic gleys of high base status. They are placed in land capability class I-II, indicating that these have poor drainage, are deep and mixed with salt soils associated with rivers, and sandy soils in intermittent strips paralleling the coast (*General Soil Map of British Guyana*, 1964).

Figure 3 Map of UG Campus (Source: Google Maps 2016)

Figure 4 Proposed Project Site

4.2 Social Characteristics of the University of Guyana Campuses

The UG was established on October 1, 1963. When the University commenced lectures on October 2, 1963, it functioned as an evening institution with only 164 students enrolled for classes in three Faculties – Arts, Natural Sciences and Social Sciences.

In January 1968, the Booker Group of Companies provided 586.7 hectares of land for the construction of the Turkeyen campus. The first building was declared open on February 24, 1970. Since then, major physical rehabilitation and expansion programmes were created and new buildings were built. However, several of these buildings have deteriorated through the years and issues related to flooding, sewage, energy and water management have been accumulated, posing challenges to the current operation of the UG. Further details about the current situation of the campus site related to the implementation of this project will be discussed in later sections.

The UG is divided into several Faculties, namely Agriculture and Forestry, Earth and Environmental Sciences, Education and Humanities, Health Sciences, Natural Sciences, Social Sciences, and Technology. Each faculty is further subdivided into several departments. The Faculties are supported by several other departments, including: Maintenance, Administration, Personnel, Bursary, Information Technology, Senior Lecturer Accommodation, Student Halls of Residence, Canteen and the Library. There are approximately 50 buildings located on the Turkeyen Campus. The Berbice Campus of the UG was established in 2000.

4.2.1 Students

The total enrolment for both Campuses for the Academic Year 2015/2016 was approximately 6,736 students. Foreign students account for approximately 0.7% of the student population. Whilst foreign students enrol in programmes across all seven of the University's Faculties, it is vital to note that all of the foreign students were registered at the Turkeyen Campus for the Academic Year 2015/2016.

Disaggregating the foreign student population further revealed that 44% of these students were enrolled in programmes offered by the FHS; followed by 21% being enrolled in programmes offered by the Faculty of Social Sciences; the remaining 35% of foreign students were spread across programmes offered by the other five Faculties.

Below is the list of programmes in which these foreign students were enrolled:

- Doctor of Philosophy (Ph.D) in Biodiversity;
- Master of Science – Urban Planning;
- Master of Science – Forest Biology;
- Master of Public Health;
- Bachelor of Medicine, Bachelors of Surgery;
- Bachelor of Science – Optometry;
- Bachelor of Science – Pharmacy;
- Bachelor of Science – Medical Technology;
- Bachelor of Law;
- Bachelor of Social Science – International Relations;
- Bachelor of Social Science – Business Management;
- Bachelor of Social Science – Communications;
- Bachelor of Social Science – Economics;
- Bachelor of Science – Mathematics;
- Bachelor of Social Science – Marketing;

- Bachelor of Agriculture Science;
- Bachelor of Engineering – Architecture;
- Bachelors of Fine Arts;
- Associate Degree – Fine Arts;
- Diploma in Electrical Engineering; and
- Diploma in Mechanical Engineering;

The programme with the highest foreign student enrolment was the Bachelor of Science – Optometry programme offered by the FHS.

In the Academic Year 2015/2016, the Turkeyen Campus offered one hundred and twenty-one (121) programmes across seven (7) Faculties and One Unit, namely the Faculties of Agriculture and Forestry, Health Sciences, Natural Sciences, Social Sciences, Technology, Education and Humanities, and Earth and Environmental Sciences, and the Open Distance Education Unit under the Office of the Vice-Chancellor (Table 1).

Also included in Table 1 are the enrolment figures for the Institute of Distance and Continuing Education (IDCE). The IDCE offers one of the programmes listed in Table 1, the Diploma in Occupational Health and Safety. It is key to note that IDCE is the arm of the UG that offers mostly technical vocational programmes.

During the period 2011 - 2015, the number of new students that enrolled in the University ranged between 2,342 - 2,629 students. Over the five years period this would translate into an average of 2,538 new students per academic year.

In the same time period the total number of students that graduated ranged from 1,480 - 1,852 (Table 2). Over the five years period this would translate into the University graduating on average a total of 1,668 students per academic year.

The Project to be developed by the World Bank will not only develop the Science and Technology arena through the addition and expansion of laboratories, but aid in the facilitation of the increasing number of student enrolment in the Faculty of Health Sciences.

At the Berbice Campus, a total of twenty two (22) programmes were offered across four (4) Faculties/Divisions, namely Agriculture and Forestry, Education and Humanities, Natural Sciences, and Social Sciences. During the period 2011 - 2015, the average number of students who entered or graduated from the Berbice Campus was less than 300 students per year (Table 3). In actual figures the average intake per academic year was 208 students and the average number of graduating students per academic year was 293 students.

The majority of the programmes offered by the UG are at the undergraduate levels but the offering of graduate programmes has relatively increased over the last ten academic years. The academic programmes offered at both Campuses and the corresponding numbers of students entering and graduating from the programmes are detailed in Table 2 and Table 3.

Table 1 Programmes for Turkeyen and Berbice Campuses - Intake and Output 2011/12 to 2015/16 (Grand Totals)

CAMPUS	GRAND TOTALS										
	2010/2011	2011/12		2012/13		2013/14		2014/15		2015/16	
	Output	Intake	Output	Intake	Output	Intake	Output	Intake	Output	Intake	Output
Turkeyen Campus	1316	2148	1343	2287	1448	2359	1615	2294	1579	2137	0
Berbice Campus	164	333	231	337	222	270	237	323	189	205	0
GRAND TOTALS	1480	2481	1574	2624	1670	2629	1852	2617	1768	2342	0

NB. The output figures for the year 2015/2016 cannot be accurately provided at this time since student profiles are yet to be approved by the Board of Examiners for the Graduating class of 2015/2016.

Table 2 Academic Programmes for Turkeyen Campus - Intake and Output 2011/12 to 2015/16

Turkeyen Campus												
Faculty/ Unit/Institute	**Programmes**	**2010/2011**	**2011/12**		**2012/13**		**2013/14**		**2014/15**		**2015/16**	
		Output	**Intake**	**Output**	**Intake**	**Output**	**Intake**	**Output**	**Intake**	**Output**	**Intake**	**Output**
Agriculture & Forestry	Degree in Agriculture (various options)	15	29	21	32	13	52	18	43	19	31	
	Degree in Forestry	6	6	4	9	8	12	8	14	12	12	
	Associate Degree in Forestry	Commenced in 2015/2016									12	
	Diploma in Forestry	9	14	9	17	17	18	20	12	11	0	
Health Sciences	Assoc Degree in Environmental Health	2	3	6	3	5	12	3	0	2	-	
	Assoc Degree in Pharmacy	27	0	29	0	4	0	3	0	2	-	
	Assoc Degree in Medical Technology (changed to Degree from 2008/09)	-	-	-	-	1		34		-	-	
	Associate Degree in Optometry	-	0	-	-	-	-	-	-	-	-	
	Assoc Degree in Radiography	Discontinued										
	Bachelor of Medicine, Bachelor of Surgery	27	37	28	36	28	41	26	41	46	32	
	Bachelor of Science – Nursing (various options)	9	31	19	34	23	29	34	18	25	26	
	Bachelor of Science – Optometry	-	0	-	28	-	30	22	22	-	24	
	Bachelor of Environmental Health	Commenced in 2015/2016									10	
	Degree in Medical Imaging	-	-	-	-	-	30	2	19	-	0	

	Degree in Medical Technology (various options)	47	50	42	39	27	41	34	40	34	29	
	Degree in Rehabilitation Science	-	0	-	9	-	0	3	-	-	-	
	Degree in Pharmacy (various options)	7	0	9	63	25	59	39	34	22	31	
	Degree in Medical Rehabilitation	-	-	-	-	-	10	-	12	-	13	
	Degree in Dental Surgery	5	9	4	11	2	11	5	10	11	10	
	Post Grad. Dip in Orthopaedics & Traumatology	3	-	-	-	-	-	1	-	1	-	
	Post Grad Diploma in Anaesthesia & Intensive Care	-	-	-	-	-	-	-	-	2	-	
	Master in Medicine - Emergency Medicine	-	-	-	-	-	-	2	-	5	-	
	M. Sc. Paediatrics	-	-	-	-	-	-	1	-	4	-	
	Master in Public Health	Commenced in 2014/2015							21	-	15	
	Post Grad. Dip in General Surgery	3	-	1	-	28	-	2	-	1	-	
Natural Sciences	Master in Forest Biology	-	0	-	0	1	4	1	3	3	2	
	Degree in Biology	24	112	35	121	23	81	67	123	44	143	
	Degree in Chemistry (various options)	13	49	9	3	7	36	14	21	12	31	
	Degree in Computer Science	17	21	27	33	19	16	22	22	29	27	
	Degree in Mathematics (various options)	4	13	6	2	2	7	8	5	10	6	
	Degree in Statistics	1	1	-	2	-	3	-	0	1	1	
	Degree in Physics	-	2	-	0	-	-	-	-		-	
	Associate Degree in Physics	1	1	-	2	-	4	1	3	2	1	

	Associate Degree in Chemistry (various options)	-	15	1	28	18	34	1	31	19	10	
	Associate Degree in Mathematics	-	1	-	8	5	12	5	0	3	2	
	Associate Degree in Biology	-	0	-	0	-	-	-	-		1	
	Diploma in Computer Science	42	65	48	61	44	48	30	59	36	59	
Social Sciences	Master in Social Sciences		Suspended									
	Masters in Development Policy & Analysis		Suspended									
	Commonwealth Masters in Business Admin.	22	3	16	-	27	31	-	15	28	17	
	Commonwealth Masters in Public Admin.	8	-	7	0	2	9	-	13	7	16	
	Post-graduate Diploma (Dev. Studies)	9	15	17	1	4	15	5	0	6	0	
	Post-graduate Diploma (International Studies)	6	3	7	0	4	12	2	2	7	-	
	Degree in Business Management	103	157	96	147	101	102	64	151	127	191	
	Degree in Communication Studies (various options)	12	35	16	41	15	30	44	31	29	29	
	Degree in Economics	45	60	31	51	45	42	43	51	36	33	
	Degree in Business Economics	Commenced in 2015/2016									7	
	Degree in Accountancy	1	-	-	-	-	-	-	-	-	-	
	Degree in International Relations	33	74	30	86	29	82	29	74	38	120	
	Degree in Law	31	50	44	58	44	78	49	76	41	57	
	Degree in Public Management	36	63	36	56	43	65	50	85	44	79	
	Degree in Social Work	20	62	48	39	53	46	35	37	37	46	

	Degree in Sociology	31	52	23	53	21	52	17	34	14	32	
	Degree in Marketing	Commenced in 2015/2016									12	
	Associate of Social Science Social Work	Commenced in 2015/2016									50	
	Diploma in Accountancy	18	36	26	56	18	33	29	17	27	32	
	Diploma in Banking & Finance	21	37	14	52	11	38	42	24	17	20	
	Diploma in Communication Studies	38	66	42	56	32	59	38	34	52	46	
	Diploma in Marketing	25	103	44	114	58	85	94	99	63	58	
	Diploma in Public Management	53	115	66	157	69	153	100	104	113	107	
	Diploma in Social Work	66	69	46	86	52	101	44	85	66	2	
Technology	Masters of Renewable Energy	Commenced in 2015/2016									8	
	Degree in Architecture	7	5	5	1	4	11	4	1	7	11	
	Degree in Civil Engineering	31	39	27	34	23	33	26	48	36	0	
	Degree in Electrical Engineering	9	11	8	10	16	15	9	16	6	14	
	Degree in Mechanical Engineering	11	10	12	8	8	8	6	12	7	9	
	Degree in Geological Engineering (various options)	9	12	9	9	7	15	12	12	4	0	
	Bachelor of Science Civil with Environmental Engineering	Commenced in 2015/2016									11	
	Bachelor of Engineering (Applied and Exploration Geology) (9206)	Commenced in 2015/2016									9	
	Associate of Science Civil Engineering	Commenced in 2015/2016									60	

	Associate of Science Electrical Engineering	Commenced in 2015/2016									23	
	Associate of Science Mechanical Engineering	Commenced in 2015/2016									8	
	Associate of Science Applied and Exploration Geology	Commenced in 2015/2016									16	
	Diploma in Aeronautical Engineering	1	-	-		-		-	-		-	
	Diploma in Architecture	5	8	4	11	7	13	8	12	6	8	
	Diploma in Civil Engineering	36	69	41	70	30	86	51	63	57	0	
	Diploma in Electrical Engineering	11	25	12	14	27	29	16	30	19	1	
	Diploma in Geological Engineering	9	29	11	38	16	25	13	18	23	0	
	Diploma in Mechanical Engineering	8	13	10	20	10	17	12	12	13	1	
	Diploma in Industrial Engineering	Commenced in 2015/2016									14	
	Certificate in Industrial Engineering	-	-	-	-	-	-	-	18	16	11	
	Post Graduate Certificate in Water Resources Management	19	-	-	-	-	-	-	-	-	-	
Education & Humanities	Master in Education (various options)	4	39	14	0	9	22	4	22	9	34	
	Master of History	-	0	2	-	-	-	-	-	-	-	
	Post-graduate Diploma in Education (various options)	-	51	-	47	44	33	41	26	27	39	
	Graduate Diploma in Education	35	-	41	-	-	-	-	-	-	-	
	Bachelors Degree in Education (various options) eventually became B.Ed Secondary in 2015/16	118	32	62	35	33	144	111	154	-	2	

	Bachelor of Arts Degree in English (various options)	17	15	-	17	5	12	14	13	15	5	
	Bachelors of Arts Degree in History	-	2	-	2	4	-	-	-	-	-	
	Bachelor of Arts (Spanish)	-	3	-	1	-	2	3	0	-	0	
	Bachelor of Arts Degree in Fine Arts (Creative Arts)	-	0	27	2	3	1	2	0	1	5	
	Bachelor of Arts Degree in Tourism Studies	-	0	-	7	-	6	8	9	2	6	
	Bachelor of Education (Administration) (various options)	-	23	-	23	21	36	-	27	9	26	
	Bachelor of Education (Secondary)	Commenced in 2015/2016 (Harmonisation)								75	147	
	Bachelor of Education (Primary)	-	42	-	43	43	80	-	121	39	43	
	Bachelor of Education (Early Childhood)	-	17	-	23	15	43	-	70	22	26	
	Associate Degree in English	-	7	-	5	2	3	-	-	3	2	
	Associate Degree in Spanish	-	2	-	1	-	1	-	0	1	0	
	Associate Degree in Fine Arts	-	2	-	0	3	1	-	-	-	2	
	Associate Degree in History	-	1	-	5	3	5	5	0	2	-	
	Associate Degree in Tourism	6	14	8	13	11	17	9	10	11	8	
	Associate of Arts Anthropology	Commenced in 2015/2016									1	
	Certificate in Education (Administration)	-	16	-	16	14	0	-	0	3	-	
	Certificate in Education (Secondary)	-	-	-	-	65	-	-	-	12	-	
	Certificate in Education (Primary)	-	58	-	60	41	0	-	0	11	0	
	Certificate in Education (Early Childhood)	-	27	-	29	17	0	-	0	3	0	

	Certificate of Competence in Spanish	-	-	-	1	1	-	-	-	-	-	
	Certificate in Education (various options)	116	79	130	72	-	0	152	0	-	0	
Earth & Environmental Sciences	Doctor of Philosophy (Ph.D.) in Biodiversity	Commenced in 2015/2016									3	
	Master of Science in Environmental Management	-	-	-	-	-	-	-	-	5	0	
	Post Graduate Diploma in Environmental Management	-	-	-	-	-	9	-	9	1	-	
	Post Graduate Diploma in Urban Planning and Development/Management	6	-	1	9	6	-	-	-	-	14	
	Post Graduate Diploma in Climate Change and Disaster	-	-	-	4	3	4	-	5	-	-	
	Post Graduate Diploma in Natural Resource Management	-	-	-	9	6	8	-	5	-	-	
	B.Sc. Geography/Economics	-	4	2	2	3	2	-	0	-	0	
	Bachelor of Arts – Geography	3	5	2	9	3	5	4	0	3	6	
	Bachelor of Science Environmental Studies	8	29	8	36	17	50	14	29	23	36	
Open/Distance Education Unit	Bachelor of Science (Computer and Information Technology) (002D)	Commenced in 2014/2015							12	-	10	
	Bachelor of Science (Environmental Management and Technology) (003D)	Commenced in 2014/2015							9	-	14	
	Bachelor of Social Science (Criminology and Psychology Studies) (004D)	Commenced in 2014/2015							17	-	15	

	Bachelor of Science (Mathematics) (005D)	Commenced in 2014/2015							29	-	7	
IDCE	Diploma in Occupational Health & Safety	7	-	-	7	-	-	-	-	-	-	
	TOTAL	**1316**	**2148**	**1343**	**2287**	**1448**	**2359**	**1615**	**2294**	**1579**	**2137**	**0**

NB. The output figures for the year 2015/2016 cannot be accurately provided at this time since student profiles are yet to be approved by the Board of Examiners for the Graduating class of 2015/2016.

Table 3 Academic Programmes for Berbice Campus - Intake and Output 2011/12 to 2015/16

Berbice Campus												
Faculty	**Programmes**	**2010/11**	**2011/12**		**2012/13**		**2013/14**		**2014/15**		**2015/16**	
		Output	**Intake**	**Output**	**Intake**	**Output**	**Intake**	**Output**	**Intake**	**Output**	**Intake**	**Output**
Agriculture & Forestry	Degree in Agriculture	3	13	2	9	8	13	2	21	12	15	
Education & Humanities	Bachelor of Education – Administration	36	3	3	15	3	0	17	25	-	9	
	Bachelor of Education - Secondary	-	8	12	3	8	3	5	22	3	8	
	Bachelor of Education – Early Childhood	-	9	7	11	9	27	9	19	11	8	
	Bachelor of Education – Primary	-	17	21	28	16	41	28	62	21	22	
	Associate Degree in English	-	12	5	13	6	0	9	-	-	0	
	Certificate in Education - Early Childhood General	-	12	11	7	11	0	6	-	1	0	

	Certificate in Education - Primary General	-	26	28	23	24	0	21	0	-	0	
	Certificate in Education (various options)	-	3	3	11	3	-	-	-	-	-	
	Certificate in Education – Administration	37	4	14	-	3	0	12	0	-	-	
Natural Sciences	Degree in Biology	-	-	-	-	-	1	-	15	-	3	
	Assoc Degree in Mathematics	1	5	4	3	2	3	3	0	4	-	
	Assoc Degree in Biology	16	56	22	42	34	30	22	33	21	45	
	Assoc Degree in Chemistry	4	7	3	11	6	3	8	4	1	2	
	Diploma in Computer Studies	9	29	15	17	11	8	6	9	7	0	
Social Sciences	Degree in Public Management	13	9	18	15	10	19	12	16	14	13	
	Degree in Social Work	Commenced in 2013/2014					28	-	15	26	13	
	Associate of Social Science Social Work	Commenced in 2015/2016									16	
	Diploma in Accountancy	13	19	14	22	17	13	20	14	14	10	
	Diploma in Marketing	10	13	13	19	9	19	10	16	20	13	
	Diploma in Public Management	14	38	21	50	21	35	23	34	18	28	
	Diploma in Social Work	8	50	15	38	21	27	24	18	16	0	
	TOTAL	**164**	**333**	**231**	**337**	**222**	**270**	**237**	**323**	**189**	**205**	**0**

NB. The output figures for the year 2015/2016 cannot be accurately provided at this time since student profiles are yet to be approved by the Board of Examiners.

4.2.2 Faculty

In Table 4, the number of full-time personnel at the University of Guyana for the periods 2002/03 to 2009/10, and 2012/13 is outlined. For the 2002/03 to 2009/10 period, and the 2012/13 Academic Year, Senior Management (the Vice-Chancellor, Deputy Vice-Chancellor, Bursar and Registrar), UA Academic Library and Non-academic positions have been relatively stable.

Table 5 and Table 6 provide a detailed breakdown of the UA Non-Academic Staff by Faculty and Department for 2014/15 and UA Academic Library Staff Designation for 2014/15, respectively.

Table 4 Full time personnel of the University of Guyana, 2002/03 – 2009/10 & 2012/13

Category	2002/03		2003/04		2004/05		2005/06		2006/07		2007/08		2008/09		2009/10		2012/13	
	TK	TN	TK	TN	TK	TN	TK	TN	TK	TN	TK	TN	TK	TN	TK	TN	TK	TN
Senior Management Staff	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1
Academic Staff	206	7	212	15	228	17	224	16	223	19	214	19	210	16	219	23	153	27
UA Library Staff	1	3	13	3	14	3	13	3	12	3	16	3	15	3	15	3	15	3
Non Academic Staff	36	1	44	1	39	2	35	1	39	1	41	1	49	1	44	3	50	2
UB Staff	315	10	365	13	332	18	317	19	313	17	288	18	313	19	315	23		
Total	575	22	638	33	617	41	593	40	591	41	563	42	591	40	597	53	322	33

Sources: University of Guyana Strategic Plan 2009-2010; and University of Guyana Personnel Division

Table 5 UA Non-Academic Staff by Faculty and Department for 2014/15

Faculty/Department	M	F	Total
Admissions Division	0	1	**1**
Bursary	0	4	**4**
Centre for Information Technology	1	0	**1**
Committees Section	0	2	**2**
Data and Records Management Division	1	0	**1**
Department of Software Services	2	0	**2**
Examinations Division	0	1	**1**
Facilities Maintenance Department	1	0	**1**
Faculty of Education and Humanities	1	0	**1**
Faculty of Health Sciences	0	2	**2**
Faculty of Natural Sciences	0	1	**1**
Faculty of Social Sciences	0	3	**3**
Faculty of Technology	1	1	**2**
Institute of Distance and Continuing Education	0	1	**1**
Internal Audit Unit	2	0	**2**
Medical Centre	1	1	**2**
Office of the Deputy Registrar	1	0	**1**
Office of the Deputy Vice-Chancellor, Academic Affairs	0	0	**0**
Office of the Deputy Vice-Chancellor, Planning and Development	0	2	**2**
Office of the Safety and Security Manager	1	0	**1**
Office of the Vice-Chancellor	0	2	**2**
Personnel Division	1	3	**4**
Public Relations Division	0	1	**1**
Registry	0	1	**1**
Students' Welfare Division	0	2	**2**
UGBC	1	1	**2**
University Library	0	1	**1**

Source: University of Guyana Personnel Division

Table 6 UA Academic Library Staff Designation for 2014/15

TURKEYEN CAMPUS				BERBICE CAMPUS			
Category	**Gender**			**Category**	**Gender**		
	M	**F**	**Total**		**M**	**F**	**Total**
Senior Assistant Librarian	1	6	**7**	Senior Assistant Librarian	0	2	**2**
Assistant Librarian	0	4	**4**	Assistant Librarian	0	1	**1**
Librarian II	0	1	**1**	Librarian II	0	0	**0**
Librarian I	0		**0**	Librarian I	0	0	**0**
Deputy University Librarian	0	1	**1**	Deputy University Librarian	0	0	**0**
University Librarian	0	1	**1**	University Librarian	0	0	**0**
TOTAL	**1**	**13**	**14**	**TOTAL**	**0**	**3**	**3**

Source: University of Guyana Personnel Division

Table 7 Teaching staff at the Turkeyen Campus of the University of Guyana during 2000/01 to 2008/09, and 2011/12; 2013/14

UG FACULTY	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2011/12	2013/14
Full Time Lecturers	206	214	206	212	228	224	223	214	210	247	452
Part time Lecturers	161	147	154	154	159	168	160	174	166	194	
TOTAL	**367**	**361**	**360**	**366**	**387**	**392**	**383**	**388**	**376**	**441**	

Sources: University of Guyana. *Strategic Plan 2009-2012, and University of Guyana Personnel Division*

The UG *Strategic Plan 2009-2012* indicates that for the Turkeyen Campus, "the number of full time teaching staff has declined steadily from a high of 252 in 1990/91 to a low of 206 in 2000/01 and 2002/03" while at the Tain Campus, the "number of full time lecturers there has grown by approximately 2.4% since the start of the campus; however the relative proportion of part time faculty (the majority of whom are full time lecturers from the Turkeyen Campus) has remained substantially

higher than full time lecturers, with the ratio being highest in 2002/03 (9:1) and lowest in 2008/09 (1:1)."

For the academic years of 2011/12, and 2014/15 there were totals of 247 and 452 full time lecturers, respectively at the Turkeyen Campus (see Table 7). There has been an 85.26% increase in the total amount of lecturers employed at Turkeyen Campus from the 2008/09 to 2011/12 academic years.

Twenty seven (27) full time lecturers, along with 30 part time lecturers were employed at the Tain Campus in 2011/12; and 24 full time lecturers in 2014/15. Table 8 details the amount of full time lecturers that were employed at both campuses by Faculty/Department in 2011/12.

Table 8 Full time Lecturers at Turkeyen and Tain Campuses

Faculty/Department	Full-Time		Total
	M	F	
Turkeyen			
Agriculture	7	8	15
School of Education & Humanities			
-Curriculum and Instruction	4	6	10
-Foundation and Education Management	2	5	7
-Language and Cultural Studies	12	18	30
-Social Studies	2	5	7
Health Sciences			
-Medical Technology	4	3	7
-Pharmacy	2	0	2
-Public Health	3	2	5
-School of Medicine	8	1	9
- School of Dentistry	0	0	0
Natural Sciences			
- Biology	7	8	15
-Chemistry	10	7	17
- Computer Science	6	4	10
- Mathematics, Physics & Statistics	12	0	12
Faculty of Earth & Environmental Science	1	6	7
Social Sciences			

- Business & Management Std.	5	7	12
-Economics	6	2	8
Government & Int'l Affairs	7	6	13
-Law	5	1	6
-Sociology	2	8	10
- Centre for Comm. Studies	1	7	8
-Institute of Dev. Studies	3	3	6
- Graduate School	0	0	0
Technology			
-Architecture	2	0	2
-Civil Engineering	3	1	4
-Electrical Engineering	7	1	8
-Mechanical Engineering	6	2	8
-Div. of Mining Engineering	2	0	2
-Div. of Engineering Management	0	0	0
-Div. of Engineering Mathematics	1	1	2
Institute of Distance & Continuous Education	2	3	5
Grand Total	**132**	**115**	**247**
Berbice			
- Div. of Agriculture	3	0	3
- Div. of Education & Humanities	3	6	9
- Div. of Natural Sciences	6	3	9
- Div. of Social Sciences	3	3	6
Grand Total	**18**	**12**	**27**

Source: University of Guyana Personnel Division

4.2.3 Science laboratories

A total of 22 laboratories are found in the science and technology faculties at the UG (Table 9). The goal of this Project is to construct a new building for the FHS to facilitate the increasing number of students being enrolled. This will allow for further development in the Science and Technology arena through the addition and expansion of laboratories.

Table 9 Number of Science laboratories at Turkeyen Campus.

Faculty/School	Number of laboratories
Faculty of Agriculture and Forestry	2
Faculty of Health Sciences	5
Faculty of Natural Sciences	7
Faculty of Technology	7
Faculty of Earth and Environmental Sciences	1 (Located in the Faculty of Natural Sciences)

5. Legal Framework

The construction of a new building for the FHS is subjected to a variety of policies and regulations instituted by the donor (World Bank) and local agencies as well as international treaties and agreements to which Guyana is a signatory. This is done to ensure that funds allocated to the project are utilised in a manner that results in the protection of people and the environment. For the purpose of this project, the principal ones which will be addressed are relevant World Bank Safeguard Policies, national policies and regulations and some international treaties and agreements.

5.1 The World Bank Safeguard Policies and Guidelines

The environmental and social safeguard policies instituted by World Bank emphasise the need to address social and environmental risks associated with project preparation and execution. The following two World Bank safeguard policies were triggered for the component 2 of the project :

i. Environmental Assessment- OP/BP 4.01

ii. Pest Management- OP/BP 4.09

5.1.1 OP/BP 4.01 – Environmental Assessment (EA)

The objective of OP 4.01 is to ensure that Bank-financed projects are environmentally sound and sustainable, and the decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. This policy is triggered if a project is likely to have potentially adverse environmental risks and impacts in its area of influence. OP 4.01 covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources, and trans-boundary and global environment concerns.

Thus the construction of the FHS building is likely to have environmental impacts, which require mitigation.

5.1.2 OP/BP 4.09 – Pest Management

Activities involving the use of pesticides or pest control measures are subject to the application of this safeguard. As a matter of policy, the safeguard promotes the use of appropriate biological or environmental pest control measures and seeks to minimise the potential health risks associated with pest management activities. The policy discourages the use of pesticides prohibited internationally and it encourages the safe application and applicator training when other pesticides are being used. Pesticides recommended for use are identified as class 1A or 1B and II in the *WHO recommended Classification of Pesticides by Hazard and Guidelines of* 2009. This safeguard is triggered owing to the possibility that termite infestation might be evident on the campus.

5.1.3 WB General EHS Guidelines and the EHS Guidelines for Health Care Facilities

The World Bank's *General Environmental, Health and Safety Guidelines* provide guidance to users on environmental, health and safety issues in specific industry sectors. Importantly, they are technical reference documents with general and industry-specific examples of Good International Industry Practice, and are expected to be used in conjunction with the specific Industry Sector Environmental, Health and Safety Guidelines. The Guidelines provide performance levels and measures for environmental; occupational health and safety; community health and safety; and construction and decommissioning.

There are a number of sections of the Guidelines that have relevance for the new FHS building. In the absence of air quality standards in Guyana, the World Bank's ambient air quality guidelines provide ambient air quality concentrations against which the impact of the construction and operation of the FHS building can be assessed. Additionally, the occupational health and safety guidelines provide guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. This is particularly relevant to the project since the UG is obligated to employ all reasonable measures to protect the health and safety of its staff, students, contractors and visitors and measures identified could be used during the construction and operation of the new FHS facility. Furthermore, the construction and operation of the new FHS building will generate, store and management waste, including hazardous waste. Hence the relevance of the Guidelines since the

document provides recommendations related to waste management planning; waste prevention; recycling and reuse; treatment and disposal; hazardous waste storage, transportation, treatment and disposal, and monitoring. This project and the University must consider adopting the appropriate measures.

The World Bank's *Environmental, Health and Safety Guidelines for Health Care Facilities* provide information specific to the management of environmental, health and safety issues associated with health care facilities. These guidelines recognise health care facilities as general hospitals, small inpatient primary care hospitals and outpatient, assisted living, and hospice facilities. Ancillary facilities include medical laboratories and research facilities, mortuary centres, and blood banks and collection services. Therefore, the FHS building could be considered an ancillary facility. In particular, the industry specific Guidelines provide measures in relation to waste (including hazardous) management, which include waste minimisation, reuse and recycling; waste segregation strategies; on-site handling, collection, transportation and storage; transportation; and treatment and disposal options. These measures, in conjunction with those identified in the World Bank's *General Environmental, Health and Safety Guidelines* provide a suite of options, which once implemented, will ensure that the new FHS facility will have a waste management system that is adequate for the scale and type of activities and identified hazardous.

5.1.4 Life and Fire Safety[2]

Life and Fire Safety form part of the WB Health Care Guidelines and General EHS Guidelines. Importantly, all new buildings accessible to the public should be designed, constructed, and operated in full compliance with local building codes, local fire department regulations, local legal/insurance requirements, and in accordance with an internationally accepted life and fire safety (L&FS) standard. (for example, the Life Safety Code82, which may be used as a point of reference to document compliance with the following Life and Fire Safety objectives:

- Project sponsors' architects and professional consulting engineers should demonstrate that affected buildings meet these life and fire safety objectives.

- Life and fire safety systems and equipment should be designed and installed using appropriate prescriptive standards and/or performance based design, and sound engineering practices.

- Life and fire safety design criteria for all existing buildings should incorporate all local building codes and fire department regulations.

[2] Information taken from the Environmental , Health, and Safety (EHS) Guidelines. General EHS Guidelines: Community Health and Safety.

With reference to fire prevention, measures should include fuel load and control of combustibles; ignition sources; interior finish flame spread characteristics; interior finish smoke production characteristics; and human acts, and housekeeping and maintenance.

Means of Egress includes all design measures that facilitate a safe evacuation by residents and/or occupants in case of fire or other emergency, such as clear, unimpeded escape routes; accessibility to the impaired/handicapped; marking and signing; and emergency lighting.

Detection and alarm systems encompass all measures, including communication and public address systems needed to detect a fire and alert, including building staff, emergency response teams, occupants, and civil defense.

Other measures are itemised below:

Compartmentation

This involves all measures to prevent or slow the spread of fire and smoke, including: separations, fire walls, floors, doors, dampers and smoke control systems.

Fire Suppression and Control

Fire suppression and control includes all automatic and manual fire protection installations, such as automatic sprinkler systems, manual portable extinguishers, and fire hose reels.

Emergency Response Plan

An Emergency Response Plan is a set of scenario–based procedures to assist staff and emergency response teams during real life emergency and training exercises. Additionally, a Fire and Life Safety Master Plan should be developed and should include an assessment of local fire prevention and suppression capabilities.

Operation and Maintenance

This involves preparing schedules for mandatory regular maintenance and testing of life and fire safety features to ensure that mechanical, electrical, and civil structures and systems are at all times in conformance with life and fire safety design criteria and required operational readiness.

5.2 Existing National Legislative and Regulatory Framework

While some of these legal instruments have been drafted within the last decade there are others that have been in existence for several decades and require urgent up-dating if they were to serve as

effective tools. The principal legislations and regulations that govern the project are identified in Table 10 below.

Table 10 National Legislations

Legislation	Year enacted	Institution
Environmental Protection Act	1996	Environmental Protection Agency (Ministry of the Presidency)
The Environmental Protection (Authorisations) Regulations	2000	
Environmental Protection (Air Quality) Regulations	2000	
Environmental Protection (Water Quality) Regulations	2000	
Environmental Protection (Noise Management) Regulations	2000	
Environmental Protection (Hazardous Waste Management) Regulations	2000	
Litter Enforcement Regulations	2014	
Occupational Health and Safety (Amendment) Act	2009	Ministry of Social Protection
Occupational Safety and Health Act (No. 32 of 1997)	1997	
Pesticides and Toxic Chemicals Control (Amendment) Regulations	2007	Ministry of Agriculture
Pesticides and Toxic Chemicals Regulation	2004	
Pesticides and Toxic Chemicals Control Act	2000	
Public Utilities Commission Bill	2011	Public Utilities Commission
National Bureau of Standards Act 11 -(Building Codes)	1984	Guyana National Bureau of Standards

5.2.1 The Environmental Protection Act, 1996 (as amended by the Environmental Protection (Amendment) Act, 2005

The Environmental Protection Act, 1996, and the Environmental Protection Amendment Act 2005, establish the basic institutional and regulatory framework within which all activities that may significantly impact on the natural, social, and cultural environments are assessed. The Act also provides that the EPA is the central coordinating agency for environmental management in the relevant sectors in Guyana. Section 68 of the Act provides for the elaboration of regulations to articulate specific areas of environmental management, and of relevance are the Regulations on hazardous waste management, water quality, air quality, noise management and environmental authorisation which were established under the Environmental Protection Act in 2000. These pollution management regulations were

developed to regulate and control the activities of developmental projects during construction and operation. Standards establishing the permissible parameters under these regulations are being developed. Five Relevant legislations are described in the sections below.

5.2.2 Environmental Protection (Air Quality) Regulations 2000

These Regulations were formulated to protect the air quality and provide the necessary infrastructure for controlling the amount of contaminants by stipulating specific allowable levels of emissions that are released into the atmosphere at any given time. Parameters are specified for several contaminants including smoke, solid particles and carbon monoxide. With the implementation of the FHS project workplace air quality will be affected during the construction phase as a consequence of the production of dust during excavation and the operation of equipment.

5.2.3 The Environmental Protection (Authorisations) Regulations, 2000

These Regulations are concerned with the guidelines for granting authorisation for projects that can have medium to high environmental impacts in Guyana. Guidelines and procedures are specified in its corpus, and a fee structure in its Schedule.

5.2.4 Environmental Protection (Water Quality) Regulations 2000

These Regulations were developed to manage the discharge of waste matter into inland and coastal water bodies. They provide for minimising the contamination of potential and existing water supply sources.

5.2.5 Environmental Protection (Noise Management) Regulations 2000

These Regulations are concerned with the control and management of noise emission in Guyana. In practice, the EPA (Guyana) combines the *Regulation* with the *GNBS Noise Standard* into the atmosphere, since the Regulation is silent on measurements and parameters for ambient noise emission. There is also the Interim Guidelines for Noise Emission into the Environment dated 2009. Developed to assist the Environmental Protection Agency in the enforcement of the *Environmental Protection (Noise Management) Regulation 2000* and to reduce the level of noise emanating from commercial, residential, institutional, educational, industrial, construction, transportation and recreational activities.

5.2.6 Environmental Protection (Hazardous Waste Management) Regulations, 2000

These Regulations cover the management of waste including chemical waste and cover industrial, commercial and any other activity that produces waste. Some of the key activities which are covered under the Regulations are generation, treatment, transport and disposal of hazardous waste. The Regulations is read and construed as being in addition to, and not in contravention of the Pesticides and Toxic Chemicals Control Act 2000 (No. 13 of 2000). Based on the definition all chemical wastes including persistent organic pollutants (POPs) are covered under these Regulations for the purposes of management. Permits are required for the generation of waste which is/are monitored throughout the production, storage, transport and release phases.

For the construction of the FHS building, waste streams must be controlled include the wastes from the use of wood preserving chemicals and possibly toxic substances if release may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon nearby systems . This regulation becomes relevant for the construction of the FHS building since it is possible that hazardous waste/materials such as flammable liquids, ceiling materials, plastic and corrosives will be used. It is recommended that an emergency preparedness plan be put in place in cases of incidents.

5.2.7 Litter Enforcement Regulations 2014

The Litter Regulations addresses the littering of public spaces and outlines several offences and penalties and provides for Litter Wardens with authority to enforce these Regulations and with special powers of court on convicting offenders. Under 'offences', "A person who, without reasonable excuse, deposits litter in or on any public place… is guilty of an offence". Also, persons who deposit litter from a moving vehicle unto a public place will be considered an offender. Enforcement activities for these Litter Regulations commenced April 2014 with the establishment of a Litter Enforcement Unit at the EPA.

5.2.8 Pesticides and Toxic Chemicals Control Act, 2000

The management of chemicals in Guyana is governed by the Pesticides and Toxic Chemicals Control Act 2000 (No.13 of 2000). This Act provides for the establishment of the Pesticides and Toxic Chemicals Control Board, which comprise representatives from the Ministry of Agriculture, Ministry of Public Health, Environmental Protection Agency and other representatives from the private sector and non-governmental organisation. A Secretariat has been established for the management of pesticides and toxic chemicals with the administrative head being the Registrar of Pesticides and Toxic Chemicals. All chemicals used in Guyana must be registered by the Board. The decision to register or not is done based on registration submission to the Board. The relevant documentation are examined along with international guidance and previous decisions emanating from international agencies such as the Food and Agricultural Organisation of the United Nations (FAO), United Nations Environmental Programme (UNEP), *Stockholm Convention on Persistent Organic Pollutants (POPs)*,[3] the *Rotterdam Convention on the Prior Informed Consent for Certain Hazardous Chemicals in International Trade*[4], European Union and United States of America Environmental Protection Agency (US EPA).

[3]See http://chm.pops.int/default.aspx and http://www.pops.int/documents/convtext/convtext_en.pdf

[4]See http://www.pic.int/home.php?type=s&id=77 and http://www.pic.int/home.php?type=t&id=49

5.2.9 Pesticides and Toxic Chemicals (Amendment) Act 2007 (No. 13 of 2007)

This Amendment provides for the regulating of exports and accession to international Agreements governing pesticides and toxic chemicals[5] management by providing for the adoption of Agreements containing legally binding instruments.

5.2.10 Pesticides and Toxic Chemicals Regulations 2004 (No. 8 of 2004)

These Regulations were established under Section 32 of the Act and provide the instruments and requirements for the implementation of the Act in the following areas:

a) Pesticide and Toxic Chemical Registration and Classification Procedure

b) Pesticide labelling

c) Certification of Pesticide Applicators

d) Pesticide Manufacturing and Distribution Certificate

e) Experimental Pesticides and Toxic Chemicals Studies

f) Transportation, Storage, Disposal and Recall of Pesticides and Toxic Chemicals

g) Ministerial Emergency Registration and Exemptions

h) Pesticide Residues

i) Pesticide Worker Protection

Pesticides are classified as Prohibited, Restricted or General Use. A prohibited pesticide is not allowed for use and is classified based on toxicity, use pattern under local conditions and the respective decisions of the following international agencies:

a) United Nations Food and Agricultural Organisation (FAO)

b) Rotterdam Convention

c) Stockholm Convention

d) United Nations Environmental Programme

e) World Health Organisation.

5.2.11 Pesticides and Toxic Chemicals (Amendment) Regulation 2007 (No. 8 of 2007)

This Amendment provides the instruments for regulating exports of pesticides and toxic chemicals and covers prohibited, restricted and registered products along with information on monthly import of any chemical into Guyana, vending premises, legislations, reports, and news pertaining to current and ongoing developments.

[5] The Stockholm and Rotterdam Conventions. The Basel Convention is addressed by the Environmental Protection (Hazardous Wastes Management) Regulations, 2000

5.2.12 Occupational Safety and Health Act 1997 (No. 32 of 1997)

The provisions for registration and regulation of industrial establishments and for occupational safety and health of persons at work is are enshrined in the Occupational Safety and Health Act 1997. The Act covers hazardous chemicals at workplaces which can endanger the health of workers, and allows for the limited or restricted use of such chemicals. It also covers the introduction of new chemicals in the workplace. Implementation of this Act is the responsibility of the Occupational Safety and Health Department of the Ministry of Social Protection.

5.2.13 Public Utilities Commission Bill 2011

This Bill repeals and replaces the Public Utilities Commission Act, Cap 57:01. It is composed of: the provisions of the Public Utilities Commission Act 1999 as amended by Public Utilities Commission (Amendment) Act, 2003 (No. 7 of 2003) and Public Utilities Commission (Amendment) Act 2010 (No. 16 of 2010), and the provisions that are required to complement and harmonize with the Telecommunications Bill No. 15 of 2016. This Bill does not disturb the existing harmony with the Electricity Sector Reform Act (ESRA) or any other law governing "public utilities" under the PUC's jurisdiction. The provisions of the bill have relevance to the new FHS building since there will be need for ICT facilities available to aid teaching and learning of a high standard.

5.2.14 Bureau of Standards Act 1984

The Bureau of Standards Act specifies the codes of practice which provide minimum standards for the promotion of health and safety practices when constructing edifices. More recently, the issue of climate change increases the level of awareness of 'climate smart' techniques and materials for the construction industry. The building codes' specify rules of the minimum acceptable level of safety for constructing edifices. These are pertinent to the FHS project since they address the following areas:

a) Enforcement
b) fire, safety, use and occupancy
c) electrical
d) plumbing
e) use of Guyanese hardwood in construction
f) concrete and block masonry
g) structural steel
h) high rise buildings
i) foundations and excavations

j) design and construction of septic tanks and associated secondary treatment and disposal systems

5.2.15 Code of Practice for Buildings – Part 3: Fire safety use and occupancy (GCP 9-3:2005)

In 2005, the Guyana Bureau of Standards developed a section of the Guyana National Building Code, namely *Code of Practice for Buildings – Part 3: Fire safety use and occupancy* (GCP 9-3:2005). This Code is comprised of a set of minimum requirements regarding the safety of buildings on aspects of fire protection and structural sufficiency. It's primary purpose is the promotion of public safety through the application of appropriate building standards. This Codes is of specific relevance to the FHS project since it provides information related to the following areas which are pertinent to the design, construction and operation of the FHS facility:

- Structural precautions requirements
- Occupancy classification of buildings
- Structural precautions (fire-resisting types of construction) – the design of materials and type of construction must adhere to approved rating of resistance to the action of fire
- Special use and occupancy requirements (high hazard occupancies)
- Means of egress/escape – the means of escape in the case of fire or other emergencies and adequate measures are identified for the safe passage of users to the building
- Fire protection and emergency systems – the requirements for installation and maintenance of fire suppression, warming systems and smoke control in buildings are identified
- Selection of fire suppression systems – the identification of fire suppression systems that are suitable for the type of hazard
- Appurtenances, equipment and installations – this section identifies the fire safety precautions in the design of appurtenances and the installation of electrical wiring and equipment
- Fire safety during construction and demolition – measures are identified to protect the workers and general public from the risk of fire during construction and demolition
- Access for disabled persons.

5.3 Summary Description of National Policies and Plans

Many national policies and plans address the social and environmental issues associated with the infrastructure development work at the University. These include the following:

- National Environmental Policy
- Low Carbon Development Strategy (LCDS)
- National Development Strategy (NDS)
- Sustainable Development Goals (SDGs)

5.3.1 National Development Strategy

Chapter 40 of the National Development strategy (NDS) (2001-2010) addresses issues related to water management and flood control policies. This document indicates the unequivocal commitment of the Government of Guyana to strengthen the capacity of key institutions responsibility for water management. For example, the strategy for the Hydro-meteorological Service will lead to improved communication links to data collection centres and automation of stations. To achieve this goal the following have been proposed:

(a) Reactivation of the stations necessary for the design network to improve forecasting capabilities;

(b) Improvement of the staff's skills through seminars, scholarships, and in-the-job training;

(c) Developing research capabilities and other related skills;

(d) Improve the collection/dissemination of hydro-meteorological information through training and recruitment of qualified staff;

(e) Introduce monitoring of ocean parameters relating to control management; and

(f) Develop a precise legal framework for the operation of the entity relating to data collection, information, and monitoring.

Recently, the Government of Guyana (GoG) has signalled its intention of re-suscitating the National Water Council whose mandate is to develop and/or review the national water policy and to oversee its management and coordination. The goal of the Policy is to provide a framework to maximise the contribution of the water sector to sustainable economic, social and environmental development in an efficient and equitable manner.

5.3.2 National Environmental Policy

The National Environmental Policy is rooted in Articles 2:25 and 2:36 of the Constitution and emphasises need for citizens to participate in activities to improve the environment and protect the health of the nation and the role of the state regarding the protection and conservation of biodiversity. The main environmental policy objects are:

a) To enhance the quality of life for the country's inhabitants by utilizing its natural resources while neither degrading nor contaminating them

b) To ensure that the natural resource base for economic growth continues to be available in the future

c) To intensify and widen the dimensions of our living standards through the conservation of unique habitats, natural treasures, biodiversity and our cultural heritage

The main goals for protecting the environment The National Environmental Action Plan (NEAP) of 2001-2005 which follows directly the NEAP of 1994 presents a summary of the policy. The main goals for protecting the environment are the following:

a) Prevent or control pollution in order to maintain the integrity of land and the natural purity of the air and water resources

b) Preserve and conserve ecological integrity and to protect natural habitats and fragile ecosystems

c) Ensure sustainability through best practice of management and use of natural resources for economic development

The Plan focuses on coastal zone management, natural resources management including land resources, biodiversity, wildlife, forestry and ecotourism, waste management and pollution control, and mining. Consideration is given to the role of public awareness and education in addressing environmental problems, as well as the roles and functions of relevant stakeholders including private sector and non-governmental organisations in environmental management (National Action Programme to Combat Desertification, 2006).

5.3.3 Low Carbon Development Strategy

The Low Carbon Development Strategy seeks to provide insights on how to stimulate the creation of a low-deforestation, low-carbon, climate-resilient economy. It identifies five strategic imperatives for Guyana to undertake in order to generate economic growth, while simultaneously eliminating approximately 30 percent of non-forestry emissions through the use of clean energy. These strategic imperatives are:

a) Invest in strategic low carbon economic infrastructure, such as: a hydro plant at Amelia Falls; improved access to unused, non-forested land; and improved fibre optic bandwidth to facilitate the development of low-carbon business activities

b) Nurture investment in high-potential low-carbon sectors, such as fruits and vegetables, aquaculture, and sustainable forestry and wood processing.

c) Invest in other low-carbon business development opportunities such as business process outsourcing and ecotourism.

d) Expand access to services and new economic opportunity for indigenous peoples through improved social services (including health and education), low-carbon energy sources, clean water and employment which do not threaten the forest.

e) Improve services to the broader Guyana citizenry, including improving and expanding job prospects, promoting private sector entrepreneurship, and improving social services with a particular focus on health and education.

5.3.4 Sustainable Development Goals (SDGs)

The Sustainable Development Goals, which are designed to build on the Millennium Development Goals. The goals which relate to the University's project are:

- SDG 4: Ensure inclusive and equitable quality education and promote life-long learning opportunities for all
- DG 6: Ensure availability and sustainable management of water and sanitation for all
- SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Overall, these goals address environmental issues and presents infrastructure design guidelines for Architects focusing on the production, material consumption, ease of deconstruction, reduce resource consumption and design in a manner that enables the facility to be deconstructed for reuse.

5.3.5 Integrated Coastal Zone Management Plan

The Integrated Coastal Zone Management Plan (ICZM, 2001) identifies, among other factors, sea level and floods as social, economic and ecological stresses that impact on the coastal zone. The Plan basically addresses issues related to policy development, analysis and planning, inter-agency coordination, public education and awareness building and education, environmental control and compliance, monitoring and measurement and information management-all of which are necessary to reduce the risks posed by climate change. One of the constraints in the implementation of the ICZM is the limited institutional capacity in terms of human, technical and physical capital to implement the specific actions to address issues affecting the coastal zone, including solid waste management, air, land and water pollution, and environmental health of its inhabitants.

5.4 Environmental Permits and Requirements

Relevant procedures and guidelines which would be of relevance to the Faculty of Health Sciences project include:

(a) Environmental Permitting and Authorisation Guidelines

Environmental Authorisation (Environmental, Operation or Construction Permit) must be completed as an administrative requirement before the Environmental Protection Agency (EPA) can consider issuing a

renewed Environmental Authorisation. However, the environmental permitting process varies depending on the type of project, potential environmental impacts or whether it is new or existing. Application for Environmental Permit is submitted to the EPA with a summary of the proposed project, including information on:

(a) site, design, size and duration of the project

(b) possible effects on the environment

(c) a non-technical explanation of the project

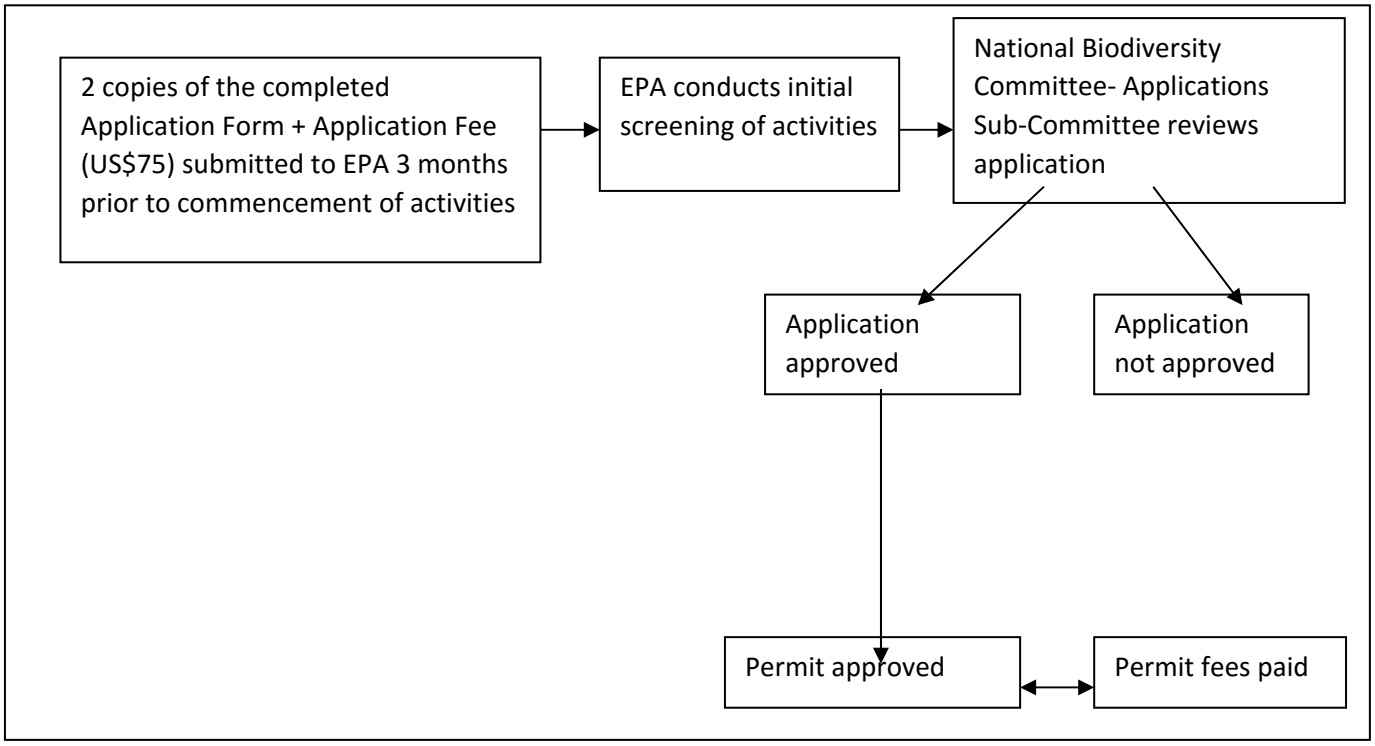


Figure 5 Application for Environmental Permit Process

Table 11 Details of Guyana International Treaties and Agreements

INTERNATIONAL AGREEMENT	OBJECTIVE OF INSTRUMENT	DATE OF APPLICATION	GUYANA'S STATUS	NATIONAL FOCAL POINT	SECTORS ADDRESSED	RELEVANT NATIONAL LEGISLATION
United Nations Framework Convention on Climate Change	To achieve stabilisation of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system	31 March, 1994	Ratified	Office of the President (focal point) Office of Climate Change(implementing agency)	Forestry	Forest Act, 2009
Kyoto Protocol	To assist developing countries in reducing the greenhouse gas emissions and preserving carbon sinks	16 February, 2005	Ratified	Office of the President (focal point) Office of Climate Change (implementing agency)	Forestry	Forest Act, 2009

Convention on Biodiversity	1. conservation of biological diversity 2. sustainable use of its components; 3. fair and equitable sharing of benefits arising from genetic resources	29 December,1993	Ratified	Office of the President (focal point) Environmental Protection Agency (implementing agency)	environmental management forestry fisheries	Environmental Protection Act, 1996 Forestry Act, 2009 Amerindian Act, 1996
Cartagena Protocol	A supplement to the Convention on Biological Diversity. In accordance with the precautionary approach, contained in Principle 15 of the Rio Declaration on Environment and Development, the objective of the Protocol is to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of 'living modified	11 September, 2003	Ratified	Environmental Protection Agency (focal point) Environmental Protection Agency (implementing agency)	environmental management forestry agriculture fisheries health customs	Regulations in draft

	organisms resulting from modern biotechnology' that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on trans-boundary movements (Article 1 of the Protocol)					
Nagoya Protocol	Adopted by the Conference of the Parties to the Convention on Biological Diversity at its tenth meeting on 29 October 2010 in Nagoya, Japan. The Nagoya Protocol will be open for signature by Parties to the Convention from 2 February 2011 until 1 February 2012.	NOT IN FORCE YET	–	Environmental Protection Agency (focal point) Environmental Protection Agency (implementing agency)	environmental management forestry agriculture fisheries	Regulations in <u>draft</u>

United Nations Convention to Combat Desertification	1.To combat desertification and mitigate the effects of drought and/or desertification, particularly in Africa, through effective action at all levels 2.Supported by international cooperation and partnership arrangement 3.Participate in regional programmes for desertification	December 1996	Acceded 10 December 1977	Office of the President (focal point) Guyana Lands & Surveys Commission (implementing agency)	land management	
United Nations Law of the Sea Convention	-Establishes a legal order for the seas and oceans that would facilitate international communication and promote peaceful use of the seas and the oceans -The equitable and efficient utilization of their resources, the conservation of	1994	Adopted 10th December, 1993	Ministry of Foreign Affairs (focal point) Ministry of Foreign Affairs (implementing agency)	management of the Guyana's marine environment fisheries shipping	Fisheries Act 2002 Draft Maritime Zones Bill, 2010

	their living resources, the study, protection and preservation of the marine environment					
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)	1.To preserve the human environment in particular the marine environment 2.To achieve the complete elimination of international pollution of the marine environment by oil and other harmful substances and minimizing the discharge of substances	2nd October, 1983	Accession 10 December 1997	Ministry of Public Infrastructure (focal point) Transport and Harbours Department (implementing agency)	shipping port facilities	Shipping Act, 1999

Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region	1.To protect the ecosystems of the marine environment of the Wider Caribbean Region 2.To protect the marine environment of the Wider Caribbean Region for the benefit and enjoyment of future generations 3.The Convention has 3 Protocols – dealing with protected areas and endangered wildlife	1983	Acceded 17th June 2010	Environmental Protection Agency (focal point) Environmental Protection Agency (implementing agency)	management of the Guyana's marine environment fisheries shipping land based sources of pollution	Environmental Protection Act, 1996 Draft Maritime Zones Bill, 2010 Water Quality Regulation, 2000 Hazardous Waste Regulation, 2000 Fisheries Act 2002
Ramsar Convention on Wetlands	The conservation and sustainable utilization of wetlands To stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the	21st December, 1975	-	Ministry of the Presidency (focal point) Environmental Protection Agency (implementing agency)		

	fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.					
Basel Convention for the Control of Trans-boundary Movements of Hazardous Wastes	To regulate the trans-boundary movement of hazardous wastes, reducing to the minimum its rational environmental management and promoting the international cooperation on this field. To protect countries from receiving unwanted shipments of waste	5th May,1992	Acceded	Ministry of the Presidency (focal point) Environmental Protection Agency (implementing agency)	hazardous wastes	Hazardous Wastes Regulations, 2000
Stockholm Convention on Persistent Organic Pollutants	Action to outlaw the use of POPs, defined as "chemical substances that persist in the	May 2004	Acceded	Ministry of Agriculture (focal point) Pesticides and Toxic Chemicals Control Board	persistent compounds used in agriculture and other industries	Pesticides and Toxic Chemicals Control Act, 2000. Pesticides and Toxic Chemicals (Amendment)

	environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment".			(implementing agency)		Regulations, 2007. Pesticides and Toxic Chemicals Regulation, 2004
Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	The convention promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans	24 February 2004	Acceded	Ministry of Agriculture (focal point) Pesticides and Toxic Chemicals Control Board (implementing agency)	hazardous chemicals	-Pesticides and Toxic Chemicals Control Act, 2000. Pesticides and Toxic Chemicals (Amendment) Regulations, 2007. Pesticides and Toxic Chemicals Control (Amendment) Act, 2007. Pesticides and Toxic Chemicals Regulation, 2004
Treaty of Amazonian Cooperation		2nd August, 1980	Adopted	Ministry of Foreign Affairs (focal point) Ministry of Foreign Affairs (implementing agency)	Environment, science and technology, indigenous affairs, education, tourism, health , transportation,	

					infrastructure,	
World Heritage Convention	Combining cultural conservation with nature conservation	16th November, 1972	Acceded 20 June 1977	Ministry of Culture, Youth and Sport (focal point) National Trust of Guyana (implementing agency)	cultural heritage natural heritage	National Trust Act 1972
UNESCO Convention of the Protection of the Underwater Cultural Heritage	Saving the underwater cultural heritage. "Underwater Cultural Heritage" means all traces of human existence having a cultural, historical or archaeological character, which have been partially or totally under water, periodically or continuously, for at least 100 years	2nd January, 2009	-			Guyana is not State Party to the Convention, but many of the provisions contained in the Draft Maritime Zones Bill, 2010 support the objectives of this treaty

Revised Treaty of Chaguaramas	Arose from the Grand Anse Declaration, which had 3 key features : 1. Deepening economic integration 2. Widening the membership and thereby expanding the economic mass of the Caribbean Community 3. Progressive insertion of the region into the global trading and economic system by strengthening trading links with non-traditional partners. 4. provides a Community instrument addressing economic issues, foreign policy coordination and functional cooperation	2007	Signed	Ministry of Foreign Affairs (focal point) Ministry of Foreign Affairs (implementing agency)	Trade	

While the construction of a new building for the FHS is subject to local legislation and regulations, donor regulations and international treaties and agreements provide much support to ensure safety of all users as well as the protection of the environment.

6. Environmental Diagnostic of the Project Area

An environment and social assessment was developed in order to (i) analyse the potential impacts of the future civil works planned to be developed under Component 2 of the Guyana Education Sector Improvement Project and its operation, and (ii) to prepare an EMP to mitigate such impacts. This section identifies the main physical and social characteristics of the UG Campus.

6.1 Physical Characteristics of the Project Area

6.1.1 Climate and Precipitation

Guyana experiences a wet tropical climate with warm temperatures and abundant rainfall. The coast of Guyana generally experiences two wet and two dry seasons due to the annual meridional migration of the Inter Tropical Convergence Zone (ITCZ). According to Guyana Hydro-meteorological Service at the Ministry of Agriculture, the mean annual rainfall recorded in Georgetown, during the period of 2000 to 2016, varied from 1500 mm to 3500 mm (Figure 6). Georgetown receives on average 2418 mm of precipitation annually.

In January 2005, unusually high rainfall was recorded in Georgetown causing flooding of the Turkeyen Campus. During the period from 2001 to 2008, there has been a general increase in the total annual rainfall on Georgetown (Figure 6). In the period 2010 to 2015, there was a marked decrease in rainfall and from 2014 to 2015 Georgetown was affected by severe drought conditions.

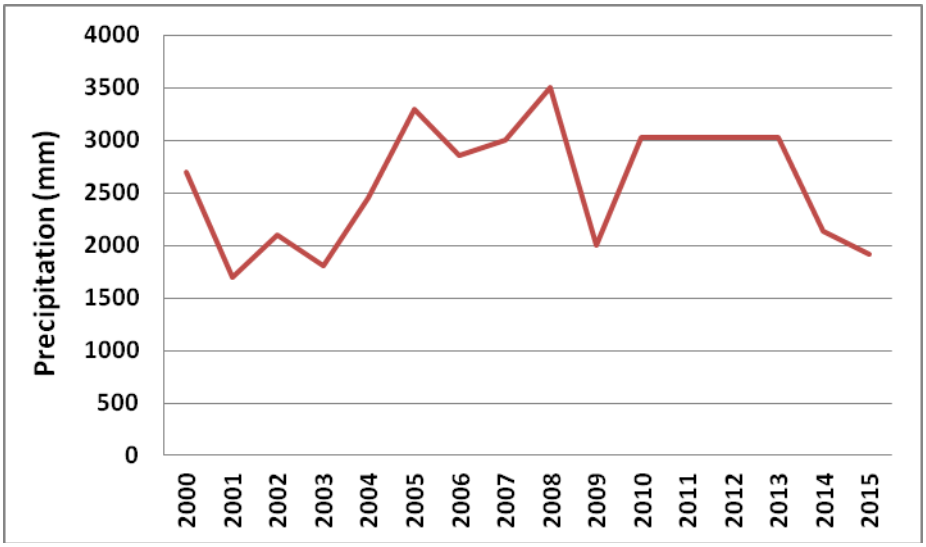


Figure 6 Mean Annual Rainfall during the Period 2000-2016. Source: World Bank, 2016

Georgetown usually experiences heavy rainfall between April and July each year (Figure 7). While this is due to the northward movement of the ITCZ, the southward migration of the ITCZ brings the second wet season to Georgetown between November and January. Generally, the wettest months are June and

December and the driest months are February, March and September. Civil construction works will need to take into consideration the rainy season in order to plan ahead the time frame of the works and in order to reduce social and environmental effects in the campus operation and academic programme.

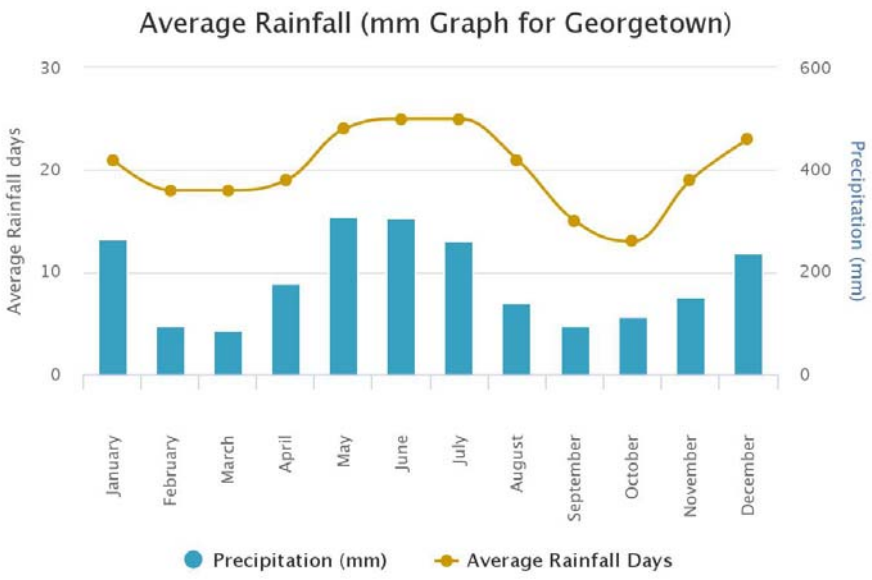


Figure 7 Average Rainfall for Georgetown

6.1.2 Temperature

The average temperature in Georgetown, Guyana is 27.0 °C (81 °F). The warmest average maximum temperature is 31.8 °C (89.2 °F) in September and October. The average minimum temperature is 24 °C (75 °F) in January, February, March, June, July, August and December. During the period 2000 to 2015, the annual mean maximum and minimum temperatures in Georgetown have remained relatively constant (Figure 8). The annual maximum and minimum temperatures averaged 31.8 and 24.1°C, respectively.

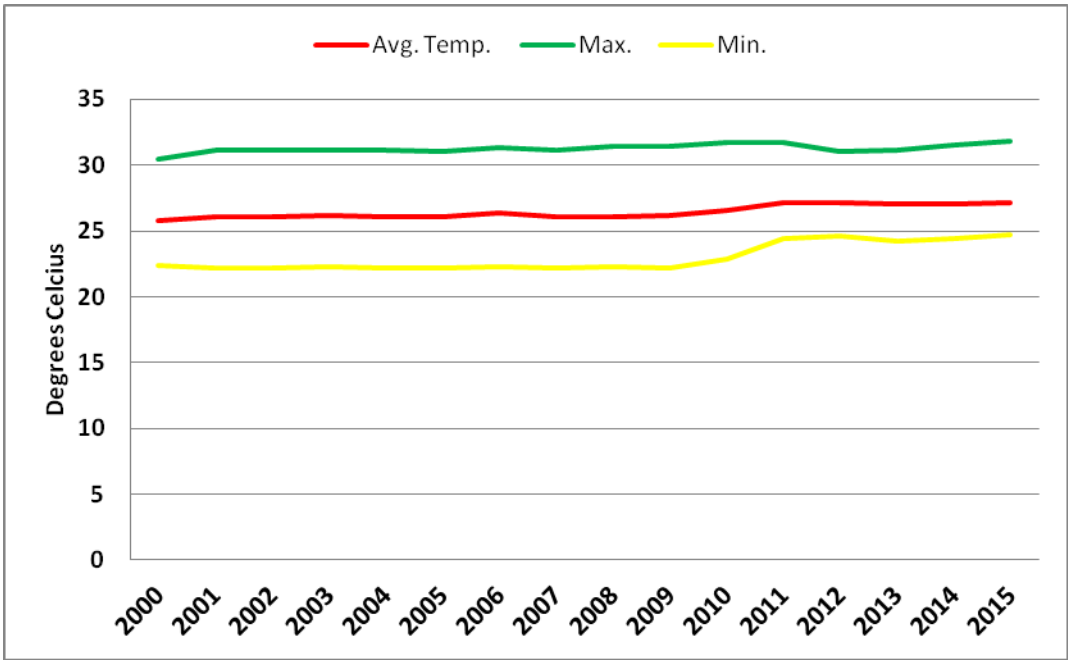


Figure 8 Average Temperature for Georgetown from 2000-2015

6.1.3 Humidity

Georgetown usually experiences high humidity. During the period of 2000-2009, the relative humidity recorded has been over 70%. The annual morning and afternoon relative humidity average 80% and 72%, respectively.

6.1.4 Ground water

The UG campus is located on a large coastal aquifer system. This groundwater system has been identified to occupy a subsurface area of about 20,000 square kilometres (km), extending about 250 km along the Atlantic coast and 40 to 150 km inland, and comprising three aquifers: the "Upper Sands", the "A Sand" and the "B sand". Overlying layers of clays confine the lower two aquifers, thereby protecting them from contamination from external sources.

The "Upper Sands" aquifer, which is the shallowest of the three aquifers, is 30 to 60 metres (m) deep varies in thickness from 15 to 120 m. This aquifer is no longer used as a source of potable water because of its high iron content (>5 mg/l) and salinity (up to 1200 mg/l) (FAO 2011). The "A sand" aquifer is 150 to 220 m deep and 12 to 27 m thick. Reports indicates that the piezometric head was 4.5 m above ground level when it was first extracted, but constant withdrawal has caused the head to fall to 14 m below ground level. The "B sand" aquifer is encountered at depths of 350 and 800 m. Most of the potable water is obtained from the two deep aquifers.

6.1.5 Drainage System

In the coastal plain where the UG is located and even 8 km inland, the land is below sea level at high tide. "Drainage throughout most of Guyana is poor and river flow sluggish because the average gradient of the main rivers is only 0.2 ^{0}/00. Drainage by gravity is possible only when the tide is low, and this form of drainage is affected by the ever-changing levels of the foreshore outside the sea defences. On account of this, it has been necessary in many areas to resort to the expensive method of drainage by pumps." (FAO, 2011).

The drainage system at UG was designed and built at the same time when the campus was constructed in the 1960's. It comprises concrete lined drains (primary and secondary) and earthen drains which covers a substantial portion of the campus. The Campus' drainage network is currently linked to the Liliendaal and Ogle pump stations located in Liliendaal and Ogle, respectively.

The system was drained by two 4800 gallons per minute (0.303 m^3/s) pumps that were located on the Southern end of the campus grounds. During the operation of these pumps, flooding of the campus was minimal although the magnitude and intensity of rainfall remained the same. Currently, due to the heavy rainfall the campus is frequently flooded and this poses a problem to the normal functioning of the university (see photos below).

According to Jackson (2010), the Faculty of Technology reports that mean land level (lawns and play field areas) of the campus is 14.933 m Georgetown Datum (GD) and pumping at the Liliendaal pump station at the outlet generally occurs between 14.935 m GD and 14.326 m GD. As a result, whenever the pump station at Liliendaal starts to operate the campus is flooded with about 187 millimetres (7.4 inches). There are some areas on the campus that are as low as 14.75 m GD.

At the outlet at Ogle, the pump station operates between 14.32 m GD and 13.71 m GD. The operation head at Ogle is lower that the land level on campus which should have contributed to an efficient gravity drainage system.

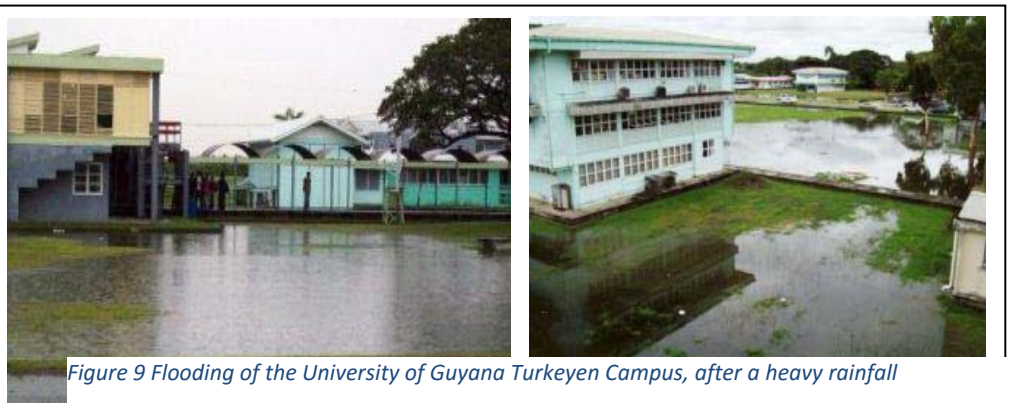


Figure 9 Flooding of the University of Guyana Turkeyen Campus, after a heavy rainfall

The presence of weeds is the primary cause of the poor state of the drainage system on campus. Moreover, the internal and external drains are clogged with weed and silt most of the time (see photos below).

A weed infested drain

A Clogged drain

Figure 10 Problematic Drains on Campus

6.1.6 Health and Safety

The current FHS building and its immediate surroundings contain numerous potential threats to the health and safety of occupants within the building and those of the immediate environs.

On the ground floor of the building there are low hanging electrical wires, exposed electrical wiring and, particularly within the female washroom, there is exposed electrical wiring along with open faced electrical panels. This was the cause for a fire a few months ago that threatened the entire building. There is also a slowly decaying septic tank system which poses a severe threat to health and overall wellness of nearby persons.

On the first floor of the building there are low hanging wires, exposed electrical wires and open faced electrical panels. There are also leaking Air Conditioning Units which presents a tripping hazard for users of the hall way. In addition, several rooms have only one door which is used as an entrance and exit or two doors with only one operational. The same issues presented for the first floor exist for the second floor.

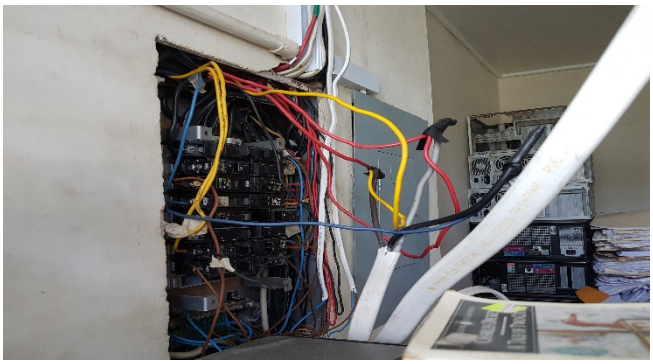
Within the laboratories there are issues with storage where boxes of equipment and materials, such as chemicals, can be seen on the counter tops which over time present health risk to persons utilising those laboratory space. It is important to note that the laboratories are frequently utilised as classroom spaces. This further highlights the need for proper storage and well defined classroom and laboratory spaces. There are some serious issues present in the FHS' laboratories, such as no fire escape, and in some instances blockage of the second entrance, lack of storage for hazardous waste which includes both chemical and biological.

In general there are several issues that are common throughout the building and its immediate environs that present potential risks to health and safety of individuals. Those are:

1. No signage (both evacuation or general);
2. No alternative routes for evacuation;
3. Absence of fire extinguishers from holding places;
4. No smoke or fire alarms or heat detectors;
5. No sprinklers;
6. The material used for the surface floors on the hall way of each floor of the building presents a serious tripping hazard when wet;
7. Debris filled and overgrown shrubs in drains; and
8. Unfinished drains which allows for accumulation of debris and water

Other pictures depicting hazards can be found in Appendix I.

Figure 11 Storage in Laboratories in the Faculty of Health Sciences



Exposed electrical wires, open face panel and low hanging wires at the Faculty of Health Sciences

Figure 12 Electrical Hazards in the Faculty of Health Sciences Building

6.1.7 Hazardous Waste

The current FHS building houses three (3) laboratories since its inception namely, the designated Medical Technology Laboratory, the Anatomy Laboratory and the Histology Laboratory. However, vertical and horizontal expansion of programmes, which led to growing student numbers, has resulted in an acute shortage of classroom space. As a consequence, in 2014 the Histology Laboratory was converted into a classroom resulting in the Medical Technology Laboratory and the Anatomy Laboratory functioning as both classrooms and Laboratory. The Medical Technology Laboratory was refurbished in 2014 through a Centers of Disease Control and Prevention (CDC) project to foster more effective teaching of the Microbiology, Parasitology and Immunology (MPI) course done within the School of Medicine.

The Medical Technology Laboratory is utilised primarily by the Medical Technology department's staff and students to conduct laboratory exercise and classes. However, because of the shortage of laboratory space the laboratory is shared among all Departments within the faculty except the Public Health department, which consist of programmes such as Nursing, Rehabilitation Sciences, and Optometry which have their own space to conduct their sessions. The Anatomy Laboratory is customarily utilised by the School of Medicine to conduct classes and laboratory/tutorial sessions. However, just as in the case of the Medical Technology Laboratory, it is used for classes and tutorial sessions by the other departments within the faculty.

Within the Medical Technology Laboratory waste is generated from laboratory sessions conducted. The waste generated is both infectious and non-infectious materials. Infectious waste which may be either solid or liquid, and include but are not limited to discarded blood and blood specimens, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human tissues, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids and laboratory waste that exhibits the characteristics described above. Waste sharps include potentially contaminated used (and unused discarded) needles, scalpels, lancets and other devices capable of penetrating skin. This waste is not disposed of properly as they are stored in biohazard bags and disposed along with non-infectious waste because there is currently no mechanism in place to which waste is segregated, sterilised and disposed of in an environmentally acceptable way. This in itself poses serious public health implications. Non-infectious waste by itself, on the other hand, can be discarded as normal waste as they present no potential human or environmental threat. The Anatomy Laboratory housed a cadaver as recent as three years ago. However, this was disposed of because of its deteriorating condition and to-date has not been replaced. Therefore, there is no infectious waste emanation out of that laboratory at present.

6.1.8 Pesticide Use

Within the FHS there is no use of pesticides. However, within the building and its environs, PESTEX which is a pest control company, sprays environmentally friendly pesticides every three (3) months as a control mechanism to avoid pest.

6.1.9 Water Quality

Water quality at the Turkeyen Campus of the UG was assessed using ground and potable water. In addition, surface water found in the drainage system in several locations across campus was analysed. Surface water taken from the drains adjacent to the Faculty of Natural Sciences building where a foul odour emanated was tested for parameters indicative of sewage contamination, while surface water near the proposed building site was assessed for other factors since several species of fauna were found in this drainage water.

6.1.9.1 Ground and Potable water

Along the coastal belt of Guyana, there are three separate but hydro-geologically connected aquifers which groundwater is extracted from: the 'Upper Sands', the 'A Sand' aquifer and the 'B Sand' Aquifer. Of the three aquifers, only the A Sand and B Sand are currently utilised (as indicated in section 6.1.4). The A Sand is the primary source of water supply for Region 4, with a handful of wells along the coast also tapping the B Sand. However, it is known that the A Sand aquifer has high iron content. This often leads to undesirable red-coloured water being supplied to consumers, where there is no water treatment. The B Sand aquifer does not have the issues of high iron content that the A Sand aquifer has; however, there are traces of hydrogen sulphide gas, which comes with a pungent odour (US Army Corps of Engineers, 1998).

The University is currently being supplied water from two interconnected wells owned by Guyana Water Incorporated (GWI): Turkeyen#1Well (Figure 13) and Turkeyen#2 Well (Figure 14). At the time of preparation of this report, Turkeyen #1 Well, which was recently repaired, is in operation by GWI, after being out of operation for some time.

Water is supplied to the campus by direct pumping of water from the wells into UG's water system, without treatment. Some buildings, including the recently rehabilitated Faculty of Natural Sciences Buildings, have filtration systems, where the potable water undergoes some sort of treatment before distribution within the building. However, this is not the case for all buildings on campus.

Figure 13Turkeyen Well#1

Figure 14Turkeyen Well#2

Methodology

Ground and potable water samples were collected on November 4, 2016 between 08:30 and 09:30 hours. The samples were collected in plastic containers which were rinsed twice before being filled with sample water. The potable water, sampled from the current FHS, was allowed to run for one minute before the sample was collected.

Three samples from each site were then analysed by Eureka Laboratory for 'Total Coliform' and 'Faecal Coliform' using the Most Probable Number (MPN) method. Samples were also tested by the Central Laboratory of the Guyana Sugar Corporation (GUYSUCO) for iron, calcium, magnesium and sulphates using atomic absorption spectroscopy and titrimetric methods.

In addition, a 'Hach 2100P Turbidimeter' and a 'Bante Instruments 900P Portable Multiparameter Metre' were used to test turbidity, pH, conductivity and total dissolved solids (TDS) at UG.

Results

The results of ground and potable water are summarised in Table 12 below.

The pH of all water samples fall below the recommended World Health Organization (WHO) of 6.5-8.5, where most samples were slightly acidic. These pH levels can be corrosive to water systems and may damage pipework (WHO, 2011). The potable water is only slightly more acidic than the well waters but may indicate some contamination along the water network. Turbidity of all samples was well above the recommended 5 Nephelometric Turbidity Unit (NTU).

The WHO recommends zero coliform - bacteria known to cause intestinal and gastric issues in humans to be present in drinking water. While there were no faecal coliform found in any of the water samples, total coliform were above zero in all three samples. Well #1 had the highest level of coliform which could be attributed to the long time period during which the well was inoperable. Such conditions are conducive to the bacterial growth and multiplication.

Iron levels from both well waters were above the WHO standard of 0.3 mg/l. However, the potable water obtained from the FHS building was just slightly below the standard.

Sulphates were analysed since some well water in coastal Guyana is known to have issues with hydrogen sulphide. Sulphide oxidises to sulphates and may leave an undesirable smell and taste. However, it was noted that all samples were odourless and sulphate concentrations were below the WHO standard.

High levels of calcium and magnesium are indicative of hard water. However, these elements are well below levels which may cause concern.

Table 12 Ground and Potable Water Quality Analysis

Date: Nov 4, 2016				
Conditions: Sunny				
	Well #1	**Well #2**	**Potable Water**	**WHO Standard[6]**
pH	6.28	6.33	6.12	6.5-8.5
Conductivity (µS/cm)	90	93.9	101.2	--
TDS (ppm)	44.8	46.9	50.6	600
Turbidity (NTU)	20.7	17	18	5
Faecal Coliform (MPN/10 ml)	0	0	0	0
Total Coliform (MPN/10ml)	6.47	2.2	0.73	0
Iron (mg/l)	0.93	0.71	0.27	0.3
Sulphates (mg/l)	3.23	7.42	3.38	250

[6]World Health Organization. (2011). *Guidelines for drinking-water quality*. Geneva: World Health Organization.

Calcium (mg/l)	4.51	3.66	3.66	100-300
Magnesium (mg/l)	1.49	1.38	1.36	100

*All samples collected were colourless and odourless.

Figure 15 Surface Water near the Faculty of Natural Sciences Building

6.1.9.2 Surface Water

Surface water was analysed for two primary purposes: to assess habitat conditions of biodiversity found near the proposed building site; and to analyse suspected contaminated surface water near the building site which has affected air quality.

Methodology

Three water samples were collected from the drain between the proposed building site and its access road on November 9, 2016 using plastic containers. The containers were rinsed twice with sample water before being filled and capped. These samples were then tested for dissolved oxygen (DO), pH, conductivity, total dissolved solids and turbidity at the UG (Table 13).

On November 4, 2016, surface water was collected from drains adjacent to two Faculty of Natural Sciences Buildings, identified as 'North drain' and 'South drain'.

In addition, samples of the water discharged from septic tanks into these drains were collected. Water from the drain adjacent to the Library was also collected on the assumption that it was not contaminated and no foul odours were present in the vicinity.

These samples were then analysed by Kaizen Environmental Services (Guyana) Inc. Biological oxygen demand (BOD), pH, total coliform, E. Coli and total nitrogen are reported (Table 14).

Results

Table 13 Surface Water Results

Surface Water Results					
Sample location: Drain adjacent to proposed building site					
Date: Nov 9, 2016					
Conditions: Sunny (with some precipitation hours earlier)					
	DO (mg/l)	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**	**TDS (ppm)**
1	1.55	7.11	33.7	770	386
2	1.58	7.155	31.0	424	214
3	1.39	7.06	32.9	762	381
Avg	1.51	7.11	32.5	652	327

Table 14 Contaminated Surface Water Results

Parameter	North Drain Discharge	North Drain	South Drain Discharge	South Drain	Library Drain
Biochemical Oxygen Demand (mg/l)	215	148	194	141	<40.0
pH	7.96	7.90	7.98	7.86	7.91
Total Coliform (CFU/100 ml)	10400	27500	7071	TNTC*	9786
E. Coli (CFU/100 ml)	3700	6571	13200	TNTC*	4214
Total Nitrogen (mg/l)	257	198	181	111	<0.3

*Too Numerous to Count

Results in Table 14 indicate tremendous bacterial contamination in the drains adjacent to the Faculty of Natural Sciences Buildings. The 'discharges' both show high BOD and total nitrogen levels, as compared to the Library drain, and are much higher than proposed effluent standards of 30 mg/l and <15 mg/l, respectively, for Guyana (GNBS, 2015).

Total coliform and E. Coli in both drains are higher than in the discharges, indicating that there are other sources of bacterial contamination since the bacteria indicators are both also present in the Library drain. The open nature of the drains may allow for contagions from birds and other animals to enter the drainage system. However, it is clear that the discharges from the septic tanks have not been treated properly and are contributing significantly to the bacterial contamination in the drains. The effluents are also well beyond accepted standards for surface water for these parameters.

6.1.10 Sewage Treatment

After commencing its operations in October in 1963 with 164 students, the UG was relocated to the Turkeyen Campus, which initially had 10 buildings, and was commissioned in October 1969. The sewerage system was built after the Campus was relocated to Turkeyen. While the Turkeyen Campus was designed and constructed to accommodate 1,500 students, the current enrolment at the Turkeyen Campus now exceeds 6,000 students and there are more than twenty five (25) buildings.

The sewage collection system consists of approximately 66 manholes, each about 2 ft wide x 2 ft long x 2 ft 9 inch deep, within a network of 4 inches diameter gravity sewer pipes, some of which are experiencing fractures in several sections. The manholes are located at points wherever there is a: (a) significant change of direction or grade; (b) change in cross section or curvature of the land; and (c) need to allow access to the sewer to facilitate inspection and cleaning (*Terms of Reference: Consultancy and Works for the Re-engineering of the University of Guyana Sewerage System,* 2016).

A sealed manhole within a building and an existing manhole at the Turkeyen campus, University of Guyana. Source: Jackson, 2010.

Figure 16 Manholes on Turkeyen Campus

The gravity sewer pipes drain to Du-O-Jet sewage injectors which operate by pneumatically ejecting the collected wastewater a distance of approximately 1846 ft via a 12 inches diameter discharge polyvinyl chloride pipeline to a Model V treatment plant. This plant was previously responsible for treating the sewage by using the "activated sludge process", after which its effluent was discharged into a nearly trench. However, the plant is no longer functional (Jackson, 2010).

The Model V sewage treatment plant was obtained from Smith and Loveless Inc. of Lenexa, Kansas during the mid-1970s. The activated sludge treatment process is a modification of the conventional treatment method and is primarily used in small communities and institutions. The major differences of the UG plant to the conventional method are: (i) there is no sludge dewatering stage; (ii) the aeration time is longer; and (iii) after the clarifiers the waste sludge is pumped into a sludge digester where the sludge is settled and the liquid on top (supernatant) is recycled into the aeration tank (*see photo below*) (Jackson, 2010).

The increase in student population and the number of buildings has placed a stain on the sewerage system. Additionally, many years of inadequate maintenance of the system has resulted in several failures both along the network and the sewage treatment plant. This has resulted in untreated sewage being allowed to flow into the nearby canals thereby posing a serious environmental and health risk to the University population and surrounding residents.

Primary Settling Tank and the Aeration Tank at the Turkeyen Campus, University of Guyana.

Figure 17 Settling and Aeration Tanks

The UG is currently benefitting from funding under the University of Guyana Science and Technology Support Project (UGSTSP) . Accompanying the rehabilitation and improvement to existing science laboratory buildings in four faculties, was the construction of septic tanks for the rehabilitated buildings (*see Figure 18 and Appendix IX)*.There are some indications that these septic tanks may not be functioning effectively and would require fixing by the Contractor.

Septic tank constructed for the Faculty of Technology

Figure 18 Septic Tank at the Faculty of Technology

As a consequence of the state of the University's sewage system, the steering committee of the UGSTSP agreed to use an unspent portion of the resources of the project for the implementation of a comprehensive wastewater treatment solution for the Turkeyen Campus.

To this end, at the time of preparation of this document, a consultancy entitled “Re-engineering of the University of Guyana Sewerage System” has been designed. The objectives of the consultancy are to:

- conduct a comprehensive condition assessment of the existing system;
- conduct a comprehensive investigation into and present the most appropriate and cost effective method of treating all generated wastewater on the Campus;
- prepare a detailed training outline for the training of the maintenance and management staff of the University to be able to optimally operate and maintain the wastewater plant and sewer network;
- optimise the use of all generated sludge by the plant in an environmentally friendly, cost effective manner.

According to the procurement process, requests for proposals were issued to a short list of 4 firms which were required to submit bids by November 8, 2016; the design is expected to be completed by April 2017 and rehabilitation completed by December 2017.

6.1.11 Solid Waste Management

Information on the exact type and quantity of solid waste generated by the UG, Turkeyen Campus is unavailable. However, in June 2010, a member of staff of the Faculty of Technology, Mr. Calvin Hector, conducted a preliminary characterisation of solid waste on the Turkeyen Campus using two faculties (as cited in *University of Guyana*, 2015). He examined the solid waste generated by the Faculties of Technology and Health Sciences. His results revealed that the weight of solid waste generated by the Faculty of Technology was two and a half times that generated by the FHS. While the highest amount of waste generated by the Faculty of Technology was mixed paper (43%), in the FHS, the main type of waste was plastic bottles (24%). Other important categories of solid waste generated by the Faculty of Technology were plastic bottles and steel and ferrous metals; and other important solid waste generated by the FHS included cardboard, and plastic bags and containers (see Table 15).

Table 15 Characterization of Solid Waste generated in Faculties of the University of Guyana.

Description	Faculty of Health Sciences[7]		Faculty of Technology [8]	
	Average weight (lbs)	Percent	Average weight (lbs)	Percent
Mixed paper	9	11.92	81	42.86
Plastic bags and containers	12	15.89	9	4.76
Aluminium cans	6	7.95	2	1.06
Styrofoam (cups and boxes)	5	6.62	3	1.59
Wood	0	0.00	6	3.17
Cardboard	12	15.89	12	6.35
Glass bottles and glasses	8	10.60	12	6.35
Plastic bottles	18	23.84	25	13.23
Steel and ferrous metals	0	0.00	30	15.87
Sponge, coal and battery	0	0.00	1	0.53
Leather and rope	0	0.00	4	2.12
Food waste	5	6.62	4	2.12
Miscellaneous	0.5	0.66		0.00
Total	**75.5**	**100.00**	**189**	**100.00**

Source: Hector (as cited in *University of Guyana* 2015).

Currently, there is no sustained separation of waste or reusing or recycling activity on the Turkeyen Campus. All of the solid waste generated by the facilities on Campus are currently stored in nineteen (19) 460 and/or 1100 Litre four wheeled plastic bins located in the vicinities of the buildings around the Campus. They are emptied daily into a compactor located at the back of the Campus (*see photos*). The waste stored within the compactor is collected once a week (Wednesdays) and disposed at the Haagsbosch landfill site, East Bank Demerara. A private solid waste contractor named Cevons is responsible for the provision and maintenance of waste storage facilities on Campus and the collection and disposal of the solid waste. There remains the need for the development of a solid waste management strategy for the University that would promote the reduction, reuse and recycling of waste and the conversion of waste to energy.

[7] Solid waste was collected over three day period June 9-11, 2010.
[8] Solid waste was collected over the three day period June 6-8, 2010.

Storage bin at the UG Turkeyen Campus

Compactor at the UG Turkeyen Campus

Figure 19 Solid Waste Management at UG

As an element of the UGSTSP, , a team from the University is finalising its hazardous materials management policies and protocols to improve hazardous materials management by the Campus. As part of this process, an inventory of hazardous waste on campus has already been compiled. In Appendix II is a list of chemical waste generated by the laboratories of the FHS. These materials are currently being moved to the Faculty of Natural Sciences' storage area. The list provides a sense of some of the chemical waste that could be generated once the newly constructed FHS building becomes operational.

6.1.12 Air Quality

Methodology

The planned construction of the FHS building is likely to interfere with the current ambient air quality of the Turkeyen Campus. As a consequence, measurement of the ambient air quality in the vicinity of the site of the proposed building was conducted over an eight hour period for three days (November 7 – 9, 2016) to establish the baseline conditions. The concentrations of the air quality parameters were measured hourly. A review of the United States National Ambient Air Quality Standards (NAAQS), see *Appendix III* and the World Bank's ambient air quality guidelines (International Finance Corporation, World Bank Group, 2007a) informed the selection of air quality parameters selected to establish the baseline; the parameters were: particulate matter of size less than 10 microns (PM10); nitrogen dioxide (NO_2); sulphur dioxide (SO_2); and carbon monoxide (CO). The E-Sampler was used to measure PM10 and the MultiRAE lite system was used to measure the gases (*see photos*). Since the MultiRAE system could also measure nitric oxide and hydrogen sulphide concentrations, these were included.

Figure 20 Air Quality Testing

Results

The mean concentration of PM10 increased from Day 1 to 3 from 3.1 to 7.6 micrograms per metre cubed (µg/m^3) (Table 16). This increase was most likely due to the fact that the grass was cut on the second day. The mean concentration of nitrogen dioxide varied from 0.1 to 0.2 parts per million (ppm), while the mean concentrations of sulphur dioxide and carbon monoxide, as well as hydrogen sulphide and nitrogen oxide, were 0.0 ppm. The levels of PM10, sulphur dioxide, and carbon monoxide did not exceed the NAAQS, (see *Appendix III*) for these parameters. However, the level of nitrogen dioxide exceeded the standard of 100 ppb for an averaging time of 1 hour.

Table 16 Results of Ambient Air Quality in the Vicinity of the Proposed Building (Nov 7-9, 2016)

Time/Air Quality Parameter	**PM10**	**NO_2**	**SO_2**	**CO**	**H_2S**	**NO**
	µg/m^3	**ppm**	**Ppm**	**ppm**	**Ppm**	**ppm**
US EPA Standards	**150 µg/m^3; 24 hour**	**100 ppb; 1 hour**	**75 ppb; 1 hour**	**9 ppm; 8 hours**		
Day 1						
Mean	3.1	0.1	0.0	0.0	0.0	0.0
Minimum	2.0	0.1	0.0	0.0	0.0	0.0
Maximum	4.0	0.3	0.0	0.0	0.0	0.0
Day 2						
Mean	6.1	0.2	0.0	0.0	0.0	0.0
Minimum	5.0	0.1	0.0	0.0	0.0	0.0
Maximum	7.0	0.3	0.0	0.0	0.0	0.0
Day 3						
Mean	7.6	0.2	0.0	0.0	0.0	0.0
Minimum	6.0	0.1	0.0	0.0	0.0	0.0
Maximum	9.0	0.3	0.0	0.0	0.0	0.0

6.1.13 Sound Pressure Level

The sound pressure level (SPL) was measured using a sound level meter (Figure 21). It responds to pressure changes in the air that are caused by sound waves.

Figure 21 Sound Level Meter

Methodology

The SPL was measured at five points. The first point was located directly at the proposed area where the new FHS building is to be constructed. The second site was located 25 m away from the first point, the third point located 50 m away from the first point, the fourth point was located at a distance of 75 m away from the first point and the fifth point was located 100 m away from the first point (see Figure 22).

Readings were taken early in the morning (06:00 hours to 07:00 hours) since at this time of day campus activity was minimal. Readings were also taken between 13:00 hours and 14:00 hours since this period is assumed to be the time period where campus activity peaks. The readings were taken on three different days during the survey exercise, *Appendix III*.

The readings were taken moving away from the proposed building site in a northern direction. At each point, the researcher spent exactly 15 minutes recording.

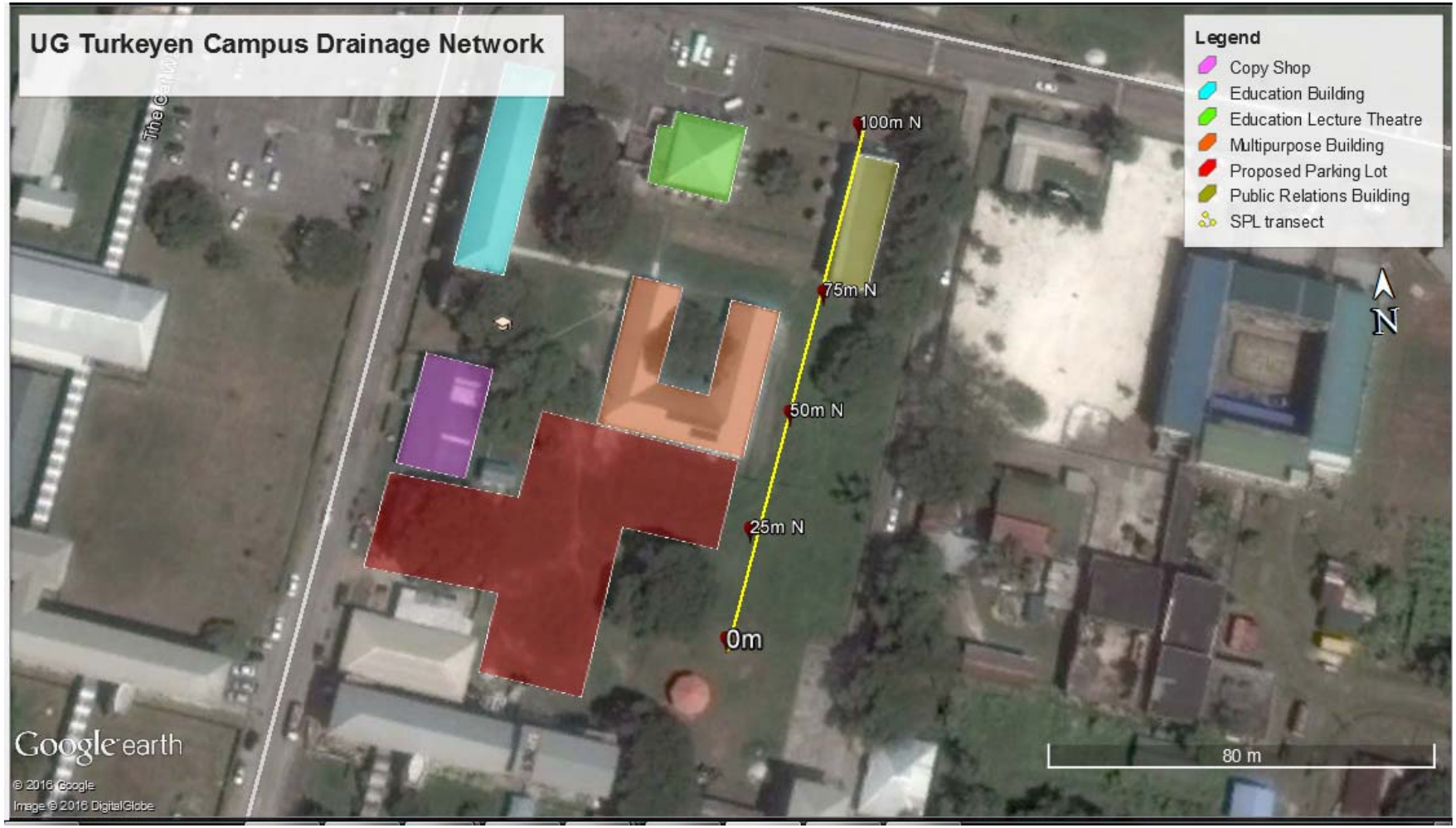
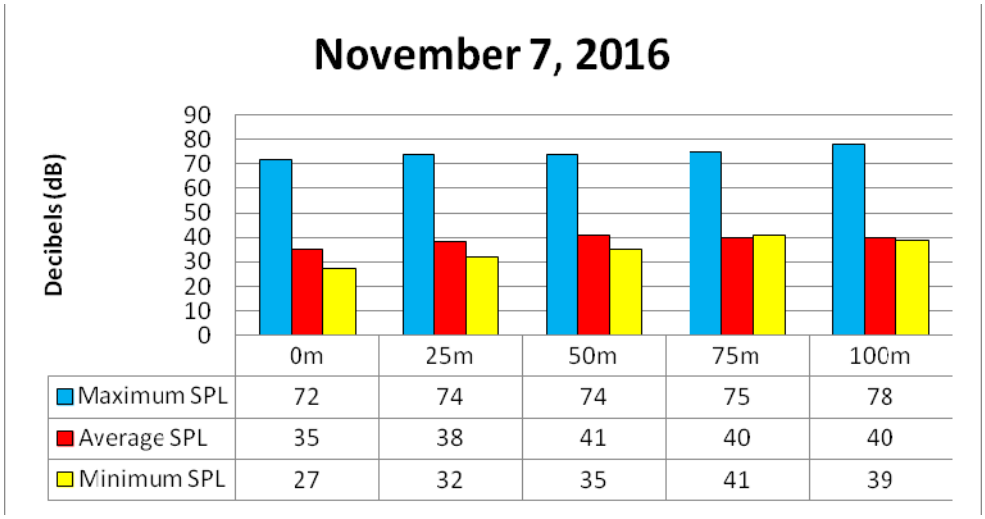
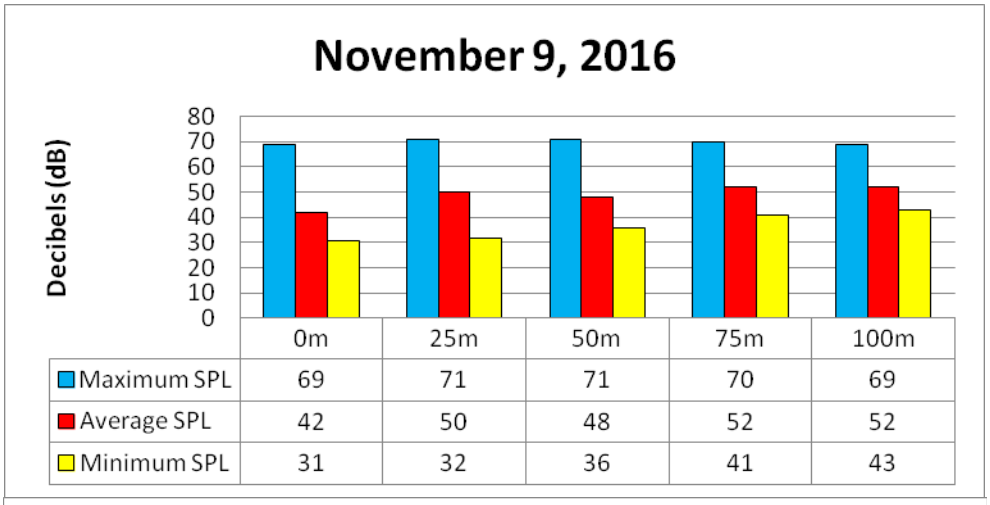


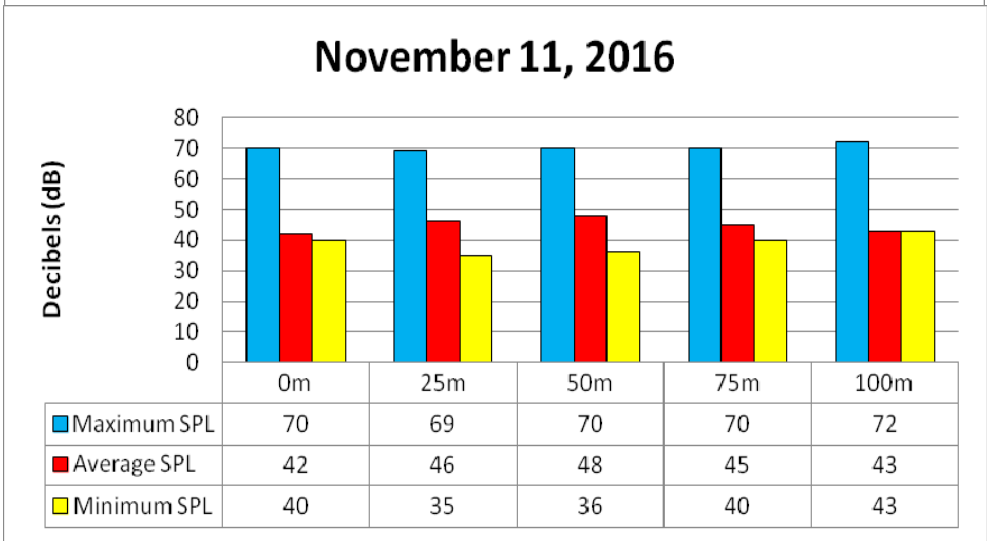
Figure 22 Sound Press1ure Level Sample Points



	0m	25m	50m	75m	100m
Maximum SPL	72	74	74	75	78
Average SPL	35	38	41	40	40
Minimum SPL	27	32	35	41	39

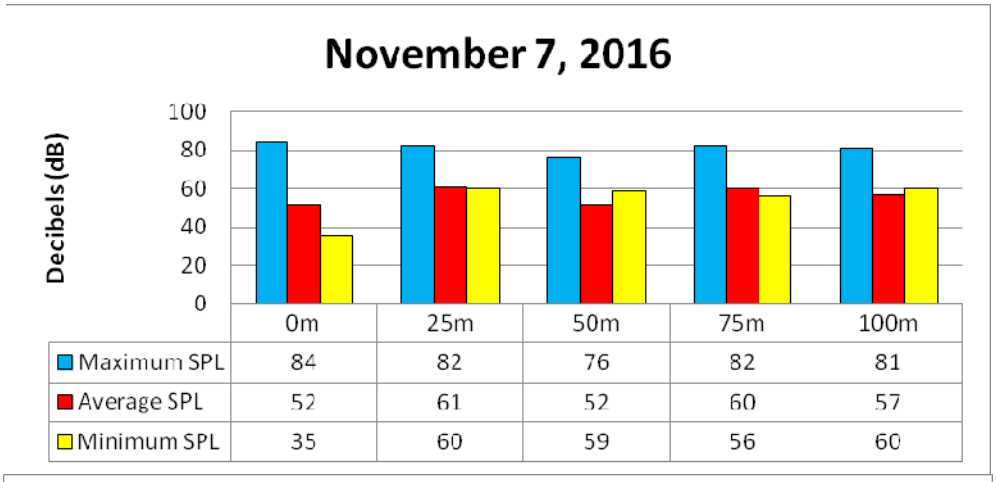


	0m	25m	50m	75m	100m
Maximum SPL	69	71	71	70	69
Average SPL	42	50	48	52	52
Minimum SPL	31	32	36	41	43

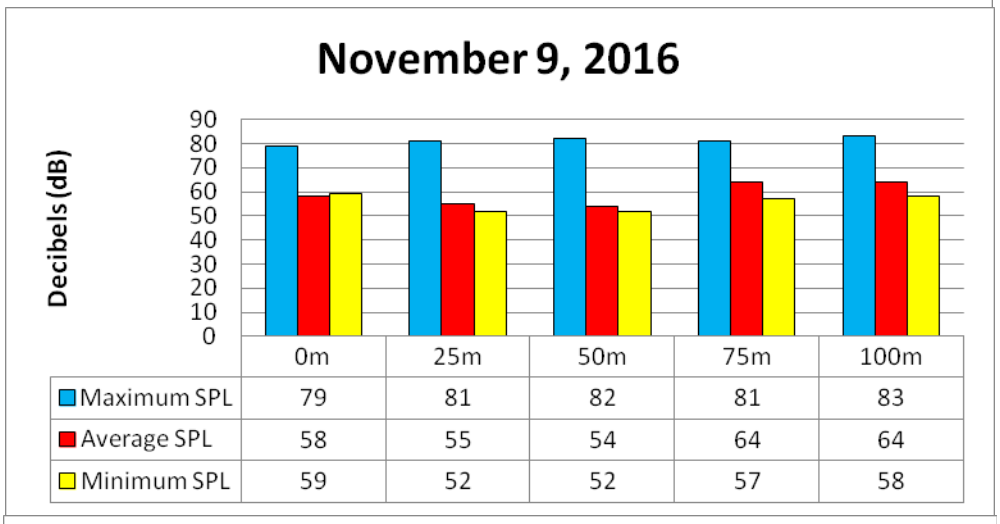


	0m	25m	50m	75m	100m
Maximum SPL	70	69	70	70	72
Average SPL	42	46	48	45	43
Minimum SPL	40	35	36	40	43

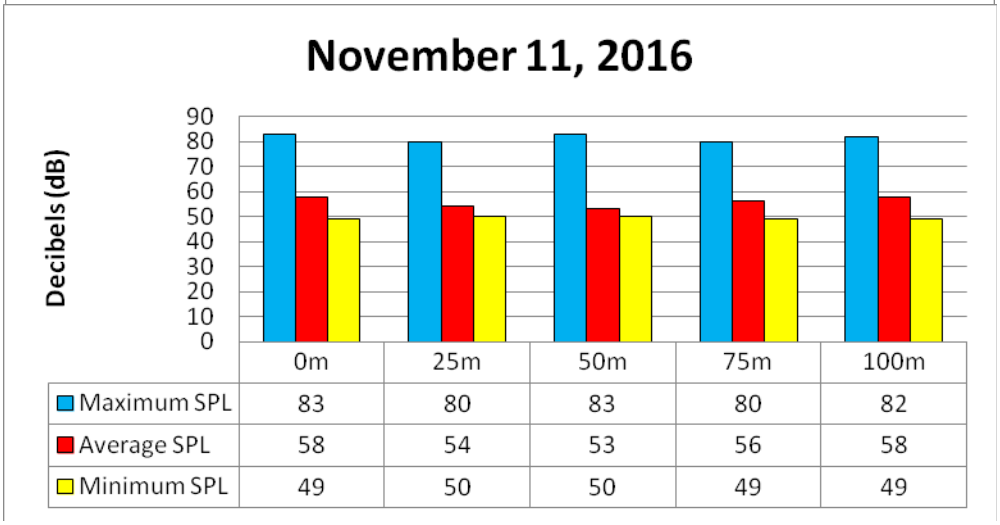
Figure 23 Sound Levels in the Mornings of Test Days



	0m	25m	50m	75m	100m
Maximum SPL	84	82	76	82	81
Average SPL	52	61	52	60	57
Minimum SPL	35	60	59	56	60



	0m	25m	50m	75m	100m
Maximum SPL	79	81	82	81	83
Average SPL	58	55	54	64	64
Minimum SPL	59	52	52	57	58



	0m	25m	50m	75m	100m
Maximum SPL	83	80	83	80	82
Average SPL	58	54	53	56	58
Minimum SPL	49	50	50	49	49

Figure 24 Sound Levels in the Afternoons of Test Days

Discussion of Results

As can be seen from Figures 23 and 24, the general trend that was observed for the SPL readings was that the SPLs tend to increase as the researcher moves further away from the proposed building site. This was because the researcher was moving closer to the main driveway; as a result the noise from the vehicular traffic increased the SPLs. In a few cases, airplanes that were passing over the campus affected the readings. However, the passing planes will not be a threat since there are less than 20 flights per day and the SPLs are well below 80 dB which is the allowable limit as prescribed by the Noise Control Guidelines of Australia (EPA Victoria, 2008).

Vehicular traffic is the main source of noise on the Turkeyen Campus, and depending on the types of vehicles that frequent the Campus, there is a possibility that the noise levels can get very high. Previous studies have shown that the normal average sound pressure levels that are usually recorded on university campuses fall between the range of 40 dB to 50 dB (Obot and Ibanga 2013, Otutu 2011).

During the morning hours, the SPLs that were recorded ranged from 27 dB to 43 dB and this range is comparable to a soft whisper, a quiet rural area or bird calls (IAC Acoustics 2016). Exposure to this range can be continuous with no adverse health effects. During the afternoon hours, the SPL rose to a range of 35dB to 84 dB which is comparable to the average factory noise level, traffic, conversation in a restaurant or a quiet suburban area (IAC Acoustics 2016). The upper limits of this range (≥ 70 dB) can cause damage to hearing if there is continuous exposure for 8 hours or more.

6.1.14 Traffic

During construction of the proposed building, traffic flow to existing buildings and businesses in the vicinity may be affected by construction vehicles and materials. A traffic survey of the access road (Shridath Ramphal Road) for the current FHS building was carried out on November 3, 2016 in order to determine peak hours for traffic and general use of access road.

Figure 25 Access Road for Proposed Project Site

Methodology

A traffic survey was conducted manually by two surveyors on November 3, 2016. Vehicles were counted as they travelled southbound on the access road to the current FHS building for a 12 hour period. Since classes usually commence at 8:15 hours on Monday to Friday, the survey commenced at 08:00 hour and concluded at 20:00 hour. Vehicles counted were grouped for each hour and the results are presented below. Other general observations on traffic flow were also made by surveyors.

Results

Table 17 presents the results of vehicles using the access road on the date of the survey. The number of vehicles using the access road per hour ranged from 19 to 1. Figure 26 shows that the main peak hours are between 09:00 – 12:00 hours, with 15:00 hour also experiencing higher traffic volume. It was noted that during 08:00-9:00 hour period, there were delivery vehicles for the canteen and more pedestrians using the access road. In addition, the afternoon peak at 15:00 hour was attributed to mostly taxi dropping off commuters.

Notably, this traffic survey was carried out during a period when classes were not conducted in the current FHS building due to rehabilitation of the building. Staff members were also not occupying or utilising the building at the time. Therefore, overall traffic volume is expected to increase once the building is occupied and used by staff and students. Peak hours may however, shift depending on class scheduling.

Table 17 Results of Traffic Survey

Time	Vehicle Count	Time	Vehicle Count
8:00-8:59	8	**14:00-14:59**	8
9:00-9:59	13	**15:00-15:59**	15
10:00-10:59	19	**16:00-16:59**	8
11:00-11:59	11	**17:00-17:59**	1
12:00-12:59	16	**18:00-18:59**	2
13:00-13:59	6	**19:00-20:00**	1

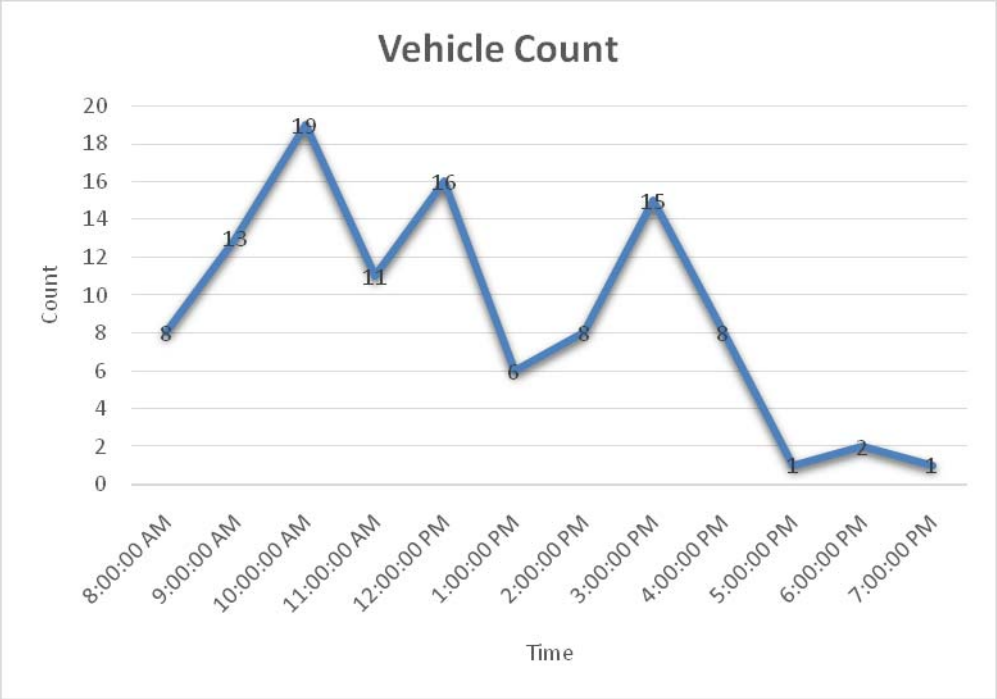


Figure 26 Vehicle Count

6.2 Biological Characteristics

This section highlights the existing faunal and floral status associated with the project site for the building of the new FHS facility, Turkeyen Campus. The faunal survey concentrated on the presence or absence of terrestrial mammals, herpetofaunal, birds and insects. They are all important in maintaining a healthy ecosystem.

6.2.1 General Site Description

The projected study site is located on the western side of the existing FHS access road. It is approximately 1.18 hectares and is the main green space in the area. The lawn is predominantly carpet grass (*Axonopusaffinis*) and a few established trees, *samaneasaman* (rain tree) from the fabaceae family are planted on the periphery. A connecting drainage system approximately 1 m deep borders the four sides of the study area. The area has limited tree cover and is very disturbed with vehicles and humans traversing on a daily basis.

6.2.2 Avifauna (Birds)

Survey Method

Audio-visual point counts were used to survey for birds, as this is the most efficient method for rapid inventories of bird species (Larsen, 2016). The point counts were conducted during early morning since this is when birds are most active. A 300 m transect along the inside of the study site was used. Walks started between 5:30 hours and 7:00 housr. Walks lasted approximately thirty (30) minutes. Opportunistic surveys were also conducted at night in tandem with herpetofaunal surveys to capture any owl species. Sampling stopped when no new species were observed. Visual identifications were confirmed with *Birds of Venezuela* (Hilty, 2002), while aural identifications were confirmed by comparison to recorded calls with confirmed identifications.

Results and Discussion

A total of 17 species were recorded during the survey period. Owls were not observed during night surveys. A detailed breakdown of the species observations is provided below. A capital "X" is used to indicate birds for which the estimate of individuals was above two (n < 2) (Table 18)

Figure 27 Tropical Kingbird (Tyrannusmelancholicus) ©Meshach Pierre

Figure 28Yellow Oriole (Icterus nigrogularis) ©Meshach Pierre

Table 18 Species Recorded during Bird Surveys

Common Name	Scientific Name	04-Nov-16	05-Nov-16	06-Nov-16	Habitat[1]	IUCN Red List Status[2]
***Ardeidae* - Herons**						
Cattle Egret	*Bubulcus ibis*		X	x	**HU**	LC
Falconidae - Falcons, Caracaras						
Yellow-headed Caracara	*Milvagochimachima*	X	X	x	SV, SC, **HU**	LC
Northern Crested Caracara	*Caracara cheriway*	X			SV, SC, **HU**	LC
Charadriidae - Plovers						
Southern Lapwing	*Vanelluschilensis*	X			FW, **HU**, SV	LC
Columbidae - Pigeons, Doves						
Common Ground Dove	*Columbina passerine*	X	X		SV, SC, **HU**	LC
Cuculidae - Cuckoos						
Smooth-billed ani	*Crotophagaani*		X		SC, **HU**	LC
Tyrannidae - Tyrant Flycatchers						
Rusty-margined Flycatcher	*Myiozetetescayanensis*	X	X		**HU**, SC, RI	LC
Great Kiskadee	*Pitangussulphuratus*	X	X	X	**HU**, SC, MN	LC

Tropical Kingbird	*Tyrannusmelancholicus*	X	X	x	SV, SC, **HU**	LC
Hirundinidae - Swallows						
Gray-breasted Martin	*Prognechalybea*	x	X	x	**HU**, SC	LC
Troglodytidae - Wrens						
House Wren	*Troglodytes aedon*	x	X	X	**HU**, SC	LC
Turdidae - Thrushes						
Pale-breasted thrush	*Turdusleucomelas*		X	x	**HU**, SC	LC
Mimidae - Mockingbirds						
Tropical Mockingbird	*Mimusgilvus*		X		**HU**, SC	LC
Thraupidae - Tanagers						
Blue-gray Tanager	*Thraupisepiscopus*	x	X	x	**HU**, SC	LC
Cardinalidae - Grosbeaks, Saltators						
GrayishSaltator	*Saltatorcoerulescens*	x		x	**HU**, SC	LC
Icteridae - New World Blackbirds						
Yellow Oriole	*Icterus nigrogularis*		X	x	**HU**, SC, MN	LC
Carib Grackle	*Quiscaluslugubris*	X	X		**HU**, SC, MN	LC

1: HU: Human altered habitat (Braun et al. 2000) 2: LC: Least Concern (IUCN 2015)

This study is to be considered only as a preliminary assessment of the avifauna within the study site. However, the avifaunal community documented appears to be representative of the human dominated nature of the location. Although owls were not observed, anecdotal evidence suggests that owls are present on campus and may nest in nearby buildings. Small mammal surveys are inconclusive, and it is uncertain whether owls use the field to feed. All recorded birds are known to thrive in secondary habitats and human settlements (Braun et al., 2000). Due to this, their populations are considered stable and they are all listed as “Least Concern” by the International Union for Conservation of Nature (IUCN) (2015b). Additionally, the availability of similar habitat throughout the UG campus ensures that affected birds are able to still access the resources they need.

Further surveys are recommended within the general Turkeyen Campus, particular in areas with more tree cover. It is not expected that species of conservation concern will be recorded from the area as the Turkeyen Campus is surrounded by human settlement, and isolated from any other green spaces and forest tracts. Development within the study site is not expected to detrimentally affect the resident bird community; considerations should be made of the area's role as an important green space for students. It is apparent that the rain trees serve as nesting sites the birds.

6.2.3 Aquatic Fauna

Description of sample area

The projected sample site is located parallel to the FHS access road. The drain is open and thus exposed to sunlight; some parts are shaded by trees. The sample site is disturbed by humans; this is evident by the presence of garbage in and around the drainage system. Leaf litter and woody debris were also observed around the study site. During the survey period the drain was measured at an approximate depth of 1 m, with 10 centimetres (cm) of silt and sand while the level of the water was 20 cm at the deepest point.

Survey Method

A topographic map of the projected study site was used to mark the water bodies. However, as a result of the dry season only one water body was sufficiently sampled. Three 20 m transects were established and named UOG16-01, UOG 16-02 and UOG 16-03.

Field surveys were conducted during the day and night for both fishes and benthic organisms. Hand nets with 5 mm eye were used to drag along the drain. Stream beds substrates and water vegetation were aggressively disturbed to drive organisms into the nets. Fish samples were collected and each individual was identified, photographed and recorded. Unlike the fishes, captured benthic organisms were taxonomically identified to the level of order, photographed and documented. Sampling stopped when no new species was observed.

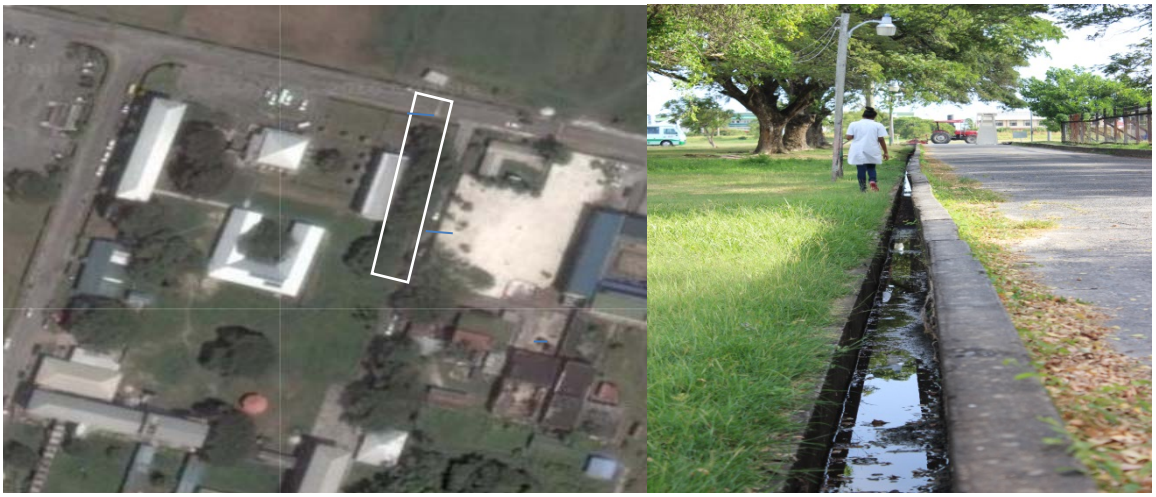


Figure 29 Map of Sample Area Divided into Transects and Sample Drain

Results and Discussion

6.2.3.1 Fishes

Table 19 Quantity of Each Fish Species Caught during both the Day and Night

CLASSIFICATION					**# of individuals**	
ORDER	FAMILY	GENUS	SPECIES	CITES	Day	Night
Cyprinodontiformes	Poeciliidae	*Poecilia*	*Vivipara*	Not Listed	109	129
	Poeciliidae	*Poecilia*	*Reticulate*	Not Listed	53	51
Cyprinodontiformes	Aplocheilidae	*Anablepsoides*	*sp*	Not Listed	2	0
			TOTAL		164	180

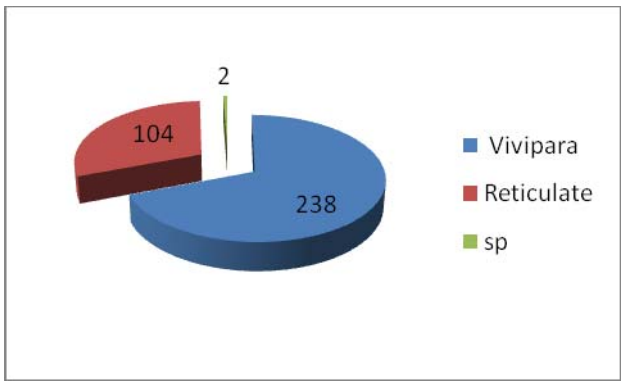


Figure 30 Total Number of Captured Individual Fish Species

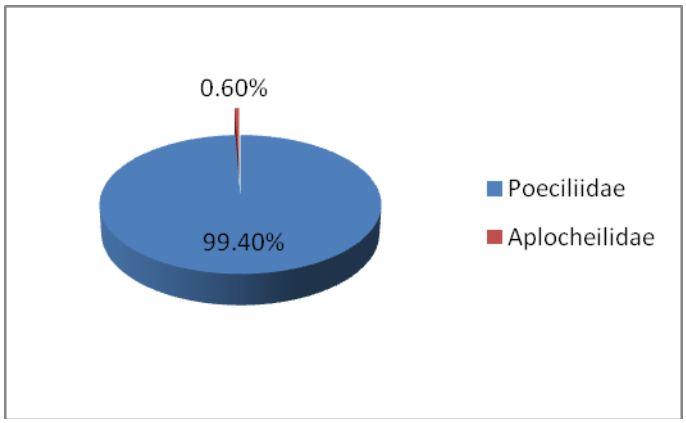


Figure 31 Fish Families by Percentages

A total of three hundred and forty-four (344) individual fishes were documented during the diurnal and nocturnal surveys. These individuals' represent two (2) taxonomic families i.e. Poecilidae and Aplocheilidae placed within one (1) taxonomic order; Cyprinodontiformes. Three different fish species were collected during this survey. The majority of the specimens collected were identified as *Poecilia vivipara*, a total of two hundred and thirty-eight (238) individuals, the second most collected specimens were *Poeciliareticulata*, with a total of one hundred and four (104) individuals. The rarest specimens of the collection were *Anablepsoides sp.* with only two (2) individuals collected.

A total of one hundred and eighty (180) specimens were recorded during the night while one hundred and sixty four (164) specimens were recorded during the day. Specifically, one hundred and (109) *Poecilia vivipara* were collected and recorded in the day while one hundred and twenty-nine (129) were documented for the night surveys. As it relates to the other species of *Poecilia, Poeciliareticulata,* fifty three (53) individuals were collected in the day while fifty-one (51) were recorded during the night surveys. Two (2) *Anablepsoides sp.* were collected during the day and none was observed during the night surveys.

The fish species collected are economically and ecologically valuable. They are used in aquariums; others are a source of food for carnivorous animals. Fishing was not observed during the research period or reported by interviewees. According to IUCN RED List of threatened species, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) watch list, the fish species documented in this survey are not endangered or threatened; they are not listed. Additionally, the availability of similar habitat due to the connecting drainage system provides other possible habits for the fishes to thrive and access the resources they need. However it is important to note that, the *Anablepsoide ssp* collected was only identified to the genus level by several experts in this field including Taphorn and Vermuelen (2016). It cannot be discerned if they are exhibiting polymorphism or if it is a new species, further deoxyribonucleic acid (DNA) analysis is required to conclude on the matter.

It is apparent that this time of the year (November) is dry; as such the water level in the drains was extremely low.

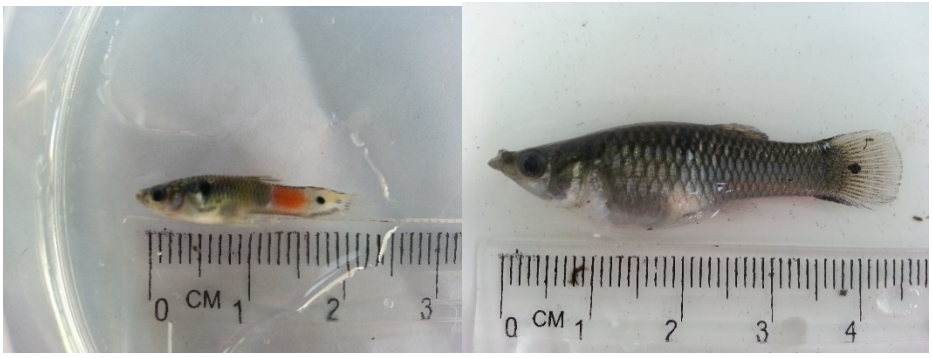


Figure 32 Poecilia Reticulate (coloured guppy, left) and Poecilia vivipara (guppy, right)

Figure 33 Anablepsoidessp *(Brown Aquarium Fish) and* other specimens that were collected

6.2.3.2 Benthic Organisms

Table 20 Quantity of Benthic Organisms found during the day and night

Order	Common Name	# of individual Species	
		Day	Night
Gastropoda	Krekatea (Adults)	6	1
Gastropoda	Krekatea (juvenile)	15	1
	TOTAL	21	2

While sampling the drainage system for fish species, a few benthic organisms were collected as well, a total of twenty-one (21) kreketae were collected during the day while only two (2) were collected in the night. Majority of the kreketae that was collected were adults, which was fifteen (15) while only six (6) were juvenile.

Benthic invertebrates are responsible for breaking down leaf litter, releasing nutrients into their environment for plants etc., and as a source of food for both aquatic and terrestrial vertebrate consumers (e.g., fishes and birds) (Covich et. al., 1999). Through interviews, it was learnt that no waterway of significant size exists within the project area and fishing for human consumption occurs outside of this area.

This species documented in this survey (for both fish and benthic) are not threatened or endangered according to IUCN RED List or CITES watch list.

6.2.4 Herpetofauna

The sampled area was approximately 120 m by 130 m. Located on the southern border of the sample site is the three story Faculty of Natural Sciences building (originally the Physics building). This area is heavily disturbed by students who traverse and also use a benab located nearby for recreational activities. To the far end of the north-western side, there are three (3) large trees serving as an ideal habitat for lizards. On the north-eastern side there is one large tree. As a result of the low level of the land, water had accumulated at the base of the tree, thus creating a temporary swamp. This is an ideal habitat for amphibian and other reptilian species, such as snakes. The majority of the sampling area was exposed to the sun and at the centre of the sample plot was a large tree covering approximately 30 m of the area.

Methodology

The sample area was located using Google maps and three transect lines were developed based on the size of the area. The map below depicts how the transects were situated. The visual encounter method was used to survey for herpetofauna. The transect lines were traced every 6 hours, starting from the 1st transect line, followed by the 2nd and finally the 3rd. The survey lasted for 1.5 hours for each walk, thus for every 24 hours, 4.5 hours was spent sampling herpetofauna. The survey encompasses both nocturnal and diurnal sampling. The diurnal survey started from 7:00 hours, 13:30 hours and 19:00 hours. The times of the survey were based on the temperature preferred by herpetofauna. Sampling was therefore both strategic and purposeful.

Figure 34 Herpetofauna Transects

Results and discussion

Table 21 Classification of Herpetofauna Recorded During the Survey

CLASSIFICATION					
ORDER	FAMILY	GENUS	SPECIES	DAY	NIGHT
Squamata	Colubridae	*Helicops*	*angulatus*	0	1
	Gekkonidae	*Hemidactylus*	*mabouia*	1	10
	Polychrotidae	*Anolis*	*fuscoauratus*	3	0
	Polychrotidae	*Anolis*	*punctatus*	3	0
Anura	Leptodactylidae	*Leptodactylus*	*fuscus*	0	16
	Bufanidae	*Rhinella*	*marinus*	0	15
	Hylidae	*Scinax*	*ruber*	0	10
			TOTAL	7	52

Squamata and Anura were the two orders recorded in the sampled area during the research period. The majority of the species were noted to be in the Squamata order while the majority of the individuals were recorded in the Anura order. Further diagnosis reveal, six families of Herpetofauna, i.e. Colubridae (snakes), Gekkonidae (Geckos), Polychrotidae, Leptodatylidae, Bufanidae and Hylidae (Frogs and Toads). The yard lizards, *Anolisfuscoauratus*and*A.punctatus*were documented more during the day, the individuals recorded were 6. This can be understood since lizards prefer the heat which aids in the accumulation of energy for hunting and mating. On the other hand, all the toads/frogs were visually encountered during the night, when the weather was cooler. Please note that individuals were not marked, released and recaptured; they were just visually noted with pictures taken.

It is apparent that this time of the year (November) is dry; they were therefore reduced amounts of preferred habits for herpetofauna to dwell.

Additionally, these individuals are mobile and thus can access similar habitats on the University's grounds for much needed resources if necessary.

Table 22 Conservation Status for the Herpetofauna Recorded During the Survey

CLASSIFICATION					
ORDER	FAMILY	GENUS	SPECIES	IUCN	CITES

Squamata	Colubridae	*Helicops*	*angulatus*	Not Listed	Not Listed
	Gekonidae	*Hemidactylus*	*mabouia*	Not Listed	Not Listed
	Polychrotidae	*Anolis*	*fuscoauratus*	Not Listed	Not Listed
	Polychrotidae	*Anolis*	*punctatus*	Not Listed	Not Listed
Anura	Leptodactylidae	*Leptodactylus*	*fuscus*	Least Concerned	Not Listed
	Bufanidae	*Rhinella*	*marinus*	Not Listed	Not Listed
	Hylidae	*Scinax*	*ruber*	Least Concerned	Not Listed

The species documented in this survey (For both reptiles and amphibians) are not threatened endangered or listed according to IUCN RED List of Threatened Species or the CITES watch list.

Figure 35 Leptodactylusfuscus (left) and Leptodactylusfuscus (right)

Figure 36 Rhinellamarinus and Hemidactylusmabouia

6.2.5 Mammals

Method

Purposeful sampling was conducted to ascertain the mammalian diversity in the study site. Sherman traps were placed at strategic locations such as under building, along fences and near to garbage bins. Peanut butter and sardine were used as the baits to lure the animals into the traps. Traps were checked every day. Diurnal and nocturnal visual encounter surveys were also conducted.

Figure 37 Sherman's Trap placed under the newly built 'stables'

Results and discussion

No mammal was caught or seen in the area during the surveyed period. *Rattusrattus* (house rat) was reported as being present in the area. Although they are considered as pests, they are ecologically important for example as food source for owls.

6.2.6 Insects

Method

Purposeful sampling was used to survey the insects in the projected study site. The beating tray and visual encountered methods were employed to survey the insects. Only diurnal surveys were conducted.

Results and discussion

The table below highlights the insect orders that were observed during the survey period. Due to the dry weather and limited number of plants in bloom there was not an abundance of insects. Insects play

important roles in the environment and are even used to tell the health of an ecosystem. They are important pollinators and also provide food for many other animals in the food web.

It is apparent that these individuals are mobile and thus can access similar habitats on the University's grounds for much needed resources if necessary. The insect orders were classified into six (6) orders.

Table 23 Insect Orders observed during Survey

Insect Orders	Abundance
Mantodea	Rare
Hymenoptera	High
Lepidoptera	Low
Coleoptera	Low
Isoptera	Lowa
Odonata	Rare

Figure 38 Coleoptera Insect Order and: Mantodea Insect Order

Limitation

1) The data should be considered as preliminary results since only the dry season was assessed.

6.2.7 Flora

Methodology

During a reconnaissance of the study area, the researcher observed that while the area was mostly homogenous, there were differences that had to be accounted for. The study site had two (2) habitats present.

The first habitat was dry and the second habitat was wet (swampy). In order to capture these differences, quadrats were randomly thrown in each of the habitat and the number of species identified and their coverage were tabulated and recorded, *Appendix IV*.

A walk around was then done to capture the various species that could be found in the area but not captured within the quadrats. The quadrat was gridded so that coverage could be easily estimated.

Figure 39 Dry and Wet Habitats within the Study Area

In the dry zone (dry habitat), the quadrat was randomly thrown a total of nine times and in the wet zone (wet/swampy habitat), the quadrat was thrown a total of three times since this area is very small.

The dry zone can be described as extremely dry and the soil is heavily compacted. The soil is clayey in nature and sandy in some areas. The area is also un-shaded and exposed to direct sunlight. The area is dominated by terrestrial herbaceous plants and is also sparsely populated with a few trees.

Plant species identified in the quadrats are as follows:

Table 24 Flora Identified in the quadrats (Dry Zone)

Common Name	Scientific Name	Family Name
Carpet grass	*Axonopus compressus*	Poaceae
Bahama Grass	*Cynodon dactylon*	Poaceae
Watch man/Desmodium	*Desmodium spp*	Fabaceae

Chowrai Bahjee	*Amaranthus spinosus*	Amaranthaceae
Nut Grass	*Cyperus rotundus*	Cyperaceae
Kyllingia	*Cyperus kyllingia*	Cyperaceae
Demerara Primrose	*Ruella tuberosa*	Acanthaceae

The area was dominated by carpet grass (*Axonopus compressus*) and Bahama grass (*Cynodon dactylon*). This is an average coverage of 81.55% and 16.88% respectively. The remaining species that were identified in the quadrats had very a very low coverage. This may be due to the disturbed nature of the area. The main limiting factors will be the highly compacted nature of the soil under which the carpet grass and Bahama grass are thriving. The habits of these species are terrestrial.

The wet zone can be described as being very swampy with an average water depth of 12 cm. The soil in this area was very soft and clayey in nature. The area appeared to be a depression. With regards to the source of the water that is being accumulated in the area, it seemed to be a broken water main that is buried. There was no evidence to suggest otherwise e.g. a spring. The area is shaded by a very large rain tree (*Samanea* saman) and not exposed to direct sunlight.

Plant species found within the quadrats of the wet zone are identified in the table below.

Table 25 Flora Identified within the quadrats (Wet Zone)

Common Name	Scientific Name	Family Name
Para Grass	*Brachiaria mutica*	Poaceae
Antlefern	*Ceratopteris pteridoides*	Pteridaceae
Rabbit Grass	*Commelina diffusa*	Commelinaceae
Demerara Primrose	*Ruella tuberosa*	Acanthaceae
Soap Bush	*Sphenoclea zeylanica*	Sphenocleaceae

Para grass (*Brachiaria mutica*) and rabbit grass (*Commelina diffusa*) exhibited the highest coverage (an average of 50% and 40.33% respectively). Demerara primrose (*Ruella tuberosa*) had an average of 15% coverage in quadrat 2 but was not found in the other two quadrats. All of the plants that were identified in the quadrats are aquatic with the exception of Demerara primrose.

Species that were also found within the study area but not captured in the quadrats are as follows:

Table 26 Other Species not found in Quadrats

Common	Scientific	Family
Almond (wild)	*Terminalia catappa*	Combretaceae
Baby Pumpkin	*Coccinia grandis*	Cucurbitaceae
Bamboo grass	*Hyachne amplexicaulise*	Poaceae
Bird Seed grass	*Echinochloca colonum*	Poaceae
Centrosema	*Centrosema pubescens*	Fabaceae
Crab grass	*Digitaria Sanguinalis*	Poaceae
Daisy	*Sphagneticola trilobata*	Asteraceae
Desmodium	*Desmodium triflrum*	Fabaceae
Digitatus	*Cyperus digitatus*	Cyperaceae
Egg Woman (green)	*Unknown*	Unknown
Fowl Foot grass	*Eulisine indica*	Poaceae
Hog Baghee	*Portulaca Oleraceae*	Portulacaceae
Iron Weed	*Unknown*	Asteraceae
Ite Palm	*Mauritia flexuosa*	*Cocus nuciferius*
Jamoon	*Syzygium cumini*	Myrtaceae
Milkweed	*Chamaesyceae hirta*	Euphorbiaceae
Morning Glory	*Ipomoea aquatica*	Convolvulaceae
Rabbit grass (red)	*Commelina elegans*	Commelinaceae
Soap Bush	Sphenoclea zeylanica	Sphenocleaceae
Rain Tree	*Samanea saman*	Mimosaceae
Bread and Cheese	*Pithecellobium unguis-cati*	Fabaceae
Rusty pod tree	*Peltophorum pterocarpum*	Fabaceae
Hairy Beggar Sticks	*Bidens alba*	Asteraceae
Soldier parsley	*Peperomia pellucida*	Piperaceae
Iron weed	*Sporobolus jacquemontii*	Poaceae

Bat Seed Tree	*Unknown*	Unknown
Bird Vine	*Phthirusa stelis*	Loranthaceae

6.3 Social Characteristics of the UG Faculty of Health Sciences

6.3.1 Students

With760 students enrolled in the 2015/2016 academic year accounting for 12.95% of the total student enrolment, the FHS offered 12 Bachelor of Science and 1 Master of Science (Master of Public Health) programmes (see Table 27). It is noteworthy that 207 of the students were freshmen. The FHS sought to increase the academic programmes offered as well as the students enrolled from six undergraduate programmes and 503 students in 2009/2011, to 12 undergraduate programmes and one master's programme with 760 students being enrolled in 2015/2016 (Table 27). Over the years however, more than half of the students enrolled are females (69.58% in 2009/2010; 70.15% in 2010/2011; 69.31% in 2011/2012; 71.15% in 2012/2013; 72.68% in 2013/2014; 72.52% in 2014/2015; and 74.47 in 2015/2016).

Table 27 Enrolment Statistics of the Faculty of Health Sciences for the Academic Years 2009/2010 to 2015/2016

Programmes Offered	Number of Students Enrolled		
	Male	Female	Total
2009/2010			
Undergraduate Programmes • Department of Pharmacy 1. Associate Degree in Pharmacy (0509)	31	82	113
• Department of Medical Technology 2. Bachelor of Science Degree in Medical Technology (0533)	39	119	158
• Department of Public Health 3. Associate Degree in Environmental Health (0505)	5	12	17
4. Bachelor of Science Degree in Nursing (0532)	3	34	37
• School of Medicine 5. Bachelor of Medicine (0531)	66	90	156
• School of Dentistry 6. Bachelor of Dental Surgery (0534)	9	13	22
Grand Total	**153**	**350**	**503**
2010/2011			

Undergraduate Programmes • Department of Pharmacy 1. Associate Degree in Pharmacy (0509)	22	56	78
2. Bachelor of Science Degree in Pharmacy (0535)	15	44	59
• Department of Medical Technology 3. Bachelor of Science Degree in Medical Technology (0533)	38	144	182
• Department of Public Health 4. Associate Degree in Environmental Health (0505)	6	10	16
5. Associate Degree in Optometry (0512)	3	2	5
6. Bachelor of Science Degree in Nursing (0532)	4	29	33
7. Bachelor of Science Degree in Optometry (0536)	5	15	20
8. Bachelor of Science Degree in Rehabilitation Science (0537)	2	7	7
• School of Medicine 9. Bachelor of Medicine, Bachelor of Surgery (0531)	70	105	175
• School of Dentistry 10. Bachelor of Dental Surgery (0534)	18	18	36
Grand Total	**183**	**430**	**613**
2011/2012			
Undergraduate Programmes • Department of Pharmacy 1. Associate Degree in Pharmacy (0509)	14	27	41
2. Bachelor of Science Degree in Pharmacy (0535)	11	32	43
• Department of Medical Technology 3. Bachelor of Science Degree in Medical Technology (0533)	40	145	185
• Department of Public Health 4. Associate Degree in Environmental Health (0505)	5	10	15

5. Associate Degree in Optometry (0512)	1	0	1
6. Bachelor of Science Degree in Nursing (0532)	3	50	53
7. Bachelor of Science Degree in Optometry (0536)			
8. Bachelor of Science Degree in Rehabilitation Science (0537)	7	15	22
	2	4	6
• School of Medicine 9. Bachelor of Medicine, Bachelor of Surgery (0531)	75	102	177
• School of Dentistry 10. Bachelor of Dental Surgery (0534)	20	17	37
Grand Total	**178**	**402**	**580**
2012/2013			
Undergraduate Programmes • Department of Pharmacy 1. Associate Degree in Pharmacy (0509)	3	8	11
2. Bachelor of Science Degree in Pharmacy (0535)	28	84	112
• Department of Medical Technology 3. Bachelor of Science Degree in Medical Technology (0533)	39	133	172
• Department of Public Health 4. Associate Degree in Environmental Health (0505)	3	9	12
5. Bachelor of Science Degree in Nursing (0532)			
6. Bachelor of Science Degree in Optometry (0536)	5	57	62
7. Bachelor of Science Degree in Rehabilitation Science (0537)	14	38	52
	5	13	18
• School of Medicine 8. Bachelor of Medicine, Bachelor of Surgery (0531)	70	112	182
• School of Dentistry 9. Bachelor of Dental Surgery (0534)	24	17	41
Grand Total	**191**	**471**	**662**
2013/2014			

Undergraduate Programmes • Department of Pharmacy 1. Associate Degree in Pharmacy (0509)	2	4	6
2. Bachelor of Science Degree in Pharmacy (0535)	35	106	141
• Department of Medical Technology 3. Bachelor of Science Degree in Medical Technology (0533)	41	130	171
4. Bachelor of Science Degree in Medical Imaging (0538)	8	22	30
• Department of Public Health 5. Associate Degree in Environmental Health (0505)	1	16	17
6. Bachelor of Science Degree in Nursing (0532)	5	64	69
7. Bachelor of Science Degree in Optometry (0536)	22	55	77
8. Bachelor of Science Degree in Rehabilitation Science (0537)	8	19	27
• School of Medicine 9. Bachelor of Medicine, Bachelor of Surgery (0531)	68	123	191
• School of Dentistry 10. Bachelor of Dental Surgery (0534)	22	25	47
Grand Total	**212**	**564**	**776**
2014/2015			
Undergraduate Programmes • Department of Pharmacy 1. Associate Degree in Pharmacy (0509)	0	1	1
2. Bachelor of Science Degree in Pharmacy (0535)	29	96	125
• Department of Medical Technology 3. Bachelor of Science Degree in Medical Technology (0533)	45	121	166
4. Bachelor of Science Degree in Medical Imaging (0538)	13	33	46

• Department of Public Health 5. Associate Degree in Environmental Health (0505)	0	10	10
6. Bachelor of Science Degree in Nursing (0532)	3	44	47
7. Bachelor of Science Degree in Optometry (0536)	18	54	72
8. Bachelor of Science Degree in Rehabilitation Science (0537)	8	27	35
• School of Medicine 9. Bachelor of Medicine, Bachelor of Surgery (0531)	69	133	202
• School of Dentistry 10. Bachelor of Dental Surgery (0534)	20	30	50
Post Graduate Programme • Department of Public Health 1. Master of Public Health (0582)	8	13	21
Grand Total	**213**	**562**	**775**
2015/2016			
Undergraduate Programmes • Department of Pharmacy 1. Bachelor of Science Degree in Pharmacy (0535)	32	86	118
• Department of Medical Technology 2. Bachelor of Science Degree in Medical Technology (0533)	41	110	151
3. Bachelor of Science Degree in Medical Imaging (0538)	11	29	40
• Department of Public Health 4. Bachelor of Science Degree in Nursing (0532)	2	20	22
5. Bachelor of Science Degree in Optometry (0536) 6. Bachelor of Science Degree in Rehabilitation Science (0537)	4	17	21
7. Bachelor of Science Degree in Environmental Health (5203)	1	0	1

8. Bachelor of Science Degree in Nursing (5204)	2	15	17
9. Bachelor of Science Degree in Medical Rehabilitation (5205)	5	21	26
10. Bachelor of Science Degree in Optometry (5206)	9	37	46
	13	56	69
• School of Medicine 11. Bachelor of Medicine, Bachelor of Surgery (0531)	55	126	181
• School of Dentistry 12. Bachelor of Dental Surgery (0534)	16	32	48
Post Graduate Programme • Department of Public Health 1. Master of Public Health (0582)	3	17	20
Grand Total	**194**	**566**	**760**

Source: University of Guyana Programme Enrolment Statistic Report 2009/2010 to 2015/2016

The second component of the Guyana Education Sector Improvement Project supported by the World Bank primarily aims to improve the learning and teaching environment of the FHS thereby fostering the increase of the number of students enrolled. The other faculties/schools may also benefit from the project by using the current Health Science building in the future.

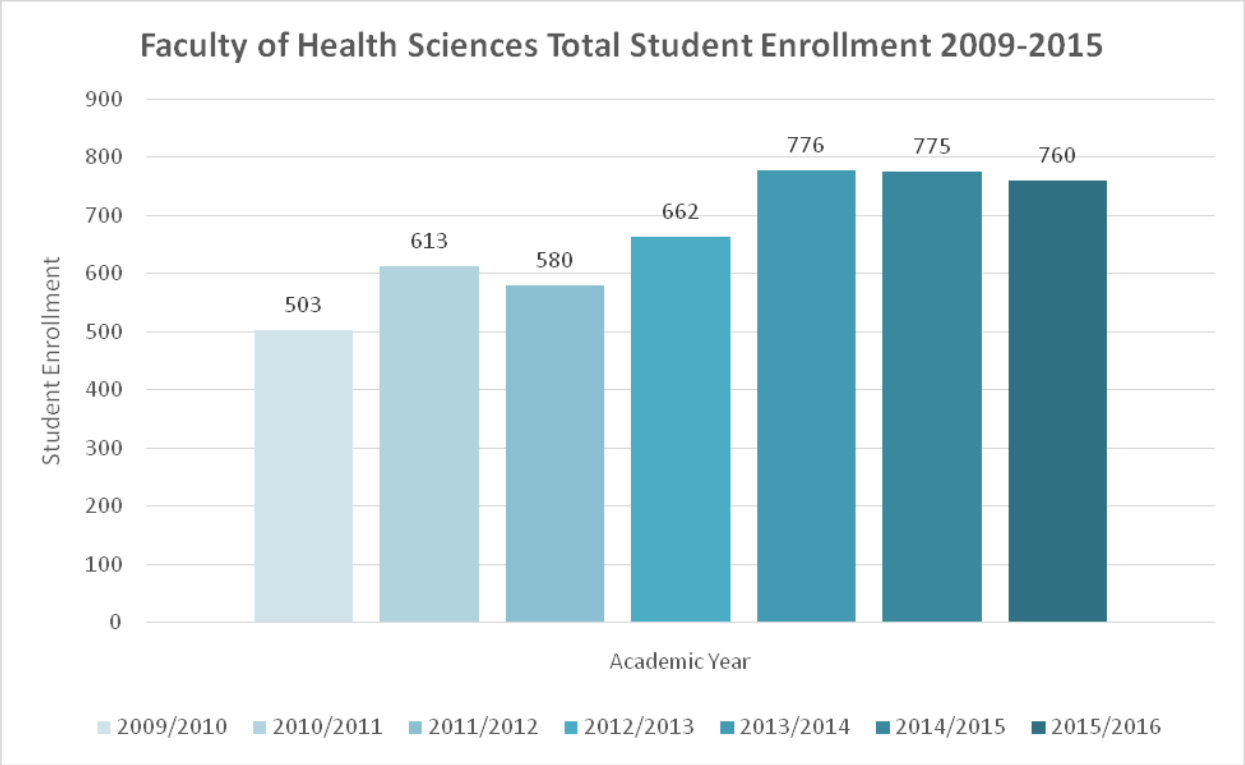


Figure 40 Faculty of Health Sciences Total Student Enrolment 2009/2010 to 2015/2016

As depicted in the graph above, there were fluctuations in the total number of students enrolled. However, an overall increase of 257 students from 2009/2010 to 2015/2016 is evident.

6.3.2 Faculty

The number of full-time teaching staff in the FHS has increased over the past ten years. In the academic year 2014/2015 there were 29 full-time teaching staff (see Table 28), a 58.62% increase from 2005/2006. This growth in the full-time teaching staff is another indicator of the rapid expansion of the FHS.

The Second Component of the Guyana Education Sector Improvement Project will therefore be beneficial to both current and future full-time, part-time teaching and administrative staff as well, by improving the working environment for staff.

Table 28 Faculty of Health Sciences Full-time and Part-time Teaching Staff 2005-2015

	Full-time			Part-time		
Academic Year	M	F	T	M	F	T
2014/2015	14	15	**29**			
2013/2014	14	13	**27**			
2012/2013			**22**			
2011/2012	17	6	**23**	33	19	52

2008/2009	8	8	**16**	36	11	47
2007/2008	9	8	**17**	26	6	32
2006/2007	8	8	**16**	28	10	38
2005/2006	8	9	**17**	30	17	47

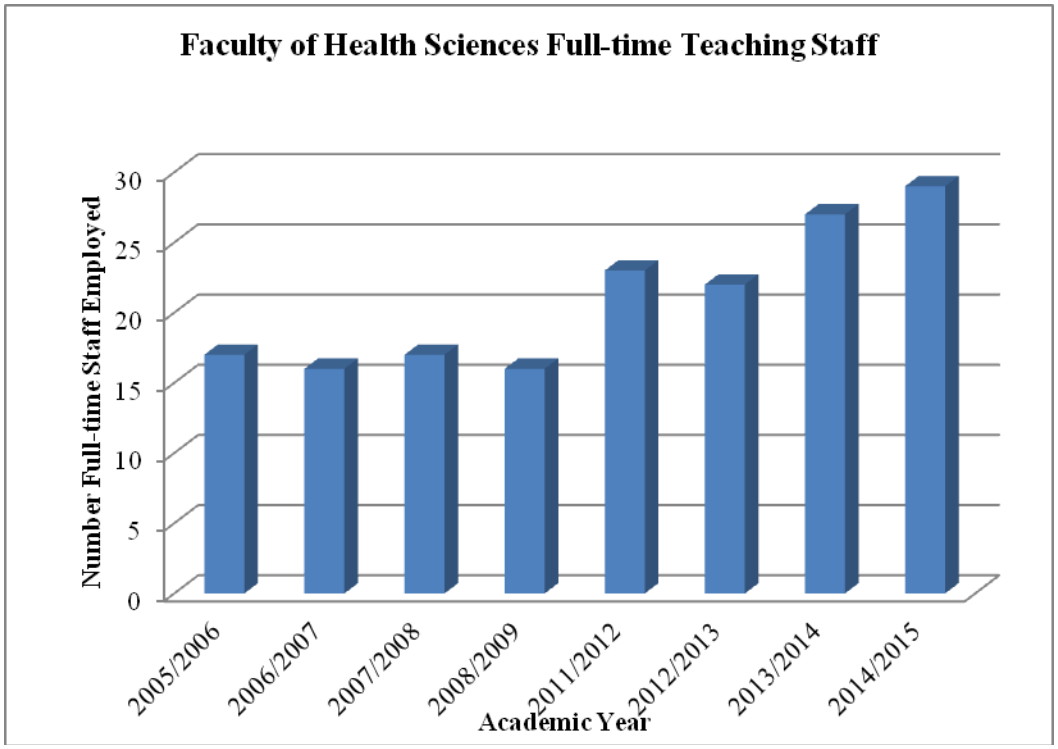


Figure 41 Faculty of Health Science Full Teaching Staff from the Academic Year 2005/2006 to 2014/2015

A steady increase in the employment of the full-time staff from the academic years of 2012/2013 to 2014/2015 can be clearly seen in the graph above.

7. Identification and Description of the Project Impact

Potential environmental and social impacts from the Project activities (Component 2) are related to the planned construction activities. Some potential impacts can also be caused by the operation/use of the new facilities; these possible impacts are identified (Table 29).

The main environmental and social impacts will be those related to construction works. Particularly important is the need to manage construction activities so as to reduce impacts on the academic environment. Environmental and social impacts related to the Project will occur during pre-construction and construction. Also, some impacts will occur during the operation period; these are mainly related to the use of the constructed laboratories and lecture rooms, production of hazardous (infectious and chemical) and solid wastes, among others.

Table 29 Identification and Description of the Potential Environmental and Social Impacts of the Construction and Operation Activities of a new Faculty of Health Sciences Building

Key: + = positive impact; - = negative impact

Activity	Component of Environment	ID code	Potential Impact
PRE-CONSTRUCTION			
Preparation of area for construction of new building Transporting and off-loading of materials	Social	PC1 PC2 PC3	Transport of materials will result in traffic congestion along access road leading to the current building that is being occupied by students and staff, plus other staff and students of the University. (-) Traffic congestion can affect students and staff punctuality to lectures, which in turn may lengthen the number of contact hours to complete courses that would have been affected.(-) Noise emanating from transporting and off-loading material supply by vehicles (mainly trucks) can be a nuisance to students and staff of the Faculty of Health Sciences and the Faculty of Natural Sciences, as well as the Public Relations Office, and persons using the multi-purpose building that are west of the project site. (-)

		PC4	The existing parking space will not be available and will therefore require alternative parking spaces, which in turn, may create security issues. (-)
		PC5	Creation of employment at unskilled and skilled levels. (+)
	Environment	PC6	The area identified for the construction of the building will require clearing of mainly grasses at it has already been decided that the large trees will remain. Any species (flora or fauna) whose habitat will be disturbed can easily adapt to suitable sites nearby. Importantly, the species that have been identified in the area are not rare, threatened, endangered or endemic. (-)
		PC7	Dust emissions are expected as a result of waste removal. (-)
		PC8	Localized pollution will occur as a result of traffic of equipment and transporting vehicles. (-)
		PC9	Soils will be disturbed as a result of preparation of land. (-)
		PC10	Soil erosion may occur during period of intense winds and rains. (-)

CONSTRUCTION PHASE			
Implementation construction works This would include: • Construction of floors, roofing, work benches, cupboards and counters, electrical outlets, sinks, bathrooms, doors and fittings, partitions and provision of air conditioning, new furniture. • Power and Light – New installations of energy efficient fittings. • Water. Construction of water storage and supply facilities	Environment	C1	Damage to vegetation due to storage of materials (-)
		C2	Generation of particulate matter, particularly due to storage of materials and operation of cement mixers (-)
		C3	Generation of construction materials (for example, moving earth for levelling of the site to make the unit platform and other solid waste materials). (-)
		C4	Overload of current capacity of waste disposal facilities. (-)
		C5	Generation of noise from machinery and construction activities. (-)
		C6	Increased traffic congestion due to on-going delivery of material supply. This will impact the timely delivery of goods and services to the existing canteen. (-)
		C7	Increased emission of gases from hydrocarbons from vehicles, dust leaks and spillages of materials, as well as particulate matter. (-)
		C8	Construction activities (work with cement and masonry) may cause discharge in surrounding area. This will exacerbate existing drainage problems, as well as disturb existing aquatic life. (-)
		C9	Reduction in aesthetic quality due to construction and storage of materials. (-)
		C10	Decreased quality of surface water due to discharge of fuel, engine oil and transmission or hydraulic fluids into surface water. (-)
		C11	Decreased quality of soil due to discharge of fuel, engine oil and transmission or hydraulic fluids. This, in turn, will impact soil biodiversity as a result of destruction of nesting and/or burrowing sites by ground

			works. (-)
	Social[9]	C12	Increased pressure on utilities (particularly water and energy). (-)
		C13	Workers safety can be endangered due to the absence of protective equipment and by eventual accidents at work. (-) Specifically, the social impact may occur due to: • Work without protective equipment and/or safety belt. • Driving equipment with improper brake system. • Loss of attention (example while using cell phone) and lack of concentration while working
		C14	Social conflicts (between University staff and students and construction workers) arising from presence of construction personnel on campus. (-)
		C15	Creation of employment at unskilled and skilled levels. (+)
		C16	Provision of a modern building (Green) for the Faculty of Health Sciences, which will provide additional facilities for the enhancement of the delivery of the medical programmes. (+)
		C17	Land 'take' which will prevent alternative uses, for example recreation (-).
OPERATION PHASE			
Use of lecture rooms to deliver	Environment	O1	Generation of solid waste by the

[9] Including: Human health, occupational health and safety, public safety, income, aesthetic quality, social infrastructure, population, social cohesion

formal education			students and staff due to their use and occupation of the facilities. This would include plastic, cardboard and paper. (-)
		O2	Generation of sewage from the use of toilets will place increased pressure on the Campus' current non-functional sewage treatment system. (-)
	Social	O3	Increased opportunities for improved health and safety arising from the provision of additional facilities. (+)
		O4	Discharge of untreated sewage into the internal and surrounding drains on campus could lead to health risk to persons on campus and the surrounding communities. (-)
Purchase of laboratory and medical equipment	Environment	O5	Generation of solid waste from the packaging of equipment. This waste could include cardboard and plastic. (-)
		O6	Reduction in natural resources used in the manufacturing of the equipment. (-)
		O7	Generation of solid waste and possibly hazardous waste when equipment becomes non-functional. (-)
		O8	Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO_2, VOCs, particulates (PM10 and PM2.5). (-)
	Social	O9	Emissions from delivery vehicle(s) exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10

			and PM2.5 particulates result in damage to human respiratory health. (-)
Purchase of materials (chemicals and biological materials) and consumables for laboratories	Environment	O10	Generation of solid waste from the packaging of the material. (-)
		O11	Reduction in natural resources used to produce the materials (-)
		O12	Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO2, VOCs, particulates (PM10 and PM2.5). (-)
	Social	O13	Emissions from delivery vehicle(s) exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)
Use of laboratory facilities	Environment	O14	Generation of hazardous (infectious and non-infectious) waste from laboratory sessions. Infectious waste which may be either solid or liquid, and include but are not limited to discarded blood and blood specimens, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human tissues, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids and laboratory waste that exhibit the characteristics described above. Non infectious waste

			would include chemical waste. (-)
		O15	Generation of solid waste from use of the laboratories. Solid waste may consist of packaging material, (broken) glass. (-)
		O16	Emissions of gases from the use of fume cupboards could result in increased local air pollution and a decrease in local air quality. (-)
		O17	Release of toxic gases and infectious substances from experiments conducted within the laboratory into the air may results in a decrease in quality of air within the laboratory. (-)
		O18	Discharge of effluent from the laboratories may result in a deterioration of the quality of water in the surrounding drains. This is a potential threat to the ecosystem within the internal drains and those external to the campus. (-)
	Social	O19	Non adherence to laboratory safety practices could result in increased health and safety risk to the students and staff. This could be due to exposure to micro-biological infections, due to the presence of microbes, upper respiratory distress due to constant inhalation of chemicals, injuries from sharps, exposure to ionizing radiation. (-)
		O20	Improved health and safety opportunities within the laboratories arising from the provision of facilities. (+)
Use of the new facilities (green)	Social	O21	The Faculty of Health Sciences would be able to meet one of the requirements for accreditation by the Caribbean Accreditation Authority for Education in Medicine and other

			Health Professions (+)
		O22	Use of modern facilities will enhance the delivery of the medical and other health programmes and thus lead to improved learning by students of these programmes. (+)
		O23	Use of the enhanced facilities will contribute to improved research output from staff and students. (+)
		O24	Use of the modern facilities could contribute to increased enrolment of and thus learning by "differently-abled" persons. (+)
		O25	Use of the enhanced facilities will reduce dependence on facilities external to the University. (+)
		O26	With the provision of the new facilities on campus there is the possibility for theft (-)
		O27	Once accreditation is restored, the Faculty could extend some basic services to the wider University and surrounding communities that can help students to acquire hands-on experience on one hand, and assist the Faculty/University to acquire funds, on the other hand. (+)
Use of electricity	Environment	O28	Use of electrical equipment and lights in the facility that would be provided with a renewable source of energy and reduce dependence on the National Grid. (+)
Use of water	Environment	O29	Use of water for laboratory and sanitation activities could place an increased pressure on the resource and contribute to water resource depletion (-)
Use of vehicles to transport staff and students to and from the	Environment	O30	Use of transportation to and from the campus could result in local and global

campus			air pollution and global warming due to vehicle exhaust emissions of CO_2 (cause global warming) CO, NOx and SO_2 (contribute to acidification), VOCs (contribute to the formation of ground level ozone, together with NO_2), PM10 and PM2.5 (cause a reduction in visibility). (-)
		O31	Decreased quality of surface water due to discharge of engine oil and transmission or hydraulic fluids into surface water. (-)
	Social	O32	Emissions from vehicle exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)

Given the limited time to complete this EMP (approximately 2 weeks), it was not practical to conduct an environmental assessment of alternatives. However, if one considers the no-project action, then it is reasonable to expect that the medicine programme may not be reaccredited by the CAAM-HP. Further, there would be the missed opportunities for enhanced learning by the students,improved research by staff and students, and the offering of a service to the wider community. Current issues, such as inadequate parking for students and staff, unreliable electricity supply would remain and inadequate space to conduct classes.

Several alternative sites have been proposed by the stakeholders. In selecting the most appropriate site, one must be cognisant of some environmental issues that can impact the site (see “10. Stakeholder Consultation”).

8. Analysis of Significance of Project Impacts

Five criteria were selected for the impact evaluation process: duration, likelihood of occurrence, geographic extent, reversibility, and nature of impact –all are standard criteria for project impact analysis. Evaluation criteria are defined in Table 30 below. Where applicable, numerical values have been assigned to criteria, as well as, to the degree of significance: values of +- 11 to +-4 (Table 30). The actual analysis was informed by expert opinion, similarity and current environmental regulations in relation to project activities and impacts that have been highlighted in this report.

Table 31 provides the detailed results of the analysis of the significance of each of the impacts identified for the project components and main activities.

Table 30 Key for Criteria for Project Impact Analysis

Criteria	**Details**
Duration: (D)	Short term < 2 years or intermittent = 1 ; Medium term 2-3 years = 2; Long term > 3 years = 3
Probability of Occurrence (PO)	High =3; Moderate =2;Low=1
Geographic Extent (GE)	Within the area of the Faculty of Health Sciences = 1; Within campus and surrounding communities = 2; Outside the area of influence (beyond surrounding communities) = 3
Reversibility (R)	Reversible 1; Irreversible = 2
Nature of Impact (NI)	Beneficial = +1; Adverse = -1
Score = (D +PO +GE +R) x NI	
Symbols = - negative ; + = positive	
Significance (S) : Beneficial Impacts: High ≥ =+9; Moderate = +6 - 8; Low= ≤ +5 Adverse Impacts: High ≥ -9; Moderate -6= -8; Low= ≤ - 5	

Table 31 Environmental Impact Valuation of Project components and main activities

Key: H= High; M=Moderate; L= Low.

Activity	Component of Environment	ID code	Potential Impact							
				D	PO	GE	R	NI	Score	Impact Significance
Pre-Construction Phase										
Preparation of area for construction of new building	Social	PC1	Transport of materials will result in traffic congestion along access road leading to the current building that is being occupied by students and staff, plus other staff and students of the University. (-)	1	3	3	2	-1	-9	H
Transporting and off-loading of materials		PC2	Traffic congestion can affect students and staff punctuality to lectures, which in turn may lengthen the number of contact hours to complete courses that would have been affected.(-)	1	3	3	2	-1	-9	H
		PC3	Noise emanating from transporting and off-loading material supply by vehicles (mainly trucks) can be a nuisance to students and staff of the Faculty of Health Sciences and	1	3	2	2	-1	-8	M

			the Faculty of Natural Sciences, as well as the Public Relations Office, and persons using the multi-purpose building that are west of the project site. (-)							
		PC4	The existing parking space will not be available and will therefore require alternative parking spaces, which in turn, may create security issues. (-)	1	3	1	2	-1	-7	M
		PC5	Creation of employment at unskilled and skilled levels. (+)	1	3	3	2	+1	+9	H
	Environment	PC6	The area identified for the construction of the building will require clearing of mainly grasses at it has already been decided that the large trees will remain. Any species (flora or fauna) whose habitat will be disturbed can easily adapt to suitable sites nearby. Importantly, the species that have been identified in the area are not rare, threatened, endangered or endemic. (-)	3	3	1	2	-1	-9	H
		PC7	Dust emissions are expected as a result of waste removal. (-)	1	3	2	1	-1	-7	M
		PC8	Localized pollution will occur as a result of traffic of equipment and transporting vehicles. (-)	1	3	2	1	-1	-7	M

		PC9	Soils will be disturbed as a result of preparation of land. (-)	1	3	1	2	-1	-7	M
		PC10	Soil erosion can occur during periods of intense winds and rains. (-)	1	2	1	1	-1	-5	L
CONSTRUCTION PHASE										
Implementation construction works This would include: • Construction of floors, roofing, work benches, cupboards and counters, electrical outlets, sinks, bathrooms, doors and fittings, partitions and provision of air conditioning, new furniture. • Power and Light – New installations of energy efficient fittings. • Water. Construction of water storage and supply facilities	Environment	C1	Damage to vegetation due to storage of materials (-)	1	2	2	1	-1	-6	M
		C2	Generation of particulate matter, particularly due to storage of materials and operation of cement mixers (-)	1	3	2	1	-1	-7	M
		C3	Generation of construction materials (for example, moving earth for levelling of the site to make the unit platform and other solid waste materials). (-)	1	3	1	2	-1	-7	M
		C4	Overload of current capacity of waste disposal facilities. (-)	1	3	2	2	-1	-8	M
		C5	Generation of noise from machinery and construction activities. (-)	1	3	2	2	-1	-7	M
		C6	Increased traffic congestion due to on-going delivery of material supply. This will impact the timely delivery of goods and services to the existing canteen. (-)	1	3	3	2	-1	-9	H
		C7	Increased emission of gases from hydrocarbons from vehicles, dust leaks and spillages of materials, as well as particulate matter. (-)	1	2	1	1	-1	-5	L

		C8	Construction activities (work with cement and masonry) may cause discharge in surrounding area. This will exacerbate existing drainage problems, as well as disturb existing aquatic life. (-)	1	1	1	1	-1	-4	L
		C9	Reduction in aesthetic quality due to construction and storage of materials. (-)	1	2	1	1	-1	-5	L
		C10	Decreased quality of surface water due to discharge of fuel, engine oil and transmission or hydraulic fluids into surface water. (-)	1	1	1	1	-1	-4	L
		C11	Decreased quality of soil due to discharge of fuel, engine oil and transmission or hydraulic fluids. This, in turn, will impact soil biodiversity as a result of destruction of nesting and/or burrowing sites by ground works. (-)	1	1	1	1	-1	-4	L
		C12	Increased pressure on utilities (particularly water and energy). (-)	1	3	2	2	-1	-8	M
		C13	Workers safety can be endangered due to the absence of protective equipment and by eventual accidents at work. (-) Specifically, the social impact may occur due to:	1	1	na	1	-1	-3	L

			• Work without protective equipment and/or safety belt. • Driving equipment with improper brake system. • Loss of attention (example while using cell phone) and lack of concentration while working							
		C14	Social conflicts (between University staff and students and construction workers) arising from presence of construction personnel on campus. (-)	1	2	2	1	-1	-6	M
		C15	Creation of employment at unskilled and skilled levels. (+)	1	3	3	2	+1	+9	H
		C16	Provision of a modern building (Green) for the Faculty of Health Sciences, which will provide additional facilities for the enhancement of the delivery of the medical programmes. (+)	3	3	1	2	+1	+9	H
		C17	Land 'take' which will prevent alternative uses, for example recreation (-).	3	3	2		-1	-8	M
OPERATION PHASE										

Use of lecture rooms to deliver formal education	Environment	O1	Generation of solid waste by the students and staff due to their use and occupation of the facilities. This would include plastic, cardboard and paper. (-)	3	3	1	2	-1	-9	H
		O2	Generation of sewage from the use of toilets will place increased pressure on the Campus' current non-functional sewage treatment system. (-)	1	3	2	2	-1	-8	M
	Social	O3	Increased opportunities for improved health and safety arising from the provision of additional facilities. (+)	3	3	1	2	+1	-9	H
		O4	Discharge of untreated sewage into the internal and surrounding drains on campus could lead to health risk to persons on campus and the surrounding communities. (-)	1	3	3	1	-1	-8	M
Purchase of laboratory and medical equipment	Environment	O5	Generation of solid waste from the packaging of equipment. This waste could include cardboard and plastic. (-)	1	3	1	2	-1	-7	M
		O6	Reduction in natural resources used in the manufacturing of the equipment. (-)	3	3	3	2	-1	-11	H
		O7	Generation of solid waste and possibly hazardous waste when equipment becomes non-	3	3	1	2	-1	-9	H

			functional. (-)							
		O8	Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO_2, VOCs, particulates (PM10 and PM2.5). (-)	1	3	2	1	-1	-7	M
	Social	O9	Emissions from delivery vehicle(s) exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)	1	2	1	1	-1	-5	L
Purchase of materials (chemicals and biological materials) and consumables for laboratories	Environment	O10	Generation of solid waste from the packaging of the material. (-)	1	3	1	2	-1	-7	M
		O11	Reduction in natural resources used to produce the materials (-)	3	3	3	2	-1	-11	H
		O12	Delivery of the purchased equipment to campus could cause local and global air	1	3	2	1	-1	-7	M

			pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO2, VOCs, particulates (PM10 and PM2.5). (-)							
	Social	O13	Emissions from delivery vehicle(s) exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)	1	2	1	1	-1	-5	L
Use of laboratory facilities	Environment	O14	Generation of hazardous (infectious and non-infectious) waste from laboratory sessions. Infectious waste which may be either solid or liquid, and include but are not limited to discarded blood and blood specimens, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human tissues, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids and laboratory waste that	3	3	1	2	-1	-9	H

			exhibit the characteristics described above. Non infectious waste would include chemical waste. (-)							
		O15	Generation of solid waste from use of the laboratories. Solid waste may consist of packaging material, (broken) glass. (-)	3	3	1	2	-1	-9	H
		O16	Emissions of gases from the use of fume cupboards could result in increased local air pollution and a decrease in local air quality. (-)	1	3	2	1	-1	-7	M
		O17	Release of toxic gases and infectious substances from experiments conducted within the laboratory into the air may results in a decrease in quality of air within the laboratory. (-)	1	3	1	1	-1	-6	M
		O18	Discharge of effluent from the laboratories may result in a deterioration of the quality of water in the surrounding drains. This is a potential threat to the ecosystem within the internal drains and those external to the campus. (-)	3	3	3	1	-1	-10	H
	Social	O19	Non adherence to laboratory safety practices could result in increased health and safety risk to the students and staff. This could be due to exposure to	3	2	1	1	-1	7	M

			micro-biological infections, due to the presence of microbes, upper respiratory distress due to constant inhalation of chemicals, injuries from sharps. (-)							
		O20	Improved health and safety opportunities arising from the provision of facilities. (+)	3	3	1	1	+1	+8	M
Use of the new facilities (green)	Social	O21	The Faculty of Health Sciences would be able to meet one of the requirements for Accreditation by the Caribbean Accreditation Authority for Education in Medicine and other Health Professions (+)	3	3	2	1	+1	+9	H
		O22	Use of modern facilities will enhance the delivery of the medical and other health programmes and thus lead to improved learning by students of these programmes. (+)	3	3	3	1	+1	+10	H
		O23	Use of the enhanced facilities will contribute to improved research output from students and staff and other collaborators. (+)	3	3	3	1	+1	+10	H
		O24	Use of the modern facilities could contribute to increased enrolment of and thus learning by "differently-abled" persons. (+)	3	3	3	1	+1	+10	H

		O25	Use of the enhanced facilities will reduce dependence on facilities external to the University. (+)	3	2	3	1	+1	+9	H
		O26	With the provision of the new facilities on campus there is the possibility for theft (-)	3	3	1	1	-1	-8	M
		O27	Once accreditation is restored, the Faculty could extend some basic services to the wider University and surrounding communities that can help students to acquire hands-on experience on one hand, and assist the Faculty/University to acquire funds, on the other hand. (+)	3	2	3	1	+1	+9	H
Use of electricity	Environment	O28	Use of electrical equipment and lights in the facility that would be provided with a renewable source of energy and reduce dependence on the National Grid. (+)	3	3	1	2	+1	+9	H
Use of water	Environment	O29	Use of water for laboratory and sanitation activities could place an increased pressure on the resource and contribute to water resource depletion (-)	3	3	3	2	-1	-11	H
Use of vehicles to transport staff and students to and from the campus	Environment	O30	Use of transportation to and from the campus could result in local and global air pollution and global warming due to vehicle	3	1	1	1	-1	-6	M

			exhaust emissions of CO_2 (cause global warming) CO, NOx and SO_2 (contribute to acidification), VOCs (contribute to the formation of ground level ozone, together with NO_2), PM10 and PM2.5 (cause a reduction in visibility). (-)							
		O31	Decreased quality of surface water due to discharge of engine oil and transmission or hydraulic fluids into surface water. (-)	1	1	1	1	-1	-4	L
	Social	O32	Emissions from vehicle exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)	3	1	1	1	-1	-6	M

9. The Environmental Management Plan[10]

9.1 Introduction

This EMP is a critical element of the environmental impact assessment process since is provides the framework for translating recommended mitigation measures and monitoring processes into often inter-related actions that shall be carried out by the project proponent. Its main objectives are as follows:

To reduce environmental and social impacts due to the Project activities and components;

- To minimise risk to the UG campus community during the construction and rehabilitation works;
- To ensure Environment, health and safety measures are implemented throughout Project development and construction activities;
- To increase environmental management capacity at UG; and
- To ensure UG stakeholder participation in the project development.

Preparation of this EMP required a systematic process which essentially comprises nine (8) interconnected steps, as outlined below.

1. Formulation of an Environmental Policy of the University of Guyana;
2. Defining the specific objectives of the plan;
3. Identification and description of the potential adverse impacts and environmental risks associated with operation of the new FHS building;
4. Description of the appropriate mitigation and enhancement measures, together with designs, equipment description and appropriate operational procedures to avoid, reduce or compensate for impacts or risks;
5. Determination of appropriate mechanisms to ensure that responses to predicted impacts are made effectively and an implementation schedule (timing) for mitigation measures that must be carried out as part of the project.
6. Development of a monitoring programme to monitor the impacts arising out of the project operational activities and the effectiveness of the proposed mitigation measures;
7. Identification of persons within the company responsible for executing the EMP; and
8. Design of an Emergency Response Plan.

Notably, the Environmental Specialist of the Project (ES) should take responsibility to verify compliance of these measures included in the EMP, EMF, Guyana regulations and the World Bank Safeguards

[10] Some of the information used in this section has been taken from the Environmental Assessment and Manual (Updated July 2015).

Policies. Environmental inspections will be performed by the ES without previous notice to contractors. The ES will revise/strengthen the EMP, EMF as deemed necessary in the light of any changes in the dynamics of environmental processes of the Project, previous No Objection of the World Bank. The ES will work in this project in all stages: pre-construction, construction and operation.

Environmental Policy for the University of Guyana

Introduction

This Environmental Policy statement is very important to the UG because it provides a core set of environmental values that should guide the management and operations of the service institution. Moreover, these environmental values will inform all employees, students, patients and visitors of Management's strong commitment to environmental responsibility.

Opening Statement

The Administration and Staff of the University of Guyana is committed to pursuing a standard policy of environmental excellence that will ensure effective resource management, pollution prevention, proper waste management, continual improvement in environmental performance, and promotion of environmental protection in the wider community.

Specific Policy Statements

We, at the University of Guyana recognise our ethical responsibility to protect the environment and to safeguard the health and well being of all employees, students and visitors. We will adhere to the following core values, as a general Code of Practice for the University:

- apply safety and health working procedures and practices, and act in conformity with appropriate safety and health legislation;

- create and maintain a working environment with adequate facilities and arrangements for the safety, health and welfare of employees, patients, and visitors;

- comply with all relevant national legislation (including the Environmental Protection Act (1996), Environmental Protection (Air Quality) Regulations 2000, Environmental Protection (Water Quality) Regulations, and Hazardous Waste Regulations, 2000), Occupational Health and Safety legislation, and other requirements (when deemed necessary) as minimum performance standards;

- implement measures to promote efficient use of energy, water, and other resources, where feasible.

- reduce, reuse, and recycle wastes, and improve hazardous waste management;

- minimise accidental spillage and potential contamination by ensuring careful handling, storage and disposal of unwanted materials and substances;

- avoid, minimise and control, where possible, the environmental impacts arising from our operations;

- consistently monitor the environmental impacts (dust, noise, air quality, solid waste and hazardous materials, waste water) of operations, as well as incorporate environmental reviews and concerns into daily work processes at the FHS;

- instill environmental consciousness and responsibility in staff through quarterly environmental awareness, education and training seminars;

- consider environmental factors during all planning, purchasing, and operating decisions;

- communicate our environmental policy to all contractors and suppliers and encourage them to comply with national environmental laws and regulations;

- adopt a proactive approach on environmental health and safety matters with all stakeholders to minimise injuries and threat to health;

- liaise with the local community on a regular basis to allow for feed-back on environmental issues relating to the FHS's operation; and

- share information on the environmental policy and environmental performance with surrounding community or other stakeholders, upon request.

It is important to highlight those impacts whose significance has been assessed as high or moderate and for which mitigation measures will be addressed.

Impacts with High significance

Pre-construction Phase

Negative

- Transport of materials will result in traffic congestion along access road leading to the current building that is being occupied by students and staff, plus other staff and students of the University. (-)

- Traffic congestion can affect students and staff punctuality to lectures, which in turn may lengthen the number of contact hours to complete courses that would have been affected.(-)

- The area identified for the construction of the building will require clearing of mainly grasses at it has already been decided that the large trees will remain. Any species (flora or fauna) whose habitat will be disturbed can easily adapt to suitable sites nearby. Importantly, the species that have been identified in the area are not rare, threatened, endangered or endemic. (-)

Positive

- Creation of employment at unskilled and skilled levels. (+)

Construction Phase

Negative

- Increased traffic congestion due to on-going delivery of material supply. This will impact the timely delivery of goods and services to the existing canteen. (-)

Positive

- Creation of employment at unskilled and skilled levels. (+)
- Provision of a modern building (Green) for the Faculty of Health Sciences, which will provide additional facilities for the enhancement of the delivery of the medical programmes. (+)

Operation Phase

Negative impacts

- Generation of solid waste by the students and staff due to their use and occupation of the facilities. This would include plastic, cardboard and paper. (-)
- Reduction in natural resources used in the manufacturing of the equipment. (-)
- Generation of solid waste and possibly hazardous waste when equipment becomes non-functional. (-)
- Reduction in natural resources used to produce the materials (-)

- Generation of hazardous (infectious and non-infectious) waste from laboratory sessions. Infectious waste which may be either solid or liquid, and include but are not limited to discarded blood and blood specimens, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human tissues, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids and laboratory waste that exhibit the characteristics described above. Non infectious waste would include chemical waste. (-)
- Generation of solid waste from use of the laboratories. Solid waste may consist of packaging material, (broken) glass. (-)
- Discharge of effluent from the laboratories may result in a deterioration of the quality of water in the surrounding drains.
- Use of water for laboratory and sanitation activities could place an increased pressure on the resource and contribute to water resource depletion (-)

Positive Impacts

- The FHS would be able to meet one of the requirements for accreditation by the CAAM-HP. (+)
- Once accreditation is restored, the Faculty could extend some basic services to the wider University and surrounding communities that can help students to acquire hands-on experience on one hand, and assist the Faculty/University to acquire funds. (+)Use of electrical equipment and lights in the facility that would be provided with a renewable source of energy and reduce dependence on the National Grid. (+)
- Increased opportunities for improved health and safety arising from the provision of additional facilities. (+)
- Use of modern facilities will enhance the delivery of the medical and other health programmes and thus lead to improved learning by students of these programmes. (+)
- Use of the enhanced facilities will contribute to improved research output from students and staff and other collaborators. (+)
- Use of the modern facilities could contribute to increased enrolment of and thus learning by “differently-abled” persons. (+)
- Use of the enhanced facilities will reduce dependence on facilities external to the University. (+)

Impacts with moderate significance

Pre-construction

Negative

- Noise emanating from transporting and off-loading material supply by vehicles (mainly trucks) can be a nuisance to students and staff of the Faculty of Health Sciences and the Faculty of

Natural Sciences, as well as the Public Relations Office, and persons using the multi-purpose building that are west of the project site. (-)

- The existing parking space will not be available and will therefore require alternative parking spaces, which in turn, may create security issues. (-)
- Dust emissions are expected as a result of waste removal. (-)
- Localized pollution will occur as a result of traffic of equipment and transporting vehicles. (-)
- Soils will be disturbed as a result of preparation of land. (-)
- With the provision of the new facilities on campus there is the possibility for theft (-)

Construction

Negative

- Damage to vegetation due to storage of materials (-)
- Generation of particulate matter, particularly due to storage of materials and operation of cement mixers (-)
- Generation of construction materials (for example, moving earth for levelling of the site to make the unit platform and other solid waste materials). (-)
- Overload of current capacity of waste disposal facilities. (-)
- Generation of noise from machinery and construction activities. (-)
- Increased pressure on utilities (particularly water and energy). (-)
- Social conflicts (between University staff and students and construction workers) arising from presence of construction personnel on campus. (-)
- Land 'take' which will prevent alternative uses, for example recreation (-).

Operation

Negative

- Generation of sewage from the use of toilets will place increased pressure on the Campus' current non-functional sewage treatment system. (-)
- Discharge of untreated sewage into the internal and surrounding drains on campus could lead to health risk to persons on campus and the surrounding communities. (-)
- Generation of solid waste from the packaging of equipment. This waste could include cardboard and plastic. (-)
- Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO_2, VOCs, particulates (PM10 and PM2.5). (-)
- Generation of solid waste from the packaging of the material. (-)
- Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO2, VOCs, particulates (PM10 and PM2.5). (-)

- Emissions of gases from the use of fume cupboards could result in increased local air pollution and a decrease in local air quality. (-)
- Release of gases toxic gases and infectious substances from experiments conducted within the laboratory into the air may results in a decrease in quality of air within the laboratory. (-)
- Non adherence to laboratory safety practices could result in increased health and safety risk to the students and staff. This could be due to exposure to micro-biological infections, due to the presence of microbes, upper respiratory distress due to constant inhalation of chemicals, injuries from sharps, exposure to ionizing radiation. (-)
- Use of transportation to and from the campus could result in local air pollution and global warming due to vehicle exhaust emissions of CO2 (cause global warming) CO, NOx and SO2 (contribute to acidification), VOCs (contribute to the formation of ground level ozone, together with NO2), PM10 and PM2.5 (cause a reduction in visibility). (-)
- Emissions from vehicle exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)

Positive

- Improved health and safety opportunities arising from the provision of facilities. (+)

Table 32 Proposed Mitigation and Prevention Measures

Pre-Construction Phase	Component of Environment	ID code	Potential Impact	Impact Significance	Proposed Mitigation Measures
Preparation of area for construction of new building	Social	PC1	Transport of materials will result in traffic congestion along access road leading to the current building that is being occupied by students and staff, plus other staff and students of the University. (-)	H	Contractor shall avoid having materials being delivered during peak hours. Traffic management shall be developed by the ES and shall be coordinated with the assistance of University officials.
Transporting and off-loading of materials		PC2	Traffic congestion can affect students and staff punctuality to lectures, which in turn may lengthen the number of contact hours to complete courses that would have been affected.(-)	H	Same as above.
		PC3	Noise emanating from transporting and off-loading material supply by vehicles (mainly trucks) can be a nuisance to students and staff of the Faculty of Health Sciences and the Faculty of Natural Sciences, as well as the Public Relations Office, and persons using the multi-purpose building that are west of the project site. (-)	M	Contractor shall use trucks and machinery with mufflers. Contractor shall organize their working hours for delivery of materials to reduce disruption, for instance working at nights, vacation periods and weekends.
		PC4	The existing parking space will not be available and will therefore require alternative parking spaces, which in turn, may create security issues. (-)	M H	Traffic management shall be coordinated with the University officials.

		PC5	Creation of employment at unskilled and skilled levels. (+)		Contractor shall employed persons within the area of influence, providing they have the skills required.
	Environment	PC6	The area identified for the construction of the building will require clearing of mainly grasses at it has already been decided that the large trees will remain. Any species (flora or fauna) whose habitat will be disturbed can easily adapt to suitable sites nearby. Importantly, the species that have been identified in the area are not rare, threatened, endangered or endemic. (-)	H	Contractor will only clear areas that are deemed necessary for the project.
		PC7	Dust emissions are expected as a result of waste removal. (-)	M	Workers must use protective equipment such as masks, ear plugs, etc. Materials that are stored will be covered.
		PC8	Localized pollution will occur as a result of traffic of equipment and transporting vehicles. (-)	M	Contractor vehicles will have all permits required by national regulations.
		PC9	Soils will be disturbed as a result of preparation of land. (-)	M	Contractor will stockpile the soils removed to be reused for landscaping after construction.
CONSTRUCTION PHASE					
Implementation construction works This	Environment	C1	Damage to vegetation due to storage of materials (-)	M	Contractor will use only areas cleared of vegetation and defined by the ES for the storage of construction materials. These sites will

would include: • Construction of floors, roofing, work benches, cupboards and counters, electrical outlets, sinks, bathrooms, doors and fittings, partitions and provision of air conditioning, new furniture. • Power and Light – New installations of energy efficient fittings. • Water. Construction of water storage and supply facilities					have had been reviewed and proposed during the review of the Construction Work Plan. The ES will have had reviewed and approved selected sites. Contractors will restore all sites in the Campus after finishing the works. For reforestation and re-vegetation activities, contractors will use only native species in a proportion 3x1. Species will be indicated by the ES.
		C2	Generation of particulate matter, particularly due to storage of materials and operation of cement mixers (-)	M	Workers must use protective equipment such as masks, ear plugs, etc. Materials that are stored will be covered.
		C3	Generation of construction materials (for example, moving earth for levelling of the site to make the unit platform and other solid waste materials). (-)	M	All construction materials and waste will be classified according to its type (domestic, recyclable, hazardous, etc,) and the final materials disposed in areas designated by the national Authority (such as the EPA/Georgetown M&CC).
		C4	Overload of current capacity of waste disposal facilities. (-)	M	Same as above
		C5	Generation of noise from machinery and construction activities. (-)	M	Contractor shall use trucks and machinery with mufflers. Contractor shall organize their working hours to reduce disruption, for instance working at nights, vacation periods and weekends.
		C6	Increased traffic congestion due to on-going delivery of material supply. This will impact the timely delivery of goods and services to the existing canteen. (-)	H	Contractor shall avoid having materials being delivered during peak hours. Traffic management shall be coordinated with the University officials
		C12	Increased pressure on utilities (particularly water and energy). (-)	M	Contractor will apply water and energy conservation by ensure resource efficiency.
		C14	Social conflicts (between University staff and students and construction workers) arising from presence of construction	M	Contractor and Staff will follow the Project Code of Conduct. The UG coordinating Unit will establish a mechanism for receiving

			personnel on campus. (-)		and responding to complaints. The ES and CEI will supervise resolution of complains. The Engineer Supervisor will inform contractors of any disciplinary action or penalty that could apply if problem is not resolved.
		C15	Creation of employment at unskilled and skilled levels. (+)	H	Contractor shall employed persons within the area of influence, providing they have the skills required.
		C16	Provision of a modern building (Green) for the Faculty of Health Sciences, which will provide additional facilities for the enhancement of the delivery of the medical programmes. (+)	H	The University Administration will develop and implement a maintenance schedule for improved facilities.
		C17	Land 'take' which will prevent alternative uses, for example recreation (-).	M	In the design of the building the use of space will be optimized (to reduce land take.
OPERATION PHASE					
Use of lecture rooms to deliver formal education	Environment	O1	Generation of solid waste by the students and staff due to their use and occupation of the facilities. This would include plastic, cardboard and paper. (-)	H	The University Administration and staff shall practise separation and shall maximize opportunities for recycling of wastes such as cardboards.
		O2	Generation of sewage from the use of toilets will place increased pressure on the Campus' current non-functional sewage treatment system. (-)	M	Design work for rehabilitation of the UG sewerage system is currently ongoing. The UG in collaboration with the Government of Guyana will be sourcing the funding to rehabilitate the UG sewerage system. The UG sewerage system would be rehabilitated before the new FHS building is completed. Therefore, there would be no need for interim measures.
	Social	O3	Increased opportunities for improved health and safety arising from the provision of additional facilities. (+)	H	The University Administration will develop and implement a maintenance schedule for improved facilities.

		O4	Discharge of untreated sewage into the internal and surrounding drains on campus could lead to health risk to persons on campus and the surrounding communities. (-)	M	The University will ensure that the Consultant who is awarded the contract for the consultancy "Re-engineering of the University of Guyana Sewerage System" includes the proposed sewage flows from the new facilities in the design of the sewerage system for the Campus. The UG in collaboration with the Government of Guyana will be sourcing the funding to rehabilitate the UG sewerage system. The UG sewerage system would be rehabilitated before the new FHS building is completed. Therefore, there would be no need for interim measures.
Purchase of laboratory and medical equipment	Environment	O5	Generation of solid waste from the packaging of equipment. This waste could include cardboard and plastic. (-)	M	The University Administration shall select suppliers that avoid excessive packaging of products. The University Administration and staff shall practice waste separation and shall maximise opportunities for recycling of wastes such as cardboard.
		O6	Reduction in natural resources used in the manufacturing of the equipment. (-)	H	The University Administration shall select suppliers who provide sustainable products, including recycled and energy efficient products.
		O7	Generation of solid waste and possibly hazardous waste when equipment becomes non-functional. (-)	H	The University will segregate, handle, store, transport, treat and dispose of waste, particularly hazardous waste in accordance with the Hazardous Waste Management System that is currently being finalised for the University, and World Bank's *Environmental, Health, and Safety Guidelines for Health Care Facilities.* .
		O8	Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO_2, VOCs, particulates (PM10 and PM2.5). (-)	M	The delivery vehicles will have all permits required by national regulations.
Purchase of materials (chemicals and biological materials) and	Environment	O10	Generation of solid waste from the packaging of the material. (-)	M	The University Administration shall select suppliers that avoid excessive packaging of products.

consumables for laboratories		O11	Reduction in natural resources used to produce the materials (-)	H	The University Administration shall select suppliers who provide sustainable products and services, including recycled and energy efficient products.
		O12	Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO_2, VOCs, particulates (PM10 and PM2.5). (-)	M	The delivery vehicles will have all permits required by national regulations.
Use of laboratory facilities	Environment	O14	Generation of hazardous (infectious and non-infectious) waste from laboratory sessions. Infectious waste which may be either solid or liquid, and include but are not limited to discarded blood and blood specimens, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human tissues, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids and laboratory waste that exhibit the characteristics described above. Non infectious waste would include chemical waste. (-)	H	Efficient inventory management practices and monitoring (e.g. for chemical and pharmaceutical stocks) will be upheld by the University. These include small/frequent orders for products that spoil quickly and strict monitoring of expiry dates; and complete use of old products before new stock is used. The University staff will maximise safe equipment reuse practices, such as reuse of equipment following sterilisation and disinfection (e.g. sharps containers). Prior to the beginning of the operation phase, waste should be identified and characterised. Waste will be segregated. Non-hazardous waste should be collected separately and disposed according to the Hazardous Waste Management System that is currently being finalised for the University. Infectious and / or hazardous wastes should be identified and segregated according to its category as identified by World Bank's *Environmental, Health, and Safety Guidelines for Health Care Facilities.* Waste storage areas shall be provided/constructed within the vicinity of the FHS and its size shall be determined by the quantities of waste generated, with the following design considerations: hard, impermeable floor with drainage, and designed for cleaning/disinfection with available water supply;

					have locks with restricted access; protected from sun, and inaccessible to animals/rodents; and equipped with appropriate lighting and ventilation. Waste will be handled, stored, transported, treated and disposed in accordance with the World Bank's *Environmental, Health, and Safety Guidelines for Health Care Facilities.*
		O15	Generation of solid waste from use of the laboratories. Solid waste may consist of packaging material, (broken) glass. (-)	H	The University Administration and staff shall practise separation and shall maximise opportunities for recycling of wastes such as cardboard.
		O16	Emissions of gases from the use of fume cupboards could result in increased local air pollution and a decrease in local air quality. (-)	M	The University shall implement the Laboratory Safety and Use Plan which is a component of the Hazardous Waste Management System currently being finalised for the University
		O17	Release of toxic gases and infectious substances from experiments conducted within the laboratory into the air may results in a decrease in quality of air within the laboratory. (-)	M	The University shall implement the Laboratory Safety and Use Plan which is a component of the Hazardous Waste Management System currently being finalised.
		O18	Discharge of effluent from the laboratories may result in a deterioration of the quality of water in the surrounding drains. This is a potential threat to the ecosystem within the internal drains and those external to the campus. (-)	H	The University shall investigate the possibility of including the effluent discharge from the laboratory in the design of the sewerage system for the Campus.
	Social	O19	Non adherence to laboratory safety practices could result in increased health and safety risk to the students and staff. This could be due to exposure to micro-biological infections, due to the presence of microbes, upper respiratory distress	M	The University shall implement the Laboratory Safety and Use Plan which is a component of the Hazardous Waste Management System currently being finalised This includes, but is not limited to training for all laboratory users in laboratory safety practices when using laboratories and good housekeeping habits.

			due to constant inhalation of chemicals, and injuries from sharps. (-)		
		O20	Improved health and safety opportunities arising from the provision of facilities. (+)	M	The University Administration shall develop and implement a maintenance schedule for improved facilities.
Use of the new facilities (green)	Social	O21	The Faculty of Health Sciences would be able to meet one of the requirements for Accreditation by the Caribbean Accreditation Authority for Education in Medicine and other Health Professions (+)	H	The University Administration shall develop and implement a maintenance schedule for improved facilities.
		O22	Use of modern facilities will enhance the delivery of the medical and other health programmes and thus lead to improved learning by students of these programmes. (+)	H	Same as above
		O23	Use of the enhanced facilities will contribute to improved research output from students and staff and other collaborators. (+)	H	Same as above
		O24	Use of the modern facilities could contribute to increased enrolment of and thus learning by "differently-abled" persons. (+)	H	Same as above
		O25	Use of the enhanced facilities will reduce dependence on facilities external to the University. (+)	H	Same as above.
		O26	With the provision of the new facilities on campus there is the possibility for theft (-)	M	The University shall determine and install the most appropriate security measures for the facilities. These shall include, but not be limited to the use of grill and CCTV cameras.
		O27	Once accreditation is restored, the Faculty could extend some basic services to the wider University and surrounding	H	The University shall publicise its services to the wider society.

			communities that can help students to acquire hands-on experience on one hand, and assist the Faculty/University to acquire funds, on the other hand. (+)		
Use of electricity	Environment	O28	Use of electrical equipment and lights in the facility that would be provided with a renewable source of energy and reduce dependence on the National Grid. (+)	H	The University shall develop and implement an energy management programme.
Use of water	Environment	O29	Use of water for laboratory and sanitation activities could place an increased pressure on the resource and contribute to water resource depletion (-)	H	The University Administration shall optimise the use of low flow devices and equipment (e.g., faucets and toilets). The University shall develop and implement a water conservation programme.
Use of vehicles to transport staff and students to and from the campus	Environment	O30	Use of transportation to and from the campus could result in local and global air pollution and global warming due to vehicle exhaust emissions of CO_2 (cause global warming) CO, NOx and SO_2 (contribute to acidification), VOCs (contribute to the formation of ground level ozone, together with NO_2), PM10 and PM2.5 (cause a reduction in visibility). (-)	M	The University will promote initiatives to increase use of sustainable methods of transport, including travel reduction initiatives, unless there is no reasonably alternative.
	Social	O32	Emissions from vehicle exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)	M	The University will promote initiatives to increase use of sustainable methods of transport, including travel reduction initiatives, unless there is no reasonably alternative.

9.2 Risk Assessment

The assessment of risk is central to the management of environment and health and safety. To assess the level of the risk, three criteria were selected – probability of occurrence, severity and extent. These are criteria that are used to define risk. For each criteria, numerical values varying from 1 to 3 (1 being the lowest and 3 being the highest) have been assigned. The score is a number between 2 and 18, with the higher scoring risks viewed as a major risk (see Table 33).

Table 33 Key for Criteria for Risk Assessment

Criteria	Details
Probability of Occurrence (PO)	Low (event will seldom occur)= 1 Medium (event will occur occasionally) =2 High (will occur frequently) =3
Severity: (S)	Slight (injuries requiring no more than first aid treatment or brief absences from work/classes = 1 Serious (injuries requiring medical treatment or more than three days off work) = 2 Major (death or severe injury may result) = 3
Extent (E)	Individual (single individual affected) = 1; Within campus and surrounding communities = 2; Outside the area of influence (beyond surrounding communities) = 3
Score = (S + E) x PO	
Level of Risk (R) : High ≥ 9; Moderate 5-8; Low ≤ 4	

Table 34 provides the detailed results of the risk assessment.

Table 34 Detailed Risk Assessment

Risk	Description of Consequence	Risk ID Code	S	E	PO	Score	Risk Level
Spillage of chemicals and biological materials (including infectious substances) in the laboratories. This could occur due to: • Poor housekeeping, e.g., if a container is placed on a cluttered bench top. • Improper storage of materials, e.g., placing bottle at the edge of a shelf • Improper transport of materials, e.g., carrying the material in an open container. • Improper use of the materials, e.g., holding containers with wet hands.	Contamination of water and soil and air and exposure of staff and students to the materials resulting in a health risk.	R1	2	2	2	8	Moderate
Spillage of hazardous waste. This could occur due to improper storage, such as storage of hazardous liquids and dangerous solids over, storage of flammable wastes	Contamination of water and soil and air and exposure of staff and students to the materials resulting in a possible health risk.	R2	1	2	1	3	Low

Risk	Description of Consequence	Risk ID Code	S	E	PO	Score	Risk Level
in close proximity.							
Fire could occur in facilities, particularly the laboratories due to the following reasons: • Storage of large quantity of flammable (or combustible chemicals) in close proximity. • Defective wiring, extension cords and electrical equipment. • Smoking near combustible and flammable substances.	Local and global air pollution and the possibility of nuisance, harm to human health (e.g. through suffocation, burns, fire etc.) and damage to property.	R3	2	2	2	8	Moderate
Flooding due to the likelihood of heavy rain and overload of surface drainage system.	Inundation of grounds could lead to the spread of debris and untreated water (from drains) and thus an unhealthy condition of campus and possibility of diseases to students and staff.	R4	1	2	2	6	Moderate
Traffic accidents arising from increased traffic on campus during construction	Traffic accidents could lead to damage of property and life.	R5	2	2	2	8	Moderate

Risk	Description of Consequence	Risk ID Code	S	E	PO	Score	Risk Level
Exposure to needle sticks	This could result in exposure to blood borne pathogens, leading to diseases	R6	2	2	2	8	Moderate

9.3 Contingency Plans

Table 35Contingency Plans

Risk	Description of Consequence	Risk ID Code	Proposed Contingency Measures
Spillage of chemicals and biological materials in the laboratories. This could occur due to: • Poor housekeeping, e.g., if a container is placed on a cluttered bench top. • Improper storage of materials, e.g., placing bottle at the edge of a shelf • Improper transport of materials, e.g., carrying the material in an open container. • Improper use of the materials, e.g., holding containers with wet hands.	Contamination of water and soil and air and exposure of staff and students to the materials resulting in a health risk.	R1	The University will implement Laboratory Safety Management System currently being finalised . The user will complete the Reporting form for accident/incident regarding chemical and other hazardous waste. . Specifically, users of the laboratories should practise good housekeeping, including keeping their work areas uncluttered, and safe work practices such as covering chemicals immediately after usage and using personnel protective equipment, such as goggles. There would be training conducted for all users of the laboratories in the handling of chemicals and biological materials. Training will include: spill response procedures and materials safety data sheets. In the event of the occurrence of a chemical spill, the pre-trained persons would: • Institute spill response procedures which involve

			stopping the spill, containing it and disposal of the spilled material, and • Follow instructions on Material Safety Data Sheet for specific chemicals.
Spillage of hazardous waste. This could occur due to improper storage, such as storage of hazardous liquids and dangerous solids over, storage of flammable wastes in close proximity.	Contamination of water and soil and air and exposure of staff and students to the materials resulting in a possible health risk.	R2	The University shall implement the Hazardous Waste Management System currently being finalised for the University. The user will complete the Reporting form for accident/incident regarding chemical and other hazardous waste. Precautions at the material storage will include limiting the quantity and amount of time such materials are stored, or providing additional containment between hazardous materials and waterways, and using trained personnel to monitor activities at the storage facility. Clean-up materials, including absorbent spill pads and spill kits will also be stored in these storage areas.
Fire could occur in facilities, particularly the laboratories due to the following reasons: • Storage of large quantity of flammable (or combustible chemicals) in close	Local and global air pollution and the possibility of nuisance, harm to human health (e.g. through suffocation, burns, fire etc.) and damage to property.	R3	All works related to the erection of the FHS building structure shall be undertaken in conformity with the provisions of the *Code of Practice for Building – Part 3:*

proximity. • Defective wiring, extension cords and electrical equipment. • Smoking near combustible and flammable substances.			*Fire safety use and occupancy (first revision)*. In the event of fire, adequate fire suppression equipment (as indicated in Table 13 of *the Code of Practice for Building – Part 3: Fire safety use and occupancy (first revision)*shall be made available to restrict the fire growth to the compartment of origin, minmise damage to the building and its contents; and prevent fire spread to adjoining compartments, buildings or allotments; and adequate smoke control systems shall be installed to minimise the spread of smoke to escape paths, compartments and other buildings; and to assist access by fire fighters. Fire equipment will be inspected and tested at least each quarter of the year by the Fire Service and a log of tests made should be maintained by the University and shall be available for inspection at any time by the GNBS. Hand operated and portable extinguishers would be installed at strategic locations in the building. These systems would be regularly tested and approved by the Guyana Fires Service and records of

			the dates when tests were carried out shall be kept. In keeping with the *Code of Practice for Building – Part 3: Fire safety use and occupancy (first revision)*, the roof: (a) shall be of reinforced concrete construction with a fire-rating of 1h; (b) be constructed with a metal or fire-resistant or impregnated timber frame and lined with a non-combustible material; (c) having a ceiling lined with a 1h fire-rated material; (d) roof lights constructed in the roof shall have an area of light spread not greater than 20% of the roof surface, and shall not be closer than 3 metres to another building or to any unprotected part of the building that projects above the roof light. All materials and equipment used in the fire protection system for the proposed FHS building shall be consistent with the requirements of the *Code of Practice for Building – Part 3: Fire safety use and occupancy (first revision).* **Others are as follows:** Evacuation routes will be provided for use in the event of emergencies. A separate facility will l be provided for the storage of hazardous materials from the

			main building. Incompatible materials will be stored in separate areas. Signs will be erected prohibiting smoking in applicable areas, such as near storage facilities for hazardous materials, in laboratories. Signs to demarcate evacuation will be installed. Smoke alarms and sprinkler systems will be installed. All fire safety systems will be maintained in proper working order, including self-closing doors in escape routes. Staff and students will be trained in the operation of fire extinguishers and evacuation procedures. All of the above measures shall be incorporated in the design of the building.
Flooding due to the likelihood of heavy rain and overload of surface drainage system.	Inundation of grounds could lead to the spread of debris and untreated water (from drains) and thus an unhealthy condition of campus and possibility of diseases to students and staff.	R4	A maintenance manual will be completed under the drainage rehabilitation works that are being executed by the UGSTSP; importantly, additional resources have been identified to install a drainage pump. The FHS building will be constructed on a concrete slab.

Traffic accidents arising from increased traffic on campus during construction	Traffic accidents could lead to damage of property and life.	R5	The University will manage traffic on campus during construction
Exposure to needle sticks	This could result in exposure to blood borne pathogens, leading to diseases	R6	The University will implement the guidelines currently being developed for laboratory safety. Contaminated needs and other sharps would not be bent or recapped unless such an act is required by a specific procedure or has no feasible alternative Contaminated sharps would not be broken Needle disposal containers will be placed near where needles would be used Contaminated needles and sharps will be put, immediately after use or as soon as feasible into a puncture resistant container that is appropriately labelled with the universal bio-hazard symbol As far as practicable, safer needle devices and needleless devices would be used to decrease needle stick or other sharps exposures

9.4 Planning and Preparation[11]

Institutional arrangements

The institutional arrangements that have been identified in the *Environment and Social Manual* for the UG Science and Technology Support World Bank (Project ID Number: P125288) are expected to be continued for this project.

Project Implementing Unit

The PIU will be located in the Ministry of Education (MOE) and at the UG. The Project Coordinator of the PIU at the UG will provide support and the necessary equipment to the Environmental Specialist appointed by Project in order to develop the project in a way to reduce, prevent and mitigate any social or environmental impact.

The Engineer supervisor of the works

The Engineer supervisor of the works and appointed either by the UG and/or at the MOE will coordinate closely with ES that contractors follows and complies with this EMP and Guyana national regulations. The Engineer supervisor of the works will support the ES in every way to ensure contractors compliance with all bidding environmental and social clauses.

Project Environmental Specialist (ES)

- The Project Environmental Specialist is the professional with environmental expertise hired or contracted by the PIU for the overall environmental and social supervision of the Project.
- ES is selected and named. The ES will comply with the profile described in *Appendix VII*. The ES reports to the UG Project Coordinator and he/she will be contracted before the bidding and any other contract is prepared. ES revises the EMP and other safeguards instruments of the Project and the Operational Manual and if needed environmental amendments are made (these must be approved by the World Bank);
- ES prepares the Environmental Technical Specifications (ETS) to be included in the bidding documents, includes the clauses included in this EMP and adds as necessary other pertinent clauses, consult the Bank and other necessary sources and agencies. The Bank will give its clearance to the ETS
- ES revises Bidding documents include the ETS and all necessary environmental and social clauses; including the requirement that contractor will hire an environmental staff to oversees and coordinate environmental supervision of the works
- ES revises contractors company's environmental management proposals, environmental permits, traffic permits, etc.

[11] This section is based on the World Bank's procedures and those outlined in the *Environmental and Social Manual*

- ES works with the PIU team in selecting operational sites for the contractors (parking, dining rooms, material storages sites, etc.); water, electricity sources are agreed.

- The ES will be responsible for monitoring overall works performance and will use Environmental Datasheets (EDS to monitor the project environmental and social management. Appendix VIII contains some examples of EDS. The ES as soon as appointed by the PIU will need to prepare additional EDS to monitor all mitigation measures agree in this EMP.

- The ES will be assigned an office at UG (and any other members responsible of the Environmental and social supervision) with telephone, fax, computer and printer.

Contractor's Environmental Inspector

The contractor's Environmental Inspector is the professional appointed by the contractor to support its company in the compliance of this EA and EMP developed for the mitigation and prevention of social and environmental impacts associated with the construction and rehabilitation works for which the company was hired.

PIU ensures that bidding documents request Contractors to hire an environmental staff responsible to prepare and supervise implementation by the contractors and subcontractor of EMPco and provide overall training (health, safety, environment, code of conduct, etc.) to workers and subcontractors, etc. This person will be named "Contractor's Environmental Inspector" (CEI) and the professional qualifications will be defined in the bidding documents. The CEI will be hired as soon as possible after the contract is signed.

Design of construction works

While the design of the facilities is currently ongoing, during the EA evaluation of this project and the consultation process with UG stakeholders, it was possible to identify major problems that need to be addressed during the pre-construction and construction works planned in this Project (see Table 29). The PIU and consultants hired to design these works shall revised this EA and EMP. The ES must ensure that UG community (student, faculty, and staff) are offered opportunities to consult the design and construction plans, that communication activities are prepared before the final designs are approved and the designs include the recommendations given in this EMP and by the ES.

Some major needs identified during this EA and important to address in the Design of the construction works are:

- Traditional building design. The staff emphasised that traditional design of buildings on campus does not necessarily guard against the effects of climate change. The new building should be a model which could influence the design of future buildings.
- Unreliable power supply. Unreliable power supply from the national grid to the Faculty's building was cited as a concern by a number of the stakeholders, and one that will have implication for lighting, ventilation and for the power-sensitive laboratory equipment and other

materials which will be accommodated in the building. The use of solar energy to power the building and back-up generators were recommended. The building should have its own transformer. Importantly, this recommendation of the use of renewable source of energy has been addressed in the project.

- Access. There should be more entry and exist points for the new facility as opposed to what currently exists at the CBJ building.
- Parking facility. The proposed parking facility should be adequate and cater for the projected increase in student population and for if basic services will be offered to the wider community. The parking facility should be close to the new building.
- Safety and security. Staff and students noted that security is an issue on campus. The design of the building should include measures to enhance the security of the structure, staff and students. The example of the use of grill was suggested. For the operation phase, additional able-bodied security personnel should be recruited to provide support.
- Fire. Fire points and exists should be clearly marked and adequately provided for safety. New building being fully equipped with modern facilities the need to guard against fire becomes very important. It was recommended that a sprinkler system should be in place in the case of such incident
- Facilities for lecturers. There should be the provision of a common room for staff members. Staff members are willing to share office space, except for certain designated positions, such as Heads of Department and Dean.
- Flooding. In light of the fact that there have been flooding episodes on campus which affected the current buildings, in which books and other materials were destroyed, the design should be such that the building would be placed above the flood line.
- Drainage. It was noted that adequate drainage system should be put in place to avoid overloading the current and outdated drainage infrastructure.
- Lavatory facilities. Concern was raised regarding the inadequate lavatory facilities in the current Faculty building. Students noted that it is a serious issue which must be addressed in the new building. They suggested that the student population should be used as the benchmark for determining the number of lavatory rooms that should be available.
- Sewage disposal. A main concern of staff was whether the sewage system for the new building would be linked to the current system without having any negative impacts. The system is already compromised. One suggestion was for the building to have a sewage system separate and independent of UG's current one but it should be done in such a manner that facilitates inter-linkage with UG system which will have to be built at some point.
- Storage for chemicals. Staff noted that separate storage space/facility for chemicals and laboratory materials should be addressed since the Faculty uses various types of chemicals for different purposes.

EMP prepared by the Contractor

The Contractor will need to prepare and submit an EMP (EMPco) which will be designed in accordance with this EMP. The Contractor will be responsible for the implementation of all plans and actions described in the EMPco, in addition to other actions defined by the ES to ensure adequate environmental and social management during the construction works. The Contractor will closely follow the technical specifications outline in this document and any other environmental clause of the bidding document.

The Contractor shall verify, adapt, and optimize all the mitigation measures included in this EA and the environmental plans listed in this EMP and prepare the environmental management plan for the construction and rehabilitation works (EMP contractor or EMP co) that will as minimum the following programs and plans (the ES might request additional programs or plans to the contractor):

- Public Participation and Communication Programme
- Code of Conduct Plan
- Environment, Social, Health and Safety Programme
- Waste Management Programme
- Environmental Restoration Programme
- Monitoring Programme
- Contingency and emergency Plan
- Environmental Closure Plan

Construction Work Plan (CWP)

The EMP will be part of the Construction Work Plan (CWP) that will be prepared by the contractor (see next sections for more details).

1. The ES verify and identify areas of interest and sites sensitive (environmental and social) to construction or the rehabilitation works. ES is potential sites to assign for the contractors operation office, parking lots, material and storage sites, waste collecting sites, etc.

2. Selected Contractor prepares and submits the **Construction Work Plan (CWP)** (see next sections for more details).

3. The CWP should include among other things related to the civil works, an Environmental Management Plan (EMPco) proposal which will incorporate all measures and programs and plan define in this EMP. The EMP co will also include a (i) proposal of the areas needed to place materials, to park trucks and machinery, demolished materials, management of hazardous areas and materials (chemistry labs), (ii) a proposal of the rehabilitation chronogram, (iii) an academic relocation plan if needed, etc.

4. The CWP will be approved by the PIU team assigned to this task. The Es in coordination with the Engineer Supervisor of the works, UG representatives, and other PIU members will review and

make amendments to the Construction Schedule proposal, the logistics plan proposal and the intervention and relocation plan.

5. The ES will review the CWP carefully to ensure proper sites have been selected for the contractor's operation sites, approve the EMPco proposed. The ES must ensure that the construction of the facilities will cause the minimum environmental and social impact in the UG campus assets, community and services.

Operation Phase

During the operation phase, it is necessary that the environmental and social performance of the project be managed with a view towards reducing environmental and social negative effects of use of the facilities. To this end, it is expected that either the consultant or UG staff appointed as ES during the construction could become a permanent staff of the University to function as the UG's ES to continue supervising activities related to the operation

PROGRAMMES AND PLANS OF THE EMP

To facilitate implementation and supervision of the EMP, mitigation and prevention measures are included into programmes and plans where more detail is given. The programmes and plans are basic components of any EMP. Depending of the development of the project and works, it might be necessary to include other programmes or plans not include in this section.

Programme 1. Code of Conduct

In order to reduce any potential social impacts to have outside workers within the campus, the contractors and subcontractors and any one related to the Project will follow the Project Code of Conduct which is a set of principles which will ensure adequate relationships during the construction period.

All TGP workers and contractors must comply with the rules and procedures indicated in this Code of Conduct which strives to maintain harmonious relations with the UG community and the local population located around the UG campus (area of direct influence of the project). Non-compliance of this Code of Conduct will lead to disciplinary and other measures.

The Code of Conduct will be an integral part of the EMPco and the CEI will inform about it during capacity building activities with the workers.

Table 36 Code of Conduct for contractors and workers working in the UG Project

1	All workers must leave the UG campus or working sites at the agreed hour of their schedule, unless a written authorization is issued by the Engineer Supervisor of the works or other member of the PIU.
2	All workers must carry appropriate identification on their clothing at all times during the construction/rehabilitation period.
3	The UG is the most important academic institution in the country and its students, professors and staff must be treated (male and females) with respect at all times.
4	All workers are forbidden to possess or consume alcohol within the UG campus.
5	All workers are forbidden to carry guns or any other type of weapon, unless they are performing guarding activities and posses the required permits by national legislation to carry a gun and have approved a permit by the UG authorities.
6	All workers will take care of the environment and will follow the Environmental Management Plans agreed with the contractor.
7	Complaints of students, faculty, visitors, etc. regarding problems with misbehaviour of workers (verbal or sexual insinuations to students) or other type of problems during construction works will be communicate to the contractor and disciplinary measures will be taken.
8	Workers will not take any archaeological piece found during excavations in the work sites. If such archaeological pieces are found while works are being carried on, works must be stopped and informed to the CEI and the ES.
9	Other.
10	Other ..

Programme 2. Environment, Social, Health and Safety Programme

- ***Training Plan***

The Contractor, prior to commencement of work, will inform and train (the CEI will support this training) all staff on matters pertaining to the EMPco and the environmental clauses included in the bidding document and shall reinforce this training throughout the construction period. The ES will also participate in this training by providing initial presentations to the contractor and its technical personnel in relation to the EMP, the UG campus, the expected results and the grievance and participatory mechanism that will be implemented during the construction period.

The Contractor shall therefore establish a training plan (written and verbal) on topics such as Health and Safety, Code of conduct, Environmental and Social Management Plan, Speed limits, waste management,

etc for their staff and sub-contractors in compliance with the approved EMP and EMPco. The plan will be revised and approved by the ES.

Training workshops will cover the following topics

1. The EMP prepared by the contractor and the responsibilities of workers on following the EMP and the Code of conduct within the campus, the supervision of the PIU on the works and environmental management.
2. Health and safety at the worksite, Safety equipment, speed limits (within the campus will be 25/km) emergency procedures, etc. All contractors must attend these courses specially workers responsible of driving within the campus or transporting materials, or operating heavy duty machinery, working at heights, managements of electrical installations, etc.
3. The Code of conduct within the UG campus; respectful treatment to students and faculty, especially female students and faculty; penalties for breaking the code of conduct.

The ES will 'monitor' the Contractor to ensure that ensure compliance with the occupational health and safety standards of Guyana and those health and Safety regulations of the World Bank.

- ***Health and safety equipment***

Contractor will provide health and safety equipment for workers (helmets, safety masks, gloves, vests, caps, ear muffs, safety shoes, etc).

Contractors will provide potable water to workers and portable toilets and showers.

Contractors will provide first aid equipment and Portable Fire Extinguishers.

Contractor will provide identification cards to all workers who must carry it at all times.

Programme 3. Public Participation and Communication Plan

Since public participation is an essential element of the EIA process in Guyana and the World Bank Safeguards Policies (OP 4.01), this project has facilitated and will continue to facilitate the involvement of the 'public' (stakeholders including project beneficiaries including students and lecturers, affected groups such as surrounding communities and IAST; government ministries; the Environmental Protection Agency and the utility companies).

The public participation process will involve the conduct of public participation workshops aimed at: (i) provision of information on project phases, components and activities; (ii) discussion of environmental and social concerns and recommended mitigation measures. Agreed actions will be incorporated into the EMP-contractor document.

To complement these workshops the EMP-contractor document will be posted on the UG website and a *Facebook* account will be open for stakeholders to provide feedback throughout the construction and operation phases of the Project. The ES and the UG administration, in collaboration with the Contractor, will respond appropriately, either by remedial actions or verbally whenever and explanation or a clarification is needed.

- ***Construction Communication Plan (CCP)***

The Construction Work Plan (CWS) and schedule will be informed to the UG community through the Construction Communication Plan (using emails, websites, meetings, official communication channels of the UG) to inform the UG at large of work schedules and actions that could cause environmental and social impacts. Special attention will be given to diversion of traffic, generation of noise and dust to inform all mitigation and prevention measures that will have to be taken by the University, students and staff (academic and non-academic staff) to accommodate the construction works and the academic programme.

All measures will try to prevent injuries to passersby and to inform the 'university community' of the scheduled activities of the Contractor. The Contractor must provide the schedule of activities at least 6 months before any work to ensure that UG Coordination Committee can take the necessary measures to minimise the negative impacts to the UG campus life and academic programme.

The ES will approve and monitor the Communication Plan to ensure effective and efficient implementation of this EMP and the EMP-contractor. Thus, information must be communicated at least 2 weeks of planned minor works and 1 month for major works. The EA will help guide the Contractor on how to communicate the plan more efficiently, based on feedback or direct observation.

The work plan will be prepared by the Supervisor of Works in collaboration with the Director of the PIU. The work plan must be approved by the university authorities and should know and ensure that the impact on academic life and operation of the university is minimal.

- ***Grievance Mechanism and Resolution of conflicts***

The safeguards policies of the World Bank ensure the establishment of a grievance mechanism during project implementation which aims to offer a clear set of opportunities for affected people or any other interested stakeholder to post a claim, request information and have a formal mechanism to communicate with project developers and supervisors.

A project-level grievance mechanism for affected communities is a process for receiving, evaluating, and addressing project-related grievances from affected communities at the level of the company, or project.

Grievance mechanisms will be established early to respond early and effectively to any potential escalation of tensions with UG students or staff or members of near communities. It is possible that most of the grievances may relate to any flaws in the consultation process, noise, traffic, and access to classrooms. A straightforward procedure has been established and the CEI will to act as a point of contact to receive complaints and to foster positive engagement when issues arise.

The Communication methods will consist of the following:

a. The Project will prepare a web site within the UG web site which will contain the information of the Project, the EA, EMP, EMF and all safeguards instruments and project documents. A section of the Project web site will indicate the names of all the members of the Project implementation Unit in both the UG and MOE, such as PIU coordinator, ES, the Engineer Supervisor, etc.

b. The Project web site will inform about report or consultation meetings, seminars, etc that will be given during the Project implementation period.

c. In the Project web site a section will be named Grievance Mechanism of the Project. Here the visitor will find an explanation how to post a claim, recommendations and just a note to the project coordinators. Grievance forms, emails and on line chat channel will be offer to the visitor.

d. The ES and UG Coordination Committee will develop clear tasks and responsibilities for addressing grievances and the way that contractors will respond to any claim.

e. The following steps will be following for the grievance mechanism:

Step 1	Inform the mechanism and develop accessible ways to use by stakeholders
Step 2	Receive and register using different grievance mechanisms
Step 3	Review and investigate issue
Step 4	Resolve issue. Define solutions.
Step 5	Monitor and evaluate

If necessary, a clear list of tasks and outcomes that an investigation is expected to achieve shall be developed. If issues are related to conduct of contractor workers (this will be address by the Code of conduct described in the Program Social Interference)

The PIU, contractors and ES will handle claims with respect, respond as quickly as possible, and will maintain records of the resolutions since these documents could be requested at any time by the Bank.

Programme 4. Waste Management

- ***Solid waste management***

The contractor will place wastes bins and containers for each specific type of solid waste: paper-cartoon, glass (windows), metals (pipes, etc), electrical (old wires, etc), plastic (all types), wood (all types). All containers will be properly labelled and will have lids which will not easily fall.

No burning all any type of materials will be allowed for the wastes generated by this Project.

The Contractor, under the supervision of the ES, will develop out spill prevention, control, and containment (SPCC) plans. In addition, the ES shall conduct intermittent spill training exercises for the contractors and UG staff and coordinate with the CEI training activities for the Contractor, Sub-Contractor, etc.

Type 1. Construction materials

All construction materials will be classified according to the type of materials and place accordingly in labelled containers and in agreed sites with the ES and the Engineer Supervisor of the works.

Transportation: all waste transported to the final disposal sites will be transported with care (loads will be covered with heavy tarts or plastics) and truck will drive at speed of 25 km/h within the campus and 50 km/h outside the campus.

Type 2: Recyclables

The Contractor will implement a programme to classify waste materials to ensure that those waste that can be recycled[12] (paper, cardboard, aluminium, metals, glass) can be collected and donated to interested parties of the adjacent communities.

Type 3: Domestic Materials

The Contractor will collect all this wastes in the designed containers and will dispose the wastes of in an area designated by the Authority (such as the EPA/Georgetown M&CC) or other site (the Haag Bosh landfill).

Type 4: Hazardous Wastes

Hazardous wastes (for example, waste oils, grease, fibres, hydrocarbons etc.) that arise during contraction works will be carefully collected, characterized, labelled, stored, and if possible, recycled or transported and disposed of in accordance with World Bank standards, to avoid soil contamination. Hazardous wastes will be placed in proper ventilated sites and with impermeable floors.

The University is in the process of finalising its Hazardous Waste Management System. Implementation of this System would reduce the occurrence of risks discussed above, with the exception of flooding. The Hazardous Waste Management System shall be completed by mid June 2017 which is prior to the construction of the new FHS building. The University's Hazardous Waste Management System has been informed by internationally accepted norms, such as the World Bank's *Environmental, Health, and Safety Guidelines* (International Finance Corporation, World Bank Group, 2007a and 2007b)

Components of this Hazardous Waste Management Systems include: the proposed rganisational structure for occupational safety, health and the environment (OSHE) with specific reference to hazardous materials; inventory management system; hazardous materials and waste management; laboratory safety and use plan; standard operating procedures for accidents/incidents related to hazardous materials; and a training and induction programme.

When the FHS building becomes operational, all the components of this Hazardous Waste Management System shall be implemented. Hazardous materials and waste management would be the responsibility of the ES in collaboration with the proposed University Occupational Health and Safety Operations Committee, Departmental Occupational Safety and Health Coordinators and the Occupational Safety

[12] *Recycling* involves separation and collection of waste materials, preparation, and reuse, re-processing, or re-manufacturing, which leads to a reduction of waste to be land filled.

and Health Compliance Officer. These positions are all part of the Occupational Health and Safety Policy Guidelines for the University which includes the hazardous materials.

What follows below is an outline of the steps that a team of professionals from the UG developed, with the guidance of consultants from the University of the West Indies (UWI), St. Augustine Campus , in June 2016. To date, ten of the fifteen steps have already been completed, and the draft documents would be submitted to the UWI for review and any necessary revisions. It is envisaged that by mid-June 2017, the UG should have a Hazardous Waste Management System that would have been approved for implementation by the institution's Academic Board.

Steps in the Preparation of Components of its Hazardous Waste Management System

Step 1

1) Collection, review of and cross-referencing of the OSH and environmental regulations (EPA Act, Hazardous Waste Management Regulations).
2) Benchmarking against other universities' OSHE policies in North America, EU, Caricom.
3) Benchmark organizational structures at other Universities in North America, EU, Caricom.
4) Catalogue contribution from various UG stakeholders through focus group meetings.

Step 2

1) Review of current OSHE baseline and organisational chart at UG in reference to the national legislation and against other overseas Universities.

Step 3

1) Prepare SOP's, accident/incident reporting forms/documents [*1] regarding chemical and other hazardous waste.

Step 4

1) Prepare reporting documentation and procedures for compliance and monitoring.

Step 5

1) Consult with stakeholders (needs based).
2) Explore available commercial systems (cost, availability, usability/appropriateness).
3) Procure and implement chosen Inventory Management Software system.
4) Develop protocol for ownership of Inventory Management Software System.
5) Inventorize current biological and chemical waste at UG.
6) Source and review existing protocols for waste minimisation.
7) Develop RRR procedures to minimise impact of material use on cost and waste disposal at UG.

8) Review and select appropriate equipment for implementation of RRR protocols.

Step 6

1) Review existing policies and protocols (external) for the classification of hazardous waste.
2) Design specific protocols for all aspects of hazardous waste management.

Step 7

1) Review relevant policies at other universities.
2) Prepare chemical and biological material use policy for UG.

Step 8

1) Design procedures to enable the risk assessment process/system.
2) Prepare risk assessment forms, templates and guidelines.

Step 9

1) Design a training policy.
2) Develop generic and specific training manuals.
3) Conduct cyclical, dynamic and mandatory training for all University staff and students.
4) Develop train the trainer programme and evaluation procedures for trainers.

Step 10

1) Develop maintenance plans (schedule, procedures, evaluation, reporting) for equipment and Labs.

Step 11

1) Develop lab safety and use regulations.
2) Develop lab management procedures.
3) Develop lab safety and use plans.

Step 12

1) Craft SoPs for managing events (large, medium and small scale).
2) Craft procedures to manage visitors to the UG space/environment (encompasses persons, vehicles, animals).
3) Develop code of conduct for special events and external visitor interaction at UG.

Step 13

1) Conduct a baseline study of the level of awareness of staff and students in respect of OSHE matters.

2) Design the strategy for awareness building.

3) Design the relevant materials to build awareness of OSHE matters and advances at UG.

Step 14

1) Conduct focus group meetings with staff to catalogue gaps in knowledge and skills in relation to OSHE and their job descriptions.

2) Design a programme that encompasses all aspects of the OSHE policies, procedures and protocols of UG.

3) Identify resource persons to conduct training programme.

Step 15

1) Compile and produce a final document for hazardous waste management.

Type 5: Soils affected by accidental spills, oils or mal-functioning vehicles

Oil changes will not be permitted on campus, and therefore should be done at the nearest gas station. The Contractor will restrict the locations of hazardous materials.

- ***Water pollution and effluents***

Water quality monitoring will be conducted to ensure compliance with water quality discharge limits established by the EPA. Sample locations, which will be discharge points, will be determined by the Environmental Specialist. Surface water samples will be recovered quarterly during construction. Ground water samples will also be collected and analyzed by both the Contractor and the ES.

Programme 5. Control of noise and dust

- ***Noise***

Noise disturbance was mentioned as an issued during the stakeholder engagement process. The Contractor shall ensure that the equipment is in good working order with manufacturer supplied noise suppression (mufflers etc.) systems functioning and in good conditions. Contractor will make reasonable efforts to schedule heavy noise activities for weekends or in the late afternoon and keep the less noisy activities for normal working hours (between 8 am and 5 pm). Contractor will request Noise Permits to EPA is necessary in order to reduce noise impact to the academic programme, administrative staff in the nearby buildings and the neighbouring IAST. Where noise is likely to pose an impact to the normal environmental surrounding the UG campus and the community, the Contractor shall inform the site manager and shall develop a public notification and noise management plan for approval by the ES and UG authorities.

Contractors will follow noise limits established by Guyana and those included in this EMP. The CEI and ES will monitor noise levels frequently during the construction works.

The Guyana National Bureau of Standards and EPA developed Guidelines for Noise emissions into the Environment. Under these Guidelines, noise emissions from construction activities are: 90 dB (Daytime Limits; (6AM-6PM) and 75 dB (Night time Limits; 6PM-6AM) at the property boundary or 15 meters from the source (as cited in SRKN'gineering & Associates, 2014).

During construction these noise levels will be frequently increased, if noise reaches more than 85 decibels and remain more than an hour, all workers must use hearing protection. The ES will follow the World Bank standards in case necessary. The ES will review the World Bank "Pollution Prevention and Abatement Handbook" which can be downloaded at the internet. [13]

- **Dust**

Excavation will be done at night or weekends or break periods so students are not affected by the dust. Workers must use protective equipment such as masks, ear plugs, etc. All trucks transporting materials and waste must cover their load with a heavy tart. If considered necessary by the ES, water will be spray on the areas of mayor works. However, fine sediment traps will need to be set up in the drainage channels and ditches where water will run in order to capture sediments and fine particulate matter and avoid polluting surface waters. The ES will follow the World Bank standards in case necessary. The ES will review the World Bank "Pollution Prevention and Abatement Handbook."

Programme 6. Excavation activities

Workers will have to use personal safety equipment at all times. During excavation for the construction of the foundation, soil (organic layer) should not be contaminated with any type of waste from the construction. Soil must be separated and cover with plastic to avoid soil runoff and contamination. Soil layer will be very important to restore natural areas affected by the works. Neither explosives nor highly noisy equipment will be allowed to be use during the works at UG.

If during excavation, archaeological pieces are found, works must be stopped and the CEI and ES must be informed. In the bidding document, it is important to include a clause related to potential chance findings of cultural or archaeological, paleontological resource, following the OP 4.11 of The World Bank.

Programme 7. Restoration Plan

All sites intervened by the contractor and construction works at the UG campus will be restored and re-vegetated. Excavations areas, drainage channels will be recovered and any solid waste sites if included in the campus (cement only) will be restored. Plant species that will be preferred for the restoration are native species. The ES will be responsible to guide the CEI in the selection of plants and re-vegetation and reforestation activities. No pesticides or any agrochemical include in the List 1a, 1b and II of the WHO will be used to maintain these plants or any other activity supported by Project such as the Research Fund (Component 1).

[13] http://www.ifc.org/ifcext/sustainability.nsf/Content/Publications_Handbook_PPAH

Programme 8. Contingency and Emergency Plan

Contractors will include in the EMPco, a section describing the Contingency and Emergency Plan which will be followed during the construction works.

This plan must include the possible contingencies and emergency situations:

a. Workers possible accidents and injuries related to the construction works where they will be involved
b. Fires. Fire extinguishers must be placed in working sites and training provided to use them.
c. Flooding. During the rainy season in common that the UG campus becomes flooded. The contractor must have a plan to deal during this period and maintain the works on the timeline agreed and reduced environmental and social impact.
d. Structural collapse. During the demolition and restoration works, some structures could collapse and generate possible accidents.
e. Explosions. Explosions might occur due to the presence of chemical compounds in several labs and a fuel tank in the UG Campus, thus there is a need to proper handle this areas and materials by trained staff.

Programme 9. Sustainable Development

The new facilities will be powered by solar energy. The project will also try to incorporate energy efficient equipment and request the purchase and use of sustainable materials (certified woods, use of low carbon emission equipment).

The project will request Contractors to increase opportunities to people living close to UG in order to increase social benefits by targeting recruitment of local people, students, etc. Also, the World Bank seeks opportunities to women in developing countries and contracts must make any efforts to provide opportunities for women as part of the personnel or subcontractors.

Programme 10. Environmental Monitoring Plan

Environmental monitoring will be implemented throughout the pre-construction, construction and operation phases by the Contractor, the PIU and the UG. Baseline monitoring shall be conducted early on by the Contractor to establish a baseline of conditions before the works begins and track any changes that could be attributed to the project, in the event of complaints or issues arising in the construction and operation phases. The Contractor will be responsible for implementing this Monitoring Plan and ensuring that construction activities are carried out in compliance with the EMP. The ES will also monitor overall works performance and will use Environmental Datasheets (EDS) developed to monitor the project environmental and social management. *Appendix VII*I contains some examples of EDS. The ES as soon as appointed by the PIU will need to prepare additional EDS to monitor all parameters agree in this EMP.

The objectives of the Environmental Monitoring Plan are to:

- control impact generating activities or actions;
- monitor impacts and verify that, where applicable, environmental parameters/indicators are within regulatory standards;
- verify that recommended mitigating measures are effective in protecting the environment; and
- Response to unexpected environmental impacts.

Monitoring Activities

The primary monitoring activities are highlighted below:

- Vegetation monitoring activities will include maintaining records on vegetation re-growth after clearing activities for dining room, storage site and new parking sites; and area cleared/vegetation destroyed.

- Air quality and particulate (dust) monitoring will include ensuring that the implemented dust suppression methods are effective and will be visual or the PM10 levels measured.

- Water quality monitoring will be conducted to ensure compliance with water quality discharge limits established by the EPA. Sample locations, which will be discharge points, will be determined by the Environmental Specialist. Surface water samples will be recovered quarterly during construction. Ground water samples will also be collected and analyzed.

- Monitoring of waste from the project will include the preparation of weekly inventories on types and quantities of solid and hazardous waste generated; and methods of collection, storage and disposal.

- Health and safety monitoring will be undertaken weekly through the recording of incidents and accidents.

- Noise monitoring will be conducted by measuring noise levels weekly in the vicinity of construction areas and new parking area and surrounding buildings to ensure compliance with the noise level standards established by the Guyana National Bureau of Standards.

- Code of conduct. It will be very important for the CEI to inform contractors' workers of the code of conduct and the penalties related if code is broken. The CEI and ES will supervise closely its compliance and will investigate any claim or issue.

<u>Specific Monitoring Pre-Construction and Construction Phases</u>

During the pre-construction and construction phases, the CEI under the supervision of the ES will be responsible for continuously monitoring the following environmental impacts at the construction site:

- loss of vegetation;
- generation of particulate matter;

- generation of noise;
- traffic congestion; and
- social conflicts.

The Contractor should be responsible for the monitoring of various impacts to ensure the proper functioning and implementation of mitigation measures (Table 37). CEI will perform constant monitoring and weekly inspections to ensure that the mitigation measures are implemented and that the project is not adversely affecting the environment. The Environmental Specialist will be responsible to supervise adequate monitoring by the contractors and the CEI. During the pre-construction and construction periods, the Environmental Specialist will perform monitoring weekly or daily inspections and during operation on monthly basis. The ES will use standard environmental datasheets (EDS) to record all monitoring activities (see *Appendix VIII* for some examples of EDS).

Table 37 Monitoring Plan for the Pre-Construction and Construction Phases

Environmental Impact	Monitoring Parameter	Sampling Frequency	Officer Responsible	Monitoring Location
Pre-construction				
Transport of materials will result in traffic congestion along access road leading to the current building that is being occupied by students and staff, plus other staff and students of the University. (-) Traffic congestion can affect students and staff punctuality to lectures, which in turn may lengthen the number of contact hours to complete courses that would have been affected.(-)	Number and duration of delays Number of contact hours lost Number of courses affected Level of decibels	Weekly Weekly Weekly	Contractor Environmental Specialist Contractor Environmental Specialist Contractor Environmental	The University of Guyana The University of Guyana All intervened sites - construction

Noise emanating from transporting and off-loading material supply by vehicles (mainly trucks) can be a nuisance to students and staff of the Faculty of Health Sciences and the Faculty of Natural Sciences, as well as the Public Relations Office, and persons using the multi-purpose building that are west of the project site. (-) The existing parking space will not be available and will therefore require alternative parking spaces, which in turn, may create security issues. (-)	Number and duration of disruptions to lectures Number of staff and students affected	Weekly Weekly	Specialist Contractor Environmental Specialist Contractor Environmental Specialist	sites, workers' area, new parking lot, designated waste disposal area to be identified by the Environmental Specialist in collaboration with the FHS All intervened sites
The area identified for the construction of the building will require clearing of mainly grasses at it has already been decided that the large trees will remain. Any species (flora or fauna) whose habitat will be disturbed can	Area cleared/amount of vegetation destroyed Total area recovered Number of plants planted by Contractor(s)	Within 3 months of construction Annually Annually	Contractor Environmental Specialist	All intervened sites – workers' area, storage area, new parking sites

easily adapt to suitable sites nearby. Importantly, the species that have been identified in the area are not rare, threatened, endangered or endemic. (-)				
Dust emissions are expected as a result of waste removal. (-)	Ease of visibility PM10	Weekly Weekly	Contractor Environmental Specialist	
Localized pollution will occur as a result of traffic of equipment and transporting vehicles. (-)	Number of vehicles arriving covered			
Soils will be disturbed as a result of preparation of land. (-)	Area cleared/amount of soil removed			
Construction				
Generation of particulate matter, particularly due to storage of materials and operation of cement mixers (-)	Frequency of maintenance of vehicles Ease of visibility PM10 Number of vehicles arriving covered	Monthly Weekly Weekly Weekly	Contractor Environmental Specialist Contractor Environmental Specialist	All intervened sites – construction areas, storage areas, new parking sites
Generation of construction materials (for	Quantity and type of waste	Weekly	Contractor	All intervened

example, moving earth for levelling of the site to make the unit platform and other solid waste materials). (-)	Waste collection, storage and disposal method/s	Weekly	Environmental Specialist	sites – construction sites, workers' area, new parking lot, designated waste disposal area
Overload of current capacity of waste disposal facilities. (-)	Quantity and type of waste Waste collection, storage and disposal method/s	Weekly Weekly	Contractor Environmental Specialist	All intervened sites – construction sites, workers' area, new parking lot, designated waste disposal area
Generation of noise from machinery and construction activities. (-)	Level of decibels	Weekly	Contractor Environmental Specialist	All intervened sites - construction sites, workers' area, new parking lot, designated waste disposal area To be identified by the Environmental Specialist
Increased traffic congestion due to on-going delivery of material supply. This will impact the timely delivery of goods and services to the existing canteen. (-)	Number of accidents	Weekly	Contractor Environmental Specialist	All intervened sites
Increased pressure on utilities (particularly				

water and energy). (-)				
Social conflicts (between University staff and students and construction workers) arising from presence of construction personnel on campus. (-)	Number of reported complaints/grievances	Monthly	Contractor Environmental Specialist	All intervened sites
Land 'take' which will prevent alternative uses, for example recreation (-).	Area cleared and utilised	Within 3 months of construction	Contractor	All intervened sites – workers' area, storage area, new parking sites

Specific Monitoring Activities for Operation Phase

During the operation phase, monthly monitoring of some critical parameters will be necessary, and will be the responsibility of the University of Guyana's Environmental Specialist. It is expected by the project that the consultant or UG staff appointed as ES during the construction period could become a permanent staff of the UG so he/she could continue supervising activities related to the operation phase.

The environmental impacts that will be monitored at the Campus include: generation of solid and hazardous waste, decreased water quality, generation of particulate matter, and health and safety risk. Other parameters may be included with the review of this EMP. The Environmental parameters to be monitored, frequency and responsible body are indicated in the Table 38.

Table 38 Monitoring Plan for the Operation Phase

Environmental Impact	**Monitoring Parameter**	**Sampling Frequency**	**Officer Responsible**	**Monitoring Location**
Operation				
Generation of solid waste by the students and staff due to their use and occupation of the facilities. This would include plastic, cardboard and	Quantity and type of waste Waste collection, storage and disposal methods	Monthly	Environmental Specialist UG	All intervened sites

paper. (-)				
Generation of sewage from the use of toilets will place increased pressure on the Campus' current non-functional sewage treatment system. (-)	Number of incidents of backup of or spills from the sewerage system	Monthly	Environmental Specialist	All intervened sites
Discharge of untreated sewage into the internal and surrounding drains on campus could lead to health risk to persons on campus and the surrounding communities. (-)	pH Turbidity levels Conductivity Total nitrates Total phosphorus BOD or COD Coliform	Quarterly	Environmental Specialist UG	At discharge points To be determined by the Environmental Specialist
Generation of solid waste from the packaging of equipment. This waste could include cardboard and plastic. (-)	Quantity and type of packaging Waste collection, storage and disposal methods	Monthly	Environmental Specialist UG	All intervened sites
Reduction in natural resources used in the manufacturing of the equipment. (-)	Number of suppliers who provide sustainable products, including recycled and energy efficient products.	Annually	Environmental Specialist UG	All intervened sites
Generation of solid waste and possibly hazardous waste when equipment becomes non-functional. (-)	Volume of hazardous waste Collection, storage and disposal of hazardous waste according to Hazardous Waste Management System	At the end of life of the equipment	Environmental Specialist UG	All intervened sites
Delivery of the purchased equipment to campus could cause local and global air pollution and global	Number of vehicles arriving CO_2 CO NOx	Upon arrival of delivery equipment	Environmental Specialist UG	All intervened sites

warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO_2, VOCs, particulates (PM10 and PM2.5). (-)	SO_2 VOCs PM10 PM2.5			
Generation of solid waste from the packaging of the material. (-)	Quantity and type of packaging Waste collection, storage and disposal methods	Monthly	Environmental Specialist UG	All intervened sites
Reduction in natural resources used to produce the materials (-)	Number of suppliers who provide sustainable products, including recycled and energy efficient products.	Annually	Environmental Specialist UG	All intervened sites
Delivery of the purchased equipment to campus could cause local and global air pollution and global warming due to vehicle exhaust emissions of CO_2, CO, NOx and SO2, VOCs, particulates (PM10 and PM2.5). (-)	Number of vehicles arriving CO_2 CO NOx SO_2 VOCs PM10 PM2.5	Upon arrival of delivery equipment	Environmental Specialist UG	All intervened sites
Generation of hazardous (infectious and non-infectious) waste from laboratory sessions. Infectious waste which may be either solid or liquid, and include but are not limited to discarded blood and blood specimens, sharps, unwanted	Volume of hazardous waste Collection, storage and disposal of hazardous waste according to Hazardous Waste Management System	Monthly	Environmental Specialist UG	All intervened sites

microbiological cultures and stocks, identifiable body parts, other human tissues, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids and laboratory waste that exhibit the characteristics described above. Non infectious waste would include chemical waste. (-)				
Generation of solid waste from use of the laboratories. Solid waste may consist of packaging material, (broken) glass. (-)	Quantity and type of packaging Waste collection, storage and disposal methods	Monthly	Environmental Specialist UG	All intervened sites
Emissions of gases from the use of fume cupboards could result in increased local air pollution and a decrease in local air quality. (-)	CO_2 CO NOx SO_2 VOCs PM10 PM2.5	Monthly	Environmental Specialist UG	All intervened sites
Release of toxic gases and infectious substances from experiments conducted within the laboratory into the air may results in a decrease in quality of air within the laboratory. (-)	Micro organisms and toxic gases To be decided by the Environmental Specialist UG	Monthly	Environmental Specialist UG	All intervened sites
Discharge of	pH	Quarterly	Environmental	At discharge

effluent from the laboratories may result in a deterioration of the quality of water in the surrounding drains. This is a potential threat to the ecosystem within the internal drains and those external to the campus. (-)	Turbidity levels Conductivity Total nitrates Total phosphorus BOD or COD Coliform		Specialist UG	points To be determined by the Environmental Specialist
Non adherence to laboratory safety practices could result in increased health and safety risk to the students and staff. This could be due to exposure to micro-biological infections, due to the presence of microbes, upper respiratory distress due to constant inhalation of chemicals, injuries from sharps, exposure to ionizing radiation. (-)	Number of incidents or accidents in the laboratory due to non adherence to safe laboratory practices	Weekly	Contractor Environmental Specialist UG	All intervened sites
With the provision of the new facilities on campus there is the possibility for theft (-)	Security features are in all facilities Number of theft incidents	Annually	Environmental Specialist UG	All intervened sites
Use of water for laboratory and sanitation activities could place an increased pressure on the resource and contribute to water resource depletion (-)	Volume of water consumed Water conservation measures implemented	Monthly	Environmental Specialist UG	All intervened sites
Use of	CO_2	Monthly	Environmental	All intervened

transportation to and from the campus could result in local and global air pollution and global warming due to vehicle exhaust emissions of CO_2 (cause global warming) CO, NOx and SO_2 (contribute to acidification), VOCs (contribute to the formation of ground level ozone, together with NO_2), PM10 and PM2.5 (cause a reduction in visibility). (-)	CO NOx SO_2 VOCs PM10 PM2.5		Specialist UG	sites
Emissions from vehicle exhausts can cause a decrease in the local air quality and therefore are likely to be harmful to human health of staff and students on campus. CO is toxic to humans, NO and NOx and SO_2 cause human respiratory problems, VOCs are toxic to humans and PM10 and PM2.5 particulates result in damage to human respiratory health. (-)	Number of complaints of illness by staff and students	Monthly	Environmental Specialist UG	All intervened sites

Mid Term Reviews and Closure Phases

As part of any World Bank Project, an evaluation of the project is performed at the middle of the project period and at the end of the project. The ES will be responsible to prepare in report for these evaluations periods in order to highlight main environmental and social challenges during project implementation, main results, products and pending issues to resolve. The ES will report about all project components and safeguards issues.

Some of the topics to be included in these reports are:

a. Compliance with the EMP, prepared for the project.

b. Issues arisen during project implementation in relation to the construction period

c. Issues arisen during project implementation in relation to the research program

d. Consultation, participation, the Grievance Mechanism and main claims posted by UG stakeholders if any.

e. Improvement in the UG of environmental management and maintenance facilities works.

f. Establishments of the Health, Safety and Environmental Management Guidelines at the UG

g. Capacity building activities achieved in relation to Health, Safety and environmental Management.

h. Any other topic important to report.

The World Bank will perform periodical supervision mission to the Project and will request reports to the ES about Project implementation.

9.5 Estimated Budget for Implementation of Mitigation and Monitoring Activities

The budget plan presented below in Table 39 provides information on (i) the key mitigation and monitoring activities to be implemented by contractor and (ii) the estimated budget that has been informed by desk review of the cost of similar actions, knowledge of the consultants, and consultation with engineers. The purpose of presenting this budget plan is to ensure that there are resources to implement the EMP .

Table 39 Budget Plan

Programme Activities (Mitigation and Monitoring)	**Project Phases of Implementation**	**Estimated Cost in USD**
Hiring of an ES for a period of 3 years	Pre-construction Construction Operation	36,000
Development of traffic management plan	Pre-construction	2,000
Development of training plan and implementation of training activities	Pre-construction Construction Operation	10,000
Purchase of health and safety equipment (helmets, safety masks, gloves, vests, caps, ear muffs, safety shoes, portable toilets and showers, first aid equipment, Portable Fire Extinguishers, etc.)	Pre-construction	50,000
Programme 3. Public Participation and Communication Plan		
Development of a Public Participation and Communication Plan	Pre-construction	3,000
Stakeholder Engagement/Participation workshops	Pre-construction Construction Operation	15,000
Establishment of a Communication Plan (using emails, websites, meetings, official communication channels of the UG) to inform the UG at large of work schedules and actions that could cause	Pre-construction Construction	30,000

environmental and social impacts.	Operation	
Establishment and maintenance of a web site that will contain the information of the Project, the EA, EMP, EMF and all safeguards instruments and project documents.	Pre-construction Construction Operation	18,000
Programme 4. Waste Management		
Placement of wastes bins and containers for each specific type of solid waste: paper-cartoon, glass (windows), metals (pipes, etc), electrical (old wires, etc), plastic (all types), wood (all types).	Pre-construction Construction	2,000
Intermittent spill training exercises for the contractors and UG staff and coordinate with the CEI training activities for the Contractor, Sub-Contractor, etc.	Construction	5,000
Collection of all this wastes in the designed containers and disposal of the wastes of in an area designated by the Authority (such as the EPA/Georgetown M&CC) or other site (the Haag Bosh landfill).	Operation Construction	3,000
Programme 6. Excavation activities		
Soil must be separated and cover with plastic to avoid soil runoff and contamination.	Pre-construction Construction	500

Programme 7. Restoration Plan All sites intervened by the contractor and construction works at the UG campus will be restored and re-vegetated. Excavations areas, drainage channels will be recovered and any solid waste sites if included in the campus (cement only) will be restored. Plant species that will be preferred for the restoration are native species.	Post –construction	15,000
Programme 10. Environmental Monitoring Plan		
Hiring of an ES for a period of 3 years	Pre-construction Construction Operation	36,000
Implementation of all activities covered under monitoring plan	Pre-construction Construction Operation	10,000
Estimated Total Cost		**235,500**

10. Stakeholder Consultation

10.1 Background

Under the Guyana Education Sector Improvement Project (P159519) funded by the World Bank, the Faculty of Health Sciences, University of Guyana is expected to benefit from the construction of a new building to support the Government in improving the learning environment for the Faculty. The proposed new facility is expected to have the capacity to accommodating 850 students. As a requirement for the Accreditation process by the Caribbean Accreditation Authority for Education in Medicine and other Health Professions (CAAM-HP), all classrooms must have adequate ventilation, proper lighting, comfortable seating, internet access to facilitate teaching, LCD projectors and computers and white boards. The Labs would include proper ventilation, trained laboratory staff and adequate relevant equipment. The proposed new building would be organized to respond to current and future teaching, research and services demands.

This report contains the results of a series of consultations with various groups of key stakeholders within and external to the University to apprise them about the project and to obtain their views on the likely impacts of the project on the University and the wider community, mitigation measures and other pertinent themes outlined in the group reports that follow. It is anticipated that the information collected will support the preparation and implementation of the Environmental Management Plan for the construction of the facility.

Consultations were held with staff and students from the Faculty of Health Sciences, Deans and staff of other Faculties, Senior Administrators, and representatives of the University of the University of Guyana Workers Union (UGWU). The Minister within the Ministry of Social Protection as well as representatives of the Environmental Protection Agency (EPA) and the Institute of Applied Science and Technology (IAST) were also consulted. Altogether, forty-eight (48) persons participated in the consultations (Refer to the Attendance Register in Appendix V). The consultations were done through face-to-face discussions and interviews and took place from October 31, 2016 to November 9, 2016. All of the sessions and interviews were conducted by Ms. Linda Johnson-Bhola (Faculty of Earth & Environmental Sciences) and Mr. Cecil Boston (Faculty of Health Sciences). The constricted period given for the completion of the consultations led to the restriction of each session to less than two hours.

10.2 Report on the Consultation with the Faculty of Health Sciences Staff

The session with staff of the Faculty of Health was held on Monday, October 31, 2016 from 09:00h in Room 4, Centre for Information Technology (CIT) (Refer to Appendix V for Register of Participants). Ten staff from the following Departments attended the session:

- School of Medicine
- School of Dentistry
- Department of Medical Technology (all programmes within)
- Department of Pharmacy
- Department of Public Health (all programmes within)

Benefits of the construction of a new building to the Faculty of Health Sciences and the University

Staff concurred that the proposed new facility for the FHS will help to address the issued related to the loss of accreditation from the CAAM-HP. They stressed the need for a 300-seater classroom and walls that can be adjusted manually to separate classrooms. Other needs include smaller classrooms and laboratories with adequate ventilation (AC or fans), proper lighting, comfortable seating, common rooms for lecturers and students, reliable internet access, LCD projectors and computers, white boards, and other relevant and up-to-date equipment to facilitate teaching, learning and research of high standard. The provision of the facility therefore will assist the Medical School to regain the status of a certified Division. Never-the-less, all departments could benefit from the facility.

Staff believed that once the accreditation is restored, it would be possible for the Faculty to extend some basic services to the wider University and surrounding communities that can help students to acquire hands-on experience on one hand, and assist the Faculty/University to acquire funds, on the other hand.

Most suitable site for the building

The group noted that having both buildings in close proximity to each other would allow for efficient use of resources by both students and staff.

Programmes the building should be designed to accommodate

While emphasis should be placed on the programmes in the Medical Technology Department, it was unanimously agreed that all programmes currently being offered should be accommodated in the new building. Staff members anticipate a fully equipped Anatomy and Physiology Laboratory which would serve Medical Students throughout their entire course of study, a Biochemistry Laboratory to facilitate effective teaching within the School of Medicine, a skills lab and a sterile room to serve all programmes would be provided.

Main issues that will have to be confronted and ways to address the issues

Many key issues were identified by the staff. The main ones included the following:

- Inaccessibility

If the building is constructed away from the existing structure that currently houses the FHS, there would be need for new access route/s. Importantly, the building should cater for the needs of a variety of users, including physically challenged individuals.

- Limited parking facility

It was felt that current parking facility is grossly inadequate for both staff and students and the projected increase in student population would demand additional parking space. One area suggested for parking was a portion of the play field.

- Unreliable power supply

Unreliable power supply from the national grid to the current Faculty's building was cited as a grave concern and one that will have implication for lighting, ventilation, power-sensitive laboratory equipment and other materials which will be accommodated in the new building. The use of solar energy to power the building was recommended.

- Lack of maintenance of the building

A common issue expressed was the lack of maintenance of the buildings across the campus. This point was noted in the context that is possible that the new building will be treated similarly.

The suggestion was to have competent staff/contractors to undertake maintenance works (painting etc.) at specific periods.

Current infrastructural issue - UG

- Classroom design

Staff noted that classrooms are not usually designed for "smart" teaching for the main reason being they were constructed decades ago and were never altered to suit changes in technology, student population and other critical factors.

In order to address this weakness, classrooms should be furnished with public address systems, both black and white boards and seating arrangements should be flexible. Internet should be accessible in the classrooms.

General recommendations

The following were recommended by staff:

- Shared office spaces for staff members, except for the Heads of Department and Deans
- All rooms should be sound-proof
- Buildings should cater for the projected increase in student and staff numbers
- Staff members should have a common room to relax and unwind
- There should be more entry and exist points for the new building as opposed to what currently exists at the CBJ building
- Fire points and exists should be clearly marked and adequately provided for safety

10.3 Report on the Consultation with the Faculty of Health Sciences Students and Representatives of the University of Guyana Students' Society

Two sessions were held with the students of the Faculty of Health Sciences and Representatives of the University of Guyana Student Society on Monday, October 31, 2016 from 11:00h and Thursday, November 3, 2016 from 13:30h in Room 4, Centre for Information Technology (CIT) (Refer to Appendix V for the Attendance Register). The UGSS President was consulted on Tuesday, November 8, 2016. Altogether twenty-one (21) students from the following Departments were present:

- School of Medicine (1st & 2nd year students)
- School of Dentistry (1st & 2nd year students)
- Department of Medical Technology (1st – 4th year students for all programmes within)
- Department of Pharmacy (1st – 4th year students for all programmes within)
- Department of Public Health (all programmes within)- (1st – 4th year students for all programmes within)

Benefits of the construction of a new building to the Faculty of Health Sciences and the University

All of the students echoed the sentiments of a modernized and well-equipped building to undertake laboratory exercises and to conduct research, as they felt this area is severely lacking and hinders their understanding of concepts and limit the acquisition of skills. They anticipate that there would be adequate classroom space and a common room to accommodate the growing student population. This would reduce dependence on the limited number of classrooms available for lectures, laboratory work, examinations and social events.

Students shared the view that some peers from the Faculties of Agriculture and Forestry and Natural Sciences benefit from the facilities in the Faculty of Health Sciences since they register for some courses offered there. They opined that the Faculty can provide some basic services to the wider University and surrounding communities for students to acquire practical experience and become less reliant on the Georgetown Public Hospital facilities. Services such as dental cleaning and blood pressure testing can be offered.

Most suitable site for the building

Two areas were identified by the students for the construction of the facility: one on the available space west of the Faculty of Health Sciences building (between the Book Store and the existing FHS building) and the other west of the university (close to the CBJ building). The first site was considered bearing in mind accessibility to both buildings while the latter was suggested based on the desire to integrate with the wider university. Students strongly recommended that the location selected should have adequate space to facilitate expansion and the use of green energy. It was noted that the GPL grid could become overloaded with the addition of a new building that will require a lot of power.

Programmes the building should be designed to accommodate

They agreed that the building should be designed to accommodate all programmes being offered by the Faculty but emphasis should be on the Medical School since it is understood that the accreditation process requires a fully functional facility that satisfies the CAAM-HP requirements.

Main issues that could be to be confronted and proposed measures to address the issues

The main issues identified by the students are the following:

- Insecurity

Students suggested that burglar bars and doors be used to fortify each classroom and to provide a sense of security to students who are desirous of late night studying or attend late classes.

- Flooding

Students recalled hearing about the different flooding episodes which affected the current buildings, in which books and other materials were destroyed. They suggested that the building be raised or placed on stilts to prevent damages to the infrastructure and all contained therein.

- Limited parking facility

Parking for both staff and students would have to be addressed if the student and staff population increases and if basic health services will be offered to the wider community. Parking close to the new building was suggested.

- Unreliable power supply

Students complained about the constant disruption of power while conducting experiments, making presentations or studying in small groups. They suggested adequate and efficient alternative power supply in the form of solar energy to prevent frequent power shortages.

- Sewage disposal

Concern was raised regarding the inadequate lavatory facilities in the current Faculty building. Students noted that it is a serious issue which must be addressed in the new building. They suggested that the student population should be used as the benchmark for determining the number of lavatory rooms that should be available.

General recommendations

The following were recommended:

- The new building should be aligned with the University's Development Plan
- Windows and doors for the new building be grilled and have the grills cleaned regularly to prevent respiratory problems
- The building should be designed to facilitate physically challenged persons
- Lockers should be provided for students
- Cost for maintaining the building should be considered
- Laboratory must be equipped with modern facilities and updated specimens to aid teaching and learning
- Determine the best possible security measure to avoid theft of the new equipment. Alternatively, CCTV cameras should be placed in the new building

10.4 Report on the Consultation with the Deans and other Representatives of the Faculties

Two consultations with Faculty Representatives took place on November 4, 2016 at the Faculties of Social Sciences and Technology from 09:00h and 11:30 h respectively. The seven (7) persons who participated in the sessions represented the following Faculties:

- Faculty of Social Sciences
- Faculty of Education & Humanities
- Faculty of Natural Sciences
- Faculty of Social Sciences

Benefits of the construction of a new building to the Faculty of Health Sciences and the University

Faculty recognized that the building will accommodate up-to-date laboratory facilities required to promote research that will benefit the nation. They noted that such facilities would strengthen the delivery of courses such as Biochemistry, Anatomy and Physiology. Using modern facilities, the building will reduce UG's dependence on the provision of electricity by the public utility company.

Some staff believed that the Faculty and the University by extension would become less dependent on services provided by the Ministry of Public Health. However, there will still be the need for collaboration.

Most suitable site for the building

Staff recognized that many sites are available for the construction of the building but the most suitable one would facilitate expansion. They noted that space is available west of the campus, east of the current Faculty of Health Sciences building (south of IAST) and the eastern section of the play ground. Each of the sites will require development before actual construction could be facilitated. For example, the space identified east of the Faculty would require an access road from the UG road to the site and the areas on the play field would need to be elevated because it floods very easily. Staff also stressed the need for the facility to fall with UG's Development Plan.

Programmes the building should be designed to accommodate

While emphasis should be placed on the programmes in the Medical Technology Department, the building should cater for other existing programmes within the Faculty. Faculty could build on the existing ones, market them aggressively when the building becomes operationalised and try to attract local and overseas clientele.

Main issues that will have to be confronted and proposed measures to address the issues

Many key issues were identified by the staff. The main ones include the following:

- Storage for chemicals

Staff noted that separate storage space/facility for chemicals and laboratory materials should be addressed since the Faculty uses various types of chemicals for different purposes.

- Inadequate parking for students and staff

It was felt that lack of parking facilities will add to the issue of parking for increased numbers of staff and students. Staff noted that with the construction of a new building there will be increased traffic on campus and as such adequate facilities for separate parking should be put in place. It was suggested that a parking system where individuals pay for space should be instituted.

- Unreliable power supply

Unreliable power supply from the national grid to the current building was cited as a concern and one that will have implication for lighting, ventilation and for the power-sensitive laboratory equipment and other materials which will be accommodated in the building.

The use of solar energy to power the building was recommended. It was further suggested that the design of the building should foster efficient cooling and ventilation. To facilitate this, a centralized cooling system was suggested. Another possible source of electricity is from Gift Land, which is situated west of the campus and known to produce its own electricity.

- Drainage

Staff noted that adequate drainage and irrigation systems should be put in place to avoid overloading the current and outdated drainage infrastructure. The building should have its own.

- Termites

It was recognised that termite infestation is a problem affecting the buildings on the campus. To deal with this issue, it was recommended that the soil on and around the campus be treated.

- Sewage disposal

Staff stated that the sewage system at the University is approximately 30 - 50 years old. A main concern was whether the sewage system for the new building would be linked to the current system without having any negative impacts. The system is already compromised. One suggestion was for the building to have a sewage system separate and independent of UG's current one but it should be done in such a manner that facilitates inter-linkage with UG system which will have to be built at some point.

Current weaknesses in infrastructure at UG

- Design of buildings

Some of the older buildings do not have facilities for persons who are differently able. For example, two storey buildings do not have lifts.

- Dry walls

Staff stressed the issue of dry walls in the old and new buildings at the University.

Suggestions for avoiding the weaknesses in infrastructure at UG

- Special attention should be given to facilities such as elevators to cater for the physically challenged users
- Do not use dry wall because the material is inferior, not sound proof and reduces privacy

Recommendations

The following were recommended:

- The conceptual design of the building should be opened to facilitate entries from various architects/designers (including students), presented at public forums, then the best should be selected. The design should be driven by the need to handle specialized classrooms, laboratories and other conveniences.
- Staff from the Faculty of Health Sciences should be integrally involvement in all phases of the project, including the design phase. This would prevent errors in the design for example, since they know what is specifically required for teaching and learning in the medical field.
- Staff and students should have separate common rooms as it is felt that the conditions under which they work and study are unfit by any standard
- The provision of recreational facilities for students should be a key consideration
- Elevators should be provided
- Roof should be designed to facilitate solar energy and rain water harvesting in order to maximize on natural source of light and water
- A water purification system should be provided for the faculty
- Louvre windows should not be used
- Chemical should be stored away from the building

10.5 Report on the Consultation with Representatives of the Bursary, Personnel Division and Maintenance Division

A session was held with the representatives on November 2, 2016 from 11:30h in the Office of the Bursar. Present were the Bursar, the Personnel Officer and the Supplies and Logistics Officer. The Director of Facilities Maintenance was interviewed on November 8, 2016.

Benefits of the construction of a new building to the Faculty of Health Sciences and the University as whole

It is expected that the building will accommodate up-to-date laboratory facilities. Staff noted that such facilities would strengthen the delivery of courses such as Biochemistry, Anatomy and Physiology.

Most suitable site for the building

The facility should be in close proximity to the existing building so as to facilitate sharing or resources. The participants also stated that if the building is constructed away from the existing structure that houses the FHS, there would be need for new access route/s.

Programmes the building should be designed to accommodate

While emphasis should be placed on the programmes in the Medical Technology Department, it was noted that other programmes currently being offered should be accommodated in the new building.

Main issues that will have to be confronted and proposed measures to address the issues

Many key issues were identified by the staff. The main ones include the following:

- Traditional building design

The staff emphasized that traditional design of buildings (esp. on campus) does not necessarily guard against the effects of climate change. Hence, the new building should be a model which could influence the design of future buildings. The major concern is whether the new building would be utilizing an alternative source of energy such as solar. They suggested that "smart" classrooms are required, catering for teaching space, examinations, beds and other facilities to perform physical examinations in the Medical School, for instance.

- Inaccessibility

It was emphasized that the building should cater for the needs of a variety of users, including the differently able. It was suggested that ramps and elevators are provided for such needs.

- Inadequate parking for students and staff

It was felt that the lack of parking facilities will add to the issue of parking for increased number of staff and students. Further, if the Faculty begins to offer basic services to the surrounding communities, the current parking facility would be grossly inadequate. Areas suggested for parking include a portion of the play field and close to the new building.

- Unreliable power supply

Unreliable power supply from the national grid to the Faculty's building was cited as a concern and one that will have implication for lighting, ventilation and for the power-sensitive laboratory equipment and other materials which will be accommodated in the building. The use of solar energy to power the building and back-up generators were recommended. The building should have its own transformer.

- Safety and security

The staff noted that security is an issue on campus and with the new building being fully equipped with modern facilities the need to guard against fire becomes very important. It was recommended that a sprinkler system should be in place in the case of such incident. Addition able-bodied security personnel should be recruited to provide additional support.

- Sewage

It was noted that the sewage system at the University is approximately 30 to 50 years old. A main concern was whether the sewage system for the new building would be linked to the current system without having any negative impacts. The system is already compromised. One suggestion was for the building to have a sewage system independent of UG's current one but it should be done in such a manner that facilitates inter-linkage to UG system in the future.

- Maintenance of new facility

It was stressed that the maintenance department is not fully equipped to handle additional work. It was suggested that more staff be recruited to provide critical support

Current weaknesses in infrastructure at UG

- Classrooms

Classrooms were not designed for "smart" teaching for the main reason that they were constructed decades ago and were never altered to suit changes in technology.

Suggestions for avoiding the weaknesses in infrastructure at UG

- Classrooms should be well constructed with adequate space, they must have proper furniture, and seating arrangements should be flexible to accommodate different shapes and sizes of relevant furniture.

Recommendations

The following were recommended:

- Special attention should be given to facilities for the physically challenged individuals
- Staff from the Faculty of Health Sciences should be integrally involvement in all phases of the project, including the design phase. The design must be compatible with the requirements of the medical programmes
- Staff and students should have separate social area as it is felt that the conditions under which students and staff work and socialize are unfit by any standard
- The provision of recreational facilities for students should be a key consideration
- There should be greater scrutiny of the construction work during the execution phase to ensure work is done according to the contractual agreement
- The building should be integrated in the University's development plan

10.6 Report on the Consultation with the Registrar and Deputy Vice-Chancellor, Academic Engagement

Interviews with the Registrar and the Deputy Vice-Chancellor- Academic Engagement were held on Friday, November 4, 2016 from 10: 35 hrs and Monday, November 7, 2016 respectively at the University of Guyana.

Benefits of the construction of a new building to the Faculty of Health Sciences and the University as whole

The interviewees noted that it is imperative for the Medical programmes offered through the FHS to be subjected to the accreditation process by CAM-HP. This is to ensure that the programmes meet international standards that permit graduates to have mobility of labour within Caricom. Modern amenities, inclusive of a library, that satisfy international criteria are key requirements for accreditation of any programme. Currently the learning environment does not provide opportunities for accreditation. Hence, the provision of a new facility would place the School of Medicine in a position for it to be re-accredited as well as advance the credibility of the University.

Most suitable site for the building

It was suggested that the building be constructed in an area where certain criteria are met. The following criteria were identified:

- Easy access to site and connection to other existing facilities
- Safe and secured area for staff, students and clinical data
- Open space for possible physical expansion
- Availability of adequate water supply
- Availability of proper drainage and irrigation systems

The building should also cater for possible expansion of new programmes and it should be designed to reflect “green” architecture to ensure compatibility with the environment and in recognition of the treaties to which Guyana is a signatory.

Two suggestions were presented. Firstly, the facility should be constructed on a portion of the play field (close to the NBS building/dormitory). In this way it could attract foreign students who can easily relate to the ambience provided by the NBS build/dormitory. Secondly, it could be integrated with the UG

Medical Centre to allow for the practical application of teaching e.g. emergency medicine is being taught but this is not often practically experience on campus.

Programmes the building should be designed to accommodate

While emphasis should be placed on the existing programmes in the Medical School, it was noted that there should be an assessment of current programmes to determine if they address the critical training needs and whether there is need to promote more research to support affiliate programmes. This would provide opportunities for integration of the medical programmes offered in the faculty as well as collaboration with research intuitions locally and abroad to address medical issues such as cancer. The programmes should also provide opportunities for on-the-spot practical applications or mini clinics.

Main issues that will have to be confronted and proposed measures to address the issues

Many key issues were identified by the staff. The main ones include the following:

- Noise

The level of noise around campus especially when construction is underway and weeding takes place affects the teaching/learning process.

Sound proof rooms should be constructed to address this issue.

- Drainage and Access to water

It was recognized that drainage and access to water are central to the construction process. It was suggested that the new building should have independent drainage facility and water system.

- Waste disposal

The issue of solid and liquid waste disposal is a recurrent one and it needs to be addressed for the new facility. It was noted that the sewage system at the University is dated and can become compromised if additional stress is placed on it. It was further noted that sensors should be installed on all lavatory facilities such as the doors and sanitizers to preserve health and sanitation.

- Information and Communication Technology (ICT)

Staff noted the issue regarding internet access across the campus. They stressed the importance of having the ICT Department determine the IT needs for the new facility, especially regarding access to online materials.

- Inadequate parking for students and staff

Parking would also be an issue when the new building is erected and dedicated parking space should be available for both student and staff to prevent incidents where students park in spaces allocated for staff. There must be clearly marked signs and barricades.

- Power failures

It was agreed that since the new thrust for Guyana is a "green economy", predictable energy in the form of solar energy could help to eradicate the constant power interruptions. Unreliable power supply from the national grid to the Faculty's building was cited as a concern and one that will have implication for lighting, ventilation and for the power-sensitive laboratory equipment and other materials which will be accommodated in the building. The use of solar energy to power the building and back-up generators were recommended. The building should have its own transformer.

Current weaknesses in infrastructure at UG

- Building design

It was recognized that buildings are constructed haphazardly; going higher without consideration for the physically challenged campus users.

Suggestions for avoiding the weaknesses in infrastructure at UG

- Attitudinal change with respect to the recognizing the rights of individual and building regulations

Recommendations

The following were recommended:

- Special attention should be given to facilities for the differently able
- UG's energy policy needs to be updated to provide guidance with respect to greening the environment
- The new building should be integrated in the University's development plan which address the enhancement of the teaching/learning environment

10.7 Report on the Consultation with Representatives from the Ministry of Social Protection, the Environmental Protection Agency (EPA) and the Institute of Applied Science & Technology (IAST)

Interviews with the Representatives of IAST and EPA and the Minister within the Ministry of Social Protection took place on Monday, November 7 and Wednesday November 9, 2016.

Benefits of the construction of a new building

All of the interviewees concurred that the addition of a new building is welcomed and that the facility would eventually have a tremendous impact on the learning capability of students. Adequate number of well-furnished classrooms would provide appropriate environment for students to learn. It will also

provide a step closer to re-accreditation of the Medical programmes. The new facility will enhance the university's image.

It was suggested that the facility should be constructed where there is adequate space to accommodate staff, students and other users. South of the CIT was identified for the site of the building. Additionally, the building should be futuristic to inspire students and staff and to help them to reveal their potential and creativity.

The interviewees stated that the building should be designed to accommodate the medical, public health, pharmacy and environmental science programmes but the facility can also be used for cross-faculty courses.

Key considerations

- Dust from the construction site. Dust nets can be used to address this issue
- Construction noise during class hours (Building site will greatly influence this factor)
- Designated and adequate first aid space, sprinklers, fire extinguishers and fire buckets
- Adequate parking facilities for both student and staff. This can be provided on the ground floor of the building
- Provision of adequate facilities for physically challenged persons, example ramps and elevators
- Adequate funds being released on time for each phase of construction
- Co- ordination of construction activities

Recommendations for the new building

- Adequate ventilation must be provided
- Modern technology should be incorporated in the roof and windows design
- Use other durable materials for the roof, other that zinc

10.8 Report on the Consultation with the Representative of the University of Guyana Workers' Union (UGWU)

An interview was conducted with the President of the UGWU on November 9, 2016 from 18:00h.

Benefits of the construction of a new building to the Faculty of Health Sciences and the University as whole

The representative recognized that the new building will complement the existing one and once it is fully equipped with the relevant facilities, the quality of teaching, learning and research would improve.

Most suitable site for the building

It was felt that the building should be sited downwind west of CBJ. The considerations here are the availability of space and wind direction. Since chemicals and other hazardous materials will be stored and used in the building bio- and chemical hazards must be key considerations. Staff also stressed the need for the facility to be incorporated in the UG's Development Plan.

Main issues that will have to be confronted and proposed measures to address the issues

Many key issues were identified by the staff. The main ones include the following:

- Storage for hazardous chemicals

Staff noted that the need for separate storage spaces/facilities for chemicals and laboratory materials has to be addressed. Staff and students must be adequately trained about how to handle, store and use the materials as well as adhere to the protocols and safeguards associated with the chemicals.

- Inadequate parking for students and staff

It was felt that lack of parking facilities will add to the issue of parking for increased number of staff and students. Staff noted that with the construction of a new building there will be increased traffic on campus and as such adequate facilities for separate parking for staff and students should be put in place.

- Unreliable power supply

To avoid the issue of constant blackout, the building should have an independent solar power grid backed up by a hybrid standby system powered by solar energy or by GPL.

- Drainage

Staff noted that adequate drainage should be put in place to avoid overloading the current and outdated drainage infrastructure.

Current weaknesses in infrastructure at UG

- Buildings are not energy efficient. Hence special consideration should be made to ensure the new building is "green"
- The design of the buildings does not facilitate quick response
- Buildings are constructed without taking flooding into consideration

Recommendations

The following were recommended:

- The facilities provided in the new building should provide comfort to the users.
- Communication system must be of high quality and readily available especially in cases of emergencies
- The design of the building should provide for quick response
- Some rooms would have to be constructed in such a way to prevent

- Evacuation plans must be available for emergencies
- Architects must consider design protocols
- Some rooms must be designed to isolate hazardous materials but simultaneously provide access to the rooms

10.9 Conclusions from Consultations

The report illustrates that all stakeholders recognised the importance of having a modern and full-furnished building to support the programmes offered in the Medical School and related Departments. Reaccreditation of the School was cited as the central and most important benefit that the Faculty and the University will derive from the construction of the building. Various sites were identified for the building but stakeholders emphasized the need to be cognizant of some environmental and structural issues that can impact the site and situation of the new building. These include flooding, sewage disposal, inadequate drainage, unreliable power supply, dry walls, lack of facilities for physically challenged individuals, and limited space for access and egress. A range of recommendations related to occupational safety and health were put forward to ensure that a safe, secure and comfortable teaching-learning and research environment is provided.

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Appendix I

Garbage Filled and incomplete drains

Low hanging wires close to the Faculty building and adjoining building

Unsanitary toilet and partially decaying septic system

Leaking Air Conditioning Units

Empty Fire Extinguisher Holder

Appendix II

Table 40 Lists of Chemicals currently stored by the FHS

Glass Jars and bottles (small > 300 ml)	
BACL 2	Tri-Butyl. Amine
Calcium Oxide	Sodium Sulphate
Bismuth Sub Carbonate	Pulv. Phthalylsulphathiazole
Suplhur Powder	Azorubrum
Pot. Dichrom. Cryst.	Potassium Chloride
Chloroxylenol	Silicon Dioxide
Pulv. Chrloromyletin	Sodium carbonate anhydrous
Iodoform (x2)	Ammoniated Mercury
Bismuth. Subgallate	Potassium Audtart
Potassium Nitrate	Creta Gall
Phenolphthalein	Tr. Gentco (x2)
Sodium Sulphate	Mercuric Chloride
Sodium lauryl	Ammoniated Mercury
Creta Prep	Sodium Sulphide
Sulphanlic Acid	Bism. Saliculate
Acetic Acid	Azorubrum
Pot. Chlorate	Bismuth.Submit
Pot. Bic	Potassium Iodate
Borax	Sodium Thiosulphate
Bismuths-alicyclate	Pathsol in Methonol
Mercurous Chloride	Cresol
Arseni Trioxide	Bacto saccharose

Light Naolin (x2)	0.1m Sodium Hydroxide
Pulv. Rhei	Citric Acid
Tinct .Nux. Vomica (x3)	Talc
5% NAOH	CaCL2
Sod. Metabisulphite	0.5 %Ponleaus in 2% Trichloracetic acid
5 % Sod. Bicarbonate	Conc. Gentian .Infusion .Compound
Saliciyclic Acid	Quinolin
Alumin .Hydrox. Gelat	Creta Prep B.P
Tr. Digitalis	Tr .Camph. Co.
Tincture Scillae	Bentonite
Tr. Myrrh	Tinct Auranti
Sat, Aqueous Ammonium Oxalate	Creosote
Chenopodium oil	Yellow Mercury Oxide
Liq. Ammon Acet. Ft	Beef Extract
Oceic Acid (x2)	Tetrachloroethylene B.P
Conc Gentian	Chlorocresol
	Hyocyamus Tincture

Glass Jars(250ml)	
Amethocain.Hyd	20% Sulphosalicyli
Oleum.Myristic. AE	10% Foric Acid
Laltophenol	Lactic Acid
Benzaldehide	Oxalic Acid
Nitric Acid	Strong lead subacetate
Annaline Blue	Potassium Bicarbonate
Acetic Acid	Code Oil
N-Butyl Alcohol	Sodium Benzoate
2-Methyl Propan-1-nol	Picric. Acid .Sat.
Ammonium Hydroxide Dil (x2)	
Glass Jars(500ml)	
Lactic Acid	RPC Diluting Fluid
Quartz	4M Piricac
1% Barium Chloride	Anise Waterdiluted
1% Oleic Acid	Soln. Cuzam. Reagent
Nitrous Ether Spirit	2% HCL
Juniper Oil B.P.L	Bellandonna Tincture
Chloroform spirit	Sulphuric Acid 10%
Sulphite Rinse	Potassium Terro Cyanide
1.0 Perchloric Acid	20% Sulphuric acid
STD. Ammonium. Chloride .Sol	Buta-2-ol
Nitrobenzene	Oxalic Acid
Acetalaldehyde	Phosphate Buffer
90% Alcohol	Cyclohexene
Glass Jars(1L)	**Large Bottles**

Tinct Aconite	Tri-potassium citrate
Sodium Benzoate	Potassium Bicarbonate (500mL)
Chalk	Potassium Chloride
Potassium Chlorate	Benzoic Acid Sol (1 L)
	Potassium Chloride
Small Bottles	Caffeine
Bacto – Phenolphthal	Zinloxxide
Planolain	
Dodeca - Tungstophosphoric acid	**Windchester Bottles (2L)**
Mercury oxide (red)	Carbon tetra Chloride
Sulphuric Acid 10%	Acealdehyde
Acid Hydrocycenric Oil	Collodio (flexible)
	Ligroin (x2)
Unknown	Charcoal decoding powder
250 ml jars	Benzene
47 windchester bottles	Ortho phosphoric acid
14 unknown bottles	Sulphur acid
39 unknown jars / small bottles	Talc (firepowder)
9 Boxes (179 small to medium bottles)	Tincture Stramonil
	Liquid Paraffin
Box No. 10	Ammonium Acetate Fortified
Bottles	Barbitone
Calcium Hypochlorite (x2)	Cetovacrogol
Sodium Thiophate (x2)	
Tins	
Lanolin Hydrous	
Chromium Trioxide	
Potassium Iodide	
Ferric Ammonium Citrate (x2)	
Thenacetin 1 Kg	

Appendix III

United States National Ambient Air Quality Standards (NAAQS)

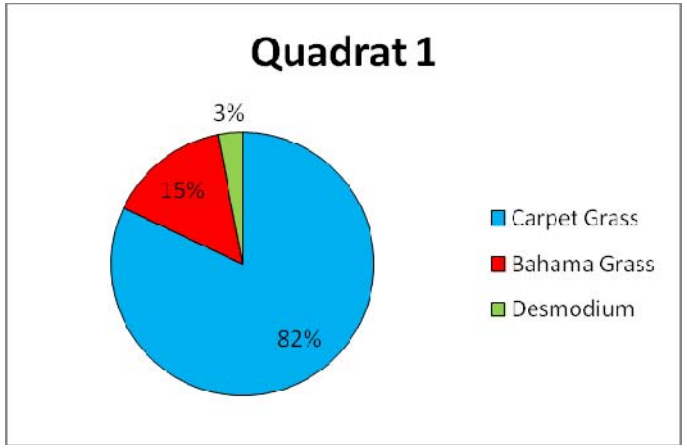
Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

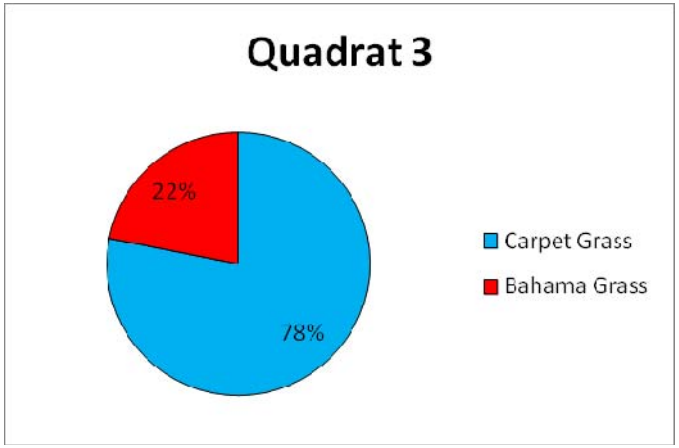
Table 41 Sound Pressure Level (SPL) Survey

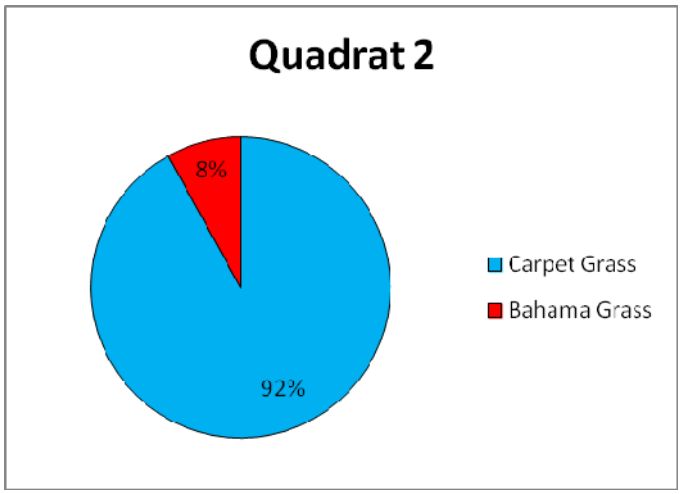
Sample Points	Date	Time	Maximum SPL (dB)	Average SPL (dB)	Minimum SPL (dB)
0m	November 7, 2016	a.m.	72	35	27
25m		a.m.	74	38	32
50m		a.m.	74	41	35
75m		a.m.	75	40	41
100m		a.m.	78	40	39
0m	November 9, 2016	a.m.	69	42	31
25m		a.m.	71	50	32
50m		a.m.	71	48	36
75m		a.m.	70	52	41
100m		a.m.	69	52	43
0m	November 11, 2016	a.m.	70	42	40
25m		a.m.	69	46	35
50m		a.m.	70	48	36
75m		a.m.	70	45	40
100m		a.m.	72	43	43
0m	November 7, 2016	p.m.	84	52	35
25m		p.m.	82	61	60
50m		p.m.	76	52	59
75m		p.m.	82	60	56
100m		p.m.	81	57	60
0m	November 9, 2016	p.m.	79	58	59
25m		p.m.	81	55	52
50m		p.m.	82	54	52
75m		p.m.	81	64	57
100m		p.m.	83	64	58
0m	November 11, 2016	p.m.	83	58	49
25m		p.m.	80	54	50
50m		p.m.	83	53	50
75m		p.m.	80	56	49
100m		p.m.	82	58	49

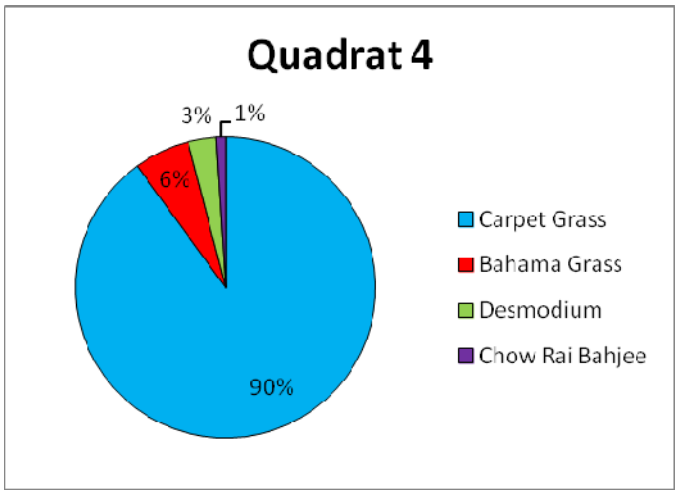
Appendix IV

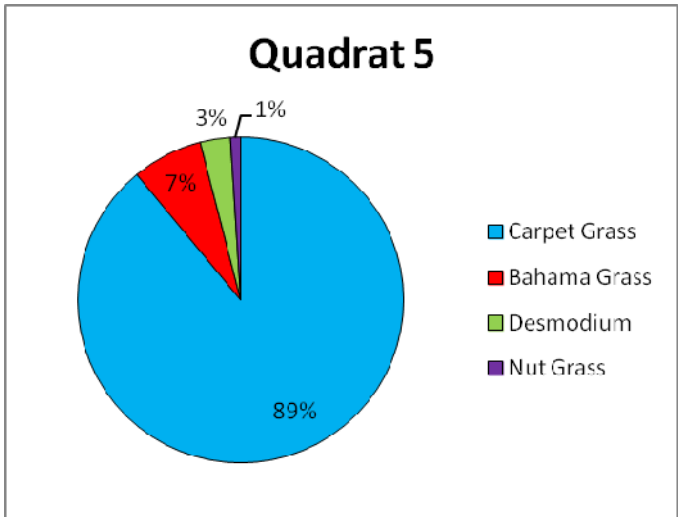
Dry Zone

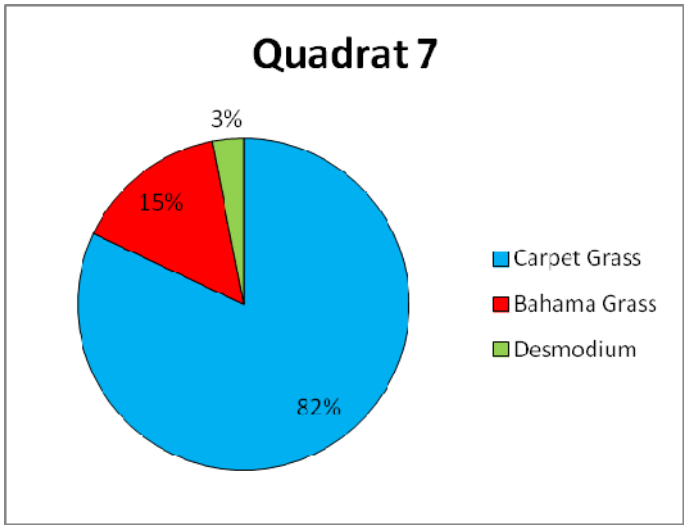


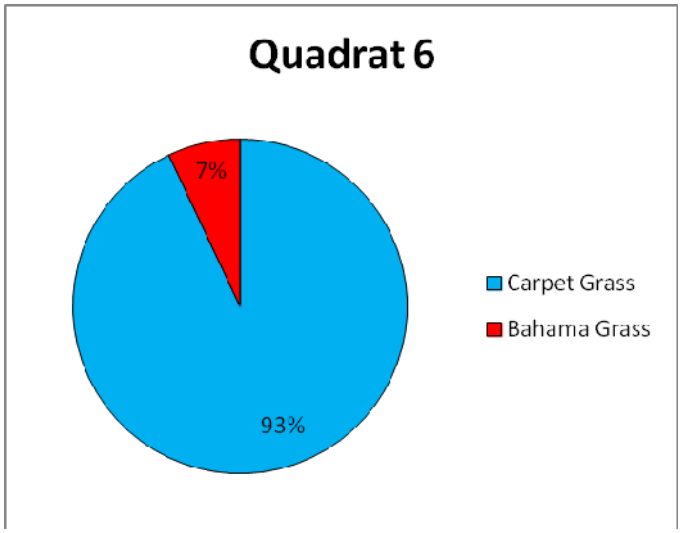


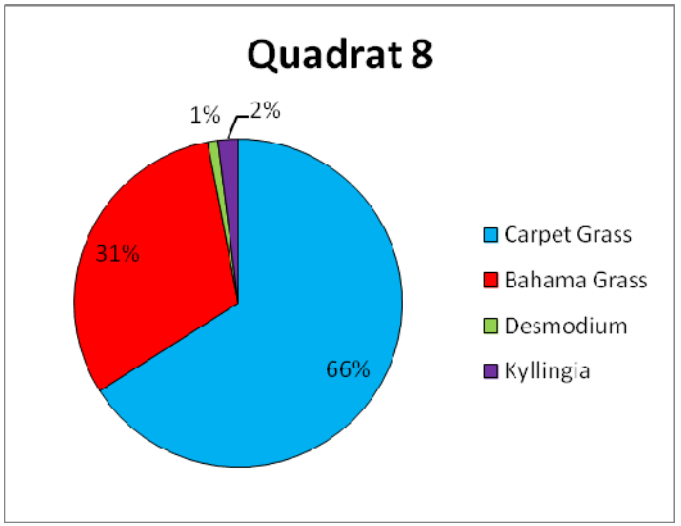


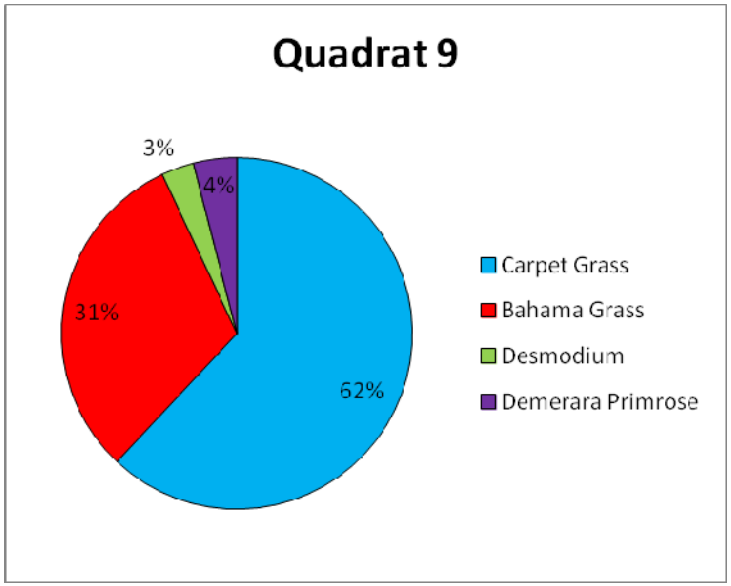



Quadrat 5
3%
1%
7%
89%
Carpet Grass
Bahama Grass
Desmodium
Nut Grass

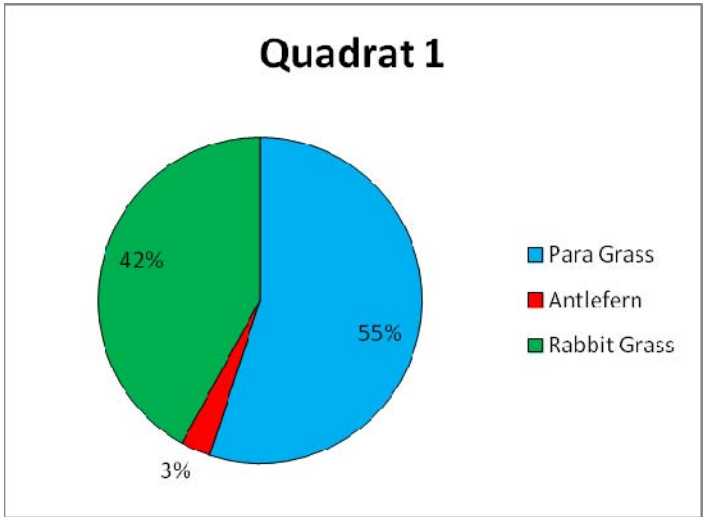

Quadrat 7
3%
15%
82%
Carpet Grass
Bahama Grass
Desmodium

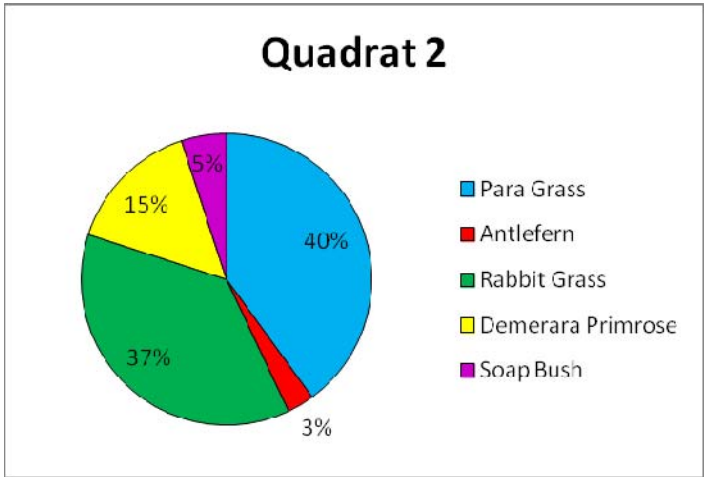

Quadrat 6
7%
93%
Carpet Grass
Bahama Grass

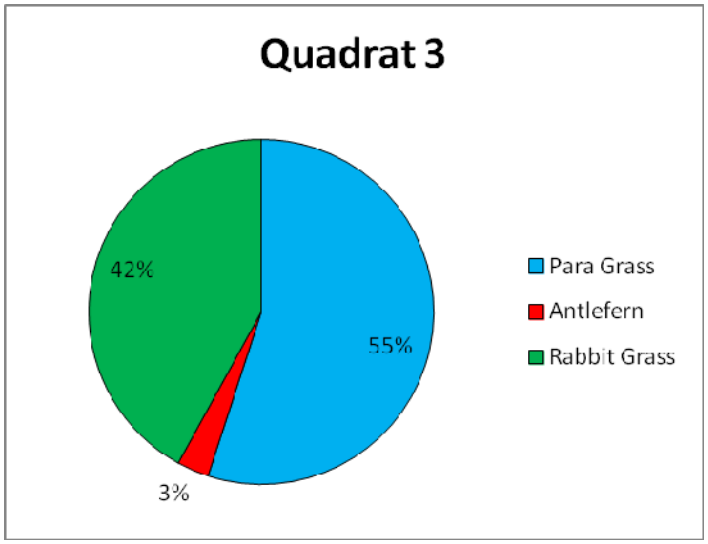

Quadrat 8
1%
2%
31%
66%
Carpet Grass
Bahama Grass
Desmodium
Kyllingia


Quadrat 9
3%
4%
31%
62%
Carpet Grass
Bahama Grass
Desmodium
Demerara Primrose

Wet Zone


Quadrat 1
42%
55%
3%
Para Grass
Antlefern
Rabbit Grass


Quadrat 2
5%
15%
40%
37%
3%
Para Grass
Antlefern
Rabbit Grass
Demerara Primrose
Soap Bush


Quadrat 3
42%
55%
3%
Para Grass
Antlefern
Rabbit Grass

Appendix V

Register of Participants for Focus Group Meetings

UNIVERSITY OF GUYANA
FACULTY OF EARTH AND ENVIRONMENTAL SCIENCES

REGISTRATION FORM FOR FOCUS GROUP MEETING
ENVIRONMENTAL ASSESSMENT/ENVIRONMENTAL MANAGEMENT PLAN

FACULTY OF HEALTH SCIENCES STAFF 2016-10-31

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UNIVERSITY OF GUYANA
FACULTY OF EARTH AND ENVIRONMENTAL SCIENCES

REGISTRATION FORM FOR FOCUS GROUP MEETING
ENVIRONMENTAL ASSESSMENT/ENVIRONMENTAL MANAGEMENT PLAN

DEANS & REPS 04/11/2016

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8.	Sharon Roopchand-Edwards			

PERSONNEL + BURSARY 02/11/2016

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Min. of Labour + EPA + IAST 2016-11-07

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2.				

UNIVERSITY OF GUYANA
FACULTY OF EARTH AND ENVIRONMENTAL SCIENCES

REGISTRATION FORM FOR FOCUS GROUP MEETING
ENVIRONMENTAL ASSESSMENT/ENVIRONMENTAL MANAGEMENT PLAN

STUDENT REPS – 03/11/2016

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Appendix VI

Pictures from Public Consultations

Appendix VII

Environmental Specialist Profile

The PIU will contract an expert on environmental management to be responsible of the overall environmental and social management of the project. This person will be selected by an open competition and the position make public in the UG, MOE websites to increase the chances of selecting the appropriate consultant for this position.

The Environmental Specialist will report to the UG Project Coordinator.

- Specific Tasks
- The specific tasks of the Environmental Specialist are:
- Supervise the overall environmental and social management of the project and its subcomponents. Provide guidance, support and orientation to increase environmental and social good practice and improve UG Environmental Management.
- Coordinate closely with the UG Technical –coordination Unit and the PIU at MOE anything related to the environmental, social aspects of the project, supervision, monitoring, consultations, stakeholders involvement, participation in project development in order to reduce environmental and social impacts.
- Interact with UG representatives, faculty, students, other stakeholders to maintain a clear dialogue between the project and the UG stakeholders.
- Provide support in preparation of the Environmental Section of the Operations Manual based on the Project's established environmental safeguards instruments (EA, EMP, EMF, IPP) and the World Bank's Safeguards Policies and guidelines.
- Prepare and review terms of reference for contracting environmental studies defined in the Project documents to increase UG environmental management and research development (Hazard assessment, Laboratory guidelines, waste management plan and manuals, Biodiversity Center, feasibility studies, etc).
- Participate in training workshops for use of Operations Manual under the program.
- Provide support in reviewing the Project bidding Documents, Direct Contracts, etc. to ensure the proper environmental and social management of the project by contractors.
- Maintain dialogue and report about the project advances and overall development to the UG community, local stakeholders, national agencies, collaborators, etc.

- Supervise contractors during construction and rehabilitation works and monitor compliance to the EA, EMP and EMF, Guyana National Legislation and the World Bank Safeguards policies.
- Monitor timely environmental and social performance of the project, contractors and subcontracts and other parties.
- Develop capacity building activities to increase environmental management capacity of contractors and UG counterparts.

Qualifications

The Environmental specialist should have the following qualifications:

a) A degree in Environmental Management, Environmental Engineering, Biology, Ecology or related field.
b) At least five years of experience in Environmental impact assessment of civil works and as environmental inspector and coordinator of environmental management plan.
c) The professional should have strong experience also as researcher in Guyana.
d) Must have knowledge and experience in the Guyana environmental regulations and permitting processes (both civil works, biodiversity research) in different agencies (EPA, Forestry commission, etc).
e) Demonstrated ability to work in teams and have leadership skills.
f) Fluency in English and good communication and writing skills.
g) Must be an organized person to keep track of different project activities and components.

Time frame

The Environmental specialist will be recruited for the total period of the project. He/she will be hired at least six month before the bidding process is launched.

Appendix VIII

ENVIRONMENTAL DATA SHEET -	**EDS -1- Safety and Prevention**
Date:	
Site Inspected:	
Environmental Specialist:	**Signature:**
Objective	
Avoid conflicts with the population and ensure the safe movement people and vehicles and machinery.	
Actions creating impacts in the area	
- Traffic control or rerouting. - Movement of construction materials and contractor's vehicles	
Impacts to prevent	
- car accidents - discomfort with UG population - discomfort with UG neighbors	
Influence area of the impacts	
- The UG campus. - Public roads connecting UG campus with Georgetown, disposal sites, material purchase sites, etc.	

Measures to supervise	**Compliance YES - NO**
• Training activities to drivers by the ES of the Contractor about health, safety (speed limits, etc.) and the EMP	
• Parking lots for the contractors vehicles are marked and defined	
• Place warning signs, according to the National Highway standard. At a minimum: - Posters: work in progress (signaling the distance), caution and diversion. - Devices Pipeline: fences, cones, drums. - Lighting devices, especially at night in the campus and near parked trucks, material storage sites, other to define by the ES	
• Speed limits signs are place within the campus.	
• Traffic control at the entrance and other points of the UG is according to plan	
• All contractors vehicles have all the required permits, accident insurances, etc.	
• All contractor vehicles have carbon emissions reduction filters	

• All contractors trucks carry plastic, vinyl, or any other type of covers for covering the loads and avoid spills in the roads and potential accidents	
• All personnel performing tasks in the roads (flagmen) will have reflective vests and ponchos.	
• No open ditch, channel in the roads or shoulders will be maintained for more than 4 hours without proper safety signs to avoid any accidents.	
• Other	
• Other	
Sites of compliance	
UG campus All sites connected to the construction works	
Stage for supervision	
All construction period	
Staff Responsible to supervise	
The PIU Environmental Specialist responsible of the environmental and social supervision of the Project	
Monitoring	
Every week the ES will fill this datasheet and report any incident associated with the traffic safety and prevention measure associated with the works.	
Compliance Indicators	
Numbers of car-vehicle accidents associated with the construction Works within UG campus	
Number of car- vehicle accidents associated with the construction Works outside the UG campus	
Number of complaints received by any stakeholder	
Other:	

Contractor's Name:	
Contractor's Environmental Inspector:	**Signature of receiving copy:**
Engineer in charge to inform of this EDS:	**Signature of receiving copy:**

ENVIRONMENTAL DATA SHEET -	EDS -3- SOLID WASTE MANAGEMENT
Date:	**Number:**
Site:	
Environmental Specialist:	**Signature:**

Objective
To manage waste generated by the constructions and rehabilitation works at the UG campus
Actions creating impacts in the area
-overall construction and rehabilitation Works -demolition and removal activities of old materials, walls, ceilings, windows, pipelines, ventilation, electrical systems, etc.
Impacts to prevent
-un-comfort and potential accidents -improver management and disposition of solid wastes -generations of odors, fumes, dust which can affect workers and UG population
Influence area of the impacts
- The UG campus. - Surrounding areas around the UG campus, disposal sites.

Measures to supervise	**Compliance YES - NO**
• Waste containers are properly labeled and placed in agreed sites. All containers have lids which will not fall.	
• Each type of waste is properly managed as agreed with contractors, reuse and recycling of materials are according to work plan (for example: cement wastes are placed in defined areas to dry, for later disposal in agreed sites, electrical wires are collected in specific bins to proper recycling,	
• Hazardous wastes are placed in proper ventilated sites and with impermeable floors. Hazardous wastes are transported to agreed sites.	
• Final wastes are disposed in the agreed sites	
• Recycled materials are properly classified and donated to interested stakeholders	
• No isolated clumps of wastes materials are left on roads, ditches or near sidewalks for more than 24 hours.	
• Workers use protective gear to handle wastes (gloves, masks, etc). Remember some wastes may contain PCBs, asbestos and fine particulate matter which can affect UG community and workers.	

• CEI has provided periodically training to workers in waste management and Health and safety matters.	
• Truck drivers carry covert waste materials with a heavy tart cover.	
• Other	
Total of Non – Compliance activities	
Sites of compliance	
UG campus All sites connected to the construction works	
Stage for supervision	
I-Planning and organization, 2-Construction	
Staff Responsible to supervise	
The PIU Environmental Specialist responsible of the environmental and social supervision of the Project	
Staff responsible to comply	
Contractors and their personnel. CEI must supervise compliance by contractor and coordinate with ES any non-compliance issue.	
Monitoring	
Every month the ES will fill this datasheet and report compliance and non- compliance issues to the contractors, CEI and the Engineer Supervisor of the Works by the PIU.	
Compliance Indicators	
Numbers of trucks per month carrying wastes to agreed disposal sites	
Estimated Volume of recycled material donated to interested stakeholders	
Estimated Volume of hazardous waste material properly managed and disposed.	
Number of workers trained to properly handled demolished waste materials	
Informed Parties:	
Contractor's Name:	
Contractor's Environmental Inspector (CEI):	**Signature of receiving copy:**
Engineer in charge to inform of this EDS:	**Signature of receiving copy:**
ENVIRONMENTAL DATA SHEET -	**EDS -2- Communication and participation**
Date:	

Place:	
Name of the activity:	
Environmental Specialist:	**Signature:**
Objective	
To communicate the UG population and neighbors about the construction work plan and avoid potential impacts.	
Actions creating impacts in the area	
-overall construction and rehabilitation Works -demolition and removal activities of old materials, walls, ceilings, windows, pipelines, ventilation, electrical systems, etc.	
Impacts to prevent	
-lack of information -un-comfort and potential accidents - disruption of academic program and negative effects on university campus life	
Influence area of the impacts	
- The UG campus. - Surrounding areas around the UG campus.	
Measures to supervise	**Compliance YES - NO**
• Date and place for the Communication event is informed at least 1 week before.	
• Communication material is prepared (powerpoint presentations, brochures, posters, etc) for the event	
• Representatives from the PIU, Engineers Supervisors, contractors (if already contracted) are present	
• Participants have opportunity to ask, present recommendations and make any claim to the organizations and representatives of the PIU.	
• Registry of participants (attendees list, photos, etc)	
• During each event agreements, claims, recommendations given, are registered and there is a clear definition who will be responsible to do the follow up and resolve any issue.	
• Registries are posted in the project web site at the UG web site	
• Other	
• Other	
Sites of compliance	

UG campus All sites connected to the construction works	
Stage for supervision	
I-Planning and organization, 2-Construction	
Staff Responsible to supervise	
The PIU Environmental Specialist responsible of the environmental and social supervision of the Project	
Monitoring	
Every month the ES will fill this datasheet and report communication and participation activities developed by him/her, the PIU, contractors and others entities associated with the development of this project	
Compliance Indicators	
Numbers of meetings, assemblies, workshops developed	
Number and type of material prepared per each session	
Number of people who attended the activity	
Other:	
Registry of comments, recommendations, questions, claims, rise during the event	**Notes**
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Fill this section if activity is developed before or during construction:	

Contractor's Name:	
Contractor's Environmental Inspector:	**Signature of receiving copy:**
Engineer in charge to inform of this EDS:	**Signature of receiving copy:**

Appendix IX

Septic Tanks Built by UGSTSP			
Item	**Location**	**Description**	**Number**
1.0	**Lot 1 – FOAF and FOT**		
1.1	Building B	Concrete septic tank, with two chambers and filter bed. Inlet and outlet pipes are of PVC	1
1.2	Building C	Concrete septic tank, with two chambers and filter bed. Inlet and outlet pipes are of PVC	2
2.0	**Lot 2 – Former SEES and FNS**		
2.1	Building P	Prefabricated plastic septic tank with main chamber and filter bed	1
2.2	Building I	Concrete septic tank, with two chambers and filter bed. Inlet and outlet pipes are of PVC	1
2.3	Building H	Concrete septic tank, with two chambers and filter bed. Inlet and outlet pipes are of PVC	1